ALVEOLAR ABSCESS.

This is common in children, especially among the class of hospital and dispensary patients, in whom little or no attention is given to the care of the teeth. It causes severe pain and acute swelling, which may be limited to the gum, or it may involve to a considerable extent the periosteum of the jaw, and even cause swelling of the whole side of the face. If there is retention of pus, there may be quite severe constitutional symptoms, such as a chill and high temperature; but in most of the cases these are wanting. The abscess usually opens spontaneously into the mouth, but it may open externally if the molar teeth are the ones affected. It may even lead to necrosis of the jaw. If its site is the upper jaw, the pus may find its way into the nasal cavity or into the maxillary sinus.

The treatment is, in the first place, prophylactic. This requires attention to the teeth to prevent decay, and the removal of old carious fangs, which are a constant menace to the health of the child in more ways than one. The free use of the toothbrush and some antiseptic mouth-wash will, in the great majority of cases, prevent the occurrence of this disease. It is important that the abscess be opened early and free drainage secured. If there is a carious tooth it should be drawn.

DIFFICULT DENTITION.

The place of dentition as an etiological factor in the diseases of infancy is one which has given rise to much discussion. From a very early period the view has descended, that a large number of the diseases occurring between the ages of six months and two years were due to difficult dentition. The list of such diseases is a long one, but year by year it has been shortened as one after another has been shown to depend upon other causes, dentition being only a coincidence.

At the present time many good observers deny that dentition is ever a cause of symptoms in children; some even going so far as to say that the growth of the teeth causes no more symptoms than the growth of the hair. Without doubt the usual mistake made in practice is in overlooking serious disease of the brain, kidneys, lungs, stomach, and intestines, because of the firm belief that the child was "only teething." The physician who starts out with the idea that dentition may produce all symptoms in infancy, usually gets no further than this in his etiological investigations. Although I strongly believe that the importance of dentition as an etiological factor in disease has been in the past greatly exaggerated, and although I have formerly held the opinion that simple dentition did not and could not produce symptoms, within the past few years I have been compelled by clinical observations to change my opinion upon this subject; and I am now willing to admit that dentition may produce many reflex symptoms, some even of quite an alarming character.

Speaking from impressions, not from statistics, I should say that in my experience about one half of the healthy children cut their teeth without any visible symptoms, local or general; in the remainder some disturbance is usually seen, and though in most cases it is slight and of short duration, it may last for several days or even a week. The symptoms most commonly seen are disturbed sleep, or wakefulness at night and fretfulness by day, so that children often sleep only one half the usual time. There is loss of appetite, and much less food than usual is taken. There is often, but not always, an increase in the salivary secretion, a slight amount of catarrhal stomatitis, and a constant disposition on the part of the child to stuff the fingers into the mouth. The bowels are often constipated or there may be slight diarrhœa. The thermometer may show a slight elevation of temperature to 100° to 101·5° F. The weight may remain stationary for a week or two, and there may even be a loss of a few ounces. The duration of these symptoms in most cases is but a few days, and they require no special treatment. If the food is forced beyond the child's inclination, attacks of indigestion with vomiting and diarrhœa are easily excited.

Symptoms more severe than the above are rare in healthy children, but are not infrequent in those who are delicate or rachitic. In such susceptible children, even so slight a thing as dentition may be the cause, or at least the exciting cause, of quite serious symptoms. Often there is some other factor in the case, such as bad feeding or feeble digestion. In delicate or rachitic children there may be seen the symptoms already mentioned as occurring in healthy infants, but in greater severity; and in addition there may be severe attacks of acute indigestion. Occasionally there is quite high fever, from 102° to 104° F., lasting usually only two or three days, but in rare cases for a week, and accompanied by no other symptoms except almost complete anorexia. Convulsions which could fairly be attributed to dentition I have never seen, yet I do not doubt that they may occur in rachitic children. There are certain cases of eczema in which the symptoms undergo a distinct exacerbation with the eruption of each group of teeth. As regards almost all the other diseases which are commonly attributed to dentition, I believe that it is a delusion to trace them to this cause.

The physician should watch a child carefully, and examine it frequently, to be sure that he is not overlooking some serious local or constitutional disease before he allows himself to make the diagnosis of difficult dentition. Probably in ninety-five per cent of the cases in which the above symptoms are present, they are due to some cause other than dentition. When, however, symptoms such as any of those mentioned disappear immediately when the teeth come through, and when we see them repeated four or five times in the same child with the eruption of each group of teeth, and accompanied by red and swollen gums, I think we can

not escape the conclusion that dentition has been a factor in their production, though perhaps not the only one.

In the treatment of this condition drugs occupy but a small place. It should be remembered that infants are at this time in a peculiarly susceptible condition, as regards the digestive tract, and attacks of indigestion, and even severe diarrhœa, are readily excited from slight causes, especially from overfeeding. Special care should be exercised in this respect. The strength of the food should be reduced, as well as the amount given. The poor appetite indicates a feeble digestion, which should not be overtaxed. As attacks of bronchitis and acute nasal catarrh are readily induced, even slight exposure should be guarded against. The nervous symptoms, when severe, may be relieved by the use of moderate doses of bromide and phenacetine, better than by opiates. All soothing syrups should be discountenanced. All the various devices for making dentition easy are a delusion. In a small number of cases lancing the gums is of decided value. I have myself seen marked and undoubted relief given by it. This is likely to be the case where the gums are tense, swollen, and very red, with the teeth just beneath the mucous membrane. That lancing the gums is often required I do not believe; that it is done by many physicians too frequently is no doubt true; but it should still have a place in our therapeutic measures. Care should always be taken that infection is not carried by the lancet.

CATARRHAL STOMATITIS.

This is characterized by redness and swelling of the mucous membrane, and by increased secretion of the salivary and the muciparous glands of the mouth. It usually involves a large part of the mucous membrane.

Etiology.—Catarrhal stomatitis may result from traumatism. This injury may be mechanical, or due to heat or any irritant accidentally taken into the mouth. It frequently occurs at the time of the eruption of a tooth. It complicates measles, scarlet fever, diphtheria, influenza, and many other infectious diseases. In these cases, and in many others, the disease is probably due to direct infection.

Lesions.—The lesions are essentially the same as in catarrhal inflammations of other mucous membranes. There are congestion with desquamation of epithelial cells, and sometimes the formation of superficial ulcers. The process may be a very superficial one, or it may extend to the submucous tissue.

Symptoms.—The whole mucous membrane is intensely injected, all the capillaries are dilated, and small hæmorrhages easily excited. The mucous membrane is swollen, this being most apparent over the gums or about the teeth. There may be some swelling of the lips. The mouth seems hot, and the local temperature is certainly increased. There is con-

siderable pain, as shown by fretfulness, but particularly by the disinclination to take food: infants, though evidently hungry, either refusing the breast or bottle altogether, or dropping it after a few moments. The increase in secretion is sometimes marked, so that the saliva pours from the mouth, irritating the lips and face and drenching the clothing. In other cases the saliva is swallowed. On close inspection there may be seen swelling of the muciparous follicles, and even the formation of tiny cysts from the accumulation of secretion within them (Forchheimer). The tongue is usually coated, the edges reddened, and the papillæ prominent. In febrile diseases, such as typhoid, etc., we may get an accumulation of dead epithelium with the formation of cracks and fissures of the tongue, and the lips may present a similar condition. The neighbouring lymphatic glands are slightly enlarged and tender. The constitutional symptoms accompanying simple stomatitis are not severe, but some disturbance is almost always present. There may be derangement of digestion with vomiting, and even a mild attack of diarrhœa. In the majority of cases the disease runs a short course, recovery taking place in a few days when the primary cause is removed. In very delicate children it may be prolonged, and from the interference with nutrition may even lead to serious consequences.

Treatment.—The mouth and teeth should be kept clean. Food is more acceptable if given cold. In very severe cases, where food is refused, gavage may be resorted to three or four times daily. In all cases children may be given ice to suck. This is refreshing, both on account of the cold and from the relief to the thirst. The mouth should be kept clean with a solution of boric acid, ten grains to the ounce, or an alkaline solution, such as Dobell's, diluted with an equal amount of cold boiled water; or simply water may be used. In the severe forms, where there is much swelling and slight catarrhal ulceration, astringents are required. In my experience alum is the best; this may be applied in the form of the powdered burnt alum mixed with an equal amount of bismuth, or in solution, ten grains to the ounce, with a swab or brush. Where ulcers are slow in healing and very painful, the powdered burnt alum may be applied directly.

HERPETIC STOMATITIS.

Synonyms: Aphthous, vesicular, follicular stomatitis.

In this form of stomatitis we have the appearance first of small yellowish-white isolated spots, and subsequently the formation of superficial ulcers. These ulcers are first discrete, but may coalesce and form others of considerable size. It is a self-limited disease, usually running its course in from five days to two weeks.

Etiology.—Very little is as yet positively known regarding the cause of herpetic stomatitis. Forchheimer reports bacteriological investigations

as yielding negative results. I adopt the term *herpetic* to designate this disease, because I believe, with Forchheimer* and others, that it is of nervous origin. There is yet lacking sufficient evidence to establish the fact that it is contagious. It occurs most frequently about the end of the first year, but may be seen at any period of childhood, least frequently in very young infants. It is often associated with disturbances of the stomach, and an attack may be coincident with the eruption of the teeth.

Lesions.—The exact nature of the lesion is still a matter of dispute. The view generally accepted is, that there is first the formation of a vesicle, followed by death of the epithelial cells covering it, and the production of an epithelial ulcer; the process being thus regarded as analogous to herpes of the skin. These ulcers may extend superficially, but never deeply; they commonly heal quickly with the formation of new epithelial cells, leaving no cicatrices behind them. Herpetic stomatitis is always associated with more or less catarrhal inflammation.

Symptoms.—The symptoms of herpetic stomatitis may precede or follow those of a catarrhal inflammation. The characteristic feature is the appearance of small, shallow, circular ulcers, usually coming in successive crops. While most frequent at the border of the tongue and the inside of the lips, they may be found upon any part of the mucous membrane of the mouth or the pharynx. There may be only half a dozen present, or the mouth may be filled with them. They are first of a yellowish colour, and on an average about one eighth of an inch in diameter. By the coalescence of several smaller ones there may form patches of considerable size, sometimes nearly covering the lips. The older ulcers are apt to have a dirty grayish colour, and in places may look not unlike a diphtheritic membrane. The smaller ones are surrounded by a red areola, and when healing the margin is of a bright red colour. Their appearance is often more like that of an exudation upon the mucous membrane than an excavation into it. The other symptoms are much the same as in catarrhal stomatitis, but usually of greater severity. The pain is particularly intense, it being often difficult to induce children to take anything in the form of food. The tongue is frequently coated, but there is never the foul breath of ulcerative stomatitis. The duration of the disease is from one to two weeks, and, if the child is in good condition, complete recovery takes place even without any special treatment. In badly nourished children the disease may last for two or three weeks; relapses may occur, and the condition may interfere very seriously with the child's nutrition.

Treatment.—This is the same as in catarrhal stomatitis, with the addition that to each one of the ulcers finely powdered burnt alum should be applied with a camel's-hair brush. If this is not effective, the solid stick of nitrate of silver may be used. The ulcers will usually yield rapidly to

* Archives of Pædiatrics, ix, 330.

this treatment. In my experience, drugs given with the purpose of affecting the lesion in the mouth have been without benefit.

ULCERATIVE STOMATITIS.

This form of stomatitis is only seen when teeth are present. It is characterized by an ulcerative process, beginning at the junction of the teeth and the gum, and extending along the teeth, involving secondarily other parts of the mouth, but never spreading beyond the buccal cavity. It occurs from several quite distinct causes, and, while not tending to spontaneous recovery, it is in most cases readily curable by the internal administration of chlorate of potash, which may be looked upon as a specific remedy.

Etiology.—Ulcerative stomatitis may be due to certain of the metallic poisons, particularly mercury, lead, and phosphorus; but from all these it is now rare, and not so often seen in children as in adults. It sometimes occurs as a sequel of acute infectious diseases. Most of the cases are seen in hospital and dispensary patients, in children whose general health is below par and who have suffered from the lack of proper food. In private practice among the better classes, it is a rare disease. A local cause of much importance is the common neglect among the poor of cleanliness of the mouth and teeth, and the presence of carious teeth. This is the form of stomatitis which occurs in scurvy; and it seems not unlikely that an allied disturbance of nutrition, causing a spongy, swollen condition of the gums, exists prior to many cases of ulcerative stomatitis. Given this state of things, it is easy to see how germs present in the mouth, finding a ready entrance, may set up an active inflammatory process; the diminished vitality from general condition taking the part of a primary cause, and infection that of a secondary one. Bacteriological investigations of these cases thus far made have revealed only the ordinary pyogenic bacteria.

Lesions.—The disease may begin at any part of the mouth, but most frequently upon the outer surface of the gum along the lower incisor teeth. From this point it extends behind the teeth, and from the incisors to the canines and molars, usually of one side only; but it may involve the whole gum and both jaws. From the gums the process may spread to the lips, affecting the fold of mucous membrane between the gum and the lip, and also to the inner surface of the cheek, especially opposite the molar teeth, where large ulcers often form. In neglected cases the disease may extend into the alveolar sockets, the teeth loosening and falling out. The periosteum of the alveolar process may be involved, and even superficial necrosis of the jaw may occur, as happened in three cases that came under my observation.

Symptoms.—The first things noticed are the very offensive breath and the profuse salivation. It is usually for one of these that the patient

is brought for treatment. On inspection of the mouth, there is seen in the mild cases, swollen, spongy gums of a deep red or purplish colour, which bleed at the slightest touch. There is a line of ulceration, usually along the incisor teeth, most marked in the front, which may extend to any or to all of the teeth; sometimes it affects only the gum along the molar teeth, the incisors escaping. At the junction of the teeth and gum is seen a dirty, yellowish deposit, on the removal of which free bleeding takes place. The diseased parts are very painful, and the child cries, and resists any attempt at examination. In the more severe cases and in those of longer duration the teeth are loosened, sometimes being so loose that they can be picked from the gum. There may be necrosis of the jaw, and even a loose sequestrum may be found. The ulceration along the gums in these cases is deeper, and there may be ulcers in the cheek opposite the molar teeth, or inside the lip. The swelling may be so great that the teeth are almost covered; this is seen particularly in the scorbutic form. The saliva pours from the mouth, adding greatly to the discomfort of the patient. Beneath the jaw are felt the large, swollen lymphatic glands, which are painful and tender to the touch, but show no tendency to suppurate. The tongue is somewhat swollen, and shows at the edges the imprint of the teeth; it is thickly coated with a dirty yellow fur. The general condition of these patients is usually poor, and there may be quite a marked cachexia. Other forms of stomatitis, particularly the herpetic, may be associated, and it should not be forgotten that the gangrenous form may follow.

When not recognised or not properly treated, ulcerative stomatitis may last for months, and seriously affect the patient's general health. When properly treated it tends in all recent cases to rapid recovery, usually in a few days. No deformity of the mouth is left, the only untoward results being shrinking of the gum, sometimes loss of some of the incisor teeth, and more rarely a superficial necrosis of the alveolar process. All these are quite uncommon. Ulcerative stomatitis can hardly be confounded with any other form, and not only should a diagnosis of the lesion be made, but the condition upon which it depends should, if possible, be discovered; scorbutus, particularly, should not be overlooked.

Treatment.—The first thing to be done is to remove the cause. When dependent upon metallic poisoning the source should be discovered. Scorbutic cases should have the usual anti-scorbutic diet. Cleanliness of the mouth is of great importance, and this may best be accomplished by the use of peroxide of hydrogen diluted with from two to ten parts of water. It should be followed by plain water, and repeated several times a day. In other cases an astringent solution of alum, five grains to the ounce, or a mouth-wash of chlorate of potash, three grains to the ounce, may be employed. The only objection to the last mentioned is the pain which it usually produces.

The specific remedy for ulcerative stomatitis is chlorate of potash. The best method of administration is to give two grains or one half teaspoonful of a saturated solution, largely diluted, every hour during the day for the first twenty-four hours and subsequently every two hours; when improvement occurs the dose may be still further reduced. Marked benefit is usually seen in one or two days even in cases that have lasted for several weeks. If the case does not yield readily to this treatment there is probably disease at the roots of the teeth, and when loose these should be removed, and the jaw examined to see if there is necrosis. Occasionally the ulcers show but little disposition to heal, and require to be touched with burnt alum or nitrate of silver.

The constitutional and dietetic treatment in all these cases should be the same as that employed in scurvy—i. e., plenty of fruit, fresh vegetables, and sometimes the internal administration of mineral acids, especially aromatic sulphuric acid. Iron is indicated in most of the cases.

Ulceration of the Hard Palate.—This is usually seen in the first few weeks of life, but may occur in any child suffering from marasmus. The primary cause may be the injury inflicted in cleansing the mouth. In other cases it is due to the friction of the rubber nipple, or something else which the child is allowed to suck. In still others it is apparently produced by the habit of tongue-sucking frequently observed in these young infants. The appearances are quite characteristic: there is found, rather far back upon the hard palate, usually upon both sides, a superficial ulcer, from a fourth to a half inch in diameter. There are no signs of acute inflammation. Thrush may coexist, but it has no relation to the production of the disease. Spontaneous recovery usually occurs in from one to three weeks, provided the cause can be removed. In children suffering from marasmus these ulcers are very intractable, and in many instances their cure is practically impossible. It is therefore especially important to prevent, if possible, their formation by care in cleansing the mouth, and in avoiding the other causes referred to. When ulcers have appeared they should be treated as cases of herpetic stomatitis.

THRUSH.

Synonyms: Sprue; German, Soor; French, muguet.

Thrush is a parasitic form of stomatitis characterized by the appearance upon the mucous membrane, usually of the tongue or of the cheeks, of small white flakes or larger patches. It is common in infants of the first two or three months, and in all the protracted exhausting diseases of early life.

Etiology.—The parasite which produces thrush is a form of fungus, but the exact class to which it belongs has not yet been definitely settled. It is now known that it is not the *oïdium albicans*, but that it belongs to

the group of the saccharomyces, and the term *saccharomyces albicans* has been given to it. If a little of the exudate from the mouth is placed upon a slide and a drop of liquor potassæ added, the structure of the fungus is readily seen. With the low power of the microscope there can be made out fine threads (the mycelium) and small oval bodies (the spores). With a high power the threads can be seen to be made up of a number of shorter rods, at the ends of which the spore formation takes place (Fig. 43). The mycelium is produced from the spores. The spores of this fungus are of very common occurrence in the atmosphere. The conditions in the mouth which favour its growth are any pathological condition of the epithelium, particularly a slight amount of catarrhal stomatitis, a scanty salivary secretion and want of cleanliness. The fungus may grow in a medium of any reaction, but best in one which is slightly alkaline or neutral. The nature of the process which it produces is in all probability a sugar fermentation, the acid reaction of the mouth being the result of the growth rather than its cause. Infection may come from another patient by means of a rubber nipple or a cloth which has been used for the infected mouth, from the nipple of the nurse, or directly from the air. The disease is an exceedingly common one in foundling asylums, in all places where many young infants are congregated, and where cleanliness of mouths, bottles, etc., is neglected. It is especially frequent in children suffering from malnutrition, marasmus, or other wasting diseases, and in those who have hare-lip, or any deformity of the mouth.

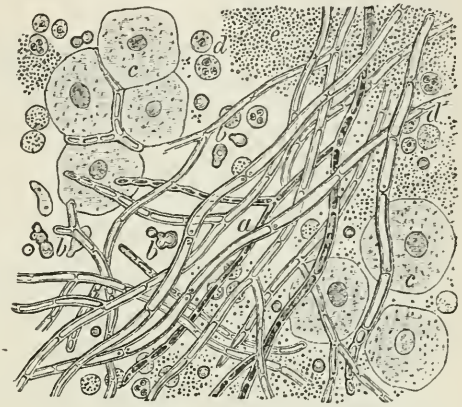


FIG. 43.—Thrush fungus (highly magnified). *a*, mycelium; *b*, spores; *c*, epithelial cells from the mouth; *d*, leucocytes; *e*, detritus. (Jaksch.)

Lesions.—According to Forchheimer, the spores lodge between the epithelial cells and gradually separate the different layers. This occurs before the formation of the white pellicle. Later the disease spreads to the surface of the mucous membrane, and also somewhat to the deeper layers. It is stated by Wagner that it may invade the blood vessels and be carried to distant parts. Although the saccharomyces albicans is commonly found upon flat epithelium, its growth is not confined to it. It usually begins at many isolated spots upon the mucous membrane, and gradually spreads until coalescence takes place; a continuous membrane may be formed. No pus is produced by the process.

The usual seat is the tongue, the inside of the cheeks, and the hard palate, but not infrequently it involves the lips, the tonsils, the pillars of the fauces, and the pharynx. Further extension than this is very rare, although cases are on record in which thrush has been found in the œsophagus, in the stomach and intestines, and even in the lower respiratory tract. I have never seen extension farther than the œsophagus, and this but once or twice. I know of but one reported case in this country (Northrup's) in which thrush has been seen in the stomach. Cases involving the œsophagus and the stomach appear from reports to be much more common in Europe.

Symptoms.—The essential symptoms of thrush are the appearance upon the mucous membrane of the mouth—usually beginning upon the tongue or the inner surface of the cheek—of small white flakes which resemble deposits of coagulated milk, but which differ from them in the fact that they can not be wiped off. If forcibly removed, they usually leave a number of bleeding points. There may be only a few scattered patches, or the mouth and pharynx may be covered. The mouth is generally dry, the tongue coated; food may be refused on account of pain, and there may be some difficulty in swallowing. The other symptoms depend upon the conditions with which the thrush is associated.

Diagnosis.—This is rarely difficult. The deposit may be mistaken for coagulated milk, but is distinguished by the features just mentioned. When existing upon the pharynx and fauces it has been confounded with diphtheria, although this mistake can hardly be made if all the features of the case are taken into consideration—the age of the patient, the involvement of the lips and tongue, the dry mouth, the absence of glandular enlargement, etc. In any case of doubt the examination of the deposit under the microscope at once reveals its true nature.

Prognosis.—Thrush is not in itself a dangerous disease, except in the very rare instances where it may obstruct the œsophagus, and this can hardly occur except in a condition of exhaustion which is necessarily fatal. In a feeble and delicate infant, thrush may be a serious complication by interfering with the taking of sufficient nourishment. With proper treatment most of the cases involving only the mouth are readily cured.

Treatment.—Thrush may be prevented in almost every case by due attention to cleanliness of the mouth, rubber nipples, bottles, cloths, etc. All rubber nipples should be kept in a solution of borax or salicylate of soda, and the child's mouth should be cleansed several times a day. On no account should a feeding-bottle be passed from one child to another.

In the treatment of the disease the essential things are cleanliness, and the use of some mild antiseptic mouth-wash. The routine treatment which I have followed for many years both in hospital and private practice, is to cleanse the mouth carefully after every feeding or nursing with a solution

of borax or bicarbonate of soda, ten grains to the ounce, and to apply four times a day to the affected mucous membrane a saturated solution of boric acid. Both these applications, however, should be carefully made, so as not to injure the epithelium. The best method is by the finger wrapped in absorbent cotton, or by a swab. Applications to be especially avoided are those mixed with honey or any syrup. In several hospital cases the disease seemed to be prolonged by the irritation of the rubber nipple of the feeding-bottle. In such cases it has been our practice to feed by gavage for two or three days, as all cases improved much more rapidly when this was done.

GONORRHŒAL STOMATITIS.

There has been described by Dohrn and Rosinski a form of stomatitis in the newly-born, due to a gonorrhœal infection. This is not likely to take place unless the epithelium has been removed. The infection in all cases occurred from the mother. The lesion consists in the formation of yellowish-white patches upon the tongue or hard palate—regions in which the epithelium is likely to be injured by rough attempts at cleansing the mouth. There may be other evidences of gonorrhœal infection, such as ophthalmia. The diagnosis rests upon the discovery of the gonococcus in the exudate. In all the above cases the general health was not affected, and recovery followed in the course of a week or ten days.

The treatment consists in thorough cleanliness and in the application of a saturated solution of boric acid, as in thrush.

SYPHILITIC STOMATITIS.

The buccal symptoms of hereditary syphilis are important both from a diagnostic and therapeutic standpoint. The most frequent lesions are fissures, ulcers, and mucous patches. Fissures are found upon the lips, most frequently at the angle of the mouth, and are usually multiple. They may be quite deep and cause frequent hæmorrhages. Mucous patches are superficial ulcers developing from papules which form upon the mucous or muco-cutaneous surface. In cases of acquired syphilis in children the primary sore may be seen upon the tongue, the lip, or the tonsil. All these symptoms are more fully considered in the chapter on Syphilis.

DIPHTHERITIC STOMATITIS.

In severe cases of diphtheria the membrane is found not only upon the pharynx and tonsils, but it may appear anywhere upon the buccal mucous membrane or the lips. It is questionable whether the diphtheritic process ever begins in the mucous membrane of the mouth, or whether it is ever confined to this part. In my own experience diphtheritic stomatitis has always been associated with deposits upon the tonsils and pharynx. It is seen only in the severest cases, and in those which, from other con-

ditions which are present, are almost necessarily fatal. Bearing in mind the above points, it can hardly be mistaken for any other variety of stomatitis, although not infrequently the mistake is made of regarding as diphtheritic, cases of herpetic stomatitis in which the ulcers have coalesced. The treatment, so far as the mouth is concerned, consists in cleanliness by frequent gargling or syringing with a saturated solution of boric acid. Forcible removal of the membrane is not to be advised.

GANGRENOUS STOMATITIS.

Synonyms: Cancrum oris, noma.

This is a gangrenous process which begins usually upon the gums or upon the inside of the cheek, and extends with great rapidity, causing extensive destruction of the tissues of the mouth, often perforation of the cheek, and usually terminating fatally. It is fortunately a rare disease. Although this is usually classed among the diseases of the mouth, the same process may occur elsewhere. I have known it to affect primarily the nose and the external auditory meatus. Cases affecting the female genitals are even more common.

Etiology.—Gangrenous stomatitis is usually a secondary disease, occurring most frequently as a complication of measles, but sometimes with other exhausting diseases of infancy and childhood. It is not often seen except in institutions for children. Whether or not there is a specific form of infection has not yet been established. In a recent case occurring in the Babies' Hospital streptococci were found in pure culture. Streptococci chiefly were found in observations by Cornil and Babes, and by Ranke. The factors necessary for the production of the disease are a very low vitality of the tissues, and infection, which, with our present knowledge, is most probably by streptococci of a peculiarly virulent type.

Gangrenous stomatitis often follows some other form, usually the ulcerative, although the two can hardly be considered as the same disease, differing only in severity.

Lesions.—The process is one of rapidly spreading gangrene. In most of the cases there are thrown out inflammatory products in quite large amount, but there is little or no tendency to limitation of the disease. This usually advances steadily until death occurs. In a small number of cases a line of demarcation finally forms, and the slough separates, leaving a large area to be partly filled in by granulation and cicatrization. Other infectious processes are likely to accompany the disease, particularly broncho-pneumonia.

Symptoms.—The general symptoms are those of profound prostration and sepsis. The constitutional depression may be great at the very beginning, or the children at first may be in fair condition, but rapidly grow worse in the course of two or three days. The temperature is

usually elevated to 102° or 103° F., and sometimes to 104° or 105° F. There are dulness, apathy, feeble pulse, muscular relaxation, and very often diarrhœa. Before death the temperature may be subnormal.

Of the local symptoms, often the first to attract attention is the odour of the breath; sometimes it is the dusky spot on the cheek or lip. On examination of the mouth, there usually is found upon the gum or inside of the cheek a dark, greenish-black necrotic mass, surrounded by tissues which are swollen and œdematous, so that the cheek or lips may be two or three times their normal thickness. Externally the parts are tense and brawny from the swelling, this infiltration always extending for

Fig. 44.—Gangrenous stomatitis, following measles. (From a photograph lent by Dr. Henry Moffat.)

some distance beyond the gangrenous part. As the process extends, the teeth loosen and fall out; there may be necrosis of the alveolar process of the jaw and perforation of one or both cheeks or lower lip. Extensive sloughing of the face may take place, usually upon one side, sometimes upon both, giving the patient a horrible appearance, as shown in Fig. 44. In this patient the process began in the right cheek, subsequently involving the left; perforation occurred in both cheeks, and before death a large part of the face was gangrenous. The odour from a severe case is very offensive, and, in spite of all efforts at disinfection, it may fill the ward or even the house. Pain is rarely severe, and in many cases it is absent. Extensive hæmorrhages are rare.

The usual duration of the disease is from three to seven days; in some cases it may last two weeks. If recovery takes place, there is seen a line of demarcation; then the slough is thrown off, and granulation and cicatrization begin, but require a long time, usually leaving an unsightly deformity.

The prognosis is very bad, about three fourths of the cases proving fatal. The results depend not only upon the disease itself, but upon the condition of the patient with which it is associated.

Gangrenous stomatitis can hardly be mistaken for any other form of disease occurring in the mouth, and early recognition is of great importance, since only early treatment is likely to be successful.

Treatment.—Much can be done to prevent the disease by careful attention to all the milder forms of stomatitis, particularly to the ulcerative variety. Frequent and thorough cleansing of the mouth in all acute infectious diseases, is a part of the treatment which is too frequently neglected. This should be a matter of routine in every severe illness in a young child. Recognising the malignant nature of gangrenous stomatitis, its treatment should be radical from the very outset. Of the measures which have been proposed, that which seems to offer the best chance of arresting the process is excision with cauterization. This should be done under anæsthesia. In excising, one should go some distance into tissues apparently healthy, for the reason that the process has always advanced farther in the subcutaneous tissues than in the skin. The edges of the wound should then be thoroughly cauterized, best by the Paquelin cautery. Of the other means employed, the use of strong nitric acid is probably the best. This is to be used after excising, or curetting the necrotic tissue. The mouth should be kept as clean as possible by the use of peroxide of hydrogen or permanganate of potash. The general treatment should be supporting and stimulating. As the possibility of contagion exists, every case should be isolated.

CHAPTER II.

DISEASES OF THE PHARYNX.

ACUTE PHARYNGITIS.

Acute pharyngitis may exist as a primary disease, or with any of the infectious diseases, particularly scarlet fever, measles, diphtheria, and influenza. Secondary pharyngitis will be considered in connection with these different diseases.

Acute primary pharyngitis is often attributed to cold and exposure, but it is probable that a large number of these cases will ultimately be

shown to depend upon some form of infection. Certain children have a constitutional predisposition to attacks of pharyngitis, and contract it upon the slightest provocation. In some of them there is a strongly marked rheumatic diathesis. Attacks are frequently associated with disturbances of digestion.

In acute catarrhal pharyngitis the inflammation may involve the entire mucous membrane of the tonsils, fauces, uvula, posterior and lateral pharyngeal walls, or any part of it. It may exist alone, or in connection with a similar inflammation in the rhino-pharynx or in the larynx. In the beginning there is seen an acute erythematous blush, usually involving the entire pharynx. This may entirely subside after twenty-four hours, or it may be followed by the usual changes of acute catarrhal inflammation—dryness, swelling, and œdema. Later there is increased secretion of mucus, and finally there may be muco-pus. Occasionally slight hæmorrhages are present.

There is pain at the angle of the jaws, which is increased by swallowing, a sensation of dryness and roughness in the pharynx, and often an irritating cough. There may be slight swelling of the neighbouring lymphatic glands. The constitutional symptoms in young children are often severe. Not infrequently there is a sudden onset with vomiting, and a rise of temperature to 103° or even 105° F. These symptoms are usually of short duration, frequently less than twenty-four hours, and in two or three days the patient may be quite well. In other cases the pharyngitis may be accompanied or followed by laryngitis.

The chief point in diagnosis, when symptoms like the above are seen, is to exclude scarlet fever and measles. A positive diagnosis is impossible until a sufficient time has elapsed for the eruption to come out. The patient should be closely watched for the first sign of its appearance. If scarlet fever is prevalent, a child with the symptoms of severe pharyngitis should at once be isolated while waiting for the diagnosis to be settled. There is commonly less difficulty in excluding measles, for in that disease the early redness is more upon the hard palate than upon the fauces, and usually consists of minute red spots rather than a uniform blush. There is, besides, a history of a previous catarrh for two or three days.

The first step in treatment of acute pharyngitis is to open the bowels freely by means of calomel, castor oil, or magnesia. The child should be kept in bed, and the diet should be fluid, or, in the case of infants, the amount of food should be much reduced. Pieces of ice may be swallowed frequently for the relief of pain and thirst. Internally there may be given two grains of phenacetine every three hours to a child of three years. It is important at the outset to induce free perspiration. The disease is not serious, and the indications are to make the child as comfortable as possible during the short attack. I have seen but little benefit from the use of aconite, although for years I saw it used as a routine treatment.

UVULITIS.

Acute inflammation of the uvula, with swelling and œdema, occurs as a part of the lesion in acute pharyngitis. In rare instances the uvula may be the principal or only seat of inflammation. Huber (New York) has reported two cases, one of which is unique. An infant ten months old was apparently well until two hours before it was seen, when there was noticed a constant irritating cough, accompanied by considerable gagging. A little later there could be seen in the mouth a prominent red mass, which was the enlarged and elongated uvula. It was accompanied by paroxysms of cough, which interfered both with nursing and deglutition. The general symptoms were quite alarming, and the child was in considerable distress. On examination, the uvula was found to be fully one inch long and half an inch wide; it was red and œdematous; in other respects, however, the throat was normal. The symptoms were relieved by multiple needle punctures and the use of ice externally and internally.

ELONGATED UVULA.

Probably this is primarily a congenital condition. It is increased by repeated attacks of acute or subacute inflammation. The degree of elongation differs very much in different cases; in some it may reach an inch in length. According to Bosworth, only the mucous membrane is involved in the elongation. The symptoms are those of local irritation, especially a cough upon lying down, and the sensation of a foreign body in the pharynx. In some cases it may be a reflex cause of asthma, or, more frequently, of catarrhal spasm of the larynx. The diagnosis is very easily made by inspecting the throat. The treatment consists in grasping the tip of the uvula with forceps and cutting off the excess with the scissors, or a uvulatome. Care should be taken not to cut off too much of the uvula, or severe hæmorrhage may occur.

RETRO-PHARYNGEAL ABSCESS.

Two distinct varieties are seen: (1) the so-called idiopathic abscesses which belong to infancy, and (2) abscesses secondary to caries of the cervical vertebræ.

Retro-pharyngeal Abscess of Infancy.—All of the later investigations regarding this disease go to show that primarily it is not a cellulitis, but a suppurative inflammation of the lymph nodes (lymphatic glands) with a surrounding cellulitis. Jules Simon has described the retro-pharyngeal lymph nodes as forming a chain on either side of the median line between the pharyngeal and the prevertebral muscles. These nodes are said to undergo atrophy after the third year, and in some cases to disappear entirely. Retro-pharyngeal abscess—or more properly retro-pharyngeal

adenitis, since the process does not invariably go on to suppuration—is probably never primary, but secondary to infectious catarrhs of the pharynx, and is set up by the entrance of pyogenic bacteria. Its pathology is the same as the more frequent suppurative inflammation of the external cervical lymph nodes, with which it is sometimes associated. Usually only a single node is involved, but sometimes two or three are affected, and these may be situated upon opposite sides. I have seen retro-pharyngeal adenitis so severe as to give rise to marked local symptoms, although it did not go on to suppuration. This is rare; Kormann's observations, however, show that swelling of these glands in diseases of the mouth and throat, is very much more common than is generally supposed. Similar abscesses from suppurative inflammation of other lymph nodes in the neighbourhood of the pharynx may occur. I have recently seen one situated between the epiglottis and the base of the tongue.

Etiology.—These cases are almost invariably seen in infancy. Fully three fourths of those that have come under my observation have been in patients under one year. Bokai (Buda-Pesth) reports that of sixty cases observed, forty-two occurred during the first year, eleven during the second year, and only seven at a later period. The primary disease is usually a severe rhino-pharyngitis, or an attack of epidemic influenza, but rarely it occurs as a sequel of scarlet fever or measles. In six hundred and sixty-four cases of scarlet fever, Bokai noted retro-pharyngeal abscess in seven cases. After measles it is even more rare. Retro-pharyngeal abscess usually occurs in winter or spring, on account of the prevalence of the diseases upon which it depends. It is seen in children previously robust, but more often in those who are delicate and who in consequence are prone to severe catarrhal affections.

Symptoms.—The early symptoms in most cases are only those of an ordinary rhino-pharyngeal catarrh. After this has subsided the temperature may remain slightly elevated, often for a week or more, before local symptoms are noticeable. Sometimes, without any distinct history of previous catarrh, there are seen quite high temperature, from 102° to 104° F., loss of flesh, and prostration. A careful examination may be required, and sometimes observation for a day or two, before the explanation of these constitutional symptoms is discovered. In other cases the early constitutional symptoms are so slight as to escape notice, and the physician is summoned on account of the local symptoms, usually the dyspnœa, which in a short time may assume an alarming character. The duration of the inflammatory process before abscess forms is generally five or six days, but it may be two or three weeks. The temperature is invariably elevated, usually from 100° to 103° F.; occasionally it may be 104° or 105° F., with symptoms of prostration seemingly out of all proportion to the local disease, but which are to be explained by the tender age and feeble resistance of the patient.

The first local symptom may be a sudden attack of dyspnœa severe enough to cause asphyxia. This is due to the pressure forward of the abscess which encroaches upon the opening of the larynx. Usually before this occurs the breathing is noisy, especially during sleep, and on account of the obstruction to nasal respiration the patient breathes with the mouth open. The mouth may be dry, or there may be a copious secretion of pharyngeal mucus. The dyspnœa is in most cases greater on inspiration, and in some it is noticed only then, expiration being normal. The dyspnœa is sometimes increased by attempts at swallowing. The degree to which deglutition is interfered with depends upon the size and the position of the tumour. It is more difficult when the tumour is low down. The child may find it impossible to swallow, and in consequence may refuse to nurse; or the difficulty in nursing may depend upon the nasal obstruction. Sometimes there is regurgitation of food through the nose or mouth. The voice is usually nasal. There is not generally hoarseness, but a peculiar short cry which is quite characteristic and which has been compared to the "quack" of a duck. There may be complete aphonia; often there is a short, dry cough. In many of the cases a tumour is to be seen externally, just below the angle of the jaw and in front of the sterno-mastoid muscle. It is rarely so large as to attract attention. The head is thrown back in order to relieve the pressure upon the larynx, and is held somewhat rigidly. In one or two cases I have noticed torticollis as an early symptom.

A positive diagnosis is made by an examination of the throat. On inspection there is seen a distinct bulging of the lateral wall of the pharynx, usually a little above the base of the tongue. The swelling may be so great as to crowd the uvula to one side and nearly fill the pharynx. It is rarely if ever in the median line. There is usually redness of the mucous membrane and œdema of the uvula and of the adjacent parts. On digital examination the swelling is made out even better than by inspection. If it is lower down it may not be visible at all. In the early stage there may be felt only a localized induration or a somewhat diffuse swelling, but by the time the swelling is large enough to produce marked symptoms, fluctuation can generally be discovered.

Prognosis.—When left to itself the abscess usually opens into the pharynx, the pus being swallowed or expectorated. The cavity closes rapidly by granulation, and the patient in a few days is entirely well. It is rare for much burrowing to occur. In young or very delicate infants the constitutional symptoms may be so severe that the child continues to fail even after the evacuation of the abscess, and, gradually sinking, dies usually from broncho-pneumonia. In other children a fatal result is generally due to the fact that the disease is not recognised.

Death before rupture may occur from asphyxia due to pressure upon the larynx or œdema of the larynx, or to rupture of the abscess into the

air passages, especially if this occurs during sleep. Carmichael, Bokai, and others have reported deaths from ulceration into the carotid artery or one of its large branches. Carmichael's patient was only five weeks old. The general mortality of the disease is about five per cent; most of the deaths are owing to a failure to make the diagnosis. Gautier has collected ninety-five cases, with forty-one deaths. In my own experience a fatal termination has been very rare; but alarming symptoms have often been present.

Diagnosis.—Retro-pharyngeal abscess is to be suspected if there is difficulty in swallowing associated with dyspnœa or mouth-breathing. A positive diagnosis is possible only by a digital examination of the pharynx. The mistake most often made in diagnosis has been, that the physician, called to a young child suffering from great dyspnœa, has jumped to the diagnosis of laryngeal stenosis, and forthwith performed tracheotomy or intubation, without taking the trouble to get the history or to make a careful examination of the pharynx. Many such cases are reported in which the child has died during the operation or immediately afterward, the autopsy first revealing the nature of the disease. If the possibility of this mistake is kept in mind, the error can hardly be made. A sudden attack of dyspnœa with difficulty in swallowing may also be due to the impaction of a foreign body in the pharynx; but a digital examination in this case will enable one to make a correct diagnosis.

Treatment.—Before the abscess has pointed, hot applications should be made to the throat to relieve the symptoms and to hasten the formation of pus, since resolution is so rare as not to be expected. Spontaneous opening should never be waited for, on account of the danger of the rapid development of serious symptoms from pressure or œdema, or of suffocation from an opening into the air passages, especially during sleep.

As soon as the diagnosis is made the case should be carefully watched, and as soon as well-marked fluctuation is detected, the pus should be evacuated. External incision has few if any advantages and very obvious objections. In opening through the mouth the patient should be seated in an upright position and the head firmly held. A gag should not be introduced, but a tongue depressor may be used, and a bistoury which has been guarded to its point plunged into the abscess at its thinnest point and the incision made toward the median line. The head should then be bent forward, to allow the pus to escape through the mouth. It is well to insert the finger into the cavity and break down any septa; for after a simple puncture the abscess may refill. Incision, although usually easy, in some cases may be quite difficult on account of the swelling and the small pharynx of the infant. For the past few years I have adopted the plan of opening these abscesses with the finger nail, a procedure simple, efficient, and free from danger. While the patient is held as above described, the wall of the abscess is perforated by the nail of the forefinger, which

has been sharpened to a cutting point. I have yet to see a case in which this was at all difficult. The amount of pus evacuated is from one drachm to half an ounce. In the majority of cases no after-treatment is required. The relief of the dyspnœa and dysphagia is immediate, and recovery rapid.

An instructive accident, which came near being fatal, occurred in a case at the New York Infant Asylum. An infant seven months old had shown for twenty-four hours stertorous breathing, difficulty in swallowing, and had refused to nurse. Examination showed the presence of quite a large abscess in the right pharyngeal region. A gag was introduced by the house surgeon preparatory to the evacuation of the abscess by incision, when the child became asphyxiated, and respiration ceased although the gag was immediately removed. Intubation was performed, but with a good deal of difficulty on account of the displacement of the larynx, and artificial respiration was required for several minutes before the patient was resuscitated. The abscess was incised half an hour later without the introduction of a gag, and the intubation tube removed. The attack of asphyxia was evidently produced by the stretching of the mouth by the gag, and the increased pressure thereby produced upon the larynx.

Retro-pharyngeal Abscess from Pott's Disease.—This form is rare in comparison with that just described, and under three years of age it is extremely so. These abscesses are usually larger, and the amount of pus contained may be from four to eight ounces. They form very much more slowly, often lasting for months, and, like other secondary abscesses, the constitutional symptoms are seldom severe. The swelling is frequently in the median line, and is not so circumscribed as in the idiopathic cases. The pus often burrows along the spine for several inches.

The symptoms of Pott's disease of the cervical region are usually present for several months before the appearance of the abscess. Sometimes the abscess precedes the deformity, and it may be the first intimation of the existence of bone disease. The local symptoms resemble those of the idiopathic cases, but they develop more slowly, and sudden attacks of fatal asphyxia are very rare. External swelling is usually seen, and it may be quite large, extending almost from one ear to the other, forming a distinct collar. On digital exploration there may be found an irregularity of the anterior surfaces of the cervical vertebræ, and occasionally a marked angular prominence.

When left to themselves these abscesses may open externally in front of the sterno-mastoid muscle, just below the jaw, sometimes nearly as low as the clavicle; they may rupture internally into the pharynx, the œsophagus, or the air passages; or they may burrow a long distance in front of the spine. Death may result from pressure upon the larynx, or from rupture into the larynx, trachea, or pleura; all these, however, are rare. The

abscesses not infrequently refill after they are evacuated, and occasionally a discharging sinus is left for many months.

Treatment.—These abscesses should be opened as soon as they are large enough to give rise to local symptoms. The external incision just in front of the sterno-mastoid muscle is generally to be preferred to opening through the mouth, since it gives better drainage, and the after-treatment is more easily carried on; and a sinus opening externally is less objectionable than one opening into the pharynx.

ADENOID VEGETATIONS OF THE VAULT OF THE PHARYNX.

This is a very common and, by the general practitioner, a much neglected condition. It is the source of more discomfort and the origin of more minor ailments than almost any other pathological condition of childhood.

There is a mass of lymphoid tissue situated at the vault of the pharynx which in structure closely resembles the tonsils. It is often spoken of as the "pharyngeal tonsil." Like the faucial tonsils, and under similar conditions, this may become greatly hypertrophied, so as to form a tumour, which may be so large as to fill the rhino-pharynx completely. These tumours have a broad base, and are attached sometimes more to the roof, and sometimes more to the posterior wall of the pharynx. The term *adenoid vegetations* was given to them by Meyer, who first described them in 1868. These growths may be soft, vascular, and spongy, or hard, firm, and fibrous. The first variety is that usually seen in infancy, and the second more often in older children. In a very considerable proportion of the cases there is associated hypertrophy of the tonsils. As a result of the growth there is sometimes present a very high palatine arch amounting almost to deformity.

Etiology.—That condition spoken of in another chapter as the lymphatic diathesis, or "lymphatism," is the one upon which these growths most frequently depend. Often every member of a large family of children is affected, and frequently both parents also. This may occur when there are no other evidences of disease except this tendency. Delicate and rachitic children are, however, more prone than others to this affection. It is most common in damp, changeable climates. The first symptoms usually follow an attack of influenza, measles, scarlet fever, diphtheria, or repeated attacks of ordinary coryza. They generally begin to be troublesome when children are about two years old; there are many cases, however, in which it seems pretty clear that the condition is a congenital one. Many observers hold this view regarding most of the cases.

Symptoms.—The symptoms of adenoid growths are those which relate to the chronic rhino-pharyngeal catarrh and to the mechanical obstruction. In infants and very young children the catarrhal symptoms are

apt to predominate; in older children, the obstructive symptoms. The chronic catarrh shows itself by a persistent nasal discharge, which is of a sero-mucous or muco-purulent character, very rarely tinged with blood. This may be continuous, with exacerbations which occur with every fresh cold and with every period of damp weather, or there may be intervals in which the symptoms are absent. In dry weather and in summer the discharge usually ceases entirely, coming on again when the damp weather of autumn and winter returns. This is the condition which underlies the repeated severe head-colds from which so many children suffer every cold season. The symptoms of obstruction are mouth-breathing, nasal voice, and difficulty in blowing the nose, sometimes total inability to do so. The mouth-breathing may be constant, or it may be noticed only during sleep, being accompanied by loud, stertorous respiration. The difficulty in breathing is increased when the child lies upon the back. In consequence of this, children sleep in all sorts of positions—lying upon the face, sometimes upon the hands and knees, and often toss restlessly about the crib in the vain endeavour to find some position in which respiration is easy. Such symptoms should always arouse suspicion of a lymphoid growth in the pharynx. In a case under recent observation the attacks of dyspnœa at night amounted almost to complete asphyxia. The child would rise upon the hands and knees and struggle violently for breath, often without waking; sometimes respiration would cease for several seconds, and he would awake exhausted and covered with perspiration. The mucus and saliva were drawn back and forth until the lips and mouth were covered with a white foam. During the day the symptoms of obstruction may scarcely be noticed. The continued inability to blow the nose, if associated with nasal discharge, should always be regarded as a suspicious symptom. In several cases this has been the first symptom noticed.

Two other symptoms are common in very young children—frequent attacks of otitis and persistent hoarseness or huskiness of voice which may lead to the suspicion that the larynx is the seat of the disease.

In older children and in neglected cases the symptoms are often more marked. The patients are mouth-breathers, both by day and night. The expression of the face is dull, stupid, often semi-idiotic (Fig. 46). Sleep is never deep, and is always accompanied with stertorous respiration and constant tossing from side to side. The voice is thick, nasal, and "wooden." In severe cases nervous symptoms of quite a serious character may be present. The children are languid, listless, sometimes depressed and prone to melancholy, suffering from frequent headaches and from attacks of indisposition, and often passing for very stupid children.

The hearing is impaired in a very large number of the cases. Blake (Boston) found this true of thirty-nine out of forty-seven cases examined, and in thirty-five of these marked improvement in hearing followed operation upon the growths. Deafness may be due to mechanical causes,

or to otitis. Where the condition has existed from infancy there is often marked deformity of the chest. There may be simply a marked pigeon-breast and prominent sternum with deep lateral depressions (Fig. 45), or there may be a deep depression over the lower portion of the sternum. Deformities are most marked in rachitic patients. These growths often produce anæmia and general malnutrition owing to the constant interference with sleep and obstruction to respiration, and they may be a reflex cause of many neuroses, such as chorea, incontinence of urine, asthma, catarrhal spasm of the larynx, and sometimes even epileptiform seizures.

Fig. 45.—Pigeon-breast due to adenoids of the pharynx.

These patients are always better in summer and worse in winter. The natural course of the growths if left to themselves is to increase up to a certain point and then to remain stationary until puberty. After this time they usually undergo atrophy, and the small ones may disappear entirely. In the more severe cases the symptoms persist, aggravated from time to time during attacks of acute catarrh. A removal to an elevated region with a dry atmosphere will often result in a disappearance of all the symptoms, and the growth may cease to increase in size, but unless such a change in residence is permanent the symptoms are liable to re-

turn. Under ordinary circumstances there is little or no tendency to spontaneous recovery. Patients with adenoid growths contract diphtheria more easily than do others, and in them attacks of diphtheria, scarlet fever, measles, and whooping-cough are all likely to be more severe.

Diagnosis.—In a well-marked case the condition is usually evident from the history, and can scarcely be overlooked. The intractable nasal catarrh, upon which no treatment, local or general, has more than a temporary influence, the mouth-breathing, the disturbed sleep, and the slight deafness—all are characteristic. In some even of the marked cases attention may be drawn to the larynx or to the ears as the seat of disease. At other times the patients come for treatment on account of the general symptoms—the nervous depression, the headaches, or the anæmia. In rare cases the leading symptom may be epistaxis. The symptoms do not always depend upon the size of the growth, for in a small cavity quite a small growth may cause very marked symptoms.

Although the history is in most cases clear, only an examination can make us certain that a lymphoid growth exists. The best method of examination consists in a digital exploration of the pharynx; but this requires a little practice before it is very satisfactory. The head is steadied by the right hand, and the left forefinger is passed up behind the palate. The growth is ordinarily felt as an irregular, soft, velvety mass, and the finger, when withdrawn, is almost invariably covered with blood. The physician must make his diagnosis by the first examination, as the child will allow no repetition. By anterior rhinoscopy, after the use of cocaine, the growth can usually be seen distinctly.

Treatment.—Absorption by internal medication is possible in but few cases. Bosworth reports the best results from the syrup of the iodide of iron, which must be given in doses of from ten to fifteen drops three times a day for a long period. This should be combined with cold sponging and general precautions to prevent a recurrence of colds, and, if possible, the child should pass the winter in a warm, dry climate. These measures may succeed when the growths are small, and where the symptoms are more catarrhal than obstructive. In larger growths and in cases of longer standing, only temporary improvement is likely to follow such treatment. An attempt to reduce by local application, growths of any considerable size, is a waste of time and not to be recommended. My experience has been that, in spite of prolonged local treatment, every marked case has ultimately required operation.

Operation during the spring or summer is generally preferable, but may be performed at any time except during attacks of acute catarrh. Some very expert operators prefer to do without an anæsthetic, and no doubt there are a few of large experience who can operate satisfactorily in most of the cases without anæsthesia. Except for very young children complete anæsthesia is to be preferred, and by chloroform rather than

ether. An exception should be made of cases where the growths are small, soft, and very spongy. These may sometimes be rubbed off with the pulp of the finger or scraped away by the finger nail, without giving the patient or friends any idea that an operation has been done; and this can frequently be accomplished under the plea of simply making a digital examination.

The instruments required are Lowenberg's cutting forceps, Gottstein's curette, and a mouth-gag like that used for intubation. After full anæsthesia is reached, the gag is introduced and the soft palate drawn forward by a blunt hook of hard rubber, or, better, by the forefinger of the left hand, which at the same time acts as a guide to the introduction of the forceps. These are introduced closed and passed up along the poste-

Before operation. Three months after operation.

FIGS. 46 and 47.—Adenoid vegetations of the pharynx; girl twelve years old. (Hooper.)

rior pharyngeal wall, and the mass seized and torn away piecemeal. The first bite of the forceps will often bring away the greater part of the growth when it is of small size; if large, eight or ten repetitions may be necessary. After the greater part has been removed by the forceps the curette is introduced and the pharyngeal vault scraped clean. In a large number of the cases with growths of small or moderate size, the entire mass may be removed by one, or at most two, applications of the curette, without previously using the forceps. This has the advantage that it can be done much more quickly. In most cases the entire operation does not consume more than two or three minutes. The child is turned upon his face, in order that the blood, which flows freely, may escape from the mouth and nose. The head should be kept low during the operation, to prevent the blood from entering the larynx. Hooper and some other writers prefer to operate with the patient in the sitting posture. Each position has its advantages.

The dangers of operation are practically none. Excessive hæmorrhage is extremely rare, although there are two or three recorded cases in which serious and even fatal hæmorrhage occurred. Attacks of acute tonsillitis or otitis occasionally develop after operation. No after-treatment is necessary. The patient remains in bed during the day of operation, and in the house for three or four days, or longer if the weather is unpleasant. No local applications are required. It is probably not necessary that every particle of the growth should be removed, since if the major part is taken away, what remains generally undergoes rapid atrophy. A recurrence of the growths is very rare.

The improvement after the operation is in proportion to the severity of the previous symptoms. The respiration is freer; the sleep becomes quiet; the mouth is soon habitually closed; the voice improves; and the benefit to the general health is in a short time apparent. The whole appearance of the child is often transformed in a few months (Figs. 46 and 47).

CHAPTER III.

DISEASES OF THE TONSILS.

The tonsils* are lymphoid structures closely resembling Peyer's patches, but, instead of having a flattened surface, the lymphoid tissue in the tonsil is folded upon itself, forming quite deep depressions—the tonsillar crypts. These crypts, like the surface of the tonsils, are lined by epithelial cells. They contain lymphoid cells, desquamated epithelium, particles of food, and bacteria. Under normal conditions the tonsils take no part in absorption from the mouth. When, however, their epithelium is rarefied or removed, the tonsils absorb with very great facility every sort of poison which the mouth may contain. Such poisons are taken up by the lymphatics, and through them reach the general circulation.

Acute inflammation of the tonsils, like that of the pharynx, occurs regularly in diphtheria, scarlet fever, and measles, less frequently in the other infectious diseases. The secondary forms will be considered with the diseases with which they are associated.

Acute catarrhal tonsillitis, or inflammation of the mucous membrane covering the tonsils, occurs as a primary disease as a part of the lesion in acute pharyngitis, but very rarely is seen alone. Occasionally the whole mucous membrane covering the tonsils is inflamed and fibrin may be

* For a critical study of the anatomy and physiology of the tonsil, see paper by Hodenpyl, American Journal of the Medical Sciences, March, 1891.

poured out in sufficient quantity to form a distinct pseudo-membrane. These cases, formerly classed as "croupous tonsillitis," will be considered elsewhere under the head of Pseudo-diphtheria.

FOLLICULAR TONSILLITIS.

This is the most frequent and most characteristic form of inflammation of the tonsil. It is essentially an inflammation of the tonsillar crypts, and secondarily of the whole glandular structure.

Etiology.—There is seen in certain children a predisposition to attacks of tonsillitis, so that from very slight exciting causes these occur, sometimes traceable to exposure, sometimes to derangement of the stomach, and sometimes without any evident reason. Children with a rheumatic inheritance appear to be more susceptible than others. One attack predisposes to a second. Patients suffering from chronic hypertrophy of the tonsils are exceedingly prone to acute tonsillitis. It is not very common in infancy, but after this period it is very frequent throughout childhood. The disease, in all probability, begins as an infectious inflammation at the bottom of the crypts, due to the presence of streptococci or staphylococci, which readily enter from the mouth, and excite an attack whenever favourable conditions are present.

Lesions.—As a result of the inflammation, the tonsillar crypts are filled with epithelial cells, pus cells, mucus, and bacteria. These form masses which appear at the mouth of the crypts as small yellow dots, often miscalled ulcers. Sometimes, in addition, fibrin is poured out, and forms, with the other inflammatory products, little plugs which project somewhat from the surface of the mucous membrane, and which can easily be pressed out. Accompanying the changes in the mucous membrane above mentioned, there are acute congestion and swelling of the whole tonsil, with more or less proliferation of the lymphoid tissue. Follicular tonsillitis is always bilateral. Although the pathological process is generally limited to the tonsils, there may be more or less pharyngitis associated.

Symptoms.—The general symptoms usually appear before the local ones, and are often quite severe. The onset is abrupt, with chilly sensations, occasionally a distinct rigour. In infants there is often vomiting, and sometimes diarrhœa. There is pain in the back, in the muscles of the extremities, and in the head. Sometimes there is pain in the lateral cervical muscles. The temperature rises rapidly to 102° or 103° F.; often it touches 104° or 105° F.

The first local symptoms are some swelling of the tonsils and the appearance of isolated yellow spots a little larger than a pin's head. Often these can be wiped off with a swab, or the little plugs can be squeezed out, leaving a slight depression. Later there is acute congestion of the tonsil, with more swelling. Even when the disease is at its height the

local pain and discomfort are only moderate, and in many cases scarcely noticeable. The swelling and tenderness of the lymph glands behind the angle of the jaw are not great, and may be absent.

The constitutional symptoms, as a rule, last three days, and are most severe upon the first day. The local symptoms last somewhat longer, but usually by the end of the fourth day the exudate has disappeared, although enlargement of the tonsil may persist for a week or even longer.

Diagnosis.—Tonsillitis may be confounded at its onset with scarlet fever. We must wait for the rash before deciding positively. Its constitutional symptoms in the beginning closely resemble an attack of malaria, influenza, or pneumonia. The great frequency of tonsillitis makes inspection of the throat imperative in every case of acute illness in children. The diagnosis from diphtheria is considered in connection with that disease.

Treatment.—Follicular tonsillitis is a mild disease without danger to life, and one which runs a short, self-limited course. The indications are, therefore, to make the patient as comfortable as possible by the relief of individual symptoms. Older children, particularly those who are rheumatic, should be treated with salol; four grains every three hours being given for the first twenty-four hours, and later smaller doses. In infants this drug is somewhat difficult of administration on account of its tendency to upset the stomach, and had better be omitted. The general aching pains of the first day are best relieved by phenacetine, two grains every four hours to a child three years old. Later it may be used in smaller doses, but enough should be given to make the patient comfortable.

Local treatment is not absolutely necessary, and in infants may be omitted. Older children may use a gargle of boric acid or a weak bichloride solution—i. e., 1 to 10,000. In all doubtful cases the patient should be isolated, and the same treatment adopted as in a case of diphtheria, until all doubt is removed.

PHLEGMONOUS TONSILLITIS—PERITONSILLAR ABSCESS—QUINSY.

This is an inflammation of the cellular tissue surrounding the tonsil, sometimes invading the tonsil itself. It may terminate in resolution, but usually goes on to the formation of an abscess. Phlegmonous tonsillitis is much less common in children than in adults, and, compared with the other forms, it is a rare disease in early life. It is the only variety which is regularly unilateral. In most cases the inflammatory process is circumscribed, but in rare instances there is seen a diffuse phlegmonous inflammation of the pharynx.

In certain patients there exists a constitutional predisposition to the disease, which is often associated with rheumatism. The exciting causes may be exposure, or anything which may reduce the patient's general

health, to which there is added local infection. Catarrhal pharyngitis predisposes to this disease.

Symptoms.—The onset resembles that of follicular tonsillitis, except that the general symptoms are usually less marked, the temperature is commonly not so high, and the aching pains and prostration less severe. The local symptoms, however, are more marked. There is very severe pain in the throat, which is increased by deglutition, and finally may be so great that swallowing is almost impossible. It is difficult to open the mouth. There is pain in the lateral muscles of the neck, and often tenderness. In the beginning but little can be seen on inspection, even though the patient complains of a very sore throat. This is always a suspicious circumstance, and should lead one to look out for quinsy. It is due to the fact that the inflammation begins in the deeper tissues, and that the mucous membrane is affected later. After twenty-four or forty-eight hours there is usually quite marked swelling, which is rather more behind the tonsil than elsewhere, pushing it upward and forward; sometimes it is more in front of the tonsil. A little later there is intense inflammation of the mucous membrane covering the tonsil, fauces, and uvula, with marked congestion and œdema; the uvula may be pushed to one side, and the isthmus of the fauces diminished to less than one half its natural size. In one of my own cases marked torticollis was present, and existed for two or three days before the diagnosis of quinsy could be made by the other symptoms.

In most cases the recognition of quinsy is quite easy by attention to the symptoms above mentioned. By inspection of the throat, less information is sometimes obtained than by palpation; by this means a fulness, and later a point of fluctuation, can readily be made out. Acute phlegmonous tonsillitis generally involves no danger to life. In very young infants serious results may follow spontaneous rupture during sleep; and in older children occasionally there may be œdema of the glottis. If not treated, abscess usually forms in from five to seven days, and opens spontaneously.

Treatment.—If an early diagnosis is made an attack of quinsy may occasionally be aborted. For this many drugs have been advocated, but to my mind the best is salol, which should be given in doses of two grains every two hours to a child of five years. In some patients larger doses may be used. This may be combined with small doses (gr. $\frac{1}{4}$) of Dover's powder. Relief may be afforded by very hot or cold applications, according to the sensations of the patient. The holding of ice in the mouth and the application of an ice-bag externally, often give great comfort. In other cases, gargling with very hot water and the application of hot flaxseed poultices externally, will be preferred. As soon as fluctuation is detected an incision should be made with a guarded bistoury. If made too early, only a small amount of pus is evacuated and the abscess may

refill. After spontaneous rupture the relief to symptoms is usually immediate.

CHRONIC HYPERTROPHY OF THE TONSILS.—CHRONIC TONSILLITIS.

The condition known as chronic hypertrophy, is a permanent enlargement due to a proliferation of the lymphoid tissue of the tonsils, and an increase in the connective-tissue stroma. If the increase in the connective tissue is slight, the tonsil is soft; if it is great, the tonsil is firm and hard, almost like a fibrous tumour. All degrees are found. Associated with hypertrophy of the tonsils there are frequently found adenoid growths of the pharynx, both of these depending upon similar local and constitutional conditions. There is in nearly all marked cases a chronic pharyngeal catarrh which may involve the Eustachian tubes.

Etiology.—Hypertrophy of the tonsils is an exceedingly common condition in the cities of the seacoast and lake districts of the temperate zone. In a routine examination of 2,000 New York school children, Chappell found enlargement of the tonsils sufficiently marked to be considered pathological, in 270 cases. The causes are constitutional and local. The constitutional causes relate to the conditions described in the chapter upon Lymphatism. This is often found in certain families for several generations. The condition is not connected with tuberculosis. It occurs in children who are in other respects healthy. Hypertrophy of the tonsils is often a congenital condition, increasing slowly during infancy, so as to produce marked symptoms by the time the child is two years old. The most important of the local causes are attacks of acute or subacute pharyngitis. While it is true that attacks of acute inflammation are often the cause of hypertrophy, it is also true that hypertrophy is one of the most frequent predisposing causes of acute attacks, and that it may be seen in children who have never had tonsillitis.

Symptoms.—Hypertrophy of the tonsils is rarely marked enough to cause any decided symptoms before the end of the second year, although I once saw in a younger child enlargement sufficient to bring the two tonsils into contact. The most important local symptoms, formerly ascribed to hypertrophied tonsils, are now known to depend upon adenoid growths of the pharynx. As these conditions are so frequently associated, it is somewhat difficult to determine which symptoms are due to the tonsils alone. In a marked case, the most prominent symptoms are mouth-breathing, disturbed sleep accompanied by snoring, and nasal voice—the patient in some cases talking as though he had food in his mouth. There may be some difficulty in swallowing solid food. Enlarged tonsils may often be felt externally. As a consequence of the obstruction of the Eustachian tubes there may be deafness. Deformities of the chest, such as pigeon-breast, are occasionally seen, but probably depend more upon obstructed respiration by adenoids than by the tonsils.

The soft tonsils may diminish somewhat in size spontaneously. They sometimes shrink very decidedly after an attack of acute tonsillitis, scarlet fever, or diphtheria. As a rule the tonsils become firmer and harder as time passes. They usually increase in size up to a certain point, and then remain nearly stationary until about puberty, when they may diminish considerably. During intercurrent attacks of inflammation, the swelling is much increased and the symptoms are proportionately aggravated. In cases of marked enlargement very little spontaneous improvement is to be looked for during childhood.

Treatment.—Very large tonsils are a source of continued danger to the patient, and in every case of marked hypertrophy treatment should be advised. The danger may be from Eustachian catarrh and deafness, or from repeated attacks of acute tonsillitis. But quite as important as these is the fact that they increase the liability to contract diphtheria, and add to the dangers both of diphtheria and scarlet fever. If the patient is removed from the locality in which acute tonsillitis is likely to occur, to a high, dry climate, considerable improvement is likely to result in a young child in whom the tonsils are soft, but not much is to be expected in older children with hard, fibrous tonsils, except, perhaps a cure of the accompanying pharyngeal catarrh.

The only internal remedy offering much chance of benefit is, in my experience, the syrup of the iodide of iron, which must be given in quite large doses (twenty drops three times a day to a child of five years), and continued for several months. In a small number of cases marked improvement is seen from this treatment, but in the majority but little change occurs. Astringent applications may accomplish something in recent, but practically nothing in old cases. In a marked case, operation is the only thing which can be relied upon to effect a cure. In those in which it is decided not to operate, or in which operation is refused, a faithful trial may be made with the other measures referred to. The question to be decided always is whether or not operation shall be done. For convenience of consideration, the cases may be divided into three groups: (1) those in which the tonsils are nearly or quite in contact;(2) those in which they project not more than one fourth of an inch beyond the faucial pillars; (3) the intermediate cases. All of the first group should unquestionably be operated upon, unless the patient's general condition is such as to forbid operation of any kind. Of the second group, few if any require operation. Whether an operation is done in the third group will depend upon the individual case. If there are frequent attacks of acute tonsillitis, and some deafness, an operation should be performed. If little or no local discomfort is experienced it may be postponed.

Of the various operations proposed, excision with the guillotine is the one which has in children superseded all others in the practice of New York physicians. The risk of hæmorrhage at this age is very slight.

The child is held as for the operation of intubation, except that the head is thrown backward. No after-treatment is required, excepting fluid diet and confinement to the house for two or three days. Excessive hæmorrhage may be controlled by digital pressure, or by the application of styptic cotton upon a swab; in extreme cases, by transfixing the tonsil stump with a hare-lip pin and the application of a ligature. I have more than once seen physicians greatly alarmed at the gray wound on the day following tonsillotomy, the appearance being such as to lead in several cases to the diagnosis of diphtheria. This mistake will not be made if the possibility of it is borne in mind. It is seldom that any but good results follow the operation of tonsillotomy if properly performed. It is too often neglected. Where adenoids of the pharynx are also present, the symptoms may depend more upon them than upon the enlarged tonsils, and little benefit is seen until the adenoid growths also are removed. Both may be operated upon at a single sitting, or at two sittings if preferred.

It is not usually necessary to remove the tonsil to a point even with the faucial pillars, but the more nearly we can come to this the better. The amount of shrinkage from cicatrization after operation has been, in my experience, generally less than was expected. As a rule, enlargement of the tonsil subsequent to an operation is not seen; but one should be careful about promising parents that it will not occur. I have seen it in two or three instances to a striking degree, and think it more likely to occur if children operated on are very young—i. e., before the third year.

CHAPTER IV.

DISEASES OF THE ŒSOPHAGUS.

MALFORMATIONS.

Congenital anomalies of the œsophagus are much less frequent than those of the lower part of the respiratory tract, with which, however, they are often associated.

There may be, (1) Congenital fistula of the neck, due to a want of closure between the second and third branchial arches. This gives an external opening just above and to the outside of the sterno-clavicular articulation, which communicates with the upper part of the œsophagus or the lower part of the pharynx. (2) The œsophagus may be absent, the pharynx ending in a blind pouch. (3) The œsophagus may be obliterated in certain portions, being represented only by a fibrous cord. (4) There may be stenosis and dilatation or diverticula. (5) There may be a

fistulous communication with the trachea, existing either alone or associated with some of the other deformities mentioned.

Congenital narrowing of the œsophagus and fistula of the neck are amenable to surgical treatment. The cases of complete obstruction in the œsophagus are almost of necessity fatal, the patients dying from inanition two or three days after birth.

The symptoms of œsophageal obstruction are regurgitation on attempts at swallowing and the impossibility of passing the stomach tube.

ACUTE ŒSOPHAGITIS.

It is quite remarkable, considering the frequency of pathological processes in the pharynx, that these so rarely extend to the œsophagus. Thrush, when very extensive in the pharynx, may involve the upper part of the œsophagus; but there it gives rise to new symptoms. Diphtheria and pseudo-diphtheria of the pharynx may invade the œsophagus, but this is seen only in very rare instances. In about seventy-five autopsies which I have seen in cases of diphtheria, the œsophagus was involved in but one, and in this case for three or four inches only. Diphtheria of the œsophagus produces no symptoms, and can not be diagnosticated during life.

Catarrhal Œsophagitis is very rarely met with. It may be caused by lacerations due to swallowing a foreign body, which may excite a simple catarrhal inflammation, or, if the foreign body is sharp and angular, lacerations may be produced which result in ulcerations of variable depth. The chief symptoms of catarrhal œsophagitis are soreness and pain on swallowing. These lacerations, when slight, are healed in a few days, and are rarely followed by any after-effects.

Corrosive Œsophagitis.—This is altogether the most frequent form, and the only one which is of clinical importance. The usual causes are the same as of corrosive gastritis, viz., the swallowing of caustic alkalies or strong acids. It is often in the œsophagus that the most extensive injury is done. The effects are superficial or deep, according to the amount of the irritant swallowed and its degree of concentration. There may be simply a destruction of the epithelial layer, which is followed by no serious consequences, or the mucous membrane may be destroyed and the submucous coat invaded; rarely, however, does the injury extend to the muscular layer. If the patient survives the dangers incident to the irritant poisoning and the acute inflammation which follows, healing by granulation and cicatrization takes place, the contraction of the cicatrix gradually narrowing the lumen of the œsophagus until stricture is produced.

The early symptoms of corrosive œsophagitis are mingled with those of inflammation of the mouth, pharynx, and stomach. There is a burning pain in the parts, great thirst, spasm of the œsophagus on attempts at

swallowing, so that deglutition may be almost impossible. There follows a period of acute inflammation of several days' duration, in which the chief local symptoms are dysphagia and pain, and in which the principal danger is that of suffocation from œdema of the glottis. After this period has passed, the patient may be comparatively well until the symptoms of stricture begin, usually in from three to six months after the injury.

The indications for treatment in the early stage, are to neutralize the caustic in order to prevent if possible its deep action, and in all cases to give oils, demulcent drinks, and ice for the local effect, and morphine for the pain.

The treatment of œsophageal stricture is purely surgical, and for this the reader is referred to surgical text-books.

RETRO-ŒSOPHAGEAL ABSCESS.

Retro-œsophageal abscess may result from the breaking down of tuberculous lymph nodes in the posterior mediastinum, and may give rise to symptoms like those which result from an abscess due to Pott's disease, from which it can not be diagnosticated. Retro-œsophageal abscess or peri-œsophagitis may occur in children after measles, scarlet fever, influenza, or with syphilis. Here its pathology is the same as retro-pharyngeal abscess, differing only in location. Retro-œsophageal adenitis, or enlargement of the lymph nodes in the posterior wall of the œsophagus, not going on to suppuration, is a rare condition. I have recently met with a case in which a tumour nearly an inch in diameter was formed at the upper part of the œsophagus, and which caused pressure symptoms, necessitating tracheotomy. The growth was at first believed to be of a malignant character, but it completely disappeared after four or five months of general treatment, including a summer in the country.

Perforation of the œsophagus, and a food-fistula connecting the œsophagus and the trachea, may result from ulceration caused by a tracheal canula or by a foreign body. This may be accompanied by abscess.

The most common variety of retro-œsophageal abscess is that due to Pott's disease of the lower cervical or upper dorsal region. The symptoms are obscure, and an exact diagnosis is not often made during life. Death may occur quite suddenly where the previous symptoms have been so slight as to be easily overlooked. The following is a fair example of such a case :

A little girl two years old, of a tuberculous family, was admitted to the Babies' Hospital in December, 1892, with spinal caries of the upper dorsal region. The symptoms were of two months' duration, and already there was a spinal deformity consisting of a small knuckle. The patient was kept in bed and a plaster-of-Paris jacket applied. A slight febrile action of irregular type was present. About a month after admission

dyspnœa was first observed; this was at times quite intense, and again almost absent. It was always on inspiration, expiration being easy. No explanation for this was found in the lungs. There was no difficulty in swallowing, and very little cough. After these symptoms had lasted for about a week, the child while eating was suddenly seized with violent dyspnœa, and in a few moments became completely asphyxiated. Tracheotomy was immediately done, and by means of artificial respiration the patient was restored to comparative comfort. About two hours later a second attack occurred, and the patient died in an hour. At the autopsy there was found an abscess a little larger than a hen's egg, containing about two ounces of curdy pus, overlying the bodies of the first three dorsal vertebræ and communicating with them. These vertebræ were carious. The right pneumogastric nerve, an inch and a half above the bifurcation of the trachea, was compressed between the abscess and a large tuberculous lymph node, with the capsule of which it was blended. In the lungs were a few small tuberculous deposits and the usual conditions found in death by asphyxia. The dyspnœa seems to have been of nervous and not of mechanical origin, and caused by irritation of the pneumogastric. The fatal issue was apparently from an increase of the pressure upon the nerve.

A case almost identical with this has been reported by Chapin, and others quite similar by Ripley, Richards, and Jarisch. In none of these was difficulty in swallowing present, probably because the œsophagus was compressed only upon one side. In all there were symptoms of irritation of the pneumogastric, or the recurrent laryngeal branch—stridulous breathing, inspiratory dyspnœa, and spasmodic cough, with or without slight hoarseness. In one case only was there aphonia. After such symptoms as these have existed for a few days or weeks there usually comes a sudden attack of asphyxia. The first attack may be fatal, or there may be several of a milder character before the fatal one. In two cases this followed a full meal, probably from the increase of pressure due to distention of the stomach. In two cases tracheotomy was done, but gave temporary relief only.

The diagnosis of this condition is very difficult, and a positive diagnosis almost impossible. It may be suspected in cases of Pott's disease of the lower cervical or upper dorsal regions, when there is spasmodic inspiratory dyspnœa, especially if accompanied by irritative cough. It should, however, be remembered that precisely similar symptoms may depend upon the irritation of a tuberculous node, and that the sudden asphyxia is exactly like that caused by the ulceration of such a node into the trachea or a large bronchus. The latter, however, may occur without the presence of Pott's disease. If the abscess is higher up, there may be a lateral swelling on either side of the neck, just above the clavicle. In most of the cases there are no external signs of disease. Such abscesses are too

low to be reached by digital examination of the pharynx. The attack of asphyxia may also be confounded with that due to the presence of a foreign body in the larynx.

The prognosis in cases of retro-œsophageal abscess is exceedingly bad. Death usually results from pressure upon the pneumogastric, as in the cases reported. The abscess may rupture into the œsophagus and recovery follow. This termination is very rare, but such a case has been reported by Knight. A fatal one is reported by Löschner and Lambl. The abscess may burrow along the œsophagus into the abdominal cavity and excite peritonitis; finally, it may open externally.

But little is to be said under the head of *Treatment*. The symptoms are rarely definite enough to justify a radical surgical operation. Tracheotomy gives but temporary relief to the asphyxia. This operation should be performed, however, in every case, because of the impossibility of making an exact diagnosis of retro-œsophageal abscess from other conditions in which the operation might be curative.

CHAPTER V.

DISEASES OF THE STOMACH.

It is difficult, wholly to separate diseases of the stomach from those of the intestines. Although in older children they are often quite distinct, in infancy they are more frequently associated; but at one time the gastric symptoms may be prominent, and at another the intestinal symptoms. Functional disorders particularly, are likely to involve the whole tract. Serious organic lesions are more frequently limited in their extent either to the stomach or to the intestine. The former are rare, while the latter are very common. The diseases in which the stomach is alone or chiefly involved will be considered by themselves. Those in which both the stomach and intestine are involved are classed with the intestinal diseases, as the intestinal symptoms usually predominate.

DIGESTION IN INFANCY.

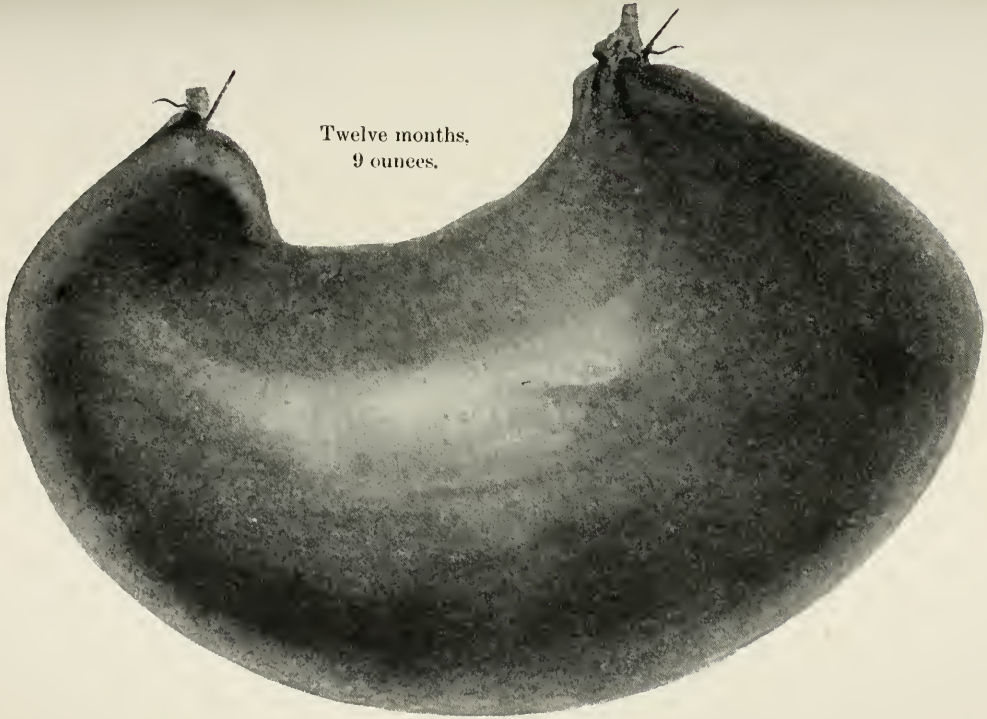
The first step in the process of digestion in the newly-born infant is sucking. During this act the nipple is grasped between the lower lip and tongue below, and the upper lip and jaw above. The back of the mouth is closed by the fall of the palate. A strong downward movement of the lower jaw rarefies the air in the mouth, and produces the suction force which causes the milk to flow. Sucking can be carried on only when the nose is free for respiration and the palate and upper jaw intact. Children with deformities of the mouth, like cleft palate and harelip, suck only

Birth,
1 ounce.

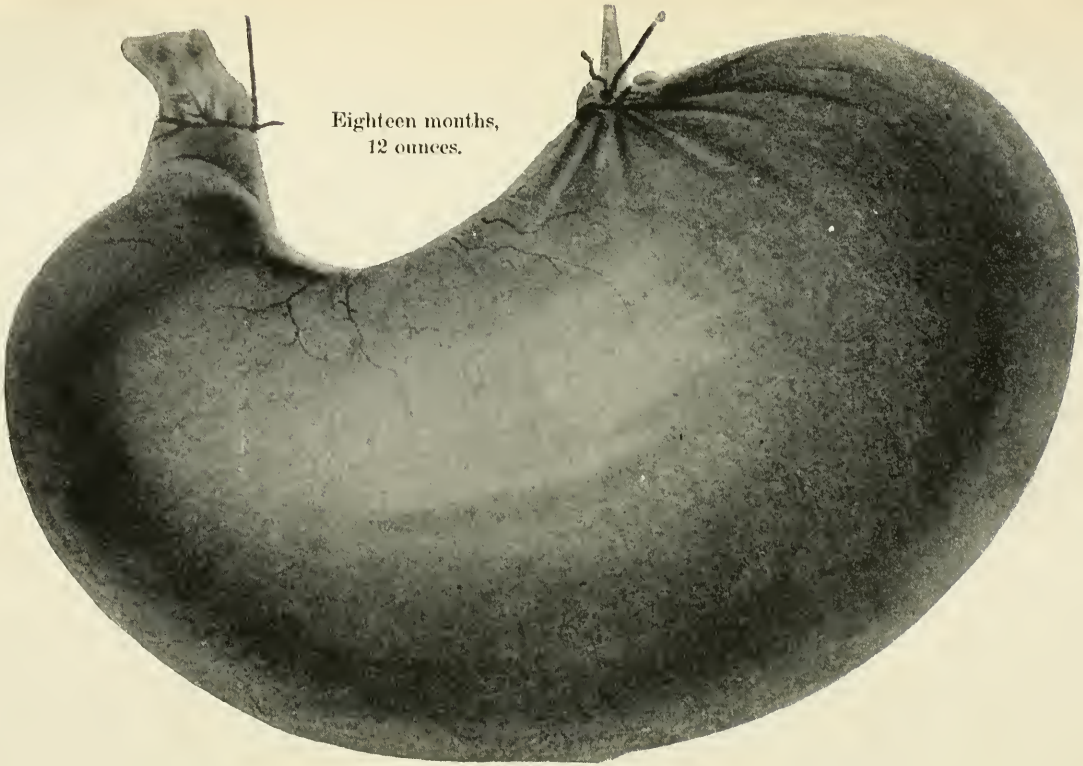
Two weeks,
2 ounces.

Three months,
4½ ounces.

Six months,
6 ounces.



Twelve months,
9 ounces.



THE STOMACH AT THE DIFFERENT PERIODS OF INFANCY.

Life size, from photographs.

with the greatest difficulty, and complete nasal obstruction prevents nursing.

The Saliva.—This is present at birth only in very small quantity, and the part which it plays in digestion in early infancy is an insignificant one. During the third and fourth months it increases markedly in amount, and at this time it possesses quite actively the power of transforming starch into sugar. This property is present only to a very slight degree during the first eight or ten weeks. With the advent of the teeth there is a further increase in the amount of saliva secreted, indicating a change in the digestion of the infant.

The Stomach.—The position of the stomach in the fœtus is nearly vertical. In the newly-born child it lies obliquely in the abdomen, and at the end of infancy has almost reached the transverse position. The stomach at birth is nearly cylindrical, but the fundus increases quite rapidly during the first year, although it does not reach its full development until quite late in childhood. In Plate VII are shown the actual size and shape of the stomach at the various periods of infancy. In the following table are given the results of post-mortem measurements of the stomach, which I have personally made in ninety-one infants under fourteen months of age:

The Capacity of the Stomach.

Age.	Number of cases.	Average capacity.	Age.	Number of cases.	Average capacity.
Birth.....	5	1·20 oz.	12 weeks.....	6	4·50 oz.
2 weeks.....	7	1·50 "	14 to 18 weeks...	12	5·00 "
4 "	4	2·00 "	5 to 6 months...	14	5·75 "
6 "	11	2·27 "	7 to 8 " ...	9	6·88 "
8 "	4	3·37 "	10 to 11 " ...	7	8·14 "
10 "	2	4·25 "	12 to 14 " ...	10	8·90 "

In brief, the average capacity was, at birth, one and one fifth ounce; at three months, four and a half ounces; at six months, six ounces; at twelve months, nine ounces.

Gastric digestion.—The part taken by the stomach in digestion is smaller than was formerly supposed, and not so important in infants as in adults. The food leaves the stomach so rapidly that a large part of the casein must pass into the intestine before it is converted into peptones. The opinion has been steadily gaining ground that the function of the stomach is largely that of a reservoir, into which the milk is received and from which it is allowed to pass gradually into the intestine; and that the gastric process is only a preliminary and partial one, even in the digestion of proteids, this being completed in the intestine.

The only part of the food acted on in the stomach is the proteids, which are transformed successively into acid-albumin, albumoses, and peptones. This is accomplished by the agency of the pepsin and the acid

of the gastric juice—generally hydrochloric acid, although lactic acid may take its place. Pepsin is found in the stomach at birth, and even in the embryo as early as the fourth month (Krüger). The reaction of the stomach in fasting is acid, and at this time usually free hydrochloric acid can be demonstrated. Soon after a meal of human milk it is alkaline or neutral; after one of cow's milk it is acid or neutral. In fifteen minutes after feeding the reaction is always acid (Leo). Free hydrochloric acid can not usually be demonstrated until about an hour after feeding, then only in small quantities, and in very many cases not at all. Some good observers go so far as to say that in health free acid is never found during digestion. The reason for this apparently is, that the acid combines with the casein of the milk, that of cow's milk in particular having a very great power of combining with hydrochloric acid.

Lactic acid is feebler in its digestive power than hydrochloric acid. It is more abundant early in infancy than later, and its source is the milk sugar. It is rarely found as free acid; never in health, according to many observers.

The coagulation of milk in the stomach is accomplished through the agency of the rennet ferment (the lab-ferment of Hammarsten). This is independent of both the pepsin and the acid of the stomach. It acts in acid, alkaline, and neutral media. Coagulation is the first change in the milk in the stomach. Human milk coagulates in loose flocculi and quite imperfectly, more firmly if the stomach is very acid. Cow's milk, unless diluted, coagulates in firm, compact masses. Under the influence of pepsin and hydrochloric acid, solution of this coagulum now begins; but this is only partially accomplished in the stomach. It goes forward much more rapidly in the case of human milk, because the amount of casein is less and because of the smaller curds. The milk begins to leave the stomach very soon after the meal, and even during the first half hour a considerable part passes into the intestine. At the end of an hour the stomach in a young infant is often empty. In the case of cow's milk, not only are the coagula firmer, but the amount of casein present is much larger, and hence the milk is detained in the stomach a longer time; even then a considerable portion of it must pass but little changed into the intestine.

The duration of gastric digestion varies with the age of the infant and with the food. During the first month the stomach of healthy nursing infants is usually found empty in an hour and a half after feeding; often after one hour. In those taking cow's milk the average is at least half an hour longer. In infants from two to eight months old the average is two hours for those receiving breast milk, and two and a half to three hours for those fed upon cow's milk. This is influenced by the size of the meal taken. This period is very much longer in all cases of disordered digestion.

The bacteria of the stomach are very few as compared with the intestine, and no varieties are constantly present (Booker).

The Intestines.—The length of the small intestine at birth is about nine feet; that of the large intestine about eighteen inches. The great length of the sigmoid flexure is the most striking peculiarity, this being nearly one half the length of the large intestine. (See page 64).

Intestinal digestion.—All the important elements of food—proteids, carbohydrates, and fats—are acted upon by the pancreatic juice. The proteids are converted into peptones by the trypsin, which is active only in an alkaline medium. How much of the proteids of the milk is left for intestinal digestion, depends upon how well the stomach has done its part. In every case something is left; in most cases a large part of the proteids passes but little changed into the intestine. The diastatic ferment of the pancreas has the power of converting starch into sugar. This action is feeble during the first six months, and, according to Koronin and Zweifel, it is entirely absent in early infancy. Fats are emulsified by a third ferment in the pancreatic juice, in connection with bile, which probably furnishes the needed alkali. Some of the fats are also saponified. The pancreatic juice actively emulsifies fat, even at birth.

The very large size of the liver in the newly born indicates how important are its functions in digestion. The biliary secretion is present as early as the third month of fœtal life (Zweifel). Bile assists in the digestion and absorption of fats, as has already been mentioned. In addition it is a stimulus to peristalsis, and in this way aids in the absorption of all kinds of food. Its antiseptic effect is very doubtful. It has a feeble diastatic action upon starch. The greater part of the bile is reabsorbed from the intestine.

Milk sugar is changed into galactose (Biedert), cane sugar into dextrose and levulose, all three being closely allied substances. Through what agency these changes are accomplished is not now positively known, but it is probably the pancreatic juice.

The action of the intestinal juice is not perfectly understood; its chief function is thought to be diastatic. It is alkaline in reaction, and probably facilitates the action of the trypsin, the diastatic ferment, and the absorption of fats.

Absorption.—From the stomach, absorption of water, salts, sugar, and peptones may take place directly into the blood. From the small intestine, in addition to the above elements, fat is absorbed especially by the villi. Absorption is less active than secretion in the small intestine, except in the duodenum. It is accomplished through the agency of the villi and the simple follicles of the mucous membrane. It is perhaps partly by filtration and endosmosis, but chiefly through the activity of the epithelial cells themselves (Hoppe-Seyler, Haidenhain). Absorption from the large

intestine is quite imperfect. There are no villi, and hence fat absorption is very slight. Sugar, salts, and peptones, however, may be absorbed with moderate facility. Since there is little or no digestive activity in the large intestine, if this is used as a means of nutrition, the food must be given in a condition in which it is ready for absorption.

Even in healthy nursing infants complete absorption takes place only of the milk sugar. From two to five per cent of the proteids and fats taken, pass through the intestinal canal. In infants taking cow's milk the fat-residue is from one to three per cent greater than in those who are breast-fed (Uffelmann). Even when the amount of fat given is considerably greater than that usually present in cow's milk, it may be almost entirely absorbed. In infants taking cow's milk the proteid residue is relatively much greater than that of the fat.

In cases of indigestion the increase in the food-residue in most cases is first in the proteids, next in the fat, and least in the sugar. In some of the chronic cases the principal increase may be in the fat-residue.

Intestinal Bacteria.—For the fundamental work upon this subject we are indebted to the researches of Escherich. Bacteria are absent from the entire gastro-enteric tract at birth. They quickly enter by the mouth, and by the end of twenty-four hours they are usually found in all parts of the intestinal tract. The meconium-bacteria are derived from the inspired air, and hence vary somewhat with surroundings. As soon as the ingestion of milk begins these varieties are displaced, and throughout the period in which the infant has this food exclusively, there have been found in healthy conditions but two varieties which are constantly present. These are the *bacterium lactis aerogenes* and the *bacterium coli commune.* The first is found most abundantly in the upper part of the small intestine, diminishing as we descend, in small numbers only in the colon, and usually none are in the fæces. It seems to require for its growth the presence of milk sugar, hence its absence from that part of the intestine where milk sugar is not found. Milk sugar is decomposed by it with the formation of lactic acid (acetic, according to Baginsky), carbon dioxide, hydrogen, and methane. This action is not hindered by the bile. The *b. lactis* has no action of importance on either the fat or casein of the milk.

The *b. coli commune* is found in but small numbers in the upper small intestine, becoming more abundant as we descend. In the colon and in the fæces it is present in immense numbers, and in the fæces is sometimes almost the only variety. The activity of the *b. coli commune* apparently begins where that of the *b. lactis* ends, viz., in the lower part of the small intestine. It does not seem to depend for its growth upon any part of the food, but upon the intestinal secretions. A change from a milk diet to a mixed diet of meat and farinaceous food, produces a constant change in the bacteria of the intestine. The *b. lactis* disappears;

the *b. coli commune*, however, continues to be found as the principal form of the colon.

Regarding the meaning of these bacteria but little is as yet known. We do not know whether they are essential to healthy digestion or prejudicial to it. The *b. lactis* is believed not to be pathogenic. There seems to be accumulating evidence in favour of the view that the *b. coli commune*, though not ordinarily pathogenic, may under certain conditions become so.

Fæces.—The first discharges after birth are called meconium; this is of a dark brownish-green colour, semi-solid, and usually passed from four to six times daily during the first two or three days. On the third day the stools begin to change in character, and by the fourth or fifth day they have usually assumed the appearance of healthy milk-fæces. Under many abnormal conditions the stools may continue to have the character of meconium for a week or more. The composition of meconium, according to Forster, is intestinal mucus, bile, the vernix caseosa, epithelial cells from the epidermis, hairs, fat-globules, and cholesterin crystals. For its formation there are necessary the secretions of the intestine and the liver, and the swallowing of a considerable amount of amniotic fluid.

Milk-fæces.—The normal amount of fæces discharged daily by a healthy nursing infant is from two to three ounces. Such stools have the colour of the yolk of egg. They are smooth, homogeneous, of a soft, butter-like consistency, with an acid reaction, and a slightly acid but not unpleasant odour. The reaction is due to the presence of fatty acids (Biedert) or lactic acid (Uffelmann). The colour depends upon bilirubin. The stools of an infant fed upon cow's milk may differ in no respect from those described; they are, however, commonly firmer, paler, and may be neutral or even alkaline in reaction, depending upon the decomposition of casein. In fact, all these differences depend chiefly upon the presence of undigested casein.

The only gases present are hydrogen and carbon dioxide (Escherich). Sulphuretted hydrogen and marsh gas, to which the odour of adult stools is largely due, are not present. The following is the chemical composition as given by Wegscheider:

Water			85·13
Solids	Organic	13·71	14·87
	Inorganic	1·16	
			100·00

The proteids of breast milk are almost entirely absorbed. According to Uffelmann, they form but 1·5 per cent of the dry residue of the fæces. The stools of infants fed upon cow's milk are usually larger, and invariably contain casein. If the casein in the milk as fed is excessive, it may be present in the fæces in large amount, the stools then being of a pale

yellow or white colour, quite dry, often formed, and with an odour sometimes cheesy, at other times foul.

Fat is always present, and forms, according to Wegscheider and Uffelmann, from 9 to 25 per cent of the dry residue of milk fæces. According to Tschernoff and some other recent observers, the proportion is as high as 28 to 35 per cent. It is present as neutral fat, fatty acids, and soaps. Sugar is not found, but its derivative, lactic acid, may be present in a small amount. Inorganic salts form about 8 per cent of the dry residue. They are chiefly the salts of lime. Of the biliary elements there are hydrobilirubin, unchanged bilirubin, and cholesterin in considerable amount. The presence of biliary acids is doubtful. Mucus is always present in considerable quantity; also columnar intestinal epithelium. Leucin, tyrosin, and other products of albuminous decomposition—phenol and skatol—are absent; indol is rarely found (Uffelmann).

Microscopically there are seen epithelial cells, chiefly of the columnar variety, a few round cells, mucous corpuscles, fat-globules and crystals of fatty acids, cholesterin, mucin, protein substance, crystalline inorganic salts, sometimes bilirubin in crystals, yeast fungi, and bacteria in immense numbers, chiefly the *b. coli commune.*

If the infant is taking a food containing starch, this will appear to a greater or less extent in the stools, a larger amount in the case of very young infants. Starch is recognised by the blue reaction with iodine, or the violet reaction if the starch has been converted into dextrine, as is often the case. Starch granules may be seen under the microscope.

The number of stools during the first two weeks is from three to six daily. After the first month two stools a day are the average; many infants have three, many others but one.

As soon as an infant is put upon a mixed diet, the peculiar characters of the stools cease, and they come to resemble more closely those of the adult, though remaining softer throughout infancy. They become darker in colour and assume the adult odour, while retaining their acid reaction. The bacteria, while still in great numbers, are no longer of the single variety met with almost exclusively in milk-fæces.

MALFORMATIONS AND MALPOSITIONS OF THE STOMACH.

These are much less frequent than those of other parts of the alimentary tract. There may be atresia or stenosis at either orifice, usually the pyloric; still more rarely a constriction has been found near the middle of the organ, dividing it into compartments. The symptoms of atresia at either orifice are persistent vomiting, and death in a few days from inanition. The stomach is sometimes in the thoracic cavity in cases of diaphragmatic hernia. It may be found in a vertical (fœtal) position, variously adherent to the colon and small intestine.

VOMITING.

Vomiting is exceedingly frequent in infants and young children, and although seen in many forms of disease, it is the one particular symptom to attract attention to the stomach. The physician must have in mind both its common and its uncommon causes. Vomiting takes place with great facility in young infants even from slight causes, owing to the position and shape of the stomach.

1. *Vomiting from overfilling of the stomach.*—This is often seen in nursing infants, and there may be no other symptom of disease. It is characterized by the fact that it comes within a few minutes after nursing, that it is easy and without effort, and that the food is but little changed. It may be excited by moving the child or making undue pressure upon the stomach. It often comes with eructations of gas or air which has been swallowed. Vomiting from overdistention may be regarded as a safety-valve, and requires no treatment except to diminish the quantity of food.

2. Vomiting is almost invariably present in cases of *acute gastric indigestion*, whether there is inflammation of the stomach or not. It does not usually come immediately after feeding, and it may be delayed for several hours. It is often preceded by fever and by marked prostration, which in young infants may approach collapse. It may cease when the contents of the stomach have been evacuated, but often mucus, serum, and, in severe cases, bile, may be vomited for some time afterward. In these cases vomiting is due to the irritation of undigested food, and to the exaggerated reflex irritability of the stomach from congestion of the mucous membrane.

3. In *acute intestinal obstruction* vomiting is rarely absent, and in most cases it is persistent. In the newly born, persistent vomiting is almost invariably dependent upon congenital obstruction of the intestine, which is most frequently in the duodenum. In malformations of the colon and rectum it is less constant and appears later. In intussusception, vomiting is forcible, immediately excited by the taking of food, and is at first bilious, but later may become fæcal. The vomiting in intestinal obstruction is associated with general symptoms of marked prostration, and usually with obstipation.

4. Vomiting is a frequent and almost a constant symptom of general *peritonitis*. It is then associated with abdominal distention, tenderness, and fever.

5. In certain *nervous diseases*, especially tumour of the brain and acute meningitis whether simple or tuberculous, vomiting is very common. It may be the earliest, and for some time the only marked symptom. As in the vomiting from intestinal obstruction, this is likely to be sudden, forcible, or projectile. It may occur after taking food, or it may have no rela-

tion to meals. The vomited matters are not characteristic, and the tongue may be clean. Headache, dulness, slight fever, constipation, and irregular pulse and respiration are usually present sooner or later, and serve to make the diagnosis complete.

6. In infants, vomiting is one of the most frequent symptoms to mark the *onset of acute infectious diseases.* It is not quite so common in older children. It is most frequent at the onset of scarlet fever, pneumonia, and malaria. In these cases vomiting may be due simply to the arrest of digestion, or to the effects of the poison upon the nerve centres.

7. An accumulation in the blood of various *toxic* materials may provoke vomiting; the most frequent example is uræmia. In cyclic vomiting it is quite probable that the cause is the accumulation of some toxic agent in the blood. The absorption of ptomaines and other poisons taken in with milk or other food, or developed in the gastro-enteric tract, may excite vomiting. In some of these conditions it is possible that the vomiting may be eliminative—an effort on the part of Nature to get rid of the toxic materials. The cases dependent upon renal disease are discovered by frequent and careful examination of the urine. The other forms are often exceedingly obscure, and recognised only by the exclusion of all other frequent and infrequent causes of vomiting.

8. Vomiting may be *reflex* from irritation in the pharynx. This is frequent in young infants, who may induce vomiting by stuffing the fingers into the mouth. In certain cases the irritation from worms in the intestinal tract may cause vomiting, and it is possible that even dentition may produce it.

9. *Habit* is a frequent cause in cases of chronic vomiting. I have seen a child who had the power of vomiting at will anything in the nature of food which he did not like, yet whose stomach at the same time would bear large doses of quinine, to which he had no aversion, without the slightest disturbance. In young infants a habit of regurgitating the food may be acquired, so that this takes place more or less during the process of digestion after every meal. This is sometimes preceded by a movement of the mouth and fauces resembling swallowing, until finally the milk appears in the mouth. Habit is a potent cause in continuing vomiting where it has occurred frequently. In children who have this habit the most trivial cause will provoke it. It may be present without any other sign of gastric disease, and appears simply to depend upon exaggerated reflex irritability of the organ. These are exceedingly troublesome cases to control. Sometimes small quantities of food are better borne, and sometimes larger meals are retained when small ones are vomited. In some of these children gavage is the only means by which the vomiting can be controlled.

10. *Chronic vomiting* may depend upon habit, as just described, or

upon chronic indigestion, or it may be associated with chronic pulmonary disease; vomiting here being excited by the attacks of cough, at first only when the paroxysms are severe, and later even when they are slight. In chronic indigestion the vomited matters always are characteristic, they have a distinct relation to meals, and they are accompanied by other symptoms of deranged nutrition.

The diagnosis of a case in which vomiting is the chief symptom may be difficult. The first important distinction to be made is between cases in which the vomiting is of gastric origin, and those in which it depends upon other conditions, like intestinal obstruction, cerebral disease, toxic conditions, etc. It is only by a careful consideration of the other symptoms associated that an accurate diagnosis can be reached.

The treatment of vomiting is the treatment of the cause upon which it depends.

CYCLIC VOMITING.

This condition is one which has received but little attention. It is classed by some as a gastric neurosis. While at the present time we are not in a position to give it a definite pathology, it seems to be associated with a general derangement of nutrition which is in some way connected with formation and excretion of uric acid. It is not certain that all these cases have the same origin.

The disease is characterized by periodical attacks of vomiting, recurring at intervals of weeks or months without any adequate exciting cause. The vomiting is severe and uncontrollable, and usually lasts from twelve hours to three days. It is attended with symptoms of general prostration which may be alarming. The children who are subjects of it may show in the interval nearly all the signs of perfect health. The clinical picture presented by these cases is unique, and is well illustrated by the history of the following case, which is the most characteristic one that has come under my observation:

The patient was a well-nourished boy of six years when he first came under treatment. He belonged to a neurotic family, and the attacks dated back to infancy. From this time they had recurred usually at intervals of a few months; occasionally five or six months would pass without one. The symptoms in all the attacks were similar in kind, differing only in degree. I observed three of them. They were preceded by a prodromal period lasting from twelve to twenty-four hours, marked by languor, dulness, dark rings under the eyes, loss of appetite, and a general sense of discomfort in the epigastrium. At this time the temperature was generally but not always elevated, sometimes to 103° F. The vomiting then began suddenly. It was attended with great retching and distress; it was forcible, and often repeated every half hour or hour for two days. On

one occasion it occurred seventeen times in a single night. Vomiting was immediately excited by the taking of any food or drink, but it occurred when nothing was taken. The vomited matters consisted of frothy mucus and serum, frequently streaked with blood, apparently from the violence of the emesis. The reaction was very strongly acid; sometimes there was bilious vomiting. The temperature usually fell to about 100° F. when the vomiting began, and continued at or below this point throughout the attack. By the end of the second day the exhaustion was very marked—so severe, in fact, as apparently to threaten life. The child lay in a semi-stupor, with eyes half open, lips and tongue dry, rousing at times to beg for water. The pulse was rapid and weak, and sometimes slightly irregular. There was no distention of the abdomen; it was usually flattened. By the third day the vomiting became less frequent and then ceased entirely. Convalescence was rapid, and by the end of the week the boy was as well as usual. After these attacks he was frequently better than for some time previously. Several other cases have come under my observation, all closely resembling this one, but, with two exceptions, the symptoms were not so severe. In one of these children the attacks lasted regularly five days.

A very similar case to the one whose history is given above, has been reported by Snow * (Buffalo). Gee † has published a series of nine cases of cyclic vomiting, two of which were of the type described, but much less severe.

Judging from these limited observations, cases may be seen at any period of childhood, and more frequently in girls than in boys. They are often seen in neurotic or gouty families. The general health and nutrition of the patients may appear excellent. The attacks are rarely traceable to the taking of indigestible food, and they have little in common with an ordinary severe attack of acute indigestion. Exhaustion or fatigue may bring on an attack, and one has been excited by some minor illness such as tonsillitis. The prodromal symptoms are lassitude, frequently headache, a sense of gastric discomfort, and very often fever, which, however, does not continue through the illness. In some of the cases, for some days before the attack, the stools are noticed to be almost white. Constipation is not marked, and is often absent. Severe epigastric pain is rare. The attacks seem to be self-limited, and they are but little affected by treatment.

Cyclic vomiting is certainly a nervous and not a gastric condition. It has many points of resemblance to an attack of migraine. The following observations made by Dr. C. A. Herter upon the urine of the case whose history I have given, strengthens this hypothesis, since the result is almost

---

* Archives of Pædiatrics, 1893.

† St. Bartholomew's Hospital Reports, 1882.

identical with what is found in migraine. All the following observations were made upon the twenty-four-hours' urine:

Time taken.	Urea, grammes.	Uric acid, grammes.	Ratio of uric acid to urea.
Before the attack (normal)	13·606	0·251	1 to 54
First day	17·249	0·110	1 to 157
Second day	12·023	0·0912	1 to 132
Third day (convalescent)	11·713	0·234	1 to 50
Several weeks after (normal)	15·040	0·283	1 to 53

Observations made upon the urine in a second attack, three months later, gave results which were practically identical with the above. A second case of a somewhat similar type, but less severe, showed a ratio of uric acid to urea 1 to 83 during the vomiting, while in the same individual in health it was 1 to 42. Further observations are necessary before the full significance of these changes can be appreciated. The frequency with which the attacks are preceded by light gray stools, indicates that disturbance of the functions of the liver has a very close connection with the symptoms.

The prostration from the attacks is usually of short duration. The paroxysms are apt to recur unless a proper treatment of the case in the interval can be carried out. There seems but little tendency to spontaneous recovery. In most of the cases reported they have extended over a period of several years.

Diagnosis.—Organic disease of the brain and kidneys must first be excluded, the latter only by careful and repeated examination of the urine. The first attack witnessed may strongly suggest the onset of meningitis, but the course of the symptoms soon shows that this is not present. Usually a history of many previous attacks may be obtained. From acute indigestion, cyclic vomiting is differentiated by the fact that attacks are not brought on by indigestible food and also by the persistence of the vomiting. It is distinguished from gastritis by its severity, the shorter duration of its symptoms, and its self-limited course.

Treatment.—When the premonitory symptoms appear, free purgation by calomel offers the best prospect of aborting an attack. If the vomiting has once begun, nothing seems to have the slightest influence in controlling it. It is usually increased by the taking of food or drink or by any medication by the mouth, and all should be withheld. Ice may be held in the mouth to allay thirst. When the vomiting has ceased for several hours it is not likely to recur if food be very judiciously administered and in small quantities. Broth, whey, kumyss, or small quantities of iced milk and limewater in equal proportions may then be given. Acting upon the theory that the symptoms were analogous to those of migraine, the treatment I have adopted in the interval has been purely dietetic, consisting

in the exclusion of all sugar and sweets, and in carefully limiting the amount of starchy foods. The diet prescribed has consisted of meat, green vegetables, milk, sour fruits, and stale bread. This diet has been followed in the case above reported, with the result that instead of having four or five attacks every year there had been at the last report but one attack in three years. In addition to careful regulation of the diet the general nutrition should be considered, and the patient's life so regulated that extreme fatigue and exhaustion should be prevented.

GASTRALGIA.

This term is applied to sudden, severe attacks of gastric pain. Gastralgia occurs as a symptom in most of the severe attacks of acute gastric indigestion; in such cases it is more marked in older children than in infancy. The pain of diaphragmatic pleurisy is often referred to the epigastrium, and may be so severe as to lead one to think that the stomach is the seat of disease. In vertebral caries of the dorsal region epigastric pain is a very frequent, early symptom. It is also common in children who suffer from malaria, at the onset of acute attacks, and it may be severe when the febrile symptoms are not well marked. In other cases pain in the stomach is of the nature of a true neuralgia, which may be excited by exposure to cold, by wetting the feet, by drinking ice-water, and by many other causes. Children who are predisposed to it often have attacks of considerable severity from comparatively slight causes.

In mild cases there is an intermittent pain, and usually no other symptoms. In severe cases the pain may be so great as to cause pallor, faintness, cold perspiration, and very marked prostration. When the origin of the pain is in the stomach the epigastrium may be hard and sometimes retracted, the stomach appearing to be in a state of spasm.

Treatment.—During the attacks the patient should be put to bed, and counter-irritation used over the stomach, best by means of a turpentine stupe or a mustard paste; sometimes a hot-water bag will suffice. Internally there should be given hot water containing brandy or gin and five drops of spirits of chloroform; all food should be withheld. Hot bottles should be applied to the feet if they are cold. In the interval between the attacks the treatment should be directed to the patient's general condition; especially should the cause be discovered. In cases of recurring pain of a neuralgic character the prolonged use of arsenic in the form of Fowler's solution, two or three drops three times a day, may prove of great benefit. In all cases attention should be directed to the diet, as in chronic indigestion.

ACUTE GASTRIC INDIGESTION.

This occurs whenever the stomach is unequal to the task imposed upon it. It may be either because the task is too great or because the capacity

of the stomach for work is diminished. Under these two heads we may group the principal causes of acute indigestion.

Under the first head the most important thing is the giving of improper food. In infants this is most frequently the use of cow's milk which contains too much casein because not sufficiently diluted. Other common causes are sudden weaning or any other abrupt change in diet, the too early use of solid food, and overloading of the stomach. In older children the usual causes are the use of indigestible articles, such as unripe fruits, pastry, etc., overloading the stomach, and swallowing food without sufficiently masticating it. Conditions which may diminish for the time the capacity of the stomach for work are fatigue, depression induced by atmospheric heat, chilling of the surface, especially the extremities, dentition, and the nervous impression caused by the onset of any acute disease. The effect is seen both on the glandular and muscular apparatus of the stomach. The secretions are diminished or altered in character, and the motor activity of the organ is arrested.

Symptoms.—One of the first consequences of arrested gastric digestion is that the food remains long in the stomach. Instead of being empty in two or two and a half hours after feeding, as is normal in infancy, the food may remain in the stomach five or six hours, or even longer. The irritation from this undigested mass excites vomiting, which usually ceases after the stomach has been emptied. The vomiting may be preceded by nausea, pain, and constitutional depression which varies with the age and susceptibility of the child; in infants it may be very alarming.

It seems probable that, as a consequence of arrested gastric digestion, the proteids are not converted into peptones, but remain in the form of albumoses. These products have been shown by experiments on animals to be toxic, producing stupor and circulatory disturbances. They are diffusible and are undoubtedly absorbed with great rapidity, and may be the cause of nervous symptoms of a striking character. There may be dulness, stupor, and sometimes contracted pupils, so as to suggest opium narcosis, or there may be restlessness, excitement, and even convulsions. There is also marked prostration, weak pulse, and fever. The temperature in most cases of acute indigestion is from 100° to 102° F.; not infrequently it rises to 104° or 105° F. The tongue is coated and the appetite entirely lost. In infants these symptoms are usually associated with more or less evidence of intestinal disturbance—generally diarrhœa, with undigested food in the stools. Epigastric distention may be present. Usually the vomiting ceases in from six to twelve hours, and after the stomach has been thoroughly emptied the temperature falls. Provided rest to the organ can be secured, and the exciting cause is one that can be removed, the patient may be quite well in two or three days. Relapses are, however, easily excited. It is surprising to see in a susceptible patient how trivial a cause may excite a relapse.

The diagnosis between a simple attack of acute indigestion and one of gastritis can not be made at the outset. The former is much more frequent, and may be quite as severe, but is of shorter duration. The continuance of the severe symptoms, especially pain, thirst, fever, and vomiting of mucus tinged with blood, justify the inference that inflammatory changes exist. The prognosis in these cases is good, except in very young or very delicate infants. In such patients an attack of acute indigestion is not infrequently fatal.

Treatment.—The indications are, to empty the stomach as completely as possible and then to secure to it absolute rest. If proper treatment is employed at the outset, the majority of such attacks can be cut short. Nothing is so efficient in infants as stomach-washing. (See page 60). A single washing usually suffices. If for any reason this can not be employed, the child may take from its bottle a large amount of lukewarm water. The free vomiting which this usually produces may be sufficient to cleanse the stomach fairly well, but by no means so easily as stomach-washing. Persistent vomiting is sometimes arrested by giving small quantities of quite hot water.

The subsequent treatment is chiefly dietetic. Nothing whatever is to be given for three or four hours, and then albumin water* or ice-cold whey (page 152), frequently, and in small quantities—e. g., half an ounce to one ounce every hour. After twenty-four hours barley water, raw beef juice or broth may be tried, but no milk for at least three days. When begun, it should be peptonized and diluted with five or six parts of water. In a nursing child, the breast should be withheld altogether for twenty-four hours, and then nursing allowed for two minutes every three hours, the time of nursing being gradually increased to three, five, and ten minutes as improvement occurs. The great mistake made in these cases is to begin food too early and to give too much, especially of cow's milk.

Drugs are relatively of little value. If the measures mentioned have been used promptly they will not often be required. In many cases injudicious medication aggravates the symptoms and prolongs the attack. Unless the bowels have acted freely, calomel (gr. $\frac{1}{10}$ every hour) may be given until this effect is obtained. Where there is continuous vomiting of very acid mucus and serum, alkalies are indicated—limewater, chalk mixture, or the subcarbonate of bismuth. It is important to keep the child as quiet as possible. Local applications to the epigastrium are very often useful. Either dry heat may be applied by means of a hot-water bag or hot flannels, or more active counter-irritation by mustard. In older children the stomach is to be emptied by an emetic, such as ipecac, accompanied by large draughts of warm water. After this it should be

---

* *Albumin-water:* The white of one fresh egg, one half pint cold water, previously boiled, a little salt, one teaspoonful of brandy; shake thoroughly, and feed cold.

kept entirely at rest for half a day, only carbonated waters or barley water being allowed in small quantities to allay thirst. Later, broth or beef juice may be given, then milk diluted with two parts of limewater. The patient should be kept upon a very low diet for four or five days.

ACUTE GASTRITIS.

In comparison with the frequency of inflammatory diseases of the intestine, those of the stomach are rare, particularly so in infancy. Gastritis seldom exists alone, but is usually associated with enteritis or colitis.

Etiology.—The causes of gastritis are, in the main, those of acute gastric indigestion—improper food or feeding. Besides, it may be caused by the introduction of irritants, which may either be accidentally swallowed or given as drugs. The mucous membrane of the stomach has much more resistance to infection than has that of the intestines; but in certain forms of inflammation, especially the membranous, infection is clearly the cause.

Lesions.—The mucous membrane of the stomach may be the seat of acute catarrhal, follicular, or membranous inflammation, all forms except the catarrhal being very rare. There is also seen a mixed form, from its cause usually designated as "corrosive" gastritis.

Catarrhal gastritis.—This is characterized by hyperæmia of the mucous membrane, exudation of cells into the mucosa, a great increase in the secretion of the mucous glands, and changes in the epithelium. About the only change which can be recognised by the naked eye is congestion and swelling of the mucous membrane. These are usually more marked toward the pyloric end and along the greater curvature. There may be small extravasations of blood into the mucosa. The stomach contains undigested food and mucus, which may be thick and tenacious, adhering very closely to the mucous membrane. The mucus may be stained brown from the capillary hæmorrhages. The stomach may be either distended or contracted. Under the microscope the changes are seen to be almost entirely in the mucosa. In places there is loss of the superficial epithelium, in others only degenerative changes in it are seen. The mucosa is infiltrated with round cells, this process being rarely diffuse, but generally occurring in patches. The blood-vessels are distended and many small extravasations are seen. Sometimes there is a moderate infiltration of the submucosa. Acute catarrhal gastritis alone is rarely severe enough to cause death. It is usually seen in cases which prove fatal from other causes, particularly diseases of the intestine.

Gastric softening (*gastromalacia*) is a condition dependent upon post-mortem changes—probably self-digestion of the stomach. It is found both where gastric symptoms have been present and where they were absent. It is situated nearly always in the posterior wall, and usually covers a considerable area, about one third or one fourth of this wall. It is

recognised by the gelatinous, translucent appearance of the walls of the stomach, which are so softened that the finger may be pushed through them without force, sometimes so that the stomach ruptures while it is being removed. This condition is rarely seen when the stomach is empty. It can scarcely be mistaken for a pathological condition, if its occurrence is borne in mind.

Follicular gastritis.—This is usually seen in connection with catarrhal inflammation, but it may form the most important feature of the lesion. The cases are quite rare. I have met with one marked example in an infant three weeks old. The others I have seen were associated with ileo-colitis. The characteristic feature is inflammation of the solitary lymph nodules of the stomach, which, like those in the colon, undergo swelling, softening, and ulceration. The lesion can not be recognised by the naked eye, unless ulcers are present. These appear rather thinly scattered over the mucous membrane of the stomach, about a line in diameter. They are seldom closely set as in the intestine. Large follicular ulcers I have never seen. Under the microscope the ulcers are seen to be in all respects similar to those found in the colon, except that they are smaller and more superficially situated, generally being entirely in the mucosa.

Membranous gastritis.—This is even more rare than the varieties previously mentioned. I have met with it but four times. One case was associated with a membranous colitis; a second case with pseudo-diphtheria of the fauces and larynx in an infant but six weeks old. The œsophagus was not involved in this case; and indeed it often escapes. No Loeffler bacilli could be found either in cover-slip preparations or by culture. Both these cases have been very fully reported by Dr. Martha Wollstein.* To the naked eye the membrane appears as of a grayish-green colour; it is adherent, but can be detached in quite large patches. Only a portion of the stomach was covered in any of the cases; in two the principal disease was about the pylorus; in another along the greater curvature. In Fenwick's case the entire surface of the stomach was lined with membrane. The microscopical appearances resemble those of membranous colitis. There is a pseudo-membrane composed of fibrin, granular matter, epithelial cells, and bacteria. The mucosa shows a moderately dense infiltration with round cells, and in places superficial ulceration. There is also infiltration of the submucosa, and in some places even the muscular coat is involved.

Membranous gastritis occurring in patients dying of diphtheria has been described by Smirnow, Andral, Rilliet and Barthez, Cahn, Fenwick, and others, but I have not been able to find any case in which the diagnosis of true diphtheria of the stomach was confirmed by cultures.

---

* Archives of Pædiatrics, July, 1892. Here will be found an excellent summary of the literature of membranous gastritis.

Corrosive gastritis (*toxic gastritis*).—This form of inflammation is excited by various irritating and caustic substances, which are usually taken by accident, sometimes for the purpose of producing emesis. The most frequent substances are carbolic acid, caustic alkalies, mineral acids, arsenic, salts of copper, zinc, or antimony, croton oil, and corrosive sublimate.

The lesions in the stomach depend upon the amount of the substance swallowed, the degree of concentration, and whether the stomach was full or empty at the time. Strong caustics, whether acids or alkalies, usually act more deeply and extensively in the pharynx and œsophagus, for, owing to the spasmodic contraction of the muscles of these parts, often but a small amount of the substance reaches the stomach. Concentrated irritant poisons produce in the stomach irregular ulcers, especially along the greater curvature, which may be so deep as to cause perforation, or they may affect the mucous membrane only. In severe cases death takes place early, often in a few hours. Dark, ragged ulcers are found in the stomach, the surrounding mucous membrane is the seat of intense congestion, and in places there are extravasations of blood. If death is later there are evidences of intense inflammation, sometimes with the production of pseudo-membrane. If the amount of poison is not sufficient to cause death, and if the patient recovers from the consecutive gastritis, a cicatricial condition of the stomach results, which may later lead to stenosis of the pylorus or other deformity of the organ.

Symptoms.—*Catarrhal gastritis* can not be distinguished in its beginning from an attack of acute indigestion. There are fever, pain, vomiting, thirst, loss of appetite, coated tongue, and prostration. The presence of inflammatory changes is indicated by the continuance of these symptoms, particularly the pain, vomiting, fever, and thirst. With the pain there may be epigastric tenderness. All food or liquids are immediately rejected, and even when nothing is taken the retching and vomiting may continue, nothing but frothy mucus or serum being brought up, sometimes streaked with blood. The vomited matters are usually very sour; they may be bilious. The temperature is high only at the outset. After the first or second day it usually ranges between 100° and 101·5° F. Thirst is intense, and all liquids are taken with avidity, especially if cold, even though they are immediately vomited. The tongue is thickly coated with a white fur, and the breath may be foul. The constitutional symptoms are generally most severe at the outset. The usual duration of such attacks is four to seven days, but with improper management, especially injudicious feeding, the disease may be much prolonged. One attack may follow another until a chronic condition is established. In most of the cases there is some disturbance of the intestines, usually a sharp attack of diarrhœa. Sometimes the gastric symptoms subside after a few days and those of the intestine become the predominant ones. The symptoms above

given are those of infancy. In older children there is less of fever, prostration, and diarrhœa, but pain and vomiting are prominent. The attacks are usually shorter and altogether less severe.

The rare cases of *follicular gastritis* have nothing by which they can be distinguished from the form described, except a more prolonged course and a greater liability to hæmorrhage, blood sometimes being vomited in quite large amounts.

Membranous gastritis also presents no peculiar symptoms. In fact, in the cases I have personally seen, the gastric symptoms were insignificant, and the condition not suspected during life.

In *corrosive gastritis* the effects of the caustic may be seen in the mouth and pharynx, the mucous membrane being of a gray or whitish colour. There are felt pain and a sense of constriction in the œsophagus and stomach, with great thirst. Vomiting follows almost immediately, and the matters vomited are usually bloody. The subsequent course in most of the cases is the rapid development of collapse, and death in a few hours from shock. The younger the child the sooner does the case terminate. In irritant poisoning not severe enough to produce death, the symptoms of acute gastritis follow, usually accompanied by more or less enteritis owing to the passage of the irritant into the intestine. There is seen a continuance of the vomiting, pain and epigastric distention, and diarrhœa, and from these symptoms death may result in two or three days. It is extremely rare in infancy for the patient to survive both the stage of shock and that of acute inflammation, so that the deformities of the stomach and the chronic conditions mentioned, are practically never met with excepting in older children.

Treatment.—Cases of acute catarrhal gastritis are to be managed very much like those of acute gastric indigestion. Thirst may be relieved by swallowing bits of ice. Where there is continuous vomiting of acid mucus, relief is sometimes afforded by repeating the stomach-washing once in twelve hours with a 1-per-cent solution of bicarbonate of soda, used at 110° F. In older children, beneficial results sometimes follow the use of bismuth subcarbonate (gr. x every two hours); but in infants I must confess to have seen but little effect from any form of medication, the reliance being upon rest, careful feeding, and stomach-washing.

Cases of corrosive gastritis require special treatment. The first indication is to administer the proper chemical antidote to the substance swallowed, and the next to use bland mucilaginous or oily fluids, such as milk, albumin-water, oils in large quantities, etc. Especially should stomach-washing be avoided. Opium is always required, on account of pain and should be given hypodermically. The general symptoms are to be treated according to the indications of the individual case.

GASTRO-DUODENITIS.

This is a catarrhal inflammation of the stomach and duodenum. Sometimes only the duodenum is involved. The inflammation commonly extends from the intestine to the common bile duct, the swelling of which causes jaundice. The term gastro-duodenitis is sometimes used synonymously with catarrhal jaundice. The condition is a rare one in young children, and especially so in infancy. I have never seen it in a child under two years.

The causes are for the most part obscure. It occasionally complicates malarial fever. I have twice seen it with influenza, and it may occur with any of the infectious diseases. Rehn has described a form which occurred epidemically.

The symptoms of the disease are quite uniform. When primary, the onset is like an ordinary attack of indigestion, with vomiting, pain, slight fever, and a moderate amount of prostration. The vomiting in some of the cases is repeated for several days. The pain may be quite severe, and localized in the region of the duodenum. It may be associated with tenderness in this region. The bowels are usually constipated. After three or four days, icterus, which is the only diagnostic symptom, appears. It is first seen in the conjunctiva, afterward in the skin, varying in degree according to the severity of the attack, but in most cases not being very intense. It is accompanied by the regular symptoms of obstructive jaundice. The stools are gray, sometimes white; there is a marked amount of intestinal flatulence. The urine is very dark, of a yellowish-green or bronze hue, and stains the clothing. There is complete anorexia; the tongue is thickly coated with a white fur. There are headache, dulness, and languor, and the patient feels generally wretched. The slow pulse and the itching skin are uncommon symptoms in children. The liver is usually found, upon examination, slightly enlarged, and sometimes tender on pressure. The duration of the disease is about two weeks, the general symptoms disappearing before the icterus.

The diagnosis rarely presents any difficulty, and the prognosis is invariably good.

Treatment.—In the diet, fats and starches should be reduced to a low point or be entirely prohibited. Patients usually do much better upon a diet of rare meat, fruit, and a moderate amount of milk. If there is very much vomiting, the milk should be largely diluted with limewater or partially peptonized. The amount of food given should be small, but water should be allowed freely, particularly the mineral waters. The bowels should be opened every other day by calomel, followed by a saline purgative. In most of the cases no other treatment is necessary. When the pain is severe it may be relieved by counter-irritation by mustard, turpentine, or even cantharides. The gastric symptoms should be managed

like those of ordinary acute gastritis. The restricted diet should in all cases be continued for at least a week after the jaundice has disappeared.

CHRONIC GASTRIC INDIGESTION—CHRONIC GASTRITIS—GASTRIC CATARRH.

Although from a pathological point of view these conditions are not identical, from a clinical standpoint there is no advantage in attempting to separate them. Nothing distinguishes chronic indigestion from chronic gastritis except that in the latter, in addition to continued derangement of function, there is a great increase in the production of gastric mucus. Chronic indigestion seldom exists long without the production of a slight amount of catarrhal inflammation. This is usually of a very low grade. This condition in the stomach seldom, if ever, exists without more or less involvement of the intestine, and in the majority of cases the intestinal condition is the more important. In some, however, the gastric symptoms predominate, and it is only those which are here considered.

Etiology.—Chronic gastric indigestion may follow acute attacks, or it may be chronic from the outset. If the latter, it depends in infancy upon the continued use of improper food or bad habits of feeding. It also complicates most of the constitutional diseases of infancy, especially rickets, syphilis, tuberculosis, malnutrition, and marasmus. It may follow any of the acute infectious diseases. In older children it is chiefly due to the use of improper food, sometimes to the habit of rapid eating and insufficient mastication. It is associated with constitutional diseases as in infancy, and may complicate valvular disease of the heart.

Lesions.—The changes found in chronic gastritis are usually confined to the mucosa. In the mild form there are degenerative changes of the epithelium of the tubules, with increased production of mucus; there may be a slight infiltration of the mucosa with round cells. The more severe form, with marked cell infiltration and the production of new connective tissue, is extremely rare. The submucous coat may be thickened and the muscular coat attenuated. The lesion can not be recognised by the naked eye. The stomach is apt to appear more or less dilated, and its surface is coated with thick and very adherent mucus. This lesion rarely exists alone, practically never in infancy, but is associated with similar lesions in the intestines, the latter being more severe.

Symptoms.—*In infants.*—For our knowledge of the conditions existing in the stomach in chronic indigestion we are indebted to the work chiefly of Cassel, Leo, Troitzky, and Wohlmann. There is in most cases an excessive production of mucus which is tough and adherent, and may interfere with digestion, even though secretions are normal. Mucus is especially abundant in young infants. The reaction of the stomach is almost invariably acid. The rennet ferment is always present. Pepsin is found in nearly all if not in all the cases. Hydrochloric acid is generally

very scanty; but is increased by irrigating the stomach. Fermentation takes place, particularly in the fats and in the gastric mucus. The results of fermentation are the production of lactic, acetic, butyric and other volatile fatty acids. New products are also formed from the decomposition of albumin, and gases are always present. Food remains long in the stomach because of motor inactivity, which is partly the cause and partly the result of the disease. It often continues after all other symptoms have disappeared.

The most constant symptom is vomiting. This is rarely absent, and it may take place at any time after feeding. Some infants vomit regularly within half an hour or an hour after feeding, some only occasionally and at longer intervals. The vomited matters consist of food, often that which has been given six or eight hours before, and mucus, which may be in large quantities, as much as an ounce at a time. The food remains long in the stomach. This is best ascertained by stomach-washing. Instead of being empty in two or three hours, as the stomach should be, food is almost invariably found four or five hours, and in some cases six or eight hours, after feeding. This is one of the most constant and conclusive signs of gastric indigestion.

Undigested food, especially casein, appears in the stools. The appetite may be good or it may be very poor. As a rule, children take less food than in health. The tongue is usually coated; there are signs of general malnutrition; there are seen fretfulness and irregular or disturbed sleep; most children cry a great deal, but some are unnaturally quiet; the weight is stationary, or there is steady loss; there is also anæmia, and the child's development is arrested. There is always some derangement of the bowels, occasionally constipation with the constant presence of masses of undigested food in the stools, but more frequently there is diarrhœa. There may be dilatation of the stomach. This is especially liable to occur in rachitic children where overfeeding has long been practised.

The course of these symptoms is indefinite. There is little tendency to spontaneous recovery, and they often go on for several months, until some intercurrent disease develops which proves fatal.

The prognosis depends upon the age of the patient, the duration of the disease, the surroundings, and upon how well treatment can be carried out. In infants under three months the prognosis as to life is often bad. If children live to the age of seven or eight months, they may recover with proper treatment. These patients do much better in private practice than in institutions. Much depends upon the co-operation of an intelligent mother or nurse. Chronic gastric indigestion is not dangerous to life except in very young infants. Its principal danger consists in the predisposition it gives to acute diarrhœal diseases in summer. Such patients are almost certain to be attacked, and are very likely to succumb. It may

also lead to the development of marasmus. Chronic indigestion increases very much the danger from all acute diseases.

In older children.—In all cases the most constant symptom is vomiting, which may occur regularly after meals, or only in the morning before breakfast. If the latter, the vomited matters consist chiefly of mucus. In addition to these regular attacks there may be the frequent regurgitation of small quantities of food. There are gastric flatulence and pain, due to hyperacidity or to acid fermentation. The appetite is variable—sometimes inordinate, sometimes entirely lost; it may be capricious, there being usually a craving for highly seasoned food. The tongue is constantly furred, and the breath usually disagreeable. These symptoms are seen in all degrees of severity. Intestinal disturbances are not so frequent as in infancy. Constipation is more common than diarrhœa. The general symptoms are those of malnutrition. There are anæmia, wasting, constant fretfulness, disturbed sleep, and various other nervous disorders. These symptoms, as in the case of infants, may continue indefinitely; there is little tendency to spontaneous recovery, but under favourable circumstances, with constant care, much may be done for all these patients and many of them may be completely cured.

Treatment.—*Infants.*—The general treatment is too apt to be ignored, but it is just as important as measures directed more specifically to the stomach. A large, roomy nursery, and plenty of fresh air by night and by day, are very important; sometimes under the influence of these alone improvement begins. General friction of the body with cocoa-butter is useful in delicate children with poor circulation. Infants must be properly covered, and it is of the utmost importance that the feet be kept warm. Of the measures directed to the stomach, only two are to be depended upon—stomach-washing and diet.

Stomach-washing (page 60) is useful, first, in removing the mucus which is so abundant in most of these cases; secondly, in cleansing the organ thoroughly at least once a day, this of itself is a most important result; thirdly, as a stimulant to the gastric secretions, especially hydrochloric acid. Plain boiled water, or a weak alkaline solution—sodium bicarbonate, one drachm to the pint—may be employed. In the early part of the treatment the washing should be done daily; later, every second or third day. The time selected is not very important, but it is better to make this about three hours after feeding. The mother or nurse may easily be taught to wash the stomach, so that it may be done as frequently and for as long a period as circumstances require.

In the matter of diet, the general purpose should be to give the stomach as little to do as possible, throwing for the time the burden of the work of digestion upon the intestine. As the greatest difficulty is in the digestion of casein, it is usually better, in the case of a young infant—i. e., one under six months—to secure a wet-nurse. But this may not succeed

as well as artificial feeding, as it is in our power to modify the food only to a limited extent. Where a good wet-nurse can not be obtained, or where even breast milk is not tolerated, cow's milk should be tried. In modifying cow's milk, it should not be forgotten that the fat as well as the casein may be a source of trouble. With the milk sugar there is usually no difficulty. The best results are obtained by beginning with such formulæ as XVII or XVIII (page 176), obtained by diluting plain milk with a sugar solution. In these, both the proteids and fat are very low and the sugar relatively high. The proportions of the first two ingredients may be gradually increased as the case improves. If this plan fails, the milk may be completely peptonized (page 148) before it is diluted. Partially peptonizing is frequently no better than the above modification used alone. In very obstinate cases whey (page 152) may be tried, and may be retained when even the small proportion of fat and casein in the formulæ mentioned, causes disturbance. Often where no casein can be tolerated, raw beef juice or some of the beef peptones, such as Mosquera's beef jelly, are assimilated without difficulty, and may be used exclusively for days at a time. In infants over six months old some farinaceous food, such as a thin gruel of barley or arrowroot, may be given alternately with the beef preparations; or one of the malted foods may be used in the same way. Other suggestions regarding diet will be found in the chapter on Feeding of Difficult Cases during the First Year (page 180).

The quantity of food given at one time and the frequency of feeding are also important. Under no circumstances should an infant with chronic indigestion be fed oftener than once in three hours, and in many cases the interval for children over three months of age should be four hours. The bottle should always be taken away in twenty minutes after the meal has begun. The number of meals in a day should be the same as for healthy infants. The amount of food should always be rather less than that required by a healthy infant of the same age. It is wise to begin with about half the quantity, gradually increasing as the child's powers of digestion improve. Gavage is sometimes useful where vomiting is frequent and can not be controlled. Food administered in this way may be retained, when it is immediately vomited if given from the bottle or the spoon.

Drugs have a very limited application in these cases. Usually they are too much employed. The majority of patients do better when they are withheld entirely. They may be useful for particular symptoms. Alkalies may temporarily relieve cases with excessive acid fermentation. Small doses of strychnine or nux vomica may stimulate the motor activity of the muscular walls of the stomach. Hydrochloric acid at times may decidedly improve the digestion where it is given well diluted after meals; often, however, it causes vomiting. Almost all the indications mentioned are

more promptly and efficiently met by stomach-washing than by the other means referred to.

The management of these cases in older children must be conducted along the lines laid down for infants. In them, stomach-washing can not be employed, and other means must be used to clear the stomach of mucus. The best is undoubtedly the use of large draughts of water, as hot as can be borne, an hour before eating. From six to eight ounces should be taken, preferably slowly by sipping. To this may be advantageously added, in many cases, fifteen or twenty grains of bicarbonate of soda.

The diet should consist of milk diluted at least three times, kumyss or matzoon, beef juice, raw meat, beef peptones, and a moderate amount of starchy food, preferably dried bread or zwieback. Sweet fruits, and in many cases all fruits, must be avoided. The amount of water taken at mealtime should be carefully restricted. Beneficial results are obtained in most of these cases by the use of nux vomica or simple bitters before meals, and the regular administration of hydrochloric acid (gtt. v to viii of the dilute acid) shortly after meals. All pastry, sweets, nuts, and candies must be absolutely prohibited. With improvement in the symptoms green vegetables may be added to the diet, and the amount of starchy food increased. The general treatment must not be neglected. The patient should lead an out-of-door life as much as possible, and regular but very moderate exercise allowed. Great caution is necessary against overfatigue. Iron may be given in most cases during convalescence; but cod-liver oil should be carefully avoided until the gastric symptoms have quite disappeared. Relapses are easily excited, and the most constant care regarding the food must be maintained for months, or even years.

DILATATION OF THE STOMACH.

Moderate dilatation of the stomach is quite a frequent condition, although it is not so large a factor in the disorders of digestion in infancy and childhood, as many who have written upon the subject would lead us to believe. A very marked degree of dilatation is rare, but in these cases its recognition is important and its treatment difficult.

Dilatation is almost invariably regular or cylindrical; it is usually most marked at the cardiac extremity (Fig. 48). Cases of irregular or saccular dilatation, except when associated with cicatricial conditions, are of somewhat doubtful occurrence. The irregular shapes of the stomach found at autopsy, dependent upon the contraction of the muscular coats, may be easily mistaken for hour-glass contraction or saccular dilatation. The degree of dilatation may be very great; thus, the stomach of a child three months old measured at autopsy nine ounces; another, four and a half months old, ten ounces; and in one extreme case, the stomach of a two-weeks old baby was dilated to the capacity of seventeen ounces. The

greatest dilatation I have measured during life was in a child four months old, where the stomach held twelve ounces.

In very rare instances dilatation may result from congenital stenosis of the pylorus. The most important predisposing cause, however, is the muscular atony which accompanies rickets. It is found to a slight degree in almost all severe cases of rickets. The principal exciting causes are continued distention from overfeeding and chronic indigestion.

In most cases the only symptoms are those of the chronic indigestion which almost invariably accompanies dilatation. If there is pyloric stenosis, vomiting is present. In young infants the pressure symptoms may be very serious. This is particularly true in infants with acute bronchitis or broncho-pneumonia, or in those with atelectasis. In these patients I have seen very grave symptoms accompany the rapid distention of a dilated

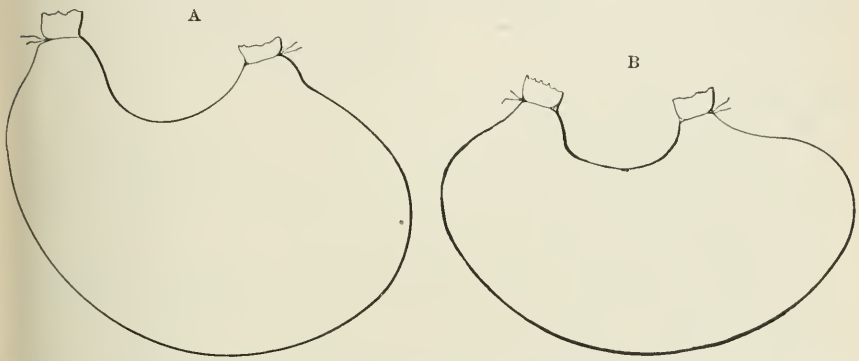


Fig. 48.—A, dilated stomach from rachitic child of six months; B, stomach of healthy child of same age. (Outlines reduced from photographs.)

stomach, and in one very delicate infant of three months this was apparently the cause of death. A positive diagnosis of dilatation is only made by the physical signs. There are epigastric fulness and distention, and in some very thin patients the outline of the stomach can be distinctly seen. Dilatation of the transverse colon, however, may be mistaken for dilatation of the stomach. In the latter, the lower outline is convex, while in the former it is usually slightly concave. The most satisfactory means of diagnosis is by percussion. The examination should be made three or four hours after feeding, at which time the whole abdomen is apt to be tympanitic. The stomach should then be filled with water; the lower limit of the area of flatness will be the lower border of the stomach. This is much more satisfactory than determining the outline after the generation of gas in the stomach. If the lower border comes nearly to the umbilicus the stomach is dilated; if it is below the umbilicus, it is much dilated. In many cases the capacity of the stomach can be measured by simply seeing how much water can be easily introduced into it by means of the funnel and stomach tube.

The prognosis in dilatation of the stomach is good except when it is due to pyloric stenosis. If the infant has any acute or chronic pulmonary disease, dilatation of the stomach may add to the discomfort and even the danger from that condition.

In the management of these cases the first point is to reduce the size of the meals, and to regulate the diet in accordance with the general plan outlined in the chapter on Chronic Indigestion. If the dilatation is marked, the stomach should be washed once a day. The general condition of the patient usually requires tonics, the best of which is strychnine; and rickets, if present, should receive its appropriate constitutional treatment.

ULCER OF THE STOMACH.

Ulceration of the stomach may be found in connection with several pathological processes which are quite distinct from one another:

1. Ulcers in the newly born. These have already been referred to in the chapter on Hæmorrhages of the Newly Born (page 101). The only characteristic symptom is hæmorrhage.

2. Ulcers resulting from follicular gastritis. These also are not frequent. As a rule they give no symptom except those of gastritis, although in several cases I have known severe hæmorrhage to result from them. These cases will be considered in the next chapter.

3. Tuberculous ulcers. These are quite rare. I have met with gastric ulcers but five times in one hundred and nineteen autopsies on tuberculous cases; however, the evidence was not conclusive in all of them that the ulcers were tuberculous. Usually there were many small ulcers; in one case but two were present, the larger one being nearly three fourths of an inch in diameter, and situated on the posterior wall near the middle of the greater curvature. All but one of these cases were in infants, one child being only ten months old. The ulcers gave no symptoms during life, and death took place from general tuberculosis. This is the history of nearly all the few cases on record. In one, however, reported by Casin, a tuberculous ulcer perforated the stomach and caused death from peritonitis. Active symptoms—bloody vomiting and bloody stools—were excited by the use of an emetic.

4. Round perforating ulcers. These are in their pathology essentially the same as similar ulcers in the adult. I have found but three cases on record in non-tuberculous patients. Two were in young children. Reimer's * case, three and a half years old, had bloody vomiting and stools for several days before death took place as a result of perforation. Colgan † has recently added another case in a child two and a half years old, where no symptoms were present until twelve hours before death,

* Jahrb. für Kinderh., x, p. 289.

† Medical News, Philadelphia, October, 1892.

when perforation occurred. The characteristic symptoms of ulcer before perforation, are gastric pain and tenderness, vomiting of blood, and often bloody stools. Perforation is accompanied by collapse, sometimes by high temperature, the rapid development of tympanites, and death from shock or from peritonitis.

The prognosis is bad in all forms of ulcer of the stomach, except the small follicular variety. In this, however, the diagnosis can not positively be made excepting by gastric hæmorrhage, and it is only this which makes these cases serious.

Treatment.—The treatment is absolute rest, ice, small doses of opium, rectal feeding, stimulants; later, bismuth, arsenic, or nitrate of silver.

HÆMORRHAGE FROM THE STOMACH (HÆMATEMESIS).

The most frequent variety of hæmorrhage from the stomach, that met with in the newly born, has already been considered. (See page 103.)

I have met with three fatal cases in young infants, the eldest being fifteen months old. In the first case there were symptoms of ordinary gastro-enteritis. On the seventh day the vomiting of blood began, and was repeated about ten or twelve times during the next twenty-four hours, when death took place. The blood was quite abundant, as much as a drachm of red blood being discharged at once. At autopsy there were found in the stomach about two ounces of dark-brown fluid, but no gross lesion was discovered, and no explanation of the bleeding. This hæmorrhage was apparently capillary. In the second case there were symptoms of acute gastro-enteritis of thirty-six hours' duration. After this time there was marked abdominal distention with symptoms of collapse; then a profuse hæmorrhage from the stomach, the child dying while vomiting blood. At least half a pint was discharged. The stomach contained at autopsy two ounces of dark fluid blood, and the mucous membrane was filled with minute ulcers extending quite through the mucosa. In the third case there was no vomiting of blood, but the patient died with symptoms of internal hæmorrhage. There was blood in the upper part of the intestine, and the stomach was filled with blood; it contained many small follicular ulcers resembling those found in the previous case.

Hæmorrhage from the stomach may occur in purpura, hæmophilia, scurvy, and rarely in malaria. In young girls about puberty it may be a form of vicarious menstruation. Occasionally blood may be vomited in cases of hæmorrhagic measles. Two cases are reported in which fatal hæmorrhage followed the swallowing of a foreign body. In both, vomiting of blood occurred long after the original accident. In one case two and a half years had elapsed. The autopsy in this case showed impaction of the foreign body and ulceration into the arch of the aorta. Spurious hæmorrhages may occur where blood has been swallowed and then vomited. The source of this is most frequently the nose or pharynx. It may hap-

pen in infants at the breast, where the blood is drawn during nursing from a fissure or ulcer in the nipple. The amount of blood vomited under these circumstances may be large enough to be quite alarming. It may be recognised by the child's general condition being normal, and by the presence of fissures or ulcers upon the nipple. It may sometimes be noticed that the vomiting of blood follows nursing from one breast and not from the other.

Symptoms.—There may be no symptoms except those of internal hæmorrhage, but this is rare. Usually there is vomiting of blood, and blood appears in the stools. If the hæmorrhage is rapid and vomiting speedily occurs, the blood may be of a bright-red colour. If it has been long in the stomach it is of a dark-brown or black colour resembling coffee-grounds. The stools containing blood from the stomach are black and tarry in appearance. The general symptoms will depend upon the amount of blood lost.

In a case where blood is vomited, the first point is to distinguish spurious from true gastric hæmorrhage. The nose and pharynx, especially its posterior wall, must be carefully examined. If the child is at the breast, the nipples should be scrutinized. In older children it is important to distinguish vomiting of blood from hæmoptysis. This distinction is to be made in accordance with the rules laid down in text-books on adult medicine. The prognosis is bad if the hæmorrhage is due to ulcer, if it is very profuse, or if it occurs in young infants. When it occurs in connection with constitutional diseases the prognosis depends upon the original disease.

Treatment.—The patient should be kept quiet, preferably upon the back, and Monsel's solution administered in small doses, largely diluted. Should the patient show signs of collapse, stimulants may be given hypodermically or by the rectum. No food should be given by the stomach until some time after the hæmorrhage has ceased.

CHAPTER VI.

DISEASES OF THE INTESTINES.

MALFORMATIONS AND MALPOSITIONS.

Malformations are not very frequent, but are of great variety. With the exception of those situated at the lower end of the intestine they are not of much practical importance, for the condition is such ordinarily as to be incompatible with life. They may be met with at any point in the canal, but most frequently they are in the rectum and anus. Aside from

these, malformations of the large intestine are much less common than those of the small intestine.

Malformations of the Rectum.—In Fig. 49 are shown the usual varieties of malformation of the rectum. The most frequent is atresia ani (1). In this the cutaneous septum has not been absorbed, but the intestine is normal to its lower extremity. This form is readily curable by a surgical operation. In the next variety (2) the cutaneous orifice and the lower part of the rectum are normal, but a membrane separates this portion from the upper part of the gut. This is usually situated within two or three inches of the anus. The bulging of the lower part of the distended intestine can usually be felt by the finger in the rectum, and a simple division of the membrane by a guarded bistoury may relieve the condition. The third form (3) is more serious. Here the rectum terminates in a blind pouch at a variable distance from the anus, and is represented below by an impervious fibrous cord. The diagnosis of this condition can not positively be made without opening the abdominal cavity. The bulging of the intestine appreciable by the finger in the rectum, is the only point which differentiates the preceding variety from this one. Instead of atresia of the rectum there may be stenosis of varying degrees, which may give rise to the usual symptoms of stricture. This is often curable by dilatation.

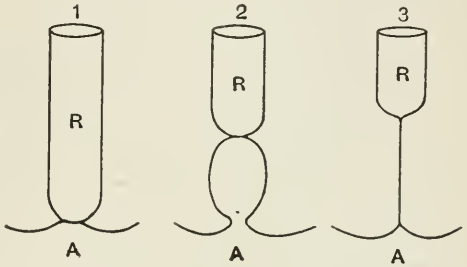


FIG. 49.—Malformations of the rectum. A, anus; R, rectum.

Malformations of the Small Intestine.—There may be stenosis or atresia at any point, often at many points. Obstruction is much more frequently in the upper than in the lower part of the small intestine, the most common seat being the duodenum. Atresia is more often seen than stenosis. There may be a single point of obstruction, or the lumen of the intestine may be obliterated for a considerable distance, the intestine being represented only by a fibrous cord which connects the two open portions, or there may be no connection between them. In all cases the intestine above is found very greatly distended, and that below empty and usually atrophied. The causes of these multiple deformities are mainly two—fœtal peritonitis and volvulus.* In fœtal peritonitis there are usually found bands of adhesions between the intestinal coils, and between

* Silbermann (Jahrb. für Kinderh., Bd. xviii, p. 420) makes peritonitis the principal cause, while Gaertner (Jahrb. für Kinderh., Bd. xx, p. 403) attributes most of these deformities to volvulus.

the intestine and the solid viscera. Syphilis has been assigned as a cause in many cases. Volvulus, or a twisting of the intestine during its development, is a more satisfactory explanation for the majority of the cases, especially where there are multiple points of atresia. All these conditions are beyond the reach of surgical treatment. The symptoms appear soon after birth and are those of intestinal obstruction. (See page 115.) The higher the point of obstruction the shorter the duration of life; it is rarely more than a week in any case of atresia; in stenosis it may be two or three months.

Meckel's diverticulum.—This is the remains of the omphalo-mesenteric duct, which in fœtal life forms a communication between the intestine and the umbilical vesicle. It is given off from the ileum, usually about a foot above the ileo-cæcal valve. Most frequently this exists as a blind pouch from one half to two or three inches long, communicating with the intestine. At the extremity of this there may be a fibrous cord, which may be free in the abdominal cavity or attached to the umbilicus. In other cases the duct may remain pervious to the umbilicus, so that there is a fæcal fistula. Prolapse of the mucous membrane of the duct may lead to an umbilical tumour. (See page 112.) Meckel's diverticulum, especially when present as a cord connecting the ileum to the umbilicus, may compress a coil of intestine, leading to obstruction or even strangulation. This may occur in infancy or later in life.

Malpositions.—The ascending colon may be found upon the left side. There may be a complete transposition of the abdominal viscera. In cases of congenital umbilical hernia a large part of the intestines may be found in the tumour, and in diaphragmatic hernia they may be in the thoracic cavity.

DIARRHŒA.

The term *diarrhœa* is used to cover all conditions attended by frequent loose evacuations from the bowels. These depend upon an increase in peristalsis and in the intestinal secretions. There are certain etiological factors which are common to all forms of diarrhœa.

Age.—A peculiar susceptibility exists in very young children. This is well brought out by the following statistics. My associate, Dr. Crandall, has tabulated three thousand cases of diarrhœa, including those treated by both of us in private and dispensary practice, and others from the records of two large dispensaries in New York. The ages of those applying for treatment were: under six months, 14 per cent; six to twelve months, 29 per cent; twelve to eighteen months, 24 per cent; eighteen to twenty-four months, 17 per cent; over two years, 16 per cent. It will be noted that the greatest susceptibility is between six and eighteen months, and that over four fifths of all the cases occurred during the first two years.

Season.—The next striking fact about diarrhœal diseases is their prevalence during the summer season. This is graphically shown in Figs.

50 and 51, where are given by months the cases treated in a large New York dispensary for ten years, and the mortuary records for the entire city during the same period. The enormous increase in the number of

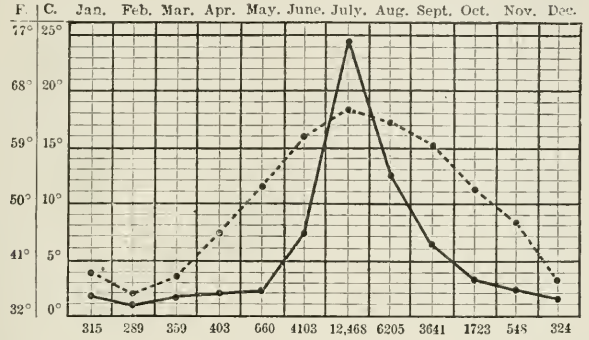


Fig. 50.—Mortality from diarrhœal diseases in New York for ten years in children under five; compared with the mean temperature for the same period. ———, mortality; - - - - -, mean temperature. (Seibert.)

cases occurring in the summer months does not have reference to any single form of diarrhœa, but to all forms. The significance of these facts will be considered later.

Surroundings.—While diarrhœal diseases are especially frequent in cities and among the poor, still they are not essentially diseases of the city nor of poverty. Severe and even fatal cases are constantly met with among all classes and in all places. Sufficient evidence has not yet accu-

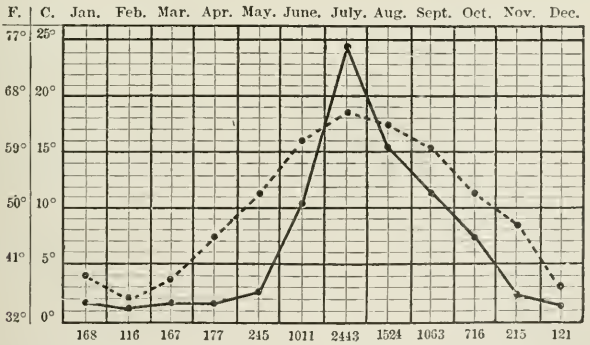


Fig. 51.—Cases of diarrhœal disease treated in the German Dispensary (New York) in ten years in children under five; compared with the mean temperature for the same period. ———, cases of diarrhœa; - - - - -, mean temperature. (Seibert.)

mulated to establish a direct connection between a polluted atmosphere and the prevalence of diarrhœal diseases. They are not essentially filth-diseases; yet their frequency and severity are both increased by want of cleanliness in apartments, in the persons and clothing of infants, especially the napkins,

chiefly, it appears, as these lead to a contamination of the food. Vacher has shown that the mortality from diarrhœa in the large English towns had no constant relation to the density of population. Poverty, neglect, and bad surroundings, predispose to diarrhœa in summer, just as they do to other forms of acute disease in the cold season.

Constitution.—Everything which lowers the general vitality increases the liability to diarrhœal diseases. Children suffering from marasmus, malnutrition, syphilis, rickets, or tuberculosis are especially prone to be affected, and these make up the bulk of the fatal cases in cities.

Dentition.—There are cases in which diarrhœa and dentition are closely associated, for the bowels quickly become normal when the teeth have pierced the gum. These, although rare, do occur. Too much, however, can not be said in contradiction of the wide-spread belief among the laity that diarrhœa accompanying dentition is normal or even beneficial. The infrequency of diarrhœa during dentition in the cold season, is the best argument against its importance as an etiological factor.

Food and feeding.—Of 1,943 fatal cases which I have collected, only three per cent had the breast exclusively. In my own experience fatal cases of diarrhœal disease in nursing infants are extremely rare. These are significant facts. They show that the manner of feeding is one of the most important factors in the production of diarrhœa. This is to be connected with the statistics with reference to age. The poor in New York are wont to nurse their infants exclusively for about six months. If nursing is continued longer, it is usually with the addition of other food, often of the most indigestible kind. Children among the poor in tenements enjoy immunity from intestinal disease just in proportion as they are breast-fed, and just so long as they are so; but as soon as artificial feeding is begun, diarrhœal diseases are prevalent. There are many reasons for this. In most cases, however, it is not artificial feeding *per se*, but artificial feeding ignorantly and improperly done, which is to be blamed. If cow's milk is employed as a substitute for breast-milk, the differences in composition are either not appreciated or else ignored, so that many artificially-fed children suffer from malnutrition. The comparative safety of cow's milk in winter and in the country, however, shows that the difference in chemical composition is not the most important one. A common and very serious mistake is that of over-feeding. Artificially-fed children are almost always over-fed. The common practice of feeding an infant every time it cries, or of keeping the bottle at its mouth the greater part of the time, is productive of untold harm.

The feeding of impure or contaminated milk is an important cause of diarrhœa, especially among the poor in cities during the summer. The condition of the milk may be due to disease in the cow, to adulteration or pollution at the dairy, during transportation, or in the homes. It may come from dirty vessels in which the milk is kept, or dirty bottles from

which it is fed. In some cases the milk may be the vehicle of specific infection. In others, its condition is owing to the ordinary fermentation changes due to the age of the milk—it being often two and sometimes three days old before it is consumed, and very often kept with little or no ice. It is surprising to see how quickly diarrhœa is excited by impure milk. I once saw in the New York Infant Asylum every one of the twenty-three healthy children, all over two years old and occupying one ward, attacked in a single day with diarrhœa which was traced to this cause. Articles of food totally unsuited to the child's digestion are often given. Among the poor it is a common practice to give all kinds of solid food to children from twelve to eighteen months old, while those of two years often get only the regular diet of the family. The great majority of the attacks of diarrhœa in children over two years old can be traced directly to improper food.

The factors mentioned—over-feeding, too frequent feeding, and the habitual use of improper food—all combine to produce a chronic indigestion which is probably the most important predisposing cause of diarrhœal diseases.

The Different Varieties of Acute Diarrhœa.—*Mechanical diarrhœa.*—This includes cases in which diarrhœa is produced by foreign bodies, or substances taken as food which virtually act as foreign bodies: such are partly-cooked rice or other cereals, dried fruits, or fresh fruits containing seeds; green corn, radishes, celery, cabbage, or other vegetables; nuts and unripe fruits. The irritation caused by such substances may produce only increased secretion and peristalsis by which the offending articles are removed, or, if sufficiently severe and continued, it may lead to actual inflammation of the mucous membrane of the intestine.

The indications for treatment are first to give an active cathartic—castor oil, calomel, or a saline—and, after thorough evacuation of the bowel has taken place, to quiet the excessive irritation by opium. The particular preparation used is not important. For two or three days after such an attack the diet should be very light, and of such a character as to leave but little residue—e. g., for infants, broth, beef juice, white of egg; and for older children, diluted milk or kumyss. The patient should be kept quiet, preferably in bed, until the stools are quite normal. The neglect of such mild attacks is a frequent cause of more severe ones.

Diarrhœa from drugs.—In susceptible infants any of the ordinary cathartic drugs may cause an attack of diarrhœa, because the physiological effects have been either exaggerated or prolonged. It is doubtful whether such attacks are often produced in nursing infants by cathartics taken by the nurse. The organic acids contained in fruits may operate in the same way as cathartic drugs. In cases like these the diarrhœa is readily controlled by opium, usually by small doses, which should be repeated after each action of the bowels.

Diarrhœa from nervous influences.—Certain nervous impressions seem to be able to produce diarrhœa where no other factors are present. Sometimes these act in conjunction with other causes. The most important are chilling of the surface, depression caused by atmospheric heat, fatigue, exhaustion, fright, and dentition. Diarrhœa may be seen in older children with anæmia, chorea, and general malnutrition. It is a characteristic of many of these cases, that the taking of food into the stomach immediately excites a movement of the bowels. The stools usually contain undigested food, because the intestinal contents are so rapidly hurried forward. The chief abnormal condition in such cases is exaggerated peristalsis. This is best controlled by rest and opium; small doses only are usually required.

Eliminative diarrhœa.—This term has been applied to cases in which diarrhœa is evidently an effort on the part of Nature to rid the blood of some irritant or toxic element. The best-known example is the diarrhœa of uræmia. It is, however, very probable that the diarrhœa of many acute infectious diseases belongs in this category. The danger of suddenly arresting such a discharge is a real one. It should be closely watched, and not allowed to become in itself a drain upon the patient, but checked only when excessive.

Acute intestinal indigestion.—Diarrhœa is a constant symptom of this condition, which is of such importance that it will be considered at length. The exciting cause of the diarrhœa may be either the mechanical irritation of particles of undigested food, or the various putrefactive products which take place from the decomposition of such food. This form is especially severe in infancy, and is usually accompanied by high fever and other marked constitutional symptoms. Gastric symptoms are present in most of the cases.

In the forms of diarrhœa above enumerated there are no lesions, and the bacteria found in the stools are the ordinary bacteria of the intestines. All other forms of acute diarrhœa are to be regarded as infectious, the infection starting from the intestinal contents. All of them also are associated with lesions, the severity of which depends upon the nature and degree of the infection, and the duration of the process. In the mildest cases and in those of short duration, the lesions involve only the superficial epithelium. In these the symptoms are due not so much to the anatomical changes, as to functional derangement and the presence of toxic materials in the intestine; some of these act locally and others produce constitutional symptoms by absorption into the general circulation. These have been classed as cases of *acute gastro-enteric infection.*

In the more severe forms, and in those of longer duration, the lesions may involve the entire mucosa, or they may extend into the submucosa quite to the muscular coat. They vary greatly in character as well as in degree. The lesions are very important, as modifying the symptoms,

course, and termination of these cases. For this reason they are sometimes classed as cases of inflammatory diarrhœa; here, from the position of the lesions, they are grouped under the term *ileo-colitis*.

According to Booker's observations, the bacteria usually associated with the superficial lesions are bacilli; those with the deeper lesions, streptococci.

The pathological relation existing between the different forms of diarrhœal disease is a very close one. The same case may pass successively through the stages of acute indigestion, gastro-enteric infection, and ileo-colitis. This transition may be very slow, or it may be so rapid that the different stages can not be distinguished. Instead of passing through the entire series, the process may stop at any stage and the case recover, or it may at any stage prove fatal.

ACUTE INTESTINAL INDIGESTION.

In infants, acute indigestion is seldom limited either to the stomach or to the intestine, although in one case the disturbance of the stomach is slight and that of the intestine serious, and in another the reverse may be observed. In these little patients the intestinal symptoms are much more frequent, and as a rule they are more severe than those referable to the stomach. There will be considered in this connection only the intestinal symptoms of acute indigestion; the gastric symptoms have been described on page 291. It should be remembered that these may be seen in all possible combinations. In older children it is not uncommon to see the intestinal symptoms alone.

Etiology.—The causes are essentially the same as those mentioned under Gastric Indigestion—the use of improper food, over-feeding, sudden change of food as in weaning, and various conditions affecting the nervous system, such as heat, cold, fatigue, or the onset of any acute disease. A predisposition to such attacks is furnished by summer weather, a delicate constitution, and especially by a feeble digestion. This predisposition is greatly increased by previous attacks of acute or chronic indigestion or intestinal inflammation. In susceptible children, both infants and those who are older, the slightest error in feeding may induce an attack.

Symptoms.—In infants, if the attack develops suddenly, gastric symptoms are usually present; if more gradually, they are usually absent. The local symptoms are colicky pain, tympanites, and diarrhœa. The important constitutional symptoms are fever, prostration, and various nervous disturbances. In older children the pain generally precedes the diarrhœa by some hours, and is referred to the region of the umbilicus. In infants, pain is indicated by the sharp, piercing cry, great restlessness, and drawing up of the legs. Tympanites is rarely very marked, and may be wanting.

The stools are always increased in number and are from four to twelve a day. If more frequent they are very small. The first stools are more or

less fæcal, but this character is soon lost. In infancy the colour is first yellow, then yellowish-green, and finally often grass-green. Wegscheider has shown that this colour is due to biliverdin. The exact nature of the process in the intestine, in consequence of which biliverdin takes the place of bilirubin as the colouring matter of the stools, is still a disputed point, but in infancy this change in colour is nearly constant. The reaction of the stools is almost invariably acid. The odour may be sour, or it may be very foul. The stools are thinner than normal, and after a few hours usually become almost fluid. Blood is not present, nor is mucus seen, unless the symptoms have lasted several days. Undigested food is always present; in infants upon a milk diet, this is seen as fat or lumps of casein. Fat may appear as small, yellowish-white masses resembling casein, but distinguished by their solubility in equal parts of alcohol and ether. Casein masses are more numerous, larger, and whiter. Unchanged starch may be recognised by the iodine reaction. The microscope shows, in addition to food-remains, mucus, epithelial cells, and bacteria. Epithelial cells, usually of the cylindrical variety, are numerous in proportion to the severity and duration of the attack. The bacteria are the ordinary forms found in the fæces (Booker).

In the cases with sudden onset the temperature is invariably elevated. In infants it ranges from 102° to 105° F.; in older children from 100° to 103° F. The high temperature does not continue. Usually after twelve or twenty-four hours it falls nearly or quite to normal. In the cases with a more gradual onset, or those of a less severe character, the temperature does not often go above 101° F. The general prostration, like the temperature, is greatest in infants and in the cases beginning abruptly. It is sometimes so severe as to threaten life. There are rapid pulse, pallor, drawn features, and general muscular weakness. There may be restlessness, due to pain and the general discomfort, or there may be dulness, apathy, or convulsions.

The course and termination of the disease depend upon the previous condition of the patient, the nature of the exciting cause, and the treatment employed. In a previously healthy child, if the cause is at once removed and proper treatment instituted, the severe symptoms rarely last more than a day or two, and in four or five days the patient may be quite well. In delicate infants, a severe attack of acute intestinal indigestion in the hot season, is likely to prove the first stage of a pathological process which may continue until serious organic changes in the intestine have taken place. This result may not follow the first attack, but one is often succeeded by others until it occurs. If circumstances are such that proper dietetic treatment and general hygienic measures can not be carried out, this termination is very common.

Diagnosis.—It is impossible to recognise an attack of acute intestinal indigestion until the diarrhœa begins; the previous symptoms of fever,

prostration, etc., are seen in many infantile diseases. From the other forms of diarrhœa, this is distinguished by its brief duration, although its symptoms may be very threatening. The nervous symptoms are usually less marked than in gastro-enteric infection, and vomiting is not so frequent.

Prognosis.—Such attacks do not endanger life except in very young or very delicate infants, in whom they may be fatal. The worst feature of most cases is that such attacks predispose to more serious intestinal diseases, many of which have their origin in acute indigestion which has been either neglected or badly managed.

Treatment.—The same general plan is to be followed as in cases of gastric indigestion—viz., first, to empty the bowels as completely as possible of all decomposing or irritating masses of food; secondly, to secure to the patient, and especially to the digestive organs, as complete rest as possible. For the first indication nothing is better than calomel, which may be given in one-fourth-grain doses, and repeated every hour until the full effect is seen. Any other active purge, such as castor oil or syrup of rhubarb, may be substituted. Thirst is always great on account of the fever and the loss of fluid by the stools, but digestion even in the stomach is feeble, and often arrested altogether. For the first twenty-four hours no plan succeeds better than that of withholding everything in the shape of food, giving only such articles as whey, albumen-water, mineral waters, or cold boiled water. Small quantities must be given—i. e., one to four teaspoonfuls—but the interval may be as short as ten or fifteen minutes. If the prostration is very great, stimulants may be needed. Brandy is the best form of administration. After the offending materials have all been swept from the intestine, but never before, opium may be given in doses large enough to control the excessive catharsis. For a child a year old, one quarter grain of Dover's powder after each stool is usually sufficient, and often a smaller dose may answer the purpose.

The difficult problem is to feed these cases during the latter part of the attack. In nursing infants, the breast may be begun after twenty-four hours, the nursing interval being six hours, and the time of one nursing being not longer than five minutes. Between the nursings other food may be given. In the case of infants past the nursing age, or those who are being artificially fed, cow's milk must be withheld in all forms for at least three days, and then given greatly diluted. For infants under six months, not more than one part of milk to seven of water should be employed. Milk sugar, in the proportion of one even tablespoonful, should be added to each eight ounces of food. Such a mixture has the following composition: fat, 0·4 per cent; sugar, 5·0 per cent; proteids, 0·5 per cent. In some cases it is necessary to use even so great a dilution as one part of milk to twelve of water, and one tablespoonful of the milk sugar to each ten ounces of food. This contains approximately: fat, 0·25 per cent;

sugar, 4·0 per cent; proteids, 0·3 per cent. With improvement, the proportions of the fat and proteids must be very gradually increased, as for some time the digestion is easily disturbed. In some cases there is an advantage in using partially or completely peptonized milk (page 148).

The diet of older children in the acute stage should be much like that of infants. Later it should consist of meat, broths, eggs, milk, and a small quantity of dried bread. All cereals, vegetables, and especially all fruits, should be withheld for some time, and when given should be allowed only in small quantities, and the effect on the stools watched. Kumyss and matzoon are frequently better borne than plain milk.

The use of drugs in these attacks, except those already referred to as indicated during the early stage, seems to me to influence the disease very little. Sometimes good results follow the giving of the extractum pancreatis half an hour after meals, or of some of the preparations of malt when farinaceous food is first allowed. If the diarrhœa following the acute symptoms is prolonged or excessive, it usually indicates that either intestinal infection or inflammation is present, and the case should be treated accordingly. General measures, such as rest, frequent bathing, fresh air, and change of air, are very important in the management of all these cases, especially when they occur during the summer.

CHAPTER VII.

DISEASES OF THE INTESTINES.—(Continued.)

ACUTE GASTRO-ENTERIC INFECTION.

Synonyms: Summer diarrhœa, gastro-intestinal catarrh, gastro-enteritis, cholera infantum, mycotic diarrhœa.

This is the form of diarrhœa which is so prevalent in summer. It occurs regularly each season as an epidemic in most large cities of the temperate zone, the lesions in the intestines are slight, amounting in most cases only to a superficial catarrhal inflammation, often bearing no relation to the severity of the symptoms which are mainly due to the absorption of toxic materials, the result of the putrefactive changes in the stomach and intestine. This form of diarrhœa may follow closely upon an attack of acute indigestion, in which it very often has its beginning. When the infection is of sufficient intensity and duration, it leads to the development of marked structural changes in the intestine, especially in the lower ileum and the colon. Acute gastro-enteric infection thus stands midway between acute indigestion and ileo-colitis.

Etiology.—Among the causes of acute gastro-enteric infection are to be mentioned, first, those which give rise to acute indigestion, and, secondly, the general factors mentioned as predisposing to all forms of diarrhœal disease—age, surroundings, constitution, food, and methods of feeding. (See page 310.) The most striking thing about these cases is their prevalence during hot weather; hence this feature demands a closer examination. While all varieties of diarrhœa are more frequent in summer, it is the form under consideration which is especially prevalent. Year after year are repeated in New York the conditions which are graphically represented in the charts on page 309—viz., an epidemic which beginning in June rapidly increases in severity reaching its height in July, from which time it diminishes steadily during August and September, regularly coming to an end in October. What is true of New York is also true of Philadelphia, Baltimore, and other large American cities, as well as of Berlin and other cities of central Europe. A study of these charts shows that while the mean temperature rises gradually during April and May, it is not until June is reached with its mean temperature of 61° F., that any notable increase in diarrhœal diseases begins. It appears then that an average mean temperature, or, according to Seibert, an average minimum temperature, of about 60° F. is needed to start the epidemic. Not many cases are seen until such a temperature has lasted for some days, usually about a week. The epidemic then begins in force and increases in severity through July. The explanation of the high mortality of this month appears to be, not the 4° or 5° F. by which the temperature of July exceeds that of June and August, but that the majority of the susceptible infants are unable to withstand the first very hot month. Humidity and rainfall, according to the careful investigations of both Seibert in New York and Baginsky in Berlin, do not influence either the prevalence of summer diarrhœa or its mortality.

The action of heat in producing diarrhœa was formerly regarded as a direct one. The worst cases were looked upon as examples of heat-stroke or thermic fever. There is no doubt that the constitutional depression produced by high atmospheric temperature may seriously interfere with digestion, and that sometimes the thirst which excessive perspiration produces may lead to the giving of too much food, which also may be a cause of indigestion. While this explanation may be satisfactory for a small proportion of the cases, it is not adequate for the great majority. The view almost universally held at the present time regarding summer diarrhœa is that it is of infectious origin. The grounds for this opinion are briefly as follows: A certain temperature is required, which is the same as that at which the growth of bacteria begins to be very active. This disease prevails to the extent to which other food than breast-milk is given to infants. Thus it affects infants after weaning, and those younger who are partly or entirely fed upon cow's milk, or at least who

are not nursed. Cow's milk, as ordinarily handled, contains in summer an enormous number of bacteria (page 144), which increase directly with the age of the milk and the height of the temperature at which it is kept. It has been shown by Vaughan and others that certain substances may be produced in milk which are capable of exciting in animals all the symptoms of severe cases of cholera infantum. In the milk which children had been taking when such symptoms developed, the same toxic substances were found. The two diseases to which summer diarrhœa has the closest analogy—typhoid fever and cholera—are both due to a specific infection.

During the past few years extended bacteriological studies of the intestinal discharges in these cases have been made, particularly by Booker (Baltimore) and Baginsky (Berlin). The results thus far obtained have failed to establish the connection between any single form of bacteria and any variety of diarrhœa. The forms most frequently associated with cases of the cholera-infantum type belong to the proteus group. The varieties found in the other cases have been chiefly the ordinary saprophytic bacteria, prominent among which is the hay-bacillus (Flügge). These germs gain entrance to the body, in the great majority of cases, through milk, although it is possible that water may sometimes be the vehicle. Whether they may be taken in with the inspired air is very questionable. In most of the cases it is probably the living bacteria which enter the body, while in others the symptoms are produced by taking food in which poisonous products have already been formed by the action of bacteria. The latter seems to be the explanation of some of the cases in which symptoms come on almost immediately after the ingestion of contaminated milk.

The acceptance of the view of the infectious character of summer diarrhœa, brings up the interesting question of direct contagion. With our present knowledge we can not believe that this is often, if it is ever, the way in which this disease is spread. When occurring in institutions or in families, it usually happens that a number of cases are attacked simultaneously rather than successively, this indicating a common cause, usually to be found in the food, for all. However, we know enough about the spread of typhoid fever and cholera from fæcal discharges, to appreciate the importance of careful disinfection of all stools and napkins, particularly in institutions.

Relation of the different etiological factors.—The predisposition to attacks of summer diarrhœa is partly general and partly local. The general influences are age (under two years), feeble constitution, unhygienic surroundings, and a condition of general malnutrition dependent upon improper food or feeding. The most important of the local causes is a chronic derangement of digestion, usually the result of improper feeding. In addition there may be present a low grade of catarrhal inflammation. The exciting cause of an attack may be acute indigestion. In conse-

quence of an arrest of digestion, there is left in the stomach and intestines food which readily undergoes decomposition; and at the same time there are furnished conditions in which bacteria may develop, which, though previously present, were unable to gain a foothold; or bacteria may be introduced in such numbers and of such virulence as to overpower the digestive organs; or, finally, bacterial products may be ingested with the food, requiring only absorption to produce their effects.

Lesions.—The statements which follow are based upon a study of forty autopsies, in twenty-two of which microscopical examinations were made. The lesion may be briefly described as a superficial catarrhal inflammation affecting the entire gastro-enteric tract, although it varies much in severity in the different regions and in the different cases. The colon, the lower ileum, and the stomach, are apt to suffer most, the duodenum and the jejunum least.

The gross appearances.—These are usually disappointing, and may often show but little that is abnormal. The stomach is distended with gas, and contains undigested food. Its walls may be coated with mucus. The upper part of the small intestine is empty. The lower portion contains particles of food, and yellow, gray, or green materials, often offensive, resembling the stools passed during life. The transverse colon, the cæcum, and sigmoid flexure are apt to be distended with gas, and contain materials similar to those mentioned, while the rest of the large intestine is usually empty and its walls contracted. It may be coated with mucus. The mucous membrane of the stomach may show intense congestion, generally in patches, or it may be pale. The mucous membrane of the small intestine may be pale throughout; there are often irregular areas of congestion, or a very intense congestion of a large part of its surface, particularly in the ileum. With this there may be redness and swelling of Peyer's patches and the lymph nodules (solitary follicles). In the colon the mucous membrane is congested, especially upon the rugæ. This congestion may be general or in patches. The lymph nodules are usually swollen; but this may be due to an antecedent process, and not to the final attack. There is no thickening of the intestinal walls. The changes described are not at all uniform, and do not differ very greatly from the appearances often seen in the intestines when patients have died of other diseases.

In the cases classed clinically as cholera infantum, the pathological changes are more characteristic. The greater part of the small intestine, and sometimes the entire colon, are distended with gas, and contain materials of a grayish-white colour about the consistency of a thin gruel. It has a mawkish odour, but usually not a very offensive one. The mucous membrane of the entire intestinal tract has in most cases a pale, "washed-out" appearance. Sometimes this is seen only in the small intestine, while there are areas of congestion in the colon. If cholera infantum has

been ingrafted upon some other pathological process in the intestines, as is not infrequent, there is found post-mortem evidence of this in the form of severe catarrhal inflammation, sometimes old ulcerations. In some cases, where the symptoms have been those of choleriform diarrhœa, there are found evidences of an intense diffuse gastro-enteritis, as shown by congestion of the stomach and almost the entire intestinal tract, with swelling of the mucous membrane, and especially of Peyer's patches.

*The microscopical appearances.**—Unless autopsies are made very soon after death—at least within four hours—it is not safe, in most of the cases, to draw conclusions from the conditions found; as post-mortem changes take place so readily in the intestines, and these changes are so like those of the disease under consideration. This applies particularly to the condition of the epithelium. One should also be cautious in interpreting the appearances of portions of the intestine which have been greatly distended with gas. The essential lesions of this disease are found in the superficial epithelium of the stomach and intestine. In places this has disappeared. In other places the cells are in position, but both the cell protoplasm and the nuclei are so changed that they do not stain normally. Bacteria, usually bacilli (Booker), are found in the epithelial layer and in the pockets of the follicles. They are not, as a rule, found in the deeper parts of the intestinal wall, nor in the lymph nodes of the mesentery. The changes in and about the blood-vessels are variable. The small vessels may be distended, and there may be hæmorrhages or an exudation of leucocytes in their neighbourhood. These appearances are seen either in the mucous or submucous layer. The exudation from the blood-vessels is usually slight, and in many cases is wanting. Peyer's patches and the lymph nodules may be enlarged from cell-proliferation. Pathologically no sharp line can be drawn between these lesions and those of the early stage of ileo-colitis; the latter affect the lower ileum and colon chiefly, often exclusively, and the lesions are more advanced and involve the deeper parts of the intestinal wall.

Clinically, there are two quite distinct forms of gastro-enteric infection, which will be separately considered—(1) the simple form and (2) true cholera infantum.

Simple Gastro-Enteric Infection.—There are seen in infants mild cases with a gradual onset, little or no fever, and no gastric disturbance, and severe cases with a sudden onset, usually attended by high temperature and by vomiting. In the mild form, there may be for the first few days no symptoms except the diarrhœal discharges, or the children may be peevish and fretful—especially at night—and may seem generally out of sorts. From the fact that the general symptoms are so few, such cases

* For fuller description, see article by the author in Keating's Cyclopædia, vol. iii, p. 80.

are often allowed to go on for several days, under the impression that the children are "only teething." The stools gradually become more frequent; they are thin, green, yellow, or brown, and always contain undigested food. After a time the odour becomes offensive, and mucus is present. The appetite may be normal, but is usually impaired, and may be almost lost. The tongue is coated, the mucous membrane of the mouth congested, and in very young infants often covered with thrush. The general health may not be noticeably affected for several days; but more often the infants become pale, their limbs grow soft and flabby, they lose their spirits, they are fretful, they sleep badly, and the scales show a loss of one or two pounds in a week.

With proper treatment, there is noticed in favourable cases an improvement in the character and frequency of the stools; the appetite returns; the strength and spirits improve; and the children recover after an illness of from one to three weeks. Occasionally the condition may last a much longer time. Relapses are very easily brought on by errors in diet, especially by overfeeding. In other cases severe symptoms may supervene at any time, and the case may become one of the cholera-infantum type. This often takes place with great suddenness, and is frequently coincident with a few days of very hot weather, or follows some gross dietetic error. In still others the symptoms may continue with the gradual formation of follicular ulcers, the case becoming one of ileo-colitis. A termination, not so common as either of the preceding, is a continuance of the mild symptoms with exacerbations and remissions, until the cool weather of autumn comes.

In the cases developing suddenly, the clinical picture is quite a different one. The attack may begin abruptly in a child previously healthy, or there may have been for some days a slight intestinal derangement. If an infant, it is restless, cries much, sleeps but a few minutes at a time, and seems in distress. The skin is hot and dry, the temperature rises rapidly to 102° or 103° F., often to 105°, and all the symptoms indicate the onset of some serious illness. The infant may lie in a dull stupor, with eyes sunken, weak pulse, and general relaxation, or there may be restlessness, excitement, even convulsions. There is great thirst, so that everything offered is eagerly taken, or everything may be refused. Usually, in the course of from four to six hours after the onset, vomiting begins; it is first of undigested food taken many hours before. If this was milk, it comes up in hard curds and very sour. Even after the stomach has been apparently emptied, mucus, serum, and sometimes bilious matters, are ejected in small quantities after much retching. Vomiting is easily excited by the giving of food or drink.

Diarrhœa soon follows—first fæcal stools, then great bursts of flatus, with the expulsion of a thin yellow material with an offensive odour. Four or five such discharges may occur in as many hours. In other cases the

stools are gray, green, or greenish-yellow, sometimes brown. They often do not differ at first from those of an ordinary attack of acute intestinal indigestion. The most characteristic features are the amount of the gas expelled, the colicky pains preceding the discharges, and the foul odour. After the first day the stools may be almost entirely fluid, varying in number from six to twenty a day, and often large even then. Their offensive character usually continues. After two or three days mucus may appear. The microscopical examination of the stools shows, besides the things mentioned in the stools of acute indigestion, great numbers of separate epithelial cells, and sometimes groups of cells attached to a basement membrane. In addition there may be round cells and some red blood-corpuscles. The bacteriological examination shows that the normal varieties are usually diminished in number, while many new forms are present, chiefly putrefactive bacteria.

In many cases the free evacuation of the bowels is followed by a drop in the temperature and subsidence of the nervous symptoms, and the child may fall asleep, to be awakened for an occasional stool after a few hours. The prostration, though often great in the beginning, is not usually of long duration. Under the most favourable circumstances, after one or two days of severe symptoms, the case goes on to a rapid convalescence. The stools continue abnormally frequent for five or six days, but gradually assume their normal character, and a prompt recovery occurs. The chief features contributing to such favourable results, are a good constitution on the part of the child and one's ability to regulate the feeding afterward.

If the circumstances are not so favourable, if the infant is very young, delicate, or cachectic, there may be no reaction from the first storm of symptoms, and the attack may terminate fatally. In such cases the temperature continues elevated from 100° to 103° F., sometimes higher. The stomach is irritable and rejects everything. The stools continue thin, green, and are often irritating to the anus and skin. There is steadily increasing prostration, and death may take place from exhaustion in semi-stupor or in convulsions. In other cases the vomiting ceases, the temperature falls, the stools become less frequent and perhaps less offensive, but contain more mucus and occasionally traces of blood. There is also some reaction from the early nervous depression, but the children become pale, worn, and waste steadily. The temperature ranges between 99° and 102° F., and all the symptoms belonging to ileo-colitis gradually develop. Sometimes there may be a series of such acute attacks separated by a week or ten days, the stools never becoming quite normal between them, but all other symptoms being absent. It may not be until the third or fourth attack that ileo-colitis is finally established.

In children over two years old there are seen some features which differ from the cases described above as occurring in infants. Vomiting

does not come on so readily as in infants, pain is a more prominent symptom, and the temperature, as a rule, is lower. Such cases, although beginning with severe symptoms, usually make good recoveries; there is much less likelihood of their going on to the development of ileo-colitis than in the case of infants.

Diagnosis.—The diagnostic points about these attacks are their sudden onset, severe symptoms, comparatively brief duration, and usually favourable termination. Attacks of acute gastro-enteric infection can not always be distinguished from acute indigestion, but as a rule they are characterized by a higher temperature, greater disturbance of the nervous system, very offensive fluid stools, and by occurring epidemically in summer. To differentiate these cases from those of ileo-colitis, may be impossible for the first two or three days. The onset may be identical in both cases. The continuance of high temperature beyond the second day points to inflammatory changes; so also do the appearance of blood and of much mucus in the stools, and the existence of continuous pain.

Almost any acute disease in infants may be ushered in with gastro-enteric symptoms, especially in summer. This is particularly true of scarlet fever, pneumonia, tonsillitis, and malaria. Each one of these is to be recognised by its peculiar symptoms: pneumonia, by its rapid respiration and physical signs; tonsillitis, by the appearance of the throat; scarlet fever, by the appearance of the throat and the eruption; malaria, by the enlarged spleen and remittent temperature. One should look for some other disease whenever there is seen very manifest improvement in the gastro-enteric symptoms, with a continuance of the high temperature and general prostration.

Prognosis.—Simple cases of gastro-enteric infection do not often prove fatal, except in infants under three months old or those already suffering from marasmus. Such patients are often overcome in the first stage of intoxication. It is surprising to see with how few symptoms they succumb. Even an apparently mild attack may prove fatal, and a guarded prognosis must always be given.

In other cases the prognosis resolves itself into this question: What are the probabilities that the existing attack will go on to the development of serious intestinal lesions? If the child has been delicate, badly fed, has suffered from frequent attacks of indigestion and diarrhœa, if its surroundings are bad, if the case has been neglected for two or three days, and if proper dietetic and hygienic treatment can not be carried out, it is probable that the process will continue until structural changes in the intestine have taken place. The degree of probability is in proportion to the number of these factors present. Manifestly, all the conditions are worse in hot weather. Much depends upon early treatment and upon our ability to remove the exciting causes. If the patient was previously suffering from any other disease, such as rickets or pertussis,

the prognosis is much worse both as to life and to the duration of the attack.

Prophylaxis.—So long as dentition and atmospheric heat *per se* were regarded as the great causative factors, the field of prophylaxis was limited; but a better understanding of the etiology brings with it great possibilities in the prevention of this disease.

Prophylaxis must have regard, first, to the hygienic surroundings of children, and to all sanitary conditions in the cities—cleaner streets and more parks. In the tenement homes and all institutions for infants, there should be more air and sunlight, less crowding, greater cleanliness about the persons of children, frequent bathing, and proper care of napkins. In summer, napkins should either be washed immediately or thrown into a disinfectant solution. In case infants are suffering from diarrhœa this latter plan should invariably be followed. City children should be sent to the country, wherever it is possible, for the months of July and August. Part of the benefit here is derived from the change of air, and a larger part from the pure milk, which is almost out of the question for the poor in the city. Where a long stay is impossible, day excursions do much good. The fresh-air funds and seaside homes have done more in New York to diminish the mortality from diarrhœal diseases in summer than all medicinal treatment; their importance and value can not be overestimated.

The second part of prophylaxis relates to foods and feeding. Maternal nursing should be encouraged by every possible means. No weaning should be done, if it can be avoided, during summer. Nothing is better established than the close relation existing between artificial feeding and diarrhœal diseases. I have elsewhere stated my belief that in the great majority of the cases it is ignorant and improper artificial feeding which is the real cause. The general rules laid down elsewhere on the subject of artificial feeding must be carried out, as to the quantity of food, frequency of feeding, modification of cow's milk, and all matters relating to the care, transportation, and sterilization of milk. Whatever causes indigestion, whether it be acute or chronic, may also be ranked as a cause of diarrhœal diseases. The important dangers to be emphasized in this connection are overfeeding, too frequent feeding, the use of improper foods, and use of impure foods, especially milk.

Overfeeding is particularly to be avoided during days of excessive heat. It is at such times an excellent rule with infants to diminish each meal by at least one third, making up the deficiency with water, and to give water very freely between the feedings. All water given to infants or young children should first be boiled. Children, like adults, require less food in very hot weather, but more water. Infants cry from thirst and heat, and even those at the breast are likely to be given too much food. Infants should never be fed more frequently during hot weather, but generally less so.

No greater work of philanthropy can be done among the poor in summer, than to provide means whereby pure, clean milk for young children can be supplied at the price now paid for an inferior article.*

Early and prompt attention should be given to all the milder derangements of the stomach and intestines. The larger proportion of serious attacks are preceded for some time by milder symptoms, which are often easily managed by prompt attention at the outset. Too much can not be said in condemnation of the practice of allowing a diarrhœa to continue for a week or more, simply because the child happens to be teething. Yet many mothers believe such a condition of the bowels to be, not only not injurious, but positively beneficial.

In brief, prophylaxis demands (1) sending as many infants out of the city in summer as possible; (2) the education of the laity up to the importance of regularity in feeding, the dangers of overfeeding, and as to what is a proper diet for infants just weaned; (3) proper legal restrictions regarding the transportation and sale of milk; (4) the exclusion of germs or their destruction in all foods given, but especially in milk, by careful sterilization in summer, and by scrupulous cleanliness in bottles, nipples, etc.; (5) prompt attention to all mild derangements; (6) cutting down the amount of food and increasing the amount of water during the days of excessive summer heat.

Hygienic Treatment.—If the attack occurs in the city in midsummer, and does not yield in three or four days to the treatment employed, the child should be sent to the country, if possible. In the case of an infant under a year this is imperative. Usually the seashore is to be preferred to the mountains, but this is not so important as it is that the child shall go where it is likely to have the best food and the best surroundings. Children must not only be sent away; they must be kept away until quite recovered. In the country or in small towns a change is not so necessary, and, in fact, not generally required. In cases which have become somewhat chronic, more can sometimes be accomplished by a change of air than by all other means.

Fresh air is of the utmost importance for all diarrhœal cases in summer. No matter how much fever or prostration there may be, these cases always do better if kept out of doors the greater part of the day. Nothing is so depressing as close, stifling apartments. Children should be kept quiet, and especially should not be allowed to walk, even if they are old enough and strong enough to do so. They can be kept out in carriages, in perambulators, or in hammocks.

* Something of this has already been done in Boston by the milk laboratory, and in New York by the milk dispensary in connection with the Good Samaritan Dispensary, which has been organized by Koplik to furnish "sterilized" milk for infants; and also by the Straus milk depots, where the same thing is done on a much larger scale, this charity having branches in half a dozen districts of the city.

The clothing should be very light flannel; a single loose garment is preferable. Linen or cotton may be put next the skin if this is very sensitive and there is much perspiration. At the seashore and in the mountains, special care should be taken that sufficient clothing at night is supplied.

Bathing is useful to allay restlessness, as well as for cleanliness and the reduction of temperature. For the first purpose a sponge bath of alcohol and water or vinegar and water, is sufficient. For the reduction of temperature, only the tub bath is to be relied on. If the temperature continues above 102° F., systematic bathing should be employed. The temperature of the bath should be about 100° F. when the child is put into it, and should then be gradually reduced to 80° or 85° F. by adding ice. The bath should be continued for from ten to twenty minutes, according to the requirements of the case. Thus used, it has generally a very quieting effect, which is entirely lost by the terror and excitement caused by putting a young child suddenly into a cold bath.

Scrupulous cleanliness should be secured in the child's person and clothing. Napkins, as soon as soiled, should be removed from the child and from the room and placed in a disinfectant solution. Excoriations of the buttocks and genitals are to be prevented by scrupulous cleanliness and the free use of some absorbent powder, such as starch and boric acid.

Dietetic Treatment.—It is of the first importance to remember that during the early stage of the acute cases, digestion is practically arrested. To give food at this time, manifestly can only do harm.

In nursing infants, the breast must be withheld so long as a disposition to vomit continues, and no food whatever given for at least twelve hours. Thirst may be allayed by giving frequently, but in small quantities, cold whey, barley or albumin water. Stimulants may be added to these if required. If they are refused or vomited, absolute rest to the stomach will do more than anything else to hasten recovery. After the stomach has been quiet for twenty-four hours, it is generally safe to allow the child to be put to the breast tentatively. The intervals of nursing should not be shorter than four hours, and the amount allowed at one feeding should not be more than one fourth the usual quantity. This may be regulated by allowing an infant to nurse at first only two or three minutes. Between the nursings may be alternated, whey, barley water, or albumin water, so that something is given every two hours. Nursing may be gradually increased, so that in three or four days the breast may be taken exclusively. If there is any reason to suspect the breast milk, such as menstruation, pregnancy, or some special nervous disturbance, it may be necessary to stop the nursing temporarily or permanently, according to circumstances, and secure a wet-nurse or begin artificial feeding. In infants just weaned the same plan is to be followed.

In infants under four months who are being artificially fed, if the

attack be a severe one and occur in summer, a wet-nurse should be secured wherever this is possible. If this is out of the question, we have to face one of the most difficult problems in artificial feeding. Cow's milk must always be withheld entirely during the stage of acute symptoms, and for several days longer. When it is begun, both the casein and the fat must be very greatly reduced by dilution, and in many cases the casein predigested. For young infants, milk should be diluted from six to ten times, and preferably with a sugar solution. (See formulæ XVII and XVIII, page 176). Instead of using only a sugar solution, part of the dilution may be with barley or rice water. In some cases it may be sufficient to peptonize milk for ten or twenty minutes; but in many we must do more, at first continuing the peptonizing for two hours, or until the digestion of the casein is complete (page 148). Kumyss and matzoon are sometimes retained when cow's milk is rejected. These should be diluted with two or three parts of water and given cold. They may sometimes advantageously be continued as the sole diet for several days. During the period of acute symptoms we must rely upon the substitutes for milk—rice or barley water, wine whey, the malted foods, albumin water, fresh beef juice, animal broths, and the liquid beef peptonoids.*

The same general principles of feeding must be applied in older children. All food is to be withheld until the vomiting ceases, and then broths and beef juice given; later, kumyss or matzoon, then milk, or thin gruels made with milk. Solid food should not be allowed for several days after the stools have become normal.

General principles of feeding.—All food, but especially cow's milk, must be stopped at once. No food whatever is to be given upon a very irritable stomach; but thirst must always be relieved by bland fluids given frequently in small quantities, and cold. Articles requiring the least digestion and leaving the smallest residue should next be tried. Food prescriptions must be made with the same care and exactness as those for drugs, for in most cases they are more important. Quantity and frequency must be definitely stated, as well as the articles ordered. Directions should be given in writing, or they will be forgotten before the physician is out of the house. A practical acquaintance with the proper appearance and taste of every food ordered, is absolutely indispensable. It is a common mistake to give too much at a time, to feed too frequently, to try too many articles at once, and to change before a thing has been fairly tested. For a single feeding the quantity allowed will vary according to the tolerance of the stomach, but it should always be much less than is given in health, usually from one fourth to one half that amount. It is very rarely, if ever, necessary to nurse or feed a sick child oftener than every two hours. In cases of great prostration, stimulants may be

* These foods are considered at length on pages 150–157.

required much more frequently. We have only to imagine how an adult suffering from nausea would feel to be offered something in the shape of food every five or ten minutes, in order to appreciate the disgust for all food which soon overtakes an infant who is similarly besieged.

Still, after all has been said, it is a difficult problem to feed these children under three years of age, capricious as they are by nature and still more by education, and the judgment and tact of the physician are taxed to their utmost. We must have many resources, for a food which one child takes well the next disdains utterly. The best plan is to select from a list of articles of accepted value, such as circumstances will permit, and such as are most likely to be properly prepared, and try them patiently, one after another, until one is found which the child under treatment will take, and one which agrees with him.

Medicinal and Mechanical Treatment.—It must be borne in mind that we are not treating an inflammation of the stomach or intestines, although such may be the ultimate result of the process. Our therapeutic measures are to be directed against the acute indigestion and the active putrefaction in the alimentary tract.

The first indication is, therefore, to evacuate the stomach and the entire intestinal tract at the earliest moment, and to do this as thoroughly as possible. Under no circumstances should the treatment be begun with the use of measures to stop the discharges.

To empty the stomach is not necessary in every case, since the initial vomiting may have done this efficiently. Whenever vomiting persists immediate resort should be had to stomach-washing (page 60). A single washing is generally sufficient, and if employed at the outset may do much to shorten the attack. If there are high fever and great thirst, it is often advisable to leave an ounce or two of water in the stomach. If the vomited matters have been very sour, ten grains of bicarbonate of soda may be introduced with the portion which is to be left behind. To older children emetics may be given, but to infants never. As a substitute for stomach-washing in children over two years old, or where it can not be employed, copious draughts of boiled water may be given. This is taken readily, and as it is usually vomited almost at once it may cleanse the stomach thoroughly; but it is inferior to stomach-washing.

To clear out the small intestine, only cathartics are available. For the colon, we may in addition employ irrigation. Calomel and castor oil are greatly superior to all other cathartics. Calomel has the advantage of ease of administration, of a favourable effect upon vomiting, and of an antifermentative as well as purgative action. One fourth of a grain should be given every hour up to eight doses, or until the characteristic green stools are seen. When the stomach is not disturbed, I prefer castor oil in most cases, as it sweeps the whole canal, causes little griping, is very certain, and its after-effects are soothing. It is important that a full dose be

given—two drachms to a child a year old, and half an ounce to one of four years.

Irrigation of the colon (page 63) is advisable in all cases, as it hastens the effect of the cathartic and removes at once much irritating and offensive material. It should be done two or three times the first day, but afterward once daily is sufficient. A saline solution (one ounce to the gallon), at a temperature of about 90° F., is to be preferred; and a long rectal tube should always be used. The initial evacuation, almost complete starvation for twenty-four hours, and careful feeding after that time, are all the treatment that is necessary in a large number of cases.

Other drugs are of secondary importance. Their value is certainly very much overestimated. This statement is made after a thorough and honest trial, in hospital and private practice, of most of those that have been recommended. Since the recognition of the fact that putrefactive processes play so important a rôle in these cases, the drift of opinion and practice has been toward the use of drugs believed to act in the alimentary tract as antiseptics. In using drugs the conditions usually present are to be kept in mind: the digestive process in the stomach and upper small intestine is feebly carried on, and there is very active decomposition in the lower part of the small intestine and in the colon. In comparison with the intestinal contents, the amount of any drug which can be administered is so small, the conditions in the intestine are so complex, and our present knowledge of the exact nature of the processes of fermentation or decomposition which we wish to control is so limited, that it is extremely doubtful whether such a thing as antiseptic medication of the gastro-enteric tract is practicable at the present time. It is more than probable that a very large number of the drugs given to influence this process, never reach that part of the intestine where the most active decomposition is going on. Experience has shown that certain drugs which have been classed as antiseptics are valuable, but as yet we must use them empirically. Those in my experience which have been found most useful are bismuth, calomel, salol, and salicylate of soda; although the list might be very much extended.

Bismuth has the advantage that it rarely causes vomiting, and that most of its preparations can be given in large doses. Of the newer preparations, the salicylate, subgallate and beta-naphthol bismuth, the subgallate is easily superior to the others. This may be given in doses of from two to four grains every two hours, to a child of one year. Like the subnitrate it is insoluble and is best given suspended in mucilage. The salicylate may be given in the same doses as the salicylate of soda. For the great majority of cases, however, I think the subnitrate is still to be preferred. To be efficient, at least two drachms of this should be given daily to a child two years old. It usually blackens the stools. It may be kept up throughout the attack. Calomel may be given in doses of one twentieth to one

tenth grain every hour. Its best effects are seen where it is used early in the disease. It should not be continued for more than twenty-four or thirty-six hours. The gray powder may be given in the same manner. Salicylate of soda is probably decomposed in the stomach, setting free salicylic acid ; to a child of one year, two grains may be given, dissolved in water, every two hours, after feeding. This is not to be used if the stomach is very irritable, as it may excite vomiting. Its best effect is seen after the vomiting has stopped, and when the stools are fluid. It should be given alone. Salol is decomposed in the intestine into salicylic and carbolic acids. To a child of two years one grain may be given every two hours ; sometimes more will be borne. It may be given alone, or with bismuth. This also may cause vomiting. Acids have been recommended, on the ground that the gastric contents, when examined, show a deficiency of hydrochloric acid, and from the experiments of Pfeiffer, which indicate that green stools are dependent upon an alkaline fermentation in the intestine. The acids most used are hydrochloric and lactic. Of the former, from one half to three drops of the dilute acid may be given, well diluted with water, every two hours, fifteen minutes after feeding. Of the latter, slightly larger doses may be used. They are not indicated in the most acute cases when vomiting is present, or when the stomach is easily disturbed. The best results are seen from them in the later stages and in the subacute cases. Acids are best given alone. Alkalies are of value only in acute cases, especially where there is acid fermentation of the stomach, with vomiting and eructations of gas. Limewater, bicarbonate of soda, magnesia, or chalk mixture may be employed. My own experience accords with that of most recent writers in attributing to astringents little or no value. They often do positive harm, by disturbing the stomach and interfering with digestion.

While opium in some form or quantity is required in many cases, as often used it undoubtedly does more harm than good. The chief symptoms indicating opium are great frequency of movements and severe pain. It is contra-indicated until the intestinal tract has been thoroughly emptied by cathartics and by irrigation ; also when the number of discharges is small, particularly if they are very offensive; it is especially to be avoided when cerebral symptoms and high temperature coexist with scanty discharges. Opium is admissible in the early part of the disease after the tract has been thoroughly emptied ; it is also useful sometimes during convalescence, when the administration of food is followed immediately by a movement of the bowels; and when, without an elevation of temperature, often with good appetite, the stools are frequent and contain undigested food, because peristalsis is so active that the intestinal contents are hurried along with such rapidity that there is not time for complete intestinal digestion and absorption. Nothing requires nicer discrimination than the use of opium in diarrhœa. It is wise to administer

it always in a separate prescription, and never in composite diarrhœal mixtures. In this way it can be regulated according to the effect produced upon the number of stools. If, following the administration of opium, the stools, though diminishing in number, do not improve in character, and the temperature rises, the dose must be greatly reduced or the drug stopped altogether. There is no great choice as to preparations. Dover's powder, the deodorized tincture, and paregoric are perhaps the most satisfactory. As to dosage, great variations are required in the different cases. Enough is to be given to produce a certain effect—the diminution of pain and the control of excessive peristalsis—but never enough to check the number of discharges entirely, or to cause stupor. The uncertainty of absorption must also be remembered; a second full dose should not be given until a sufficient time has elapsed for the effect of the first to pass away. Better results are commonly obtained by the frequent use of very small doses, than by larger ones at longer intervals. For an average child of one year, five minims of paregoric, one fourth minim of the deodorized tincture, or one fourth grain of Dover's powder, may be used as an initial dose, to be repeated every one, two, or four hours, according to the effect produced. In some cases excellent results are obtained by the use of morphine hypodermically; to a child of one year $\frac{1}{100}$ grain may be given, and the dose repeated in an hour if no effect is seen.

Stimulants are required in the majority of the severe cases. The prostration is great and develops rapidly; frequently almost no food can be assimilated for twenty-four or thirty-six hours, while the drain from the discharges continues. The general condition of the patient is the best guide as to the time for stimulation and the amount given. Usually stimulants are not begun early enough. Old brandy is the best preparation for general use, champagne possibly being preferred for older children when the stomach is very irritable. An infant a year old will, under most circumstances, take from half an ounce to an ounce of brandy in twenty-four hours. Stimulants should always be diluted with at least six parts of water, and should be given cold, preferably in small quantities, at short intervals. If they are not retained when given by the mouth, they may be used hypodermically.

In cases of extreme prostration, the hot bath, mustard to the extremities, and sometimes the mustard pack, are beneficial. Where the drain is rapid and very great, and in all cases approaching the cholera-infantum type, subcutaneous saline injections should be used, in the manner described under Cholera Infantum.

General considerations in treatment.—(1) All severe cases must be watched very closely, especially those in infants under six months. If the temperature is rising and the passages are very fluid, one should always be apprehensive. (2) The character of the discharges is a better indica-

tion than is their number, of the patient's condition and of the effect of any plan of treatment. (3) Nothing is more simple than to give opium enough to reduce the number of passages; but unless there is some other sign of improvement, very little good, and probably much harm, has been done. (4) We must treat the patient, and not direct all our thought to acid or alkaline stools, ptomaines, or bacteria. The value of every therapeutic measure is to be estimated by its effect upon the patient's general condition. (5) No matter how strongly we may be convinced of the value of any drug or combination of drugs, if they continue to disturb the stomach they are worse than useless. (6) Both the mother and nurse must be impressed by the fact that the diet is an important part of the treatment, and that foods need to be given just as carefully as drugs. (7) In the management of any single case the important thing is prompt and thorough evacuation of the stomach and bowels, then rest for these organs for from twelve to twenty-four hours, or, as some one has tersely put it, "bold starvation"; but it is necessary in all cases that water be given freely. No cases do worse than those in which the mother or nurse in charge can not be made to appreciate the value of starvation, but insists upon giving food, especially milk, in violation of the rules laid down. (8) Great care is required during convalescence, and in fact during the remainder of the summer, to prevent relapses; these usually occur from errors in diet, particularly during days of excessive heat.

Cholera Infantum.—In comparison with the class of cases just considered, cholera infantum is rare. The term should be restricted to cases of genuine choleriform diarrhœa. Much confusion has arisen from adopting this as a generic name for all cases of summer diarrhœa. There is no other form of diarrhœal disease in which the evidence of infectious origin is so strong. Its resemblance to Asiatic cholera is striking. Its close connection with the feeding of impure cow's milk is well established. The symptoms are essentially toxic, and are due to the effect of the poison upon the heart, the nerve-centres, and the vaso-motor nerves of the intestine. The secondary symptoms depend upon the abstraction of fluid.

Cholera infantum may occur in an infant previously healthy, but this is very rare. As a rule, there is some antecedent intestinal disorder. It may be a mild diarrhœa of a few days' or even weeks' duration, or it may supervene in the course of a subacute ileo-colitis with such severity as to carry off the patient in a few hours. The development of the choleriform symptoms in all cases is very rapid, and a child, who perhaps has been regarded as scarcely ill enough to require a physician, may be brought, in the course of five or six hours, to death's door.

Usually there are general symptoms—prostration, and a steadily rising temperature—for a few hours before the vomiting and purging begin, or these may be the first things to excite alarm. Vomiting may precede diarrhœa, or both may begin simultaneously. The vomiting is very fre-

quent. First, whatever food is in the stomach is vomited, then serum and mucus, and finally bilious matter. If it subsides for a time, it is almost sure to begin anew by the taking of food or drink. The stools are frequent, large, and fluid, and in the course of half a day, twelve or fifteen may occur. If less frequent they are proportionately larger. They are of a pale green, yellow, or brownish colour in the beginning, but as they become more frequent they often lose all colour and are almost entirely serous. The sphincter is sometimes so relaxed that small evacuations occur every few minutes. The first stools are usually acid, later they are neutral, and when serous they may be alkaline. In most cases they are odourless; in rare instances they are exceedingly offensive, at times the odour being overpowering. Microscopically the stools show large numbers of epithelial cells, some round cells, and immense numbers of bacteria.

Loss of weight is more rapid than in any other pathological condition in childhood. Baginsky records a case in which it reached three pounds in two days. The fontanel is depressed, and in rare instances there may be overlapping of the cranial bones. The general prostration is great almost from the outset. The face, better, perhaps, than any single symptom, indicates what a profound impression has been made upon the system. The eyes are sunken, the features sharpened, the angles of the mouth drawn down, and a peculiar pallor with an expression of anxiety overspreads the whole countenance. In the early stages the nervous symptoms are those of irritation: children cry loudly or moan, and throw themselves fretfully about in their cribs, the excitement sometimes bordering upon an active delirium. Later, these symptoms give place to dulness, stupor, relaxation, and coma or convulsions.

The temperature, in my experience, has been invariably elevated, and usually in proportion to the severity of the attack. In cases recovering, it has generally been from 102° to 103° F., while in fatal cases it has risen almost at once to 104° or 105° F., and often shortly before death it has reached 106° or even 108° F. Such a rectal temperature often occurs with a clammy skin and cold extremities, and is discovered only by the thermometer. Many writers speak of subnormal temperature in the later stages, but such has not been my experience. The pulse is always rapid, and very soon it becomes weak, often irregular, and finally almost imperceptible. The respiration is irregular and frequent, and may be stertorous. The tongue is generally coated, but soon becomes dry and red, and is often protruded. The abdomen is generally soft and sunken. There is almost insatiable thirst. Everything in the shape of fluids, especially ice-water, is drunk with avidity, even though vomited as soon as it is swallowed. Very little urine is passed, sometimes none at all for twenty-four hours; yet this need give no special concern, as it depends upon the great loss of fluid by the bowels.

Symptoms such as those described rarely continue more than one day without a decided change either for better or worse. In the fatal cases there are hyperpyrexia, cold, clammy skin, absence of radial pulse, stupor, coma or convulsions, and death. The diarrhœa and vomiting may continue until the end, or both may entirely cease for some hours before it occurs. The patients may pass into a condition resembling the algid stage of epidemic cholera, with pinched, sunken features, subnormal temperature, dyspnœa, and cool breath, and may die in collapse. In other cases, after the first day of very severe symptoms, the discharges diminish, but the nervous symptoms become specially prominent. There are restlessness and irritability or apathy and stupor. The fontanel is sunken; the eyes are half open and covered with a mucous film; respiration is irregular and superficial, sometimes even Cheyne-Stokes; the pulse is feeble, irregular, or intermittent; the extremities are cold; the muscles of the neck drawn back; the abdomen retracted; no desire for food is shown, the patient rousing only from thirst. The temperature is not elevated, but normal or subnormal. From this condition recovery may take place with gradual abatement of the nervous symptoms, improved pulse and circulation, the stools gradually becoming more consistent and having more colour; or the symptoms may merge into those of ileo-colitis. Much more frequent than either of the foregoing, is the fatal termination.

These nervous symptoms described were grouped by the earlier writers, first by Marshall Hall, under the term *spurious hydrocephalus*, or *hydrencephaloid*. They have been variously explained by different writers as due to cerebral anæmia, cerebral hyperæmia (venous), œdema of the meninges, thrombosis of the cerebral sinuses, and uræmia. In but a single instance have I met with post-mortem changes in the brain which bore any proper relation to the symptoms.* Although I have examined the brain in almost all my autopsies upon patients dying from diarrhœal diseases, I have never in such cases seen sinus thrombosis, and but rarely œdema. Cerebral hyperæmia was often met with in cases dying in convulsions, but not with any regularity otherwise. Nor have my observations upon the kidneys confirmed the observations of Kjellberg, whom most of the writers since his day have quoted, as to the great frequency of nephritis. Albumen, casts and renal epithelium in the urine are rare, and blood I have never seen. The kidneys at autopsy are found generally paler than normal, with a moderate cloudy swelling of the cortex, but not more than in other febrile disorders of infancy. These facts forbid our regarding either the renal or the cerebral changes as an explanation of the

* In this infant the cerebral symptoms were so marked and so characteristic that two excellent physicians who watched the case, unhesitatingly made a diagnosis of meningitis. The intestinal symptoms were considered of secondary importance. The autopsy revealed follicular ulcers of the ileum, moderate parenchymatous nephritis, and an extreme degree of cerebral anæmia.

nervous symptoms of most of these cases; they seem rather to depend upon acute inanition and intestinal toxæmia.

In cases going on to recovery the vomiting usually ceases first; then the stools become less frequent, contain more solid matter, and have more colour. Improvement in the pulse, a fall in the temperature, and subsidence of the nervous symptoms soon follow. The disappearance of the nervous symptoms is always to be regarded as a very favourable sign. The discharges gradually assume more and more of the character of a catarrhal diarrhœa, which continues a week or more. Convalescence is never very rapid. Sometimes, after all signs of improvement have continued for two or three days, the choleraic discharges return with great severity, and the case proves fatal.

An infrequent complication of cholera infantum is sclerema. This condition is found associated with muscular contractions, subnormal temperature, and other signs of the most extreme depression. These cases are invariably fatal.

Diagnosis.—Cholera infantum can scarcely be mistaken for any other form of intestinal disease if its chief symptoms are kept in mind—constant vomiting, profuse serous stools, great thirst, dry tongue, high temperature, and great restlessness, followed by rapidly developing collapse, sunken fontanel, pinched, anxious face, cold extremities, weak pulse, dyspnœa, cyanosis, stupor, coma, and death.

Prognosis.—The prognosis is worse in a very young infant, in one who has been badly fed and poorly cared for, when all the surroundings are unfavourable, when the patient has suffered from antecedent disease, and in midsummer. Yet fatal cases are often seen in infants previously healthy and living in good surroundings. There are cases in which it is evident, from the first few hours of the attack, that death will be the issue. The physician is never warranted in telling parents that the result would have been different had he been called in time. No matter what treatment is employed, the vast majority of the very severe cases terminate fatally. Of the cases of true cholera infantum which have come under my notice during the last ten years, fully two thirds have died. The result depends more upon the severity of the attack than upon anything else.

Treatment.—Restricting the term to the class of cases described above, all who have seen much of the disease must admit that the results of treatment are extremely unsatisfactory, and that the most severe cases pursue their course but little, if at all, influenced by the treatment employed. This statement is made after personal trial of almost every method of treatment which has been advocated by writers upon the subject.

In the way of prophylaxis much can be done. All the general rules of prevention laid down in the previous chapter should be enforced here. Special emphasis, however, is to be laid upon the early treatment of the

milder intestinal derangements, since it is a rule, to which the exceptions are few, that such symptoms precede for some days the occurrence of the choleriform diarrhœa. No case of diarrhœa in summer is to be neglected on the score of existing dentition. It is also important in convalescence from ileo-colitis that vigilance should never be relaxed until the stools are normal. One frequently sees cases which, so far as it is possible to judge, had been progressing steadily toward recovery, cut off in a day by the development of cholera infantum.

The best view of the treatment will be gained if we keep in mind that we are not treating intestinal catarrh, nor intestinal inflammation, although this may ensue, but that these are essentially cases of poisoning; that the toxic materials act by causing great depression of the heart and the system generally by acting on the nerve-centres, and by paralysis of the vaso-motor nerves of the intestines.

The main indications are: (1) to empty the stomach and intestine; (2) to neutralize the effect of the poison upon the heart and nervous system; (3) to supply fluid to the blood to make up for the very great drain of the discharges; (4) to reduce the temperature; (5) to treat special symptoms as they arise.

For the first indication we must rely upon mechanical means—stomach-washing and intestinal irrigation—for there is no time to wait for the action of cathartics. For the second, nothing in my hands has proved so useful as the hypodermic use of morphine and atropine. I believe this to be more efficient than any other means of treatment we possess. Morphine is contra-indicated where the purging has ceased or is slight, and where there is drowsiness, stupor, or relaxation. The effects of the dose should always be carefully watched; a small dose repeated is better than a single large dose. For a child a year old, not more than gr. $\frac{1}{100}$ of morphine and gr. $\frac{1}{800}$ of atropine should be the initial dose. It may be repeated every hour until the desired effects are produced: these are, arrest of the vomiting and purging (or at least their diminution), improvement in the heart's action, and in the nervous symptoms. Here, as in shock, we find morphine our most reliable heart stimulant. The use of opium by the mouth is not to be relied upon, owing to the uncertainty of absorption and the liability to produce vomiting.

For the third indication, it is useless to give fluids by the mouth. The only thing that can be depended upon is the injection into the cellular tissue of a saline solution (common salt forty-five grains, sterilized water one pint). This may be injected into the cellular tissue of the abdomen, buttocks, thighs, or back. To be efficient at least half a pint should be given in the course of every twelve hours. A very much larger quantity can often be used with advantage. This causes no irritation, and is absorbed with surprising rapidity. A simple apparatus for making the injection has been devised by Dawbarn, viz., to attach the

needle of a hypodermic syringe by a few inches of rubber tubing, to the nozzle of a bulb (Davidson's) syringe. It must be tied securely. Only a sterilized syringe should be used, and care must be taken to prevent the entrance of air. The injection is made slowly, and the exact amount introduced at each time, measured.

Only baths are to be relied upon for the reduction of temperature. The graduated bath should be used, as described on page 48. It may be continued from ten to thirty minutes. To be efficient, it must be used frequently—as often as every hour if symptoms are threatening. Iced cloths or an ice cap should be applied to the head. Ice-water injections are a valuable accessory to the treatment by baths. A rectal tube should be used, and the injection carried high up into the colon, the water being allowed to flow in and out freely. Nothing should be allowed by the mouth except ice and iced champagne or brandy. The stimulants must be given in small quantities and frequently. When stimulants taken by the mouth are vomited, they should be given hypodermically. Brandy, ether, or camphor may be employed, and used freely. During the stage of most acute symptoms, to attempt to give food or drugs of any kind by the mouth is worse than useless. After the stage of violent symptoms has subsided and reaction is established, the subsequent management in respect to feeding and medication should be the same as in the cases considered in the previous chapter. If the symptoms described as *hydrencephaloid* are present, opium is to be avoided, stimulants by the mouth used freely, and, if these are not retained, they should be given hypodermically. For cold extremities and subnormal temperature, hot mustard baths should be used to establish reaction, mustard paste applied all over the body, and hot-water bags and bottles placed about the patient.

CHAPTER VIII.

DISEASES OF THE INTESTINES.—(Continued.)

ACUTE COLITIS AND ILEO-COLITIS.

Synonyms: Entero-colitis, enteritis, enteritis follicularis, dysentery, inflammatory diarrhœa.

The terms *colitis* and *ileo-colitis* are general ones, embracing those forms of intestinal disease in which there are found more serious lesions than those of the superficial epithelium, which occur in acute gastro-enteric infection. By separating these two groups of cases it is not meant to imply that cases of ileo-colitis are not infectious; but in gastro-enteric infection recovery or death takes place before anything more than superficial changes have occurred, while in the ileo-colitis the pathological

process continues until there have been produced marked lesions, often involving all the walls of the intestine. Ileo-colitis is thus to be regarded as a condition in which any case of gastro-enteric infection may terminate. Sometimes the transition is so gradual that it is impossible, by symptoms, to draw a line between them. This is especially true of the cases terminating in follicular ulceration of the colon. In some of the other forms—acute catarrhal and acute membranous colitis—the evidences of a severe intestinal inflammation are often manifest from the very outset. This difference is probably due to the character of the infection and its virulence in the two classes of cases. The extent of the lesions depends very much upon the duration of the process. It has seemed wise, with our present understanding of these cases, to drop the term *dysentery* as a generic one, grouping them all under the general head of ileo-colitis until an etiological classification shall become possible.

Etiology.—Most of the etiological factors discussed in the previous chapter apply with equal force to the cases of ileo-colitis. It may be secondary to any of the infectious diseases, particularly measles, diphtheria, and broncho-pneumonia. Epidemics of ileo-colitis, in the true sense of the term, I have never seen. As to contagion, we are still in doubt as to the degree in which this is possible. Infants are most often affected, but the disease is not uncommon up to the fifth year. Attacks are more frequent in the summer, but they may occur at any season of the year. They are often seen in the fall months, when outbreaks sometimes seem to be very closely connected with marked changes in the temperature.

But little is as yet definitely known regarding the nature of the infection in cases of ileo-colitis. Booker found that the deeper lesions were almost invariably associated with the presence of streptococci, but whether they are primary or secondary is not easy to determine. What part the amœba coli plays in the colitis of infancy and early childhood it is now impossible to say. Amœbæ have been found by Cahen and others in the stools of typical cases, but thus far too few observations have been made to admit of any deductions.

Lesions.—The nature of the lesions in ileo-colitis differs very much in the different groups of cases, but their position is quite constant: they affect the lower ileum and the colon. In about half the cases only the colon is affected. The lesions of the ileum are frequently limited to its lower two or three feet.

The frequency with which the different varieties of ileo-colitis were found in eighty-two of my own autopsies was as follows:

Follicular ulceration	36
Catarrhal inflammation	26
Catarrhal ulceration	6
Membranous inflammation	14
	82

Acute catarrhal ileo-colitis.—In the milder cases there are changes in the epithelium and infiltration of the mucosa. In the severe cases the submucosa is involved, and the infiltration of the mucosa may be so great as to lead to necrosis and the formation of catarrhal ulcers.

Gross appearances.—While the lower ileum and the colon are most seriously affected, it is not uncommon to find quite marked changes in a considerable portion of the small intestine, and even in the stomach. In the cases of short duration, the lesions are sometimes more marked in the small intestine than in the colon. The stomach contains undigested food, and mucus which is commonly stained a dark-brown colour. It may be dilated or contracted. The mucous membrane is pale or congested; if the latter, it is usually in patches, and more about the pyloric orifice.

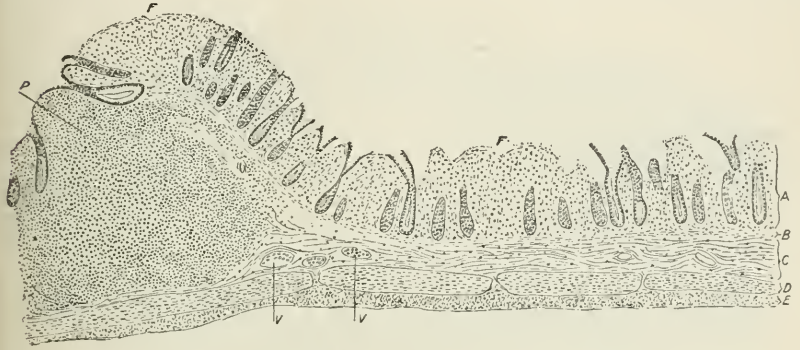


Fig. 52.—Acute catarrhal inflammation of the ileum.

At the left is seen the edge of a Peyer's patch (*P*) greatly swollen. The most striking feature of the lesion is the loss of the superficial epithelium, which is shown in all parts of the specimen. The significance of this depends upon the fact that the autopsy was made but two hours after death. At several points, *F*, *F*, the tubular follicles have loosened and fallen out. The mucosa, *A*, is slightly infiltrated with cells, especially near the Peyer's patch. The submucosa, *C*, and muscular coats, *D*, *E*, are normal. *V*, *V*, are small veins. *History.*—Infant, nine months old, previously healthy; sick three days with severe intestinal symptoms; temperature, 103° to 105° F. *Autopsy.*—Acute catarrhal inflammation of ileum and colon; Peyer's patches red and swollen. The specimen is taken from the lower ileum. The superficial character of the lesion is chiefly due to the short duration of the process.

The intestinal contents are generally green in colour, and thin. The mucous membrane is often coated with tenacious mucus. The small intestine is distended with gas, the large intestine nearly empty, except the transverse colon. The mucous membrane may appear somewhat swollen. In the small intestine there are occasionally seen swelling and œdema of the villi, so that they project abnormally and give a plush-like appearance. Congestion is a constant feature, and it may be simply upon the folds of the mucous membrane, or about the solitary lymph nodules; or it may be intense and involve the whole intestine for some distance. Small hæmorrhagic areas are often seen here and there, widely scattered. In the most severe cases there are marked thickening and uniform congestion, and the appearance is sometimes much like that seen in membranous inflammation. The

lymph nodules (solitary follicles) throughout the colon are usually swollen, projecting above the mucous membrane about the size of a pin's head. Peyer's patches may be normal, or they may be swollen and congested, with other evidences of catarrhal inflammation in the surrounding mucous membrane, or more rarely they may be involved when the rest of the mucosa appears healthy. The same is true of the lymph nodules of the small intestine. The lymph nodes of the mesentery are usually swollen and acutely congested, but they may appear normal.

Microscopical appearances.—In interpreting the changes found in the mucosa, the same precautions must be observed as stated on page 320.

There is usually loss of the superficial epithelium and of that lining the tubular glands at their orifices. Upon the surface of the mucosa and

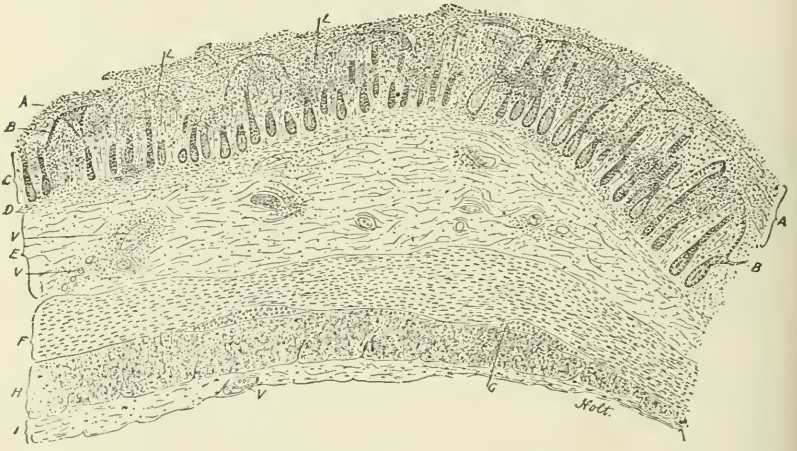
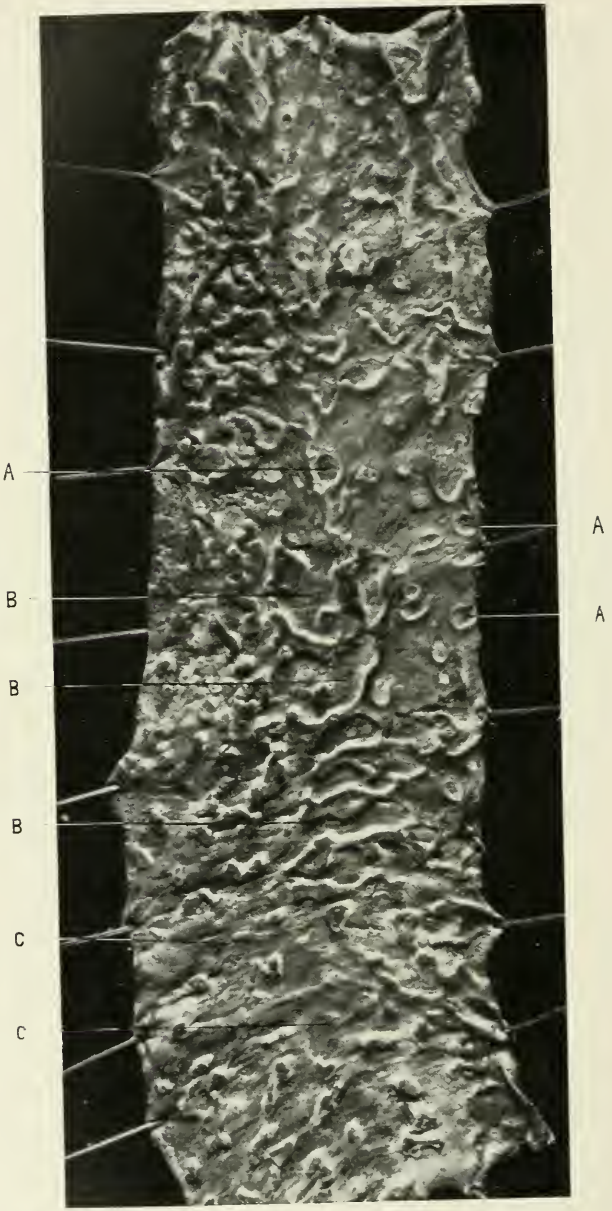


Fig. 53.—Acute catarrhal inflammation of the ileum; severe form.

The mucosa, *C*, is everywhere densely infiltrated with round cells, compressing the tubular follicles, and in places, *L*, *L*, almost effacing them. Upon the surface of the mucosa is a thick layer of cells and mucus. Beneath this the epithelial arches, *B*, *B*, covering the villi can be seen. The lesions are almost entirely of the mucosa. The only changes in the submucosa, *E*, are groups of cells about the small blood-vessels, *V*, *V*. *History.*—Infant six months old; moderate diarrhœa twelve days; severe symptoms with high temperature for six days. There was intense inflammation of the entire colon and lower three feet of the ileum. Intestine greatly congested and thickened. Specimen is from the ileum.

within the tubular glands, fine granular matter is seen from the broken-down epithelium. The goblet cells are distended with mucus, and do not stain clearly. The lumen of the tubular glands is narrowed from pressure due to the swelling of the lymphoid tissue which separates them, which is partly from œdema, and partly from cell infiltration (Fig. 52). Entire tubular glands may loosen and fall out. A thick layer of mucus and round cells, adhering closely to the surface, may resemble pseudo-membrane (Fig. 53). In the milder varieties the infiltration with round cells is not great and is usually limited to the mucosa, the extent depending principally upon the duration of the process. In the very severe cases



EXTENSIVE CATARRHAL ULCERATION OF THE COLON.

Female child nine months old; symptoms of acute ileo-colitis of fifteen days' duration; temperature, 101° to 104·5° F., and from six to eight stools daily—thin, green, and yellow, but no blood.

Extensive ulceration throughout the colon, most marked in descending portion, from which specimen is taken.

A A are small circular ulcers; B B, larger ones from coalescence of several of these; C C, large areas of ulceration, the mucous membrane being almost entirely destroyed.

there is found a dense infiltration of the mucosa and of the submucosa also, which in places extends quite to the muscular coat. These cases closely resemble those of the membranous variety, lacking only the exudation of fibrin. The lymph nodules of the colon are swollen to a greater or less degree, chiefly from an increase in the number of lymphoid cells. This swelling may be the most prominent feature of the lesion. If the process is sufficiently prolonged, the lymph nodules may break down and ulcerate. The changes in the lymph nodules of the small intestine and in Peyer's patches are similar to those seen in the colon, but are less marked, and frequently absent altogether. Ulceration in Peyer's patches is extremely rare.

The small veins and capillaries of the submucosa and mucosa are usually distended with blood; small extravasations are very common, and occasionally larger ones are seen.

Catarrhal inflammation, except in its very severe form, which is not frequent, causes no lesions that can not readily be repaired. The most persistent change is usually the swelling of the lymph nodules, which may last a long time, and appears to be an important factor in the tendency to relapses and recurring attacks. If there is a continuance of the exciting cause, or the patient's constitution is a bad one, the process may become chronic.

Catarrhal ulceration.—In the most severe form of catarrhal inflammation which does not prove fatal in the earlier stages, extensive ulceration occasionally takes place; usually these ulcers are seen throughout the entire colon, and, in rare cases, a few are found in the lower ileum. They generally begin in the mucosa overlying the lymph nodules, and while they have a wide superficial area, they do not extend deeper than the mucosa. The small ulcers are circular and usually show at the centre a small granular body—the lymph nodule. The larger ulcers result from the coalescence of several small ones, and are irregular in shape. They may be two or three inches in diameter. Sometimes for a considerable distance a large part of the mucosa may be destroyed. Often the entire surface presents a worm-eaten appearance (Plate VIII). On microscopical examination there is seen, in the greater part of the ulcer, complete destruction of the mucosa, the submucosa being densely packed with round cells quite to the muscular coat.

Inflammation of the lymph nodules with ulceration (*follicular ulceration*).—Follicular ulcers are found at autopsy in about one third of the cases dying from diarrhœal diseases. They are rarely seen in those which have lasted less than a week, and not often before the middle of the second week; the average duration of the cases being about two and a half weeks.

In thirty-six cases in which follicular ulcers were found at autopsy, they were present in the small intestine alone in but three cases; in the

small intestine and in the colon in six cases; in the remaining twenty-seven they were present only in the colon. When in the small intestine they were seen only in the lower ileum. Ulceration was seen a few times in one or two of the nodules of a Peyer's patch. Ulceration of the large intestine involved the whole colon in about half the cases; while in the remainder the process was limited to its lower portion. The deepest and also the largest ulcers were usually in the descending colon and sigmoid flexure.

In the early stage these ulcers appear as tiny excavations at the summit of the prominent lymph nodules. Later, the whole nodule may be destroyed, and a small round ulcer is formed from one twelfth to one fourth of an inch in diameter (Plate IX). These are quite deep and have overhanging edges; when closely set they give the intestine a sieve-like ap-

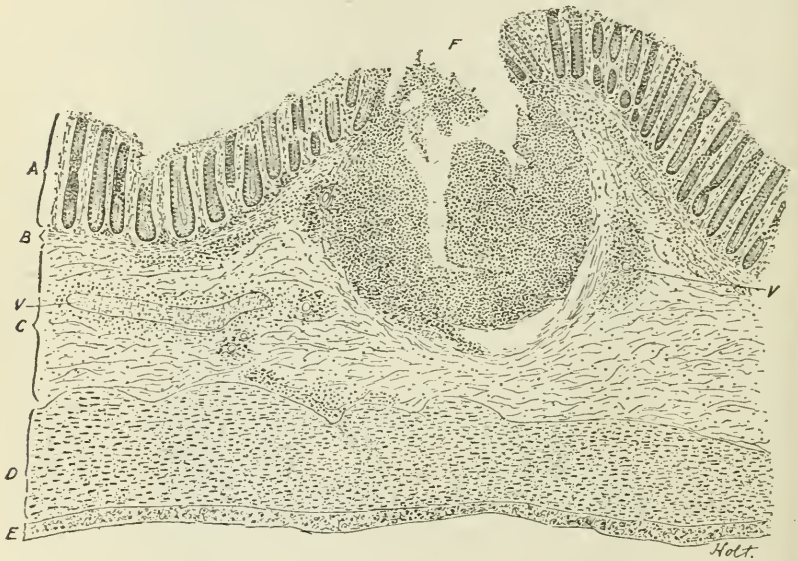


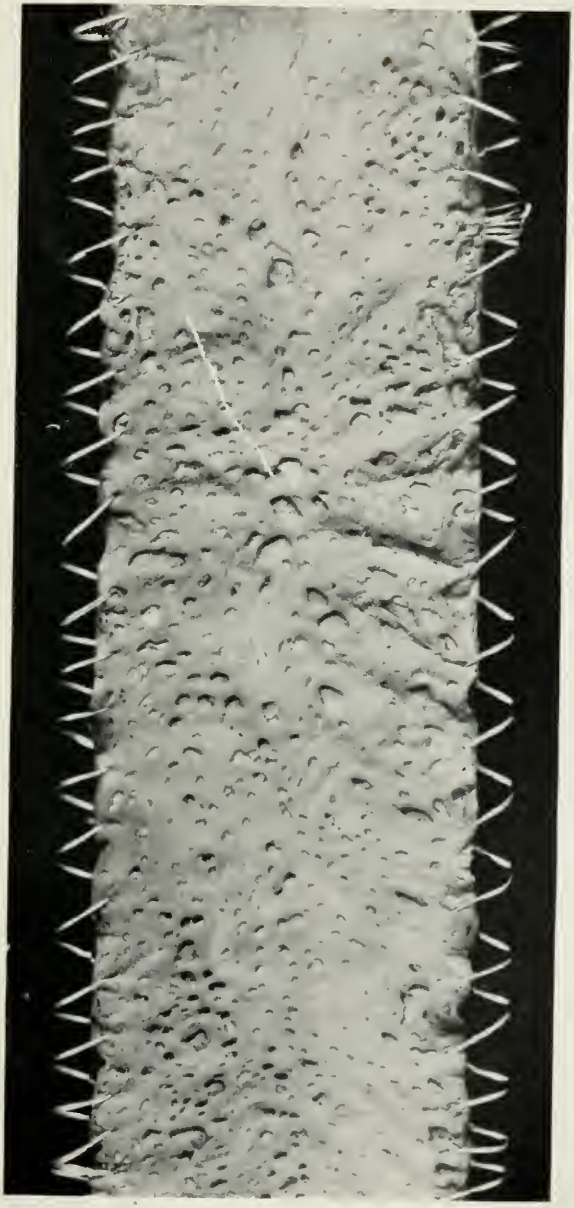
Fig. 54.—Lymph nodule of the colon in the early stage of ulceration—Follicular ulcer.

The nodule, *F*, is much enlarged, and is breaking down and discharging into the intestine. The other changes are not marked. The superficial epithelium is gone: the mucosa, *A*, shows a slight increase of cells, and in the submucosa, *C*, are nests of cells about the small vessels, *V*, *V*. *History.*—Delicate child, thirteen months old; slight diarrhœa four weeks; severe symptoms five days. The colon was filled with ulcers one twelfth of an inch in diameter, one of which is shown in the illustration.

pearance. By the coalescence of several of them, larger ulcers may form which are an inch or more in diameter. At the bottom of these larger ones the transverse striæ of the circular muscular coat are often plainly seen. I have never known them to cause perforation.

Microscopical appearances.—The lymph nodules are swollen, principally from the accumulation within them of round cells. This is followed by softening, which usually begins at the summit of the nodule and ex-

PLATE IX.



Deep Follicular Ulcers of the Colon.

A delicate child, fourteen months old, sick twelve days: stools green, yellow, brown, and watery; no blood; temperature, 100 to 101° F.

The small intestine was normal: ulcers throughout colon. The specimen is from descending colon; the ulcers are deep, and most of them extend to the muscular coat. (For microscopical appearance, see Fig. 55.)

tends downward; the reticulum breaks down, and the cellular contents escape into the intestine (Fig. 54). Softening may begin at the centre of the nodule, which ruptures like an abscess. The destruction of the whole nodule leaves a cavity, which is the follicular ulcer. At first the ulcers correspond in size to the nodule, but meanwhile infiltration of the adjacent tissue has taken place, and this may become necrotic. In this way the ulcer extends, chiefly in the submucous coat. The lesion is never

Fig. 55.—Deep follicular ulcer of the colon.

A deep ulcer is shown at *F*, a smaller one at *F'*. The separation of the mucosa at *H* is accidental. There is no trace of the lymph nodule from which the large ulcer had its origin. The destructive process has extended laterally in the submucosa, *C*, and the mucosa, *A*, is falling in to fill up the space. In the vicinity of the ulcers, the submucosa is densely infiltrated with round cells, *L''*, *L''*, which also are seen in the lymph spaces between the bundles of circular muscular fibres, *L'*, *L'*, and some are seen in the longitudinal muscular coat, *L*, *L*. *History.*—Thirteen months old, delicate; continuous diarrhœal symptoms for three weeks. Ulcers found throughout the colon, the largest, one half an inch in diameter. The illustration shows one of the small ones like those in Plate IX.

limited to the lymph nodules; but the extent of the other changes found, depends upon the severity and the duration of the process. In cases dying after an illness of a week or ten days, we usually find only moderate changes in the mucosa, and in the submucosa a slight infiltration of round cells, especially about the small blood-vessels (Fig. 54, *V*, *V*). In those which have lasted three or four weeks the ulcers are deeper, and all the structures of the intestine in their neighbourhood, are usually involved (Fig. 55). The mucosa is densely packed with round cells, as are also all the tissues in the vicinity of the ulcers; even the muscular coat may be infiltrated. The ulcers, however, rarely extend deeper than the circular layer.

Follicular ulceration of the intestine in infancy, usually terminates fatally if the process is an extensive one. In less severe cases, recovery may take place, the ulcers healing by granulation and cicatrization in the course of from four to eight weeks.

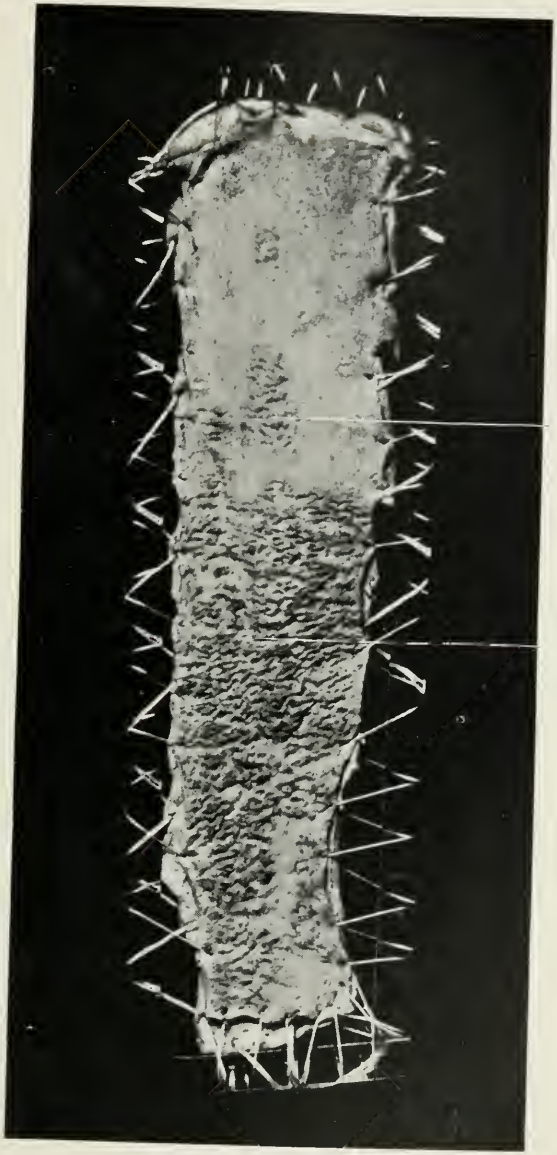
Acute membranous ileo-colitis.—This is the most severe form of intes-

tinal inflammation seen among children. The process differs quite materially from that described as occurring among adults. In only one of my own cases was it associated with membranous inflammation of any other mucous membrane, in that case with membranous gastritis. A specimen was presented to the New York Pathological Society in 1889 by Sellew, in which this lesion was associated with a membranous inflammation of the pharynx. Membranous colitis usually runs a short, intense course, with a temperature which continues moderately high, severe constitutional symptoms, and death generally in eight or ten days. The shortest case I have seen lasted six days. If recovery takes place it is only after a very prolonged illness.

Gross appearances.—There is visible to the naked eye usually very little pseudo-membrane and no deep sloughing. The lesion affects with remarkable uniformity the last two or three feet of the ileum and the entire colon. It is exceedingly rare to meet with any marked lesions high in the small intestine. The most marked changes are near the ileo-cæcal valve or in the sigmoid flexure and the rectum. In the ileum they are usually quite as severe as in the colon (Plate X). The intestinal wall is firm and stiff, and is two or three times its normal thickness. It is not thrown into deep folds, as is the healthy intestine when empty. It is very rare to find false membrane that can be stripped off in patches of any considerable size. Where membrane exists, the colour is a grayish green, and the surface is often fissured, giving a lobulated appearance. In the parts where no pseudo-membrane can be seen, the surface is usually of an intense red colour and is rough and granular, in striking contrast to the normal glistening appearance. Here and there small extravasations of blood may be seen. In the regions most affected, the normal structures of the mucous membrane—the villi, Peyer's patches, and solitary follicles—can not be distinguished. Although the whole colon is diseased, the lesions differ very much in severity in the different regions, and large areas of pseudo-membrane are rare. In a single instance I found an exudation of fibrin on the peritoneal surface of the intestine for a short distance. Except in the lower ileum the small intestine shows no constant changes, and none are usually found in the stomach.

Microscopical changes.—These (Fig. 56) are much more uniform than the gross appearances. The most characteristic feature is the exudation of fibrin, which forms a distinct pseudo-membrane upon the surface of the intestine, and may infiltrate the mucosa, and even the submucosa. Fibrin is found under the microscope in parts of the specimen, which to the naked eye shows no distinct pseudo-membrane, but only a granular appearance. In rare cases a fibrinous exudation may be found upon the peritoneal covering of the intestine. The pseudo-membrane is made up of a fibrinous network containing small round cells, some red blood-cells, and bacteria, chiefly cocci. The mucosa, and usually the submucosa, are

PLATE X.



MEMBRANOUS INFLAMMATION OF THE ILEUM.

A delicate child, eleven months old; mild diarrhœa for two weeks without fever; acute severe symptoms for twelve days; temperature, 100° to 102·5° F.; green and mucous stools; no blood.

The lesions involved the last foot of ileum and entire colon. Specimen is from lower ileum, and shows the abrupt termination of the lesion: the upper part shows normal small intestine: A is a Peyer's patch: B is the inflamed part of the intestine; it has a rough granular appearance and is much thickened.

densely infiltrated with small round cells, which in places may be so numerous as to efface the normal elements of the intestine. The tubular follicles are in some places quite destroyed, not a vestige of them remaining. In other places they are compressed and distorted by the accumulation of cells. The great thickening of the intestine is due partly to the cell infiltration, partly to the fibrinous exudation, and partly to œdema. All the blood-vessels, both in the mucosa and submucosa, are gorged

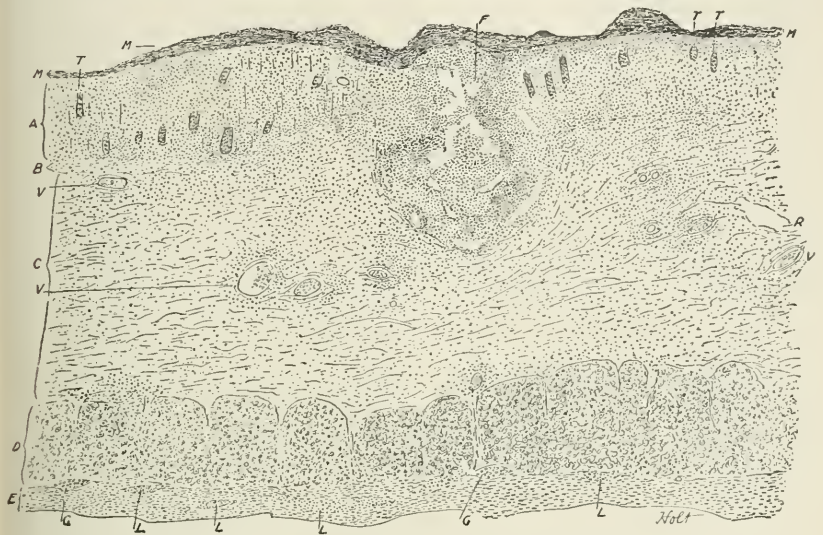


Fig. 56.—Membranous inflammation of the colon.

The intestine is covered with a pseudo-membrane, *M*, which is composed chiefly of granular fibrin; the mucosa, *A*, is densely packed with round cells, and the tubular follicles have almost disappeared, traces only being left at *T*, *T*. The submucosa, *C*, is greatly thickened, partly from cells, but chiefly from fibrin, which with a high power is seen to be everywhere in this coat, as well as the mucosa. Nests of cells are seen in the muscular coats at *L*, *L*. At *F* is a lymph nodule covered by pseudo-membrane, but breaking down at its centre. *V*, *V*, are small blood-vessels with nests of cells about them. *History.*—Fourteen months old; ill nine days; temperature 101° to 105° F.; all stools containing blood. Lesions found throughout colon and in lower ileum. Intestine greatly thickened. Specimen is from ascending colon, where lesion was especially severe.

with blood, and many small extravasations are seen. A necrotic process with the formation of deep ulcers I have never seen associated with membranous colitis.

Associated lesions of ileo-colitis.—The most important one is bronchopneumonia. It is found in quite a large proportion of the protracted cases, and not infrequently it is the cause of death. I once saw a pulmonary abscess complicating ulcerative colitis. It was at the apex, and was not associated with abscesses elsewhere in the body. Bronchitis is a very common complication. Peritonitis is rare, and when present is usually circumscribed and of the plastic variety. Acute degeneration of the epithelium of the kidney (cloudy swelling) is very common, and in

fact it is usually found in the cases which have been marked by high temperature. Exudative nephritis is, however, in my experience rare. There are no characteristic or uniform changes found either in the liver, spleen, heart, or brain.

Symptoms.—(1) *Catarrhal cases of moderate severity.*—The onset is usually sudden, often with vomiting, and for twelve, sometimes twenty-four, hours the symptoms may be those of acute indigestion: vomiting, pain, fever, and frequent thin green or yellow stools, which are partly fæcal and contain undigested food. Later the characteristic discharges are seen. These are composed of blood and mucus; they are preceded by pain and usually accompanied with tenesmus. The stools are very frequent, often every half hour and proportionately small, sometimes less than a tablespoonful being found upon the napkin after severe straining efforts. The mucus may be clear and jelly-like, or it may be mixed with fæcal matter. Blood is seen in almost every stool, but rarely in clots, usually streaking the mucus. Fluid blood may be present. These stools are almost odourless. After two or three days the blood usually disappears, or is seen only as traces in an occasional stool. Mucus is still present in large quantities, making up the bulk of the stool. The colour of the discharges now becomes a dark brown or a brownish-green. Prolapsus ani is frequent, and often occurs with nearly every stool. For the first twenty-four hours the temperature is usually high, from 102° to 104° F. Later, and throughout most of the attack, it ranges from 99° to 102° F. In the mildest cases it may not be above 101° F. at any time. The prostration is not so great at the outset as in most forms of intestinal disease, but increases steadily for several days. The appetite is lost for the first two or three days, but there is usually great thirst. Abdominal pain is present and is often quite intense just before the stool. In most cases there is tenderness along the colon.

The duration of the severe symptoms is usually less than a week, and even though the child was previously in good condition and properly treated, recovery is rarely rapid. The first symptom of improvement is generally the disappearance of blood from the stools, which at the same time become less frequent, and the pain and tenesmus cease. Gradually the stools assume more of a fæcal character, but mucus is likely to persist for two or three weeks; it may be seen in all stools, or only occasionally. In some cases both the mucus and blood disappear and the stools become thin, brown, or green, like those of an ordinary diarrhœa. Although the early stage of very acute symptoms may last but a few days, if there is a continuance for two or three weeks of the brown, mucous stools, with emaciation and slight fever, ulceration is probably present. This is likely to occur if the child is in poor condition, if its surroundings are bad, or if it is improperly treated at the outset. Relapses are readily excited, but cases like the above are rarely fatal except in very delicate infants. This is the most common form of ileo-colitis which terminates in recovery.

(2) *The severe catarrhal form.*—The symptoms closely resemble those of the membranous variety, and a diagnosis from it is to be made only by the absence of pseudo-membrane from the stools. The most rapid case I have seen lasted but three days, but the usual duration is from one to two weeks. The temperature is steadily high; the stools continue very frequent and contain much blood; there are great prostration, dry tongue, sordes on the lips and teeth, and prominent nervous symptoms. Death usually occurs from exhaustion and profound sepsis while the acute symptoms are at their height. If the patient survives this stage, the case may drag on for four or five weeks, very much like the one of follicular ulceration, and then terminate in recovery or in death from slow asthenia, broncho-pneumonia, or an acute exacerbation of the intestinal symptoms. The autopsy in such cases usually reveals the presence of catarrhal ulcers. If recovery is to be the outcome, after the symptoms have been nearly stationary for a long time, there is seen a gradual turn for the better, and improvement first in the general and then in the local conditions. Convalescence is very slow, often interrupted by relapses, and it may be months before the patient is quite well. In some cases the child never regains its former vigour.

(3) *Follicular ulceration—ulcerative inflammation of the lymph nodules.*—Follicular ulceration is not very often met with in infants under six months of age. Of thirty-six cases in which the diagnosis was confirmed by autopsy, all but four were between the ages of six and twenty-one months. The great majority of these children were in poor condition at the time of the attack.

To understand the symptoms of these cases, it must be remembered that follicular ulceration is the terminal process to which continued cases of acute gastro-enteric infection tend. It may be preceded by one or more acute attacks, or by a protracted subacute attack. On account of the feeble resistance of the child or the continuance of the exciting cause, the pathological process gradually extends from the epithelium to the lymph nodules of the intestine, chiefly the colon, which, as already described, pass successively through the stages of swelling, softening, and ulceration. The onset of the illness may therefore be sudden, with vomiting and high fever; or gradual, without vomiting and with very little fever. The patient may be ill for a week before the exact type which the disease is assuming can be positively determined. It is not possible to mark the transition from acute gastro-enteric infection to follicular ileo-colitis. Usually the latter may be assumed to exist whenever, after one of these attacks, there is a continued temperature above 101° F., and when the stools habitually contain large quantities of mucus without blood.

Vomiting is not a feature of these cases; but it is often present at the onset. Throughout the attack it is easily excited by injudicious feeding or medication. The temperature is seldom high, except at the onset;

its usual range is from 99° to 101° F.; toward the close, even of fatal cases, it may be scarcely above the normal. The accompanying chart (Fig. 57) is a very good illustration of the course of the temperature in cases beginning abruptly and ending fatally.

The stools are not usually very frequent, the number being from four to eight a day. The most constant feature is the presence of mucus, which is mixed with the stools and usually abundant. Blood is not generally present, and a large amount of blood is extremely rare. It was ab-

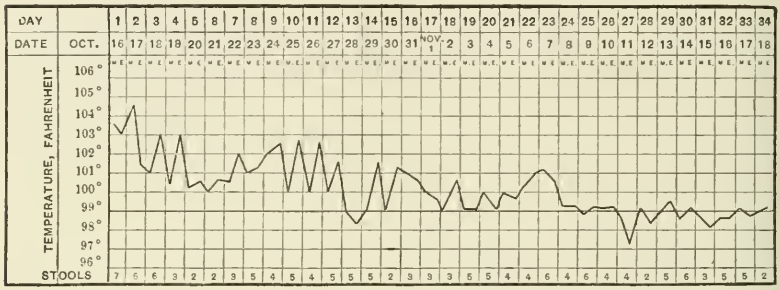


Fig. 57.—Temperature chart of ileo-colitis, fatal on thirty-fourth day. Autopsy showed follicular ulcers throughout the colon.

sent entirely in more than half of my cases in which the diagnosis was confirmed by autopsy. A small quantity of blood early in the attack is not uncommon, depending here upon congestion. Large hæmorrhages from ulcers I have never seen. The colour of the stools is most frequently of a dark green or brown. Fluid stools are seen only during exacerbations. The odour is usually offensive, particularly in protracted cases. The microscope shows epithelial cells in great numbers, and very often an abundance of small round cells, which may be looked upon as the most constant sign of ulceration.

The failure in nutrition and steady loss in weight are very constant in these cases. As emaciation goes on, the skin hangs in loose folds on the thighs; it becomes dry and scaly and loses its elasticity, and occasionally small petechial spots are seen upon the abdomen. The skin over the buttocks becomes excoriated, and bed-sores form over the heels, the sacrum, or the occiput. The abdomen may be moderately distended, or it may be relaxed and soft. Tenderness is not usually present. The appetite is lost, and in most cases great difficulty is experienced in getting children to take a proper amount of nourishment. Continued aversion to food is an unfavourable symptom. Occasionally, when there is fever, fluids are taken eagerly. A returning appetite is always an encouraging sign. The mouth is often dry, the tongue coated, sometimes dry and brown; there may be sordes upon the lips and teeth. Superficial ulcers form upon the mucous membrane of the mouth, and often thrush is seen. The

urine is usually diminished, high-coloured, and loaded with urates. Albumin and casts are rarely present. In only two cases have I seen nephritis severe enough to form a factor in the result. Tenesmus and prolapsus ani are uncommon.

The average duration of the fatal cases is about three weeks; their course is often marked by exacerbations and remissions. If recovery takes place, convalescence is always very slow and relapses are easily excited.

Very few of these cases recover completely. Even those who survive the primary illness are likely to suffer from intestinal symptoms for many months. Fatal relapses are often brought on by injudicious feeding when the children are apparently almost well. The general health is usually so undermined that the patients continue to suffer from all the symptoms of malnutrition, and ultimately succumb to an attack of some intercurrent acute disease.

The diagnosis of ulceration is to be made from the case as a whole rather than from any special symptoms. If a delicate infant which has previously been prone to diarrhœal attacks, has green mucous stools with low fever, and these continue with unabated severity for ten or twelve days, ulceration is probable. If such symptoms continue for three or four weeks with steadily failing strength and loss of weight, the diagnosis is almost certain. If, on the contrary, after three or four days of acute symptoms there is improvement in the stools and occasionally some which are quite fæcal in character, even though it may be a week or more before the mucus disappears, we may be quite certain that no ulcers have formed.

(4) *The membranous form.*—This occurs most frequently between the ages of six months and two years, and often attacks those previously in good health. It is the gravest form of inflammation of the intestine seen in children, and its symptoms are severe usually from the outset. It closely resembles the most severe cases of catarrhal inflammation. The disease begins suddenly, with vomiting, high temperature, and several large, fluid stools. The vomiting does not often continue after the first twenty-four hours. The temperature is at first from 102° to 105° F., and its course may be steadily high (Fig. 58), or remittent. In some cases the constitutional symptoms—prostration, stupor, delirium, etc.—are so severe at the onset that the intestinal symptoms are masked by them and an erroneous diagnosis is made. The abdomen is usually tender and sometimes swollen. There is severe pain, and

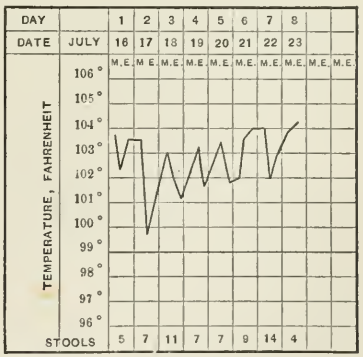


Fig. 58.—Temperature chart of membranous colitis; fatal.

at times almost constant tenesmus, during which prolapse of two or three inches of the mucous membrane of the rectum occurs. This is intensely congested, and sometimes shows patches of pseudo-membrane upon its surface, thus establishing the diagnosis.

The stools resemble those of the catarrhal variety, except that blood is more constantly present and usually more abundant; but the only positive point of difference is the presence of shreds or patches of pseudo-membrane. If the stools are thoroughly washed with water, patches of membrane may be seen as gray opaque masses, which are then easily distinguished from the transparent mucus. Large sheets of membrane are seldom discharged; usually only small patches are found. Both blood and mucus sometimes disappear from the stools, which may consist only of dirty water. Under the microscope there may be seen epithelial cells, red blood-cells, and round cells in great numbers.

The duration of the disease is usually a little less than two weeks. The course closely resembles that of the severe catarrhal form. There may be a continuous high temperature with severe intestinal symptoms and great prostration until death takes place from sepsis or exhaustion, or after three or four days the temperature may fall to 100° or 102° F., rising again at the termination of the disease. The most protracted fatal case I have known lasted four weeks. It is probable that almost every case of the severity described, terminates fatally when it occurs in an infant. In older children the prognosis is much better as to life, but in them the acute attack may be followed by the chronic form of the disease.

Diagnosis.—Ileo-colitis is to be distinguished from typhoid fever and intussusception. In infancy a doubt between typhoid fever and ileo-colitis does not often arise. Cases of typhoid fever under twenty months are extremely rare, and are not likely to be seen unless the disease is epidemic. I have never seen a case under this age. In children over two years, the two diseases are more likely to be confused. Typhoid is distinguished by the slower invasion, more constant temperature, enlargement of the spleen, tympanites, and most of all by the eruption. The fact that the disease is epidemic is also to be considered. Acute colitis may be confounded with intussusception. If the possibility of this mistake is kept in mind it will not often be made; yet the records of intussusception show that a very large proportion of them were regarded in the beginning as cases of dysentery. In intussusception, although we have a sudden onset with acute pain, tenesmus, vomiting, and marked prostration, there is no fever. The later symptoms—absolute constipation, tumour, tympanites, rising temperature, stercoraceous vomiting, and collapse—have nothing in common with colitis. A diagnosis between the different varieties of ileo-colitis is not always possible. Follicular ulceration is distinguished by its lower temperature, rather subacute course, infrequency of blood in the stools, and by the fact that it is usually preceded by one or more attacks of

acute gastro-enteric infection, upon which its peculiar symptoms are gradually ingrafted. In both the catarrhal and the membranous varieties, the symptoms of an acute inflammation of the colon are usually manifest from the outset—bloody stools, much pain, tenderness, tenesmus, and fever. They differ chiefly in severity, and by the fact that in the membranous form shreds of false membrane may be found in the stools. The course is shorter and the attack is altogether more intense than in the follicular form. Death often takes place in ten or twelve days, during the period of most acute symptoms. The protracted cases of catarrhal ulceration can not be distinguished from the more common ones of follicular ulceration.

Prognosis.—This is much worse in infants than in older children. It is especially bad in cities, among the poorer classes, and in institutions. It is rendered unfavourable by previous rickets or malnutrition, and by the existence of any complication, particularly broncho-pneumonia. The prognosis is worse in children who have been badly fed, in those recently weaned, and in those who earlier in the season have suffered from attacks of diarrhœa. The particular symptoms which make the prognosis unfavourable in a case are continued high temperature, frequent vomiting, rapid wasting, an excessive amount of blood in the stools, severe nervous symptoms, and very weak pulse. These cases are never out of danger until the end of the hot season, on account of the great liability to relapses and recurrent attacks.

Prophylaxis.—What has been said regarding general prophylaxis in the previous chapter, applies equally well to cases of ileo-colitis. Special emphasis should be placed upon the necessity of energetic early treatment of all the milder forms of diarrhœa, and particularly the cases of acute gastro-enteric infection, in order that the process may be arrested before serious anatomical changes have taken place—a thing which is often possible. Equal stress should be laid upon the importance of prompt and radical treatment at the very beginning of the cases with a sudden onset.

Hygienic Treatment.—The general plan recommended in the previous chapter should be followed here. A change of air is desirable for every case as soon as the acute inflammatory symptoms have subsided. In the protracted cases which drag on a subacute course, this change will often do more than everything else. Some children do better at the seashore, and others in the mountains. If possible, patients should be kept in the country until the last of September. A return to the city during the hot season is usually followed by a second attack, and, if the patient has not quite recovered, relapses are almost certain. Plenty of pure fresh air is necessary in all cases. The indications for bathing are the same as in other cases of acute diarrhœa. It is undesirable to crowd these patients in institutions, as they always do better when they can be separated. The dietetic treatment during the acute stage is the same as in cases of acute gastro-enteric infection. Special stress should be laid upon stopping cow's

milk at once. In the protracted cases the diet presents great difficulties, as the children have little or no appetite, and soon come to refuse everything in the shape of food that is offered. In infancy, the articles which are most to be depended upon are skimmed milk which has been completely peptonized, beef juice, broths, and liquid beef peptonoids. In some cases rice or barley water are well borne; in others, some of the malted foods, although these often increase the number of stools and have to be stopped on that account. Food which leaves little residue should always be chosen. Infants, when very ill, are much more likely to take too little than too much food. A careful record should be kept of the amount actually taken in each twenty-four hours. When this is much below the requirements of nutrition, gavage (page 62) may be tried. Sometimes all food and stimulants may be advantageously given in this way. In no case should food be given oftener than every two hours, and usually the interval should be three hours, water and stimulants being allowed between the feedings. In older children the diet during the acute stage must be much the same as in infancy. At a later period, raw beef, kumyss, or matzoon will be found useful, and during convalescence boiled milk or milk gruels made with rice or barley. Special care must be given to the diet for a long time. For months after an acute attack the intestines are very easily deranged. Relapses are excited by changes in the temperature, by great fatigue or exhaustion, but most of all by improper feeding. Especially in older children should such articles be avoided as oatmeal, potatoes, corn, tomatoes, and all fruits. I have seen a single peach given to a child two years old, excite a dangerous relapse, and a few raisins a fatal one.

Medicinal and Mechanical Treatment.—Cases, the early stage of which is marked by vomiting and thin diarrhœal stools, are to be managed at the outset according to the plan outlined in the previous chapter—viz., free purgation, irrigation of the colon, and stopping all food. Lesions of any considerable severity are not often present during the first week. In the cases in which the symptoms of acute inflammation are evident from the outset, as shown by the frequent bloody and mucous stools with tenesmus and pain, the measures to be depended upon are castor oil and irrigation of the colon, and later opium and bismuth by the mouth. Castor oil should be administered in a full dose at the outset—one drachm at six months, two drachms at one year, and half an ounce at four years. Its primary effect is to clear the intestines, and its secondary effect is peculiarly soothing to the inflamed mucous membrane. If the stomach is at all irritable, calomel one fourth grain every hour to six or eight doses, or a saline purgative, may be substituted. Opium is usually required on account of the pain and tenesmus. The dose should be regulated by the severity of these symptoms and by the frequency of the stools. The deodorized tincture and morphine are, I think, preferable to other prepara-

tions. Dover's powder may be used if the stomach is not irritable. Repeated small doses are better than a single large dose. It is very important that opium should be withheld for at least twelve hours after the initial purgative. As the pathological process is principally in the colon, and most severe in the lower half of the colon, it can be much more effectively treated by injections than by drugs given by the mouth. Irrigation of the colon (page 63) is one of our most valuable means of treatment in these cases. It should be used in conjunction with the measures already referred to. For general purposes a tepid saline solution should be employed (common salt one drachm to water one pint). At least a gallon should be given at one time; it should be injected high into the colon through a long rectal tube, and early in the disease repeated at least twice a day. Where the tenesmus is very great and blood abundant, either hot water (106° to 110° F.) or ice water may be used, and later astringent injections. A large amount of a weak solution may be given and allowed to escape, or after irrigating with a saline solution, a smaller quantity—three or four ounces—of a much stronger astringent may be introduced high into the bowel and prevented from escaping by compressing the buttocks. The most useful astringents are tannic acid and hamamelis; as a weak solution, half a drachm of tannic acid or one drachm of the fluid extract of hamamelis may be used to a pint of water; and for a strong solution, the same quantity of the astringents to three or four ounces of water. Nitrate-of-silver injections should never be used in acute cases, and their advantage in chronic ones is questionable. In conjunction with opium, benefit is often seen during the early stage by the continued use of castor oil in small doses—i. e., ten drops in emulsion every two or three hours.

For cases not influenced by the measure mentioned, or those not seen at the outset, bismuth should be tried, but it is of no use whatever unless large doses are administered. Two drachms of the subnitrate must be given in twenty-four hours to a child a year old, and proportionate doses for older children. This should be suspended in mucilage. Tenesmus and pain are sometimes relieved by the injection of three or four ounces of a starch solution to which from five to ten drops of laudanum are added. Severe tenesmus, when not controlled by the measures above mentioned, and when associated with prolapsus ani, is sometimes immediately relieved by cocaine suppositories. From one fourth to one grain of cocaine may be given, according to the child's age.

Stimulants are needed in nearly all cases. There are no valid objections to their use even in the youngest infant. The feeble digestion and assimilation of these patients compel us to use alcohol very frequently. Stimulants are indicated by a weak pulse, poor circulation, and great general prostration, no matter at what stage in the disease these symptoms are seen. Old brandy is usually to be preferred. Generally not

more than thirty drops every two hours are needed for an infant one year old, but for short periods a much larger quantity may be required. Brandy should always be diluted with at least six parts of water.

In cases where symptoms have lasted two or three weeks, and the active symptoms have subsided, where the temperature is scarcely above 100° F., and the stools reduced to four or five a day, it is wise to stop all medication and attend only to food and stimulants, with irrigation of the colon every other day. One is often surprised at this stage to find that his patients do better without drugs than with them. The prevailing tendency is to overdose cases of this type. Careful attention to diet, judicious stimulation, regular irrigation of the bowel every day or two, with change of air, will do much more than any amount of medication.

During convalescence general tonics are required, such as arsenic, iron, nux vomica, and wine. Cod-liver oil should be deferred until the stomach and appetite are quite normal and the stools free from mucus. It should, however, be continued throughout the succeeding winter months.

CHRONIC ILEO-COLITIS.

This is rarely seen except as a result of acute ileo-colitis, which is usually catarrhal or follicular, as the membranous variety is so severe that the patients rarely survive the acute stage. In the catarrhal form there may be a chronic catarrhal inflammation of the mucous membrane only, or there may be catarrhal ulcers. In the follicular form ulcers are usually present.

Lesions.—*Catarrhal form.*—In its milder type it is quite common, but in its severe grade it is exceedingly rare. There may be changes in a large part of the small intestine and in the stomach, as well as in the lower ileum and colon.

The gross appearance of the intestine often differs very little from the normal. The mucous membrane is usually of a dull gray or slate colour. Pigmentation may occur as striæ in the mucous membrane, but more frequently it is limited to Peyer's patches and the solitary lymph nodules; these, as well as the mesenteric lymph nodes, are generally swollen.

The microscopical changes are usually marked. The lesion is chiefly one of the mucosa. (Fig. 59). The important features are a disappearance of very many of the tubular glands, and in the small intestine of the villi also. There is a very marked cell proliferation in the adenoid tissue of the mucosa, and if the disease has existed long enough there may be a production of new connective tissue. The solitary lymph nodules show usually nothing but cell hyperplasia. The lesions are not uniformly distributed, but occur in patches throughout the intestine. When present in the stomach, they are of the same kind as those described in the intestine, although rarely so severe. In milder cases the gross appearances may show very little change to the naked eye, except swelling of the lymph

nodules. Under the microscope there may be found more or less extensive cell infiltration of the mucosa, but rarely any destructive changes or new connective tissue.

Ulcerative form.—This is rather rare, for the reason that in infancy a very large proportion of the cases die during the acute stage.

The ulcers are nearly always of the follicular variety; occasionally they are catarrhal. If the patient dies after an illness of from six to eight weeks, the appearances do not differ essentially from those described in acute cases. If life is prolonged from two to four months, ulcers are found in various stages of repair, sometimes associated with the formation of small cysts. Follicular ulcers require from two to four months for cicatrization, and the broad catarrhal ulcers even a longer time. It is very doubtful whether stricture ever results from these ulcers in children.

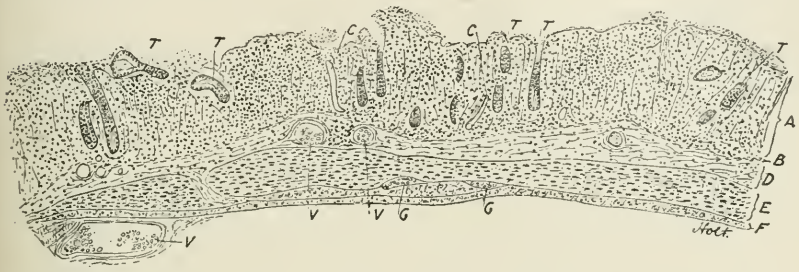


Fig. 59.—Chronic catarrhal inflammation of the ileum.

The lesions affect the mucosa, *A*, almost exclusively. It is somewhat thickened; there is extensive destruction of the tubular follicles, remains being seen at *T*, *T*; there is a great increase in the cells, and some new connective tissue in the mucosa. Large new blood-vessels are seen at *C*, *C*. *History.*—Delicate child, thirteen months old; diarrhœal symptoms for four months; during the first two weeks there was high fever; at death weighed eight pounds. The gross changes at the autopsy were very slight. The section is from the middle ileum.

The mucous membrane shows almost invariably evidences of more or less extensive chronic catarrhal inflammation. One of the rarest lesions are cysts of the colon. Fully developed cysts I have seen but once. The child had an attack of acute ileo-colitis, which became chronic, lasting about five months. He never regained his health, and died one year later from intercurrent disease. In the descending colon and rectum, about twenty cysts the size of a pea, and many smaller ones, were found. They had a thin, translucent covering. On section, a thick, transparent, gelatinous material escaped. They were situated in the submucosa, and were undoubtedly produced by the dilatation of some of the tubular glands whose orifices had been obliterated.

Associated lesions.—The important ones are in the lungs, the most common being hypostatic congestion, subacute or chronic broncho-pneumonia, more rarely pulmonary tuberculosis. It is rare to find the lungs perfectly healthy. The liver is often found extremely fatty in cases associated with great wasting, but in no case have I seen hepatic abscess. The

kidneys usually show a more or less intense cloudy swelling, and sometimes there may be well-marked nephritis. Dropsical effusions into the serous cavities are very rare. General tuberculosis is not infrequently the cause of death.

Symptoms.—These cases are usually seen in the autumn, and comprise those which have barely managed to live through the summer months. No definite line can be drawn between the acute and the chronic stages. Under the head of chronic cases, all those which have lasted over six weeks will be included; although some become chronic in a shorter time.

The symptoms of active inflammation have passed away; the temperature is usually normal; there is no pain or tenderness. There is, however, no improvement in the general condition, and either the weight remains stationary, or the child continues to lose slowly until it is little more than a skeleton. The face is pinched, the eyes sunken, and the cheeks hollow. The lips are pale, often fissured, and bleed readily. The fontanel is depressed. The body is so small that the head seems much too large. Almost every vestige of fat may disappear from the subcutaneous cellular tissue of the trunk and extremities. The skin hangs in loose folds on the thighs. The abdomen may be distended and tympanitic, or retracted and soft. The mouth is often the seat of thrush, of catarrhal, herpetic, or rarely of ulcerative stomatitis. The tongue may be heavily coated, but is more often dry, glazed, and red. In rare instances sordes covers the lips and teeth. The teeth sometimes decay quite rapidly from the general malnutrition. Baginsky states that the progress of dentition is arrested; but I have very often seen these infants, almost "living skeletons," go on cutting teeth quite as steadily as under normal conditions, and Eustace Smith has made the same observation.

Although they seldom cry for food, as a rule, these children will take nearly everything given them, and an almost unlimited amount. Notwithstanding that it is retained, the more they are fed the more rapid seems the wasting. Vomiting is not common, and seldom occurs except from overloading the stomach or during an acute exacerbation of the symptoms.

The stools are rarely frequent; five or six a day being the average; often there may be only two or three a day for a week at a time. They are thinner than normal, but are not often fluid. They contain mucus of a green or brownish colour, usually in large quantity. Blood is rarely present. The stools are sometimes green, often greenish brown, sometimes a pale gray. Undigested food is always present in quantity, and upon the diet depends very much the gross appearance of the stool, the odour of which is almost always offensive, sometimes extremely so. Pus is found under the microscope, but is rarely visible to the naked eye. Nothnagel and Baginsky have called attention to a form of stools which they believe to be characteristic of wide-spread inflammation of the mucous membrane with atrophy of the tubular glands: they are of nearly normal consistence,

homogenous, dark green or brown colour, and usually offensive; they sometimes alternate with stools of a watery character; under the microscope nuclei are found, but no unchanged epithelial cells; the food-remains are sometimes unrecognisable, from the extent to which decomposition has taken place.

Prolapsus ani is not so frequent as in the acute cases; but when it occurs it is generally more difficult to control. Flatulence and colic are prominent symptoms in some cases, but absent altogether in many others. As a rule, there is neither abdominal pain nor tenderness. When the abdomen is enlarged it is usually uniformly, but sometimes shows marked epigastric prominence, which is more often from dilatation of the transverse colon than of the stomach. The skin of the abdomen often seems very thin; dilatation of the superficial veins is rarely seen. The liver and spleen are generally normal in size, so far as can be made out by physical examination. Although the mesenteric glands are enlarged, they can not be felt through the abdominal walls. Enlargement of the inguinal and other groups of external lymphatic glands is rarely striking. The skin is loose, wrinkled, dry, and scaly, and in the worst cases frequently covered with small petechiæ over the abdomen and lower extremities. About the anus, and over the sacrum, thighs, genitals, and sometimes feet, there are excoriations, and not infrequently ulcerations. The pulse is weak, the peripheral circulation is poor, and the extremities are cold much of the time unless artificial heat is applied. The respiration is usually shallow, and often irregular without any apparent cause; it becomes rapid from the development of pulmonary complications. The temperature is elevated only during exacerbations, or from inflammatory complications. A subnormal temperature is frequently met with. I have occasionally seen it 95° F. in the rectum. A continuous subnormal temperature is a very bad sign. The urine shows no constant changes. Dropsy may be present without albuminuria. The weight is stationary, or steadily falls to an almost incredible degree. I have seen one infant weighing but eight pounds at thirteen months; another, thirteen pounds at two years and four months. There are marked cachexia and extreme anæmia. Ulcers of the cornea are not uncommon. Nervous symptoms are always present. The children are cross and irritable, sleep badly, and frequently have a low, whining cry, which is continued much of the time. Sometimes they are dull, apathetic, and quite indifferent to their surroundings. Persistent opisthotonus is occasionally seen; and there may be contractions of the extremities, but rarely general convulsions.

The duration of the disease is from two months to a year. Comparatively few patients survive more than four months. The progress is irregular, and marked by periods of improvement, during which for a time the patient may hold his own, or even gain in weight. Any trivial cause may excite a relapse, and the downward progress is rapid. Death often occurs

during one of these exacerbations, or it may be due to broncho-pneumonia, tuberculosis, or slow asthenia.

Diagnosis.—The problem usually presented is, whether the condition of the bowel is of itself a sufficient explanation of the general condition, or whether there is some underlying constitutional disorder, of which the diarrhœa is only one of the symptoms. It is important to distinguish the cases in which the cachexia is quite marked and convalescence slow—although ultimately resulting in complete recovery—from those which present at a certain stage almost identical symptoms, and yet go on steadily from bad to worse, terminating fatally. The difference in these cases is really a difference in the character and extent of the lesions. The first group are probably cases of superficial catarrhal inflammation, or of follicular inflammation which has not gone on to ulceration, these lesions being capable of repair. The second group are the cases of follicular or catarrhal ulceration, in which complete recovery from the lesions is impossible, and repair only partial, if indeed any occurs. In distinguishing between these cases the most important guide is the nature of the symptoms during the antecedent acute attack. The longer the acute febrile symptoms have lasted and the higher has been the temperature, the greater probably is the extent of the lesions, and the more severe their character.

The diagnosis of chronic ileo-colitis from general tuberculosis is difficult, particularly so from the fact that tuberculosis is not an infrequent sequel to the intestinal disease. The points in common are the existence of diarrhœa (which may occur in tuberculosis in summer apart from the presence of intestinal tuberculosis), anæmia, cachexia, and the signs of consolidation in the lungs; these, in the one case, depending upon broncho-pneumonia, and in the other upon tuberculous deposits. Tuberculosis is more likely to be met with in institutions, among the poor of cities, and in children previously delicate and with a tuberculous family history. In chronic ileo-colitis the wasting and anæmia follow the intestinal symptoms, and are usually just in proportion to their severity. For the differential diagnosis of the pulmonary condition see the chapter on Pulmonary Tuberculosis. Of the constitutional symptoms the most important differential one is fever. This is rarely absent in general tuberculosis or in tuberculous ulceration of the intestine if extensive, though it is not high and its course is very irregular. It is absent in chronic ileo-colitis, except from complications and from the occasional acute exacerbation.

Prognosis.—The prognosis depends upon the child's previous constitution, upon the duration of the intestinal symptoms, upon our ability to carry out proper treatment, upon the presence of complications; but, most of all, upon the severity and extent of the intestinal lesions. The possibility of error always exists in estimating the gravity of the lesions, so that no case should be considered hopeless. Every physician who sees much of this form of disease, has met with cases so weak, so wasted, and

so anæmic that recovery seemed out of the question; and yet after a few weeks, under favourable conditions, they have begun slowly to improve, and finally have gone on to complete recovery. If, however, continuous symptoms have existed for eight or ten weeks without any sign of improvement, recovery is extremely doubtful. The patient may linger for two or three months longer, but usually only to be carried off by the first acute disturbance which occurs.

Treatment.—Little or nothing is to be expected from drugs. No greater mistake is made than to give these children week after week the various diarrhœa-mixtures, with the expectation that ultimately the formula which exactly meets the wants of the particular case will be found. Drugs are to be used only for the relief of special symptoms. Thus a dose of opium may be needed when the movements are unusually frequent, or castor oil once in four or five days when the stools are particularly offensive. The essential and important part of the treatment consists in injections, careful feeding, stimulation, and change of air. Astringent enemata, however, are of considerable value. They should be given daily or every other day, but from time to time should be discontinued to see what the condition of the stools is without them. They should be used as described in the treatment of acute cases after irrigating the colon with a tepid salt solution (one ounce to the gallon). The stronger astringent solutions should be used, and held in place for half an hour.

Alcoholic stimulants must be given in almost all cases, and they may be continued for a long time with advantage. Old port or sherry will sometimes do better than brandy or whisky. The diet mentioned in the later stages of the acute cases should be continued. Usually we give that which the patient will take most readily. The predigested foods are useful; so also are such beef preparations as bovinine, and the liquid beef peptonoids. Raw scraped beef may be used with great benefit. Fats and starchy foods should be excluded entirely or given in very small quantities. It is usually better to give the carbohydrates in the form of the malted foods. Kumyss and matzoon are useful. The diet must be carefully watched and directed according to the effect upon the stools of the various articles employed. In some of these cases nutrition may be promoted by inunctions of cocoa butter, cod-liver oil, or some other form of fat.

The patient must first be put in the best possible surroundings; in no disease is a change of air more to be desired than in this. These cases are trying ones to the physician; for unless he can absolutely control the matter of diet, it is almost useless to attempt to do anything. Still, by careful study of the individual case and attention to minute details, success may sometimes be achieved even when the outlook seemed at the outset the most hopeless. The danger of relapses and second attacks continues long after the primary attack has subsided.

AMYLOID DEGENERATION OF THE INTESTINES.

This is rarely met with in infants. It is not so infrequent in older children, where it is associated with amyloid changes in the liver, spleen, and kidneys, usually as a result of prolonged suppuration in connection with bone tuberculosis. It is sometimes met with in syphilis. The ileum is the part of the intestine most affected. The process begins in the walls of the arterioles and capillaries, particularly of the villi, and later involves the vessels of the submucosa; subsequently the epithelium may be affected. The mucous membrane in these cases is pale, rather translucent. The condition is recognised by the application of the iodine test. This is best seen in the lower ileum, where the affected villi become of a brownish-red or mahogany colour.

Amyloid degeneration produces no definite symptoms. Diarrhœa is frequent but by no means constant. The anæmia and waxy cachexia which are present are probably dependent much more upon the associated lesions of the liver and kidneys than upon the changes in the intestines. The treatment is symptomatic.

TUBERCULOSIS OF THE INTESTINES AND MESENTERIC LYMPH NODES (MESENTERIC GLANDS).

These two conditions are usually, but not invariably, associated, and may conveniently be considered together.

Frequency.—In 109 autopsies of my own upon tuberculous cases in which the condition of the intestines was noted, they were involved in 37 per cent. The great majority of the patients were under three years of age. In 131 autopsies upon tuberculous cases published in the Pendlebury Hospital Reports, the intestines were involved in 50 per cent. These patients were mainly between four and fourteen years old, very few of them being infants. In 209 autopsies upon tuberculous children, chiefly infants, reported by Müller, the intestines were involved in 28 per cent. In 1,346 autopsies collected by Biedert there were intestinal lesions in 31·6 per cent. These figures show that the intestines are not one of the most frequent seats of tuberculosis in children, and that it is rather less frequent in infancy than at a later age. It is most common from the third to the eighth year. The figures for tuberculosis of the mesenteric lymph nodes are nearly the same as those for the intestines. They were tuberculous in 35 per cent of my own autopsies, and in 59 per cent of the Pendlebury cases. Müller and Biedert do not give the proportion.

Etiology.—In all or nearly all cases, the mesenteric lymph nodes are infected from the intestines. It is of course possible, but unlikely, that the infection may be through the general circulation. With tuberculous ulcers of the intestine, the lymph nodes are, I think, invariably found by

inoculations to be tuberculous; although they may not yet be caseous. The infection of the intestinal mucous membrane is from bacilli in the canal. Much stress has been laid upon tuberculous milk as a means by which children are infected. There is little pathological support to be found for the view that children often contract the disease in this way. In 119 autopsies upon tuberculous children, chiefly infants, there was not found one in which the most advanced, and therefore presumably the primary, lesion was in the intestines or stomach. In 127 autopsies, also upon tuberculous infants, Northrup found the most advanced lesion in the intestines in but a single case. While infection from milk is possible, it is certainly extremely infrequent. In my own autopsies, intestinal lesions have been found only in marked cases of generalized tuberculosis. In not more than one fourth of the cases in which such lesions were present were they severe. They were usually associated with an advanced pulmonary process, and were doubtless due to swallowing tuberculous sputum.

Lesions.—*Intestines.*—Tuberculosis usually affects the small intestine; with very extensive disease the large intestine may also be involved, and exceptionally it alone may be affected. The disease in the small intestine is usually found in the jejunum, and in the lower ileum near the ileocæcal valve. Of the large intestine, the cæcum is most often diseased; ulcers are often found in the appendix.

If seen very early there may be only tuberculous deposits, usually widely scattered, involving the solitary lymph nodules, or Peyer's patches. These appear as tiny yellow nodules. Usually, however, ulcers are present, and often only ulcers are seen. Their size and number vary greatly; there may be only five or six tiny ulcers, or there may be forty or fifty, the largest being two or three inches in diameter. They very frequently involve the Peyer's patches. The typical tuberculous ulcer is of irregular shape, with rounded borders and with its longest diameter at right angles to the intestinal axis. When large, it may nearly encircle the gut. The ulcers are excavated; they have overhanging, infiltrated edges of a deep red colour. The surface is covered with granulations. In those which have partly healed a distinct puckering of the intestine occurs, which is especially noticeable upon the peritoneal surface. The small ulcers involve the mucosa only; the larger and older ones the submucosa and the muscular coats, and not infrequently also the serous coat. Perforation may occur, but rarely into the general peritoneal cavity, as a localized plastic inflammation precedes it. There may be adhesions of adjacent intestinal coils, and fistulæ may form, owing to ulceration at their point of contact. With these severe cases there is always associated more or less extensive tuberculous peritonitis, frequently of the ulcerative variety. Like other tuberculous processes, the infiltration and ulceration may cease at any stage, and cicatrization follow. If the ulcers have been large ones, there is always some narrowing of the lumen of the intestine. Stricture rarely

results, because the patients die from the general disease before it has had time to occur. Monti has reported a case of obstruction at the ileo-cæcal valve, due to an old tuberculous cicatrix, in an infant of twenty-one months.

Mesenteric lymph nodes.—Usually these tuberculous lymph nodes are from half an inch to an inch in diameter; occasionally they may reach the size of a hen's egg. From a fusion of several of them, tumours of considerable size may be formed. I have seen one as large as the head of a child at birth.

The process is the same as that which occurs in other lymph nodes in the body. There is a tuberculous inflammation, followed by caseation, softening, and abscess, or by calcification. Localized peritonitis is found in all the marked cases; this is usually plastic, but may be suppurative when due to the rupture of an abscess. Pressure upon the vena cava may lead to dropsy in the lower extremities. Ollivier has reported a case in which thrombosis of the vena cava occurred. Pressure upon the portal vein may lead to ascites and dilatation of the superficial abdominal veins. There may be pressure upon the thoracic duct.

Symptoms.—The symptoms of intestinal tuberculosis are exceedingly irregular. Ulcers are very frequently found at autopsy when there have been no marked intestinal symptoms; this is especially true of the small ulcers seen in infants. On the other hand, diarrhœa is not uncommon in cases of advanced general tuberculosis where no ulcers are present. It is the most frequent symptom, and may be exceedingly obstinate. The stools do not differ essentially from those in chronic ileo-colitis, except in the occurrence of hæmorrhages and in the presence of tubercle bacilli. Hæmorrhages are not very frequent, but they may be so large as to be the cause of death. This occurred in one of my cases, an infant nine months old, the blood coming from a single ulcer in the ileum. Hæmorrhage is more common in older children. In some cases localized abdominal pain or tenderness is present. In advanced cases the symptoms of intestinal ulceration are usually mingled with those of peritonitis, and there are also present the enlarged mesenteric lymph nodes, which may aid in the diagnosis. In the vast majority of cases, these nodes are recognised only by palpating the abdomen. They can rarely be felt unless they are at least an inch in diameter. In making palpation, the hands should be placed upon the abdomen laterally, and slowly brought together at the spine. The tumours are generally felt as irregular nodular masses, lying close against the spine, not movable, and sometimes tender on pressure. The other symptoms are due to the complications which have been already mentioned.

Diagnosis.—The only positive evidence of intestinal tuberculosis is the discovery of the bacilli in the stools. In the absence of this evidence, the disease is differentiated from simple ileo-colitis, first, by the signs of tuberculosis elsewhere in the body, especially in the lungs, these being almost

invariably involved; secondly, by the slow onset and gradual development of the symptoms, while in chronic ileo-colitis an acute attack has almost invariably preceded. Large hæmorrhages always suggest tuberculosis.

The large mesenteric glands are recognised only as abdominal tumours.

Prognosis.—This depends altogether upon the extent of the tuberculous disease elsewhere, as it is extremely rare for the intestinal lesion to be the cause of death. Once formed, the ulcers probably remain, cicatrization being very rare, and then only partial.

Treatment.—The only symptom which ordinarily demands treatment is the diarrhœa. When severe, this is to be managed much as in cases of ileo-colitis, except that irrigation of the colon is, of course, not called for. The chief reliance must be upon diet and internal medication. The drugs which are most useful are bismuth, opium, and creosote, which should be given in pills coated with shellac.

CHAPTER IX.

DISEASES OF THE INTESTINES.—(Continued.)

CHRONIC INTESTINAL INDIGESTION.

As the larger and more complex part of the process of digestion goes on in the intestine, so intestinal indigestion is a more common and more complicated disturbance than gastric indigestion. In many cases we find the two associated, but in perhaps the majority the symptoms relate entirely to the intestinal process. The conditions seen in young infants are so different from those in older children that the cases may be best considered separately.

In Young Infants.—The general causes are the same as those mentioned in connection with chronic gastric indigestion: they are constitutional debility, either congenital or acquired, unfavourable surroundings, and previous attacks of acute disease. Chronic intestinal indigestion is especially common during the first six months, and is seen both in nursing infants and in those who are artificially fed. In the case of breast-fed infants the mother is often highly nervous, delicate, and anæmic, and is taking large quantities of fluids of every description, by means of which an abundant flow of milk is maintained. Why it is that the milk causes so much disturbance can not always be discovered even by the most careful analysis. The difficulty seems to be most frequently with the proteids, which are often in excess. Sometimes, proteids differing in character from those normally present seem to be produced, as the stools show that they are not digested. The microscope in some cases reveals the presence of many colostrum corpuscles in the milk. In another group of cases,

where the condition of the nurses is all that can be desired, the trouble is simply that the milk is too rich ; it being then high both in fat and proteids. It may come, although rarely, from the fact that the child gets too much, being nursed either too frequently or for too long a time.

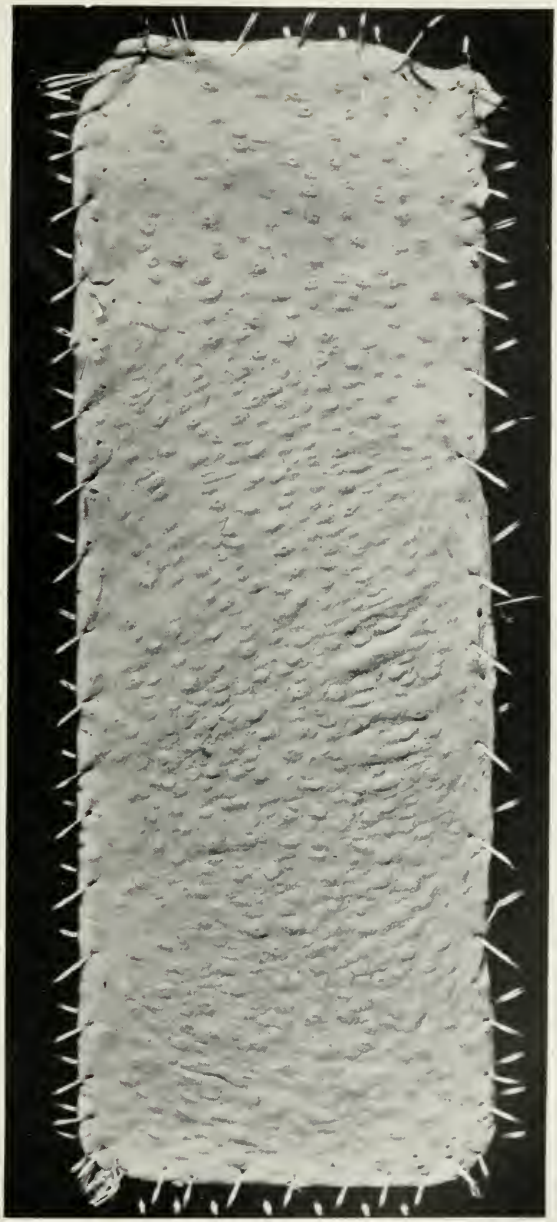
In infants who are being fed upon cow's milk, the most common cause is that the proteids are too high ; this is usually the mistake when infants are fed upon plain milk which has been simply diluted. In other cases the fat may be excessive, as in many of the milk-and-cream mixtures in vogue. Sometimes both the fat and the proteids are too high. Next to this mistake in proportions, is that of over-feeding. When other substances than cow's milk are used as foods, the usual trouble is that they contain a large proportion of starch.

Lesions.—Strictly speaking, chronic indigestion is a functional disorder without anatomical changes. Where the condition has lasted for many weeks or months, as often happens, there may result a low grade of catarrhal inflammation in the colon, attended by hyperplasia of the lymph nodules of the mucous membrane (Plate XI), and sometimes by a similar process in the mesenteric lymph nodes. Chronic indigestion may be the principal and the only symptom in cases of chronic ileo-colitis which have followed an acute attack.

Symptoms.—The general symptoms are those of malnutrition, or in the more severe form, those of marasmus. These have already been fully described (page 204), and need only be mentioned here. The most important are stationary or losing weight, anæmia, poor circulation, often subnormal temperature, almost constant fretfulness and crying, with very little quiet sleep. The tongue is usually coated and the appetite often good, these infants taking food whenever given, and in an almost unlimited quantity. There are few cases in which occasional vomiting does not occur, but it is rarely persistent. So far as the intestinal condition is concerned, the cases may be divided into those with diarrhœa and those with constipation. It may happen that the same child will suffer for a long time from diarrhœa and then from constipation, or the reverse; but usually one condition or the other is habitual. The diarrhœal stools are thin, green, and almost invariably contain curds, either in large lumps or small, flaky masses. They vary in number from three to ten in twenty-four hours. They are commonly passed without pain, although there may be flatulence. The stools have usually a sour, unpleasant odour, but they are rarely foul. They may be irritating to the skin, and cause troublesome excoriations or intertrigo. In some cases the stools contain but little solid matter, the character being that of yellowish-green water. In most of the cases, after the process has lasted two or three weeks, mucus is present, and may then become a constant feature.

If there is constipation, the stools are usually gray or white; they are smooth and pasty or like hard balls passed after much straining, often

PLATE XI.



CHRONIC HYPERPLASIA OF THE LYMPH NODULES (SOLITARY FOLLICLES) OF THE COLON.

Child ten months old; death from pneumonia without intestinal symptoms. Until five months old, nearly all stools were green or brown and contained mucus.
The condition shown existed throughout the colon.

coated with mucus and sometimes streaked with blood. Often the bowels will not move for days except after the use of laxatives or enemata. The latter often have but little effect, as the rectum may be empty. Constipated cases are especially prone to suffer much from flatulence and colic, the attacks of which may be very severe.

The duration of these symptoms is indefinite. There is little or no tendency to spontaneous improvement, and they may drag on for several months or until the problem of diet is solved. The progress of these cases is marked by frequent exacerbations, during which there is vomiting, and usually fever. These symptoms are generally dependent upon intestinal toxæmia. A low irregular fever may continue for days or even weeks. Although the general symptoms of failing nutrition are present in most cases, a mild degree of chronic intestinal indigestion with frequent loose movements may sometimes last for months, during which the patients may gain steadily in weight and give every indication of being well nourished. This is much more common in nursing infants than in those who are artificially fed.

Diagnosis.—It is not generally difficult to determine that an infant is suffering from chronic intestinal indigestion; but one should endeavour to go further in his diagnosis and discover which of the elements of the food is causing the chief disturbance. Thus, in an infant fed on cow's milk, we wish to know whether it is the casein, the fat, or the sugar; or, in another case, whether it is the starch of some proprietary food. Much valuable information may be gained from a careful history of what has already been tried in the case; often some gross error can be detected in the formula used or in the preparation of the food. Difficulty with the casein is usually shown by colic, constipation more often than diarrhœa, and by curds in the stools; often there is vomiting. Difficulty with the fat is indicated by loose movements, usually of a yellow colour. Sometimes they are white, smooth and formed, with a peculiarly offensive odour; there may be vomiting or the regurgitation of food in small quantities. Difficulty with the sugar is less common than with either the casein or fat, but there may be colic and diarrhœa, with thin, sour, irritating stools. Difficulty with the starch leads to much flatulence and colic, diarrhœa alternating with constipation, and offensive stools. One may find the foregoing symptoms in any combination, for in protracted cases the trouble is rarely limited to a single element in the food. If one is feeding cow's milk, the best way to arrive at a diagnosis is to begin with what would be a proper formula for a healthy infant somewhat younger, and watch the stools closely for two or three days. The proportion of the offending element should then be reduced until the symptoms it is causing disappear. By carefully modifying milk in this way, a diagnosis can usually be reached in a few days. Without it, all treatment is haphazard experimentation.

Prognosis.—This depends almost entirely upon how early the cases come under treatment and how they are managed. There is very little tendency to spontaneous improvement or recovery. The existence of chronic intestinal indigestion is one of the most important predisposing causes to more serious forms of intestinal disease, and in that consists its chief danger.

Treatment.—Drugs have no part in the treatment of these cases, except now and then for particular symptoms, such as constipation or colic. These infants are cured by proper dietetic and hygienic measures, and by these alone. The problem of diet has already been discussed in the chapter on Infant Feeding (page 180). For the general management of the case, which is not less important, the reader is referred to the chapter on Malnutrition.

In Older Children.—Chronic intestinal indigestion is exceedingly common in children from the first to the fourth year. It is, however, seen throughout childhood, but after the age mentioned it is much less frequent. The younger children have usually been badly fed from the time of weaning from the breast or bottle. The almost universal mistake is that an excess of carbohydrates has been given, particularly potato and oatmeal. In many children these articles have been the most important part of the diet. Children suffering from rickets are very much more prone to chronic intestinal indigestion than are others, but it is seen in many in whom there is no trace of rickets, and in all grades of society—quite as often among the better class as in dispensary practice, although the type is usually less severe.

Symptoms.—The clinical picture which these cases present is a very common one, and the symptoms are quite uniform. Patients are generally very thin, with very small extremities, a small amount of fat, and large, protuberant abdomens. There is much flatulence, and in cases of long standing there is marked tympanites. The children are pale, anæmic, and sallow in complexion; they have dark rings under the eyes; they are easily fatigued on slight exertion; they are very cross, irritable, and emotional to an unnatural degree. They are hard to amuse, hard to control, and altogether exceedingly difficult patients to deal with. Their growth is retarded if the symptoms have lasted long. They are much below the average in height and weight. Even when not rachitic they walk late, and their general development is very slow. The sleep is always unnatural and disturbed; they can rarely be made to sleep with any regularity during the day, and at night they toss about their cribs, waking frequently, crying out and often grinding their teeth; this sometimes leading to the diagnosis of intestinal worms. They perspire very readily, and, like infants thus affected, they suffer from cold extremities.

The bowels are usually constipated, the stools being of a light gray colour or perfectly white. They are always formed and generally lumpy.

The odour from the discharges is usually extremely foul. In other cases there is chronic diarrhœa. The stools are not very frequent, rarely exceeding four or five a day, but they are large, thin, gray, green, or brown in colour, very offensive, and always contain undigested food. They are often excited by the taking of food. From time to time, in many patients, large quantities of mucus are passed from the intestine; in some cases this comes to be a constant feature of the disease. It results from an intestinal catarrh, which has been set up by the irritation from the hard fæcal masses or from the chronic functional derangement. Large quantities of gas are expelled *per anum*. Pain is not a very common symptom in most cases, although in a few patients a localized pain of considerable severity may be complained of at certain times, lasting for a day or more. The appetite is capricious, and usually poor, but some patients will eat everything offered. Because of the disinclination to take simple food, the most indigestible and highly seasoned articles are often given, with the effect of increasing the severity of the symptoms. The tongue is often coated, although it may be quite clean; the breath is foul.

The nervous symptoms which these patients present are exceedingly varied, and often of the most puzzling character. In many cases they are so severe and so persistent as to lead to the diagnosis of organic disease of the brain. In addition to the condition of general nervous irritability, there may be opisthotonus, tetany, fainting attacks resembling somewhat the seizures of *petit mal*, exaggerated reflexes, attacks of dulness or sometimes stupor, with retracted abdomen, irregular pulse and respiration, and other symptoms strongly suggestive of tuberculous meningitis. Some patients have shown transient paralysis. Convulsions are not very uncommon. Headache and frequent attacks of vomiting, which are perhaps to be interpreted as instances of migraine, are occasionally seen. In fact, there is almost no end to the complexity of these cases and the combinations of nervous symptoms which they may present. Most of these are toxic in their origin. The skin shows frequently eruptions of erythema or of urticaria.

Slight fever, also of toxic origin, is sometimes present for many weeks, the temperature usually varying between 99° and 100·5° F. Sometimes for several days it may be normal, and occasionally may rise to 102° or 103° F. during a slight exacerbation in the symptoms. The urine of many of these patients contains a large quantity of indican; the amount present indicates very accurately the degree of intestinal putrefaction going on, and often fluctuates regularly with the nervous symptoms.

Intercurrent attacks of acute indigestion, with diarrhœa and vomiting, are common and quite easily excited. The course and duration of these symptoms are indefinite. In the most severe forms, if untreated, the patients gradually waste until they die from exhaustion, or fall easy victims

to any acute disease which they may happen to contract. There is but little tendency to spontaneous recovery.

Prognosis.—This depends upon the duration of the symptoms, the general condition of the patient at the time treatment is begun, and upon how thoroughly it can be carried out. The symptoms, in the great majority of cases, have existed for several months at the time the case comes under observation. Generally, the greater the mistakes in feeding have been, and the more gross the violation of hygienic and dietetic rules, the better the prognosis. A child who has developed chronic intestinal indigestion of a severe type, in spite of the fact that the hygienic surroundings were good, and where the dietetic errors were not flagrant, is not nearly so hopeful a subject for treatment as one whose hygienic surroundings have been poor and whose diet has been especially bad. In cases like the latter, a removal of the causes and the institution of proper methods of treatment almost invariably result in immediate and striking improvement, unless the general vitality of the patient has been reduced to a very low point. In the other cases, where the mistakes have been less marked, and the condition is due more to constitutional than to local causes, the improvement is slower and less striking. Thus, as a rule, hospital patients improve more rapidly than those seen in private practice, because their previous treatment has been so much worse.

Treatment.—In no class of cases that the physician is called upon to treat are results more satisfactory than in many of those of chronic intestinal indigestion, where the intelligent co-operation of the parents or a trained nurse can be secured. If the parents themselves are lax in discipline, and are unable to control the child, an efficient trained nurse should be secured, into whose hands the exclusive management of the child should be placed. The essential part of the treatment is that relating to diet. In the second and third years the most important thing is to stop all starchy food for a considerable time, and put the patient upon an exclusive diet of rare beef or beef juice and milk. The milk for many of the patients must be peptonized, as the casein of cow's milk is often very difficult of digestion even by children three years old. By some the fat also cannot be digested, and skimmed milk should then be used; in very obstinate cases it should be peptonized for two hours; in the majority of cases, however, it is sufficient to peptonize it from fifteen to twenty minutes. Additional carbohydrates are often best given in the form of some of the malted foods, which may be continued until the child can digest some form of starch. The number of feedings should be five a day during the second year, and four a day for children during the third and fourth years. These should always be at regular intervals, and nothing whatever given between meals. The meat should be rare scraped beefsteak or mutton; from one to three tablespoonfuls may be allowed once a day. Fresh fruit, especially oranges, may usually be allowed once a day, given

one hour before meals. Kumyss or matzoon is often of very great value in children who are not fond of milk, or who become tired of the diet. Although at first they are taken with difficulty, in many cases a fondness for them is very soon acquired. Sometimes they are invaluable.

After improvement has been going on for a month, bread may be added, at first in small quantities and once a day. This should preferably be stale bread, cut thin and dried in the oven until it is crisp, and given without butter. Two or three times a week raw oysters may be tried. Mutton, chicken, or beef broth, without vegetables, may be given occasionally in the place of one of the milk feedings. After this diet has been kept up for three or four months, if improvement continues, one of the green vegetables may be added once a day, preferably either spinach, stewed celery, or asparagus. After two or three months more of continued improvement, thoroughly cooked rice or macaroni may be given twice a week. With these articles of diet one can get along very comfortably for a year, and no larger variety should be given until all the symptoms have disappeared. When starchy food is finally allowed, it should be only in small quantities, and usually with some preparation of malt. Potato and oatmeal should be forbidden for a long time.

Intestinal irrigation (page 63) is useful in all cases in which there is much mucus passed. A saline solution should be employed. The irrigation should be given at first daily, and after a week or two every other day, and, later still, once or twice a week. This seems not only to exert a favourable influence upon the catarrh in the colon, but also upon the lower part of the small intestine.

The constipation can usually be controlled by the diet mentioned. If not readily so, calomel should be administered occasionally, and abdominal massage employed. Calomel seems to exert a very marked influence upon the cases, even when the constipation is not severe. It is often wise to administer a full dose of this drug every five or six days. In some patients, a purgative dose of castor oil given every few days, acts more satisfactorily than the calomel. It is sometimes objectionable, however, from its tendency to aggravate the constipation.

Drugs directed toward the process of putrefaction are extremely unsatisfactory even in older children, but sometimes diminution in the amount of flatulence follows the use of salol or salicylate of soda in five-grain doses after meals. General tonics are required, and may add materially to the improvement of the patients. Altogether the best one is nux vomica. It may be given in combination with the bitter wine of iron just before meals, three times a day. This increases the appetite and acts favourably upon the constipation. Cod-liver oil, particularly in the early stage, is badly borne, and aggravates the symptoms. It should be withheld in all cases until very marked improvement in the condition of the digestion is assured.

Relapses are easily excited by indiscretion in diet, and parents should be impressed at the very beginning with the necessity of adhering rigidly to the diet prescribed. It very often happens that the improvement which is seen after one or two months of careful treatment is so marked as to lead the parents to the belief that a cure has been accomplished, so that they relax their vigilance and allow improper articles of food—conditions which are almost certain to induce a relapse. If the case is an aggravated one, and the symptoms of long standing, it is wise to tell parents at the outset that a year's treatment is the minimum in which anything permanent can be accomplished.

The general treatment of the patient must not be overlooked. Proper clothing, regular exercise in the open air, cool sleeping rooms, sponging every morning with cold water, are all of very great importance, and contribute almost as much to the results obtained as the local measures adopted. (See chapter on Malnutrition.)

The improvement in the nervous symptoms of the patient is one of the first things noticed, and is often marked in a few days after the beginning of treatment. From an irritable, fretful, peevish child the patient is sometimes totally changed in disposition in two weeks, so as to become quiet, affectionate, docile, and playful.

INTESTINAL COLIC.

The term *colic* is applied to any severe paroxysmal pain occurring in the intestines. It may be due to many causes. The colic of lead and arsenic poisoning are both very rare in children; but colicky pains are present in appendicitis, intussusception, ileo-colitis, and, in fact, in all the severe forms of intestinal inflammation. Colic may be due to swallowing certain substances, especially foreign bodies and the seeds of fruits; and in rare cases it may be excited by the presence of round worms when they are numerous. In all the conditions mentioned, colic is only one of the symptoms, although it may be a very prominent one.

The special and peculiar colic of infancy is that which is associated with flatulence, and is due to indigestion. Here it is a symptom only, but may be a most troublesome one. This form of colic belongs essentially to the first six months of life, and is more frequent during the first three months. It may be seen at any time when digestion is very feeble. Many young infants suffer from colic a large part of the time; others have only occasional attacks, which are often repeated at a certain time in the day.

The flatulence to which the colic is usually due, may be from decomposition in the food or intestinal secretions, or in both. It is seen quite as often in nursing infants as in those who are artificially fed. Any of the elements of the milk may be a cause of colic, but in fully four fifths of the cases it is the proteids. The colic of nursing infants is nearly always due to the fact that the milk is excessive in proteids, or else that

these are digested with special difficulty. If cow's milk is the food, it is the casein which is usually at fault. It is rare that the quantity of sugar present in cow's milk is sufficient to be a cause of colic; but this may happen when sugar has been added, much more frequently with cane sugar than with milk sugar. It is extremely rare for the fat to be a cause of colic. In infants, whose food consists largely of farinaceous substances, colic is also very common.

As a result of the decomposition taking place in the intestine, gas accumulates, and, the intestines lacking sufficient muscular force to expel it, distention follows. To this in part the pain is due. But spasm of the muscular walls of the intestine is also an element in producing the pain. In some of the most severe cases it is possible that the spasm may be accompanied by a slight intussusception. Colic may occur without flatulence, as in cases when it follows cold feet or chilling the surface. In these cases also, muscular spasm appears to be the principal factor in causing the pain. Intestinal colic may occur alone, or it may alternate with or accompany gastric colic.

Symptoms.—These are in most cases so typical as to be easily recognised. They are always more severe in delicate and highly-nervous children. In the severe attacks there are contraction of the features, the loud paroxysmal cry, subsiding for a few moments and then beginning with renewed intensity, drawing up of the lower extremities, and in male infants contraction of the scrotum. With these symptoms the abdomen is usually found tense and hard. With the expulsion of the gas, the symptoms subside at once, and the child usually falls asleep. In the most severe attacks there may be considerable prostration, cold extremities, and perspiration. When the symptoms are less severe there is only continual fretfulness, and the child can not sleep. When colic is habitual there are very few hours in the twenty-four when the child seems to be entirely comfortable. In nursing infants there may at times be difficulty in distinguishing the cry of colic from that of hunger, as infants suffering from colic will usually take food eagerly, and this is often followed by temporary relief. In colic, however, the pain soon returns, and often is more severe than before. The cry of colic is usually violent and paroxysmal; that of hunger is apt to be prolonged and continuous, and is not accompanied by the other symptoms mentioned as indicating abdominal pain. In older children the less frequent causes of colic mentioned at the beginning of this article, especially appendicitis, should be borne in mind.

Treatment.—When colic is due to flatulence of the intestine, nothing given by the mouth has much effect in relieving the symptoms. Certainly food should not be given. The purpose of treatment during the attack is to assist the child to get rid of the gas; as this is usually in the colon, the most efficient means is by enemata. At first an injection of four or five

ounces of lukewarm water should be used. If this is not successful, two ounces of cold water with half a teaspoonful of glycerin may be tried. This rarely fails to start peristalsis and expel the gas. In conjunction with these measures, dry heat should be applied to the abdomen by means of hot flannels or a hot-water bag, and the feet should be well warmed. In cases of colic not associated with flatulence, where the pain is probably the result of muscular spasm, opium in some form is required in addition to heat or counter-irritation. The treatment between the attacks and the treatment of habitual colic should be directed toward the indigestion, upon which they depend.

CHRONIC CONSTIPATION.

Constipation may be said to exist whenever the stools are less frequent, harder, and drier than normal. During the first six months infants usually have two movements a day. Many, however, have only one; but if this is normal in character the child is not constipated. In other cases, although there are two and even three stools a day, they may all be small, dry, and hard, having all the characters of constipated stools, and the case should be treated accordingly.

Etiology.—The causes of chronic constipation are many and far-reaching. It may be due to a diminution in the secretion of the intestinal glands or of the liver. The movements are then hard, dry, very light-coloured, and are associated with much flatulence and other signs of intestinal indigestion. Very often the principal factor in constipation is insufficient muscular contraction in the intestine. The fæcal masses are then propelled so slowly and remain so long in the intestine that the fluid portion is absorbed, the residue becoming, in consequence, so dry and hard that it is difficult to evacuate. In other cases constipation depends upon the fact that there is insufficient volume to the stools, as may be the case when the food given leaves very little residue. Constipation may depend upon local causes, as, for example, where an evacuation of the bowels is resisted on account of pain from fissure of the anus or from hæmorrhoids. Although not the primary cause, this condition may be sufficient to keep up the constipation indefinitely. It may, in rare cases, be due to a congenital condition, such as a narrowing of the large intestine at some point. The most important causes of constipation may be grouped under two heads: diet, and conditions giving rise to muscular atony.

Diet.—In breast-fed infants the trouble is usually a lack of fat and an excess of proteids in the milk. In those who are artificially fed it is often because the fat is too low, and sometimes because both the fat and the proteids are too low, the stool lacking volume. In other cases the cause of constipation is indigestion, in still others the use of "sterilized" milk. During the second and third years the cause may be too much cow's milk, particularly that which has been boiled, or the use of an excessive amount

of starchy food. As during the first year, the trouble with cow's milk is that it contains too much casein, the digestibility of which has often been rendered more difficult by the boiling. In older children the cause may be an excess of starchy food and a lack of sufficient green vegetables, meat, and fruit.

Muscular atony.—The most common cause of muscular atony is habit; in a large number of cases this is the principal, and often it is the only factor. If the inclination to have a stool is regularly disregarded it soon ceases to be felt. The ordinary irritation from fæcal masses produces no effect whatever. The longer such a condition continues the more obstinate does it become. This is an important factor in all cases. Another potent cause of muscular atony is rickets. In this disease the muscular walls of the intestine suffer like the muscles of the extremities, and become incapable of doing their work. Again, any form of malnutrition in which there is feeble muscular tone may cause or aggravate constipation. It is often seen as a sequel to acute attacks of diarrhœal diseases, particularly when these have been prolonged. Want of sufficient muscular exercise is a frequent cause. There are many children who rarely suffer from constipation in summer when they have plenty of out-of-door exercise, who very often do so in winter when such exercise is wanting. A loss of muscular tone is not an infrequent result of the prolonged and indiscriminate use of purgative drugs or enemata.

Symptoms.—In some cases no symptoms are present except the local ones, the general health being excellent and the nutrition in no way disturbed. In the majority, however, there are symptoms of greater or less severity, depending somewhat upon the cause of the constipation. There may be simply flatulence and colicky pains, or the irritation of the hardened fæcal masses may produce a slight catarrhal inflammation of the sigmoid flexure and the rectum, so that mucus and even traces of blood may be passed with the stool. Hæmorrhoids may develop even in infancy, and frequently the constant straining leads to the production of hernia. In many of the most obstinate cases there are from time to time nervous symptoms resulting from the absorption of various toxic materials from the intestine. There may be headache, dulness, fretfulness, disturbed sleep, and often associated signs of intestinal indigestion. The urine often contains indican in considerable quantity, and there may be slight fever. This is more likely to be present in infants than in older children. In many cases it is hard to separate the symptoms due to the constipation from those which depend upon the indigestion with which it is associated.

Diagnosis.—This includes the discovery of the cause and the principal seat of the constipation. To arrive at the former the most careful and thorough investigation should be made of the child's diet and habits. It is not always possible to determine whether the seat of trouble is the rec-

tum, the upper part of the colon, or the small intestine; but there are some symptoms that will aid us. If a suppository is almost immediately followed by a stool nearly or quite normal in character, one may be sure that the rectum only is at fault, and that it needs but a little extra stimulus to make it do its work. This is a very common condition in infants who are too young to make any voluntary efforts to have a stool. In such cases there are no other symptoms present. In others, the white or gray stools, marked flatulence, offensive breath, and general irritability, leave no doubt of the fact that the trouble is in the small intestine and depends upon indigestion.

Prognosis.—This depends altogether upon the cause of the constipation, and upon how completely circumstances will admit of its being removed.

Treatment.—This is always difficult, and in obstinate cases must be continued for a long time. It is absolutely indispensable to have the cooperation of an intelligent mother or nurse. To establish the habit of regular stools should be the first step, for without this regularity nothing can be done. In infancy this can generally best be accomplished by suppositories. An older child must be taught to heed the first impulse to evacuate the bowel. Regular habits can hardly be formed unless the same time each day is chosen for the movement. That to be preferred is soon after the morning meal, as taking food into the stomach usually starts a peristaltic wave which is continued throughout the intestine, and of this advantage must be taken. Even in infants only a few months old the habit of regular stools is often easily formed if the child is put upon the chamber or chair invariably at the same hour. This will do much to prevent the formation of a constipated habit. In older children nothing should be allowed to interfere with the movement of the bowels. Breakfast should be early enough to allow ample time for this duty before the other engagements of the day. All children must be carefully watched in this respect, and nurses should be impressed with the importance of the early formation of proper habits.

Food.—With nursing infants who get good breast-milk constipation is rare. Where the milk is low in fat and high in proteids, constipation is not uncommon. For the measures by which such milk can be improved, see page 164. Where the fat can not be increased by dietetic treatment of the nurse, the infant may be given immediately after nursing, from one half to two teaspoonfuls of cream, according to the degree of constipation.

In feeding cow's milk, constipation is overcome by getting the exact proportions of casein and fat which are suited to the infant. With most infants during the early months from 2 to 3 per cent fat and 1 per cent casein succeed best; with those a little older, from 3 to 4 per cent fat and 1·5 per cent casein. During the last half of the first year 4 per cent fat and from 2 to 3 per cent casein will be found satisfactory. (See pages

174–176.) However, to feed a young infant upon 2 per cent fat and 2 per cent casein—which is what is usually given when cow's milk is simply diluted once with water—almost invariably produces constipation. With most infants during the first year, constipation may be, if not cured, at least prevented by such a modification of the milk. This is generally easy if proper feeding is begun early; but when the constipated habit has become firmly established a proper adjustment of the elements of food is often not sufficient.

During the second year, children who suffer from constipation should have both cream and water added to the milk, so that, instead of the 3·5 per cent fat and 4 per cent casein of plain milk, they get 4 per cent fat, and 3 per cent casein. (See formula IX, page 185.) These proportions can be obtained by adding two tablespoonfuls of cream to two thirds of a glass of milk, and filling up the glass with water. Further improvement may be brought about by reducing the quantity of starchy food, and adding more meat or beef juice, which is quite laxative on account of its salts. Fruits are valuable in all these cases; baked apples, oranges, stewed prunes, grapes—especially the hothouse variety—and in summer, fresh peaches, plums, and pears, may be given in small quantities; but all berries should be avoided.

For older children who are upon a mixed diet the amount of starchy food should be moderate, oatmeal being perhaps the best cereal. Milk should be given rather sparingly, and even then may be advantageously modified as for the second year. It is sometimes advisable to stop milk altogether and give only cream, from four to eight ounces of which may be allowed daily. It may be used with the breakfast cereal, mixed with potato or rice, added to soups or broths, and taken in various other ways. All bread should be made from whole wheat or unbolted flour. Meat may be allowed freely, also all green vegetables, one of which should be given every day. All fruits allowed infants may be used, but in larger quantities, and in addition raw apples. Of the dried fruits, only dates, prunes, and figs are admissible, and these are better stewed than raw. Fresh fruit is preferably given in the morning, oranges being especially useful when taken on rising.

Either hot or cold water, when taken an hour before breakfast, may be of considerable benefit to older children. The sparkling waters, like Vichy or Apollinaris, are often better than plain water.

Massage, when properly employed, is useful in conjunction with other measures, but rarely succeeds alone. It should be given for five or ten minutes after retiring and just before rising. The hand must be warm, but no oil used, the purpose being not to make friction upon the skin, but to move the skin and abdominal walls upon the intestines. This should be done with a circular motion, changing the point from time to time until the whole abdomen has been thoroughly covered. In addition to

this a general kneading of the abdomen may be employed. Only slight pressure should be made until the child becomes accustomed to the process, when quite deep pressure will be tolerated. The intestinal coils may often be felt contracting under the hand during massage.* In general torpor of the intestines massage is useful, and when properly done may affect the small as well as the large intestine.

A proper amount of active muscular exercise is necessary and should be made a part of the treatment in every case. Yale (New York) has called attention to the importance of posture during the stool, he having found that in many cases a cure was effected simply by substituting a low seat on a nursery chair or closet for the high one previously used. The low seat afforded the child an opportunity to strain to some purpose, while the higher one with the legs dangling, made this almost impossible.

Suppositories.—In many cases, particularly in young infants who are not old enough to initiate the muscular effort, a slight stimulus to the rectum is all that is required. The cone of oiled paper has a great reputation in domestic practice and is not objectionable. It may be of assistance in establishing the habit of a daily movement at a regular time. Soap suppositories produce a more marked irritation; although their immediate effect is quite satisfactory, they should not be continued indefinitely. They are, however, less objectionable than glycerin suppositories. The latter, for an immediate effect, are convenient and usually efficient; but their prolonged use, especially in infants, is likely to set up a catarrhal proctitis. The gluten suppositories produce less irritation and are consequently slower in their effect, but they have not the disadvantages of the soap or glycerin. Medicated suppositories are certainly one of our most efficient measures; if drugs must be employed, they are perhaps open to the fewest objections when used in this way. The following are the best drugs for this purpose, the dose being that for a child of two or three years: ext. nux vomica, gr. $\frac{1}{12}$; ext. belladonna, gr. $\frac{1}{24}$; ext. hyoscyamus, gr. $\frac{1}{24}$; sulphur, gr. ij; purified aloes, gr. $\frac{1}{4}$; aloin, gr. $\frac{1}{24}$. A good combination is aloin, gr. $\frac{1}{24}$; ext. belladonna, gr. $\frac{1}{24}$; ext. nux vomica, gr. $\frac{1}{12}$; ol. theobrom., gr. x. In obstinate cases this may be used night and morning, and later at night only. After some improvement has occurred the aloin may be omitted. Many of the proprietary suppositories contain the ingredients mentioned, particularly belladonna, the dose of which is often considerably larger than should be given. Suppositories are most useful where the seat of trouble is the rectum and lower colon; but very little is to be expected from them when it is in the small intestine.

Enemata.—These should be restricted to cases in which only temporary relief is desired. An injection of an ounce of sweet oil may facilitate the passage of very hard and dry stools, and larger injections of soap and water

* See Karnitzky, Archiv für Kinderheilkunde, Bd. xii, p. 66.

may be used to break up hard fæcal accumulations. For immediate effect an injection of one drachm of glycerin in half an ounce of water is perhaps the most efficient means at our command. Cases of fæcal impaction are rarely met with in children. They are to be managed as in adults, by repeated injections of warm water or of ox-gall, and sometimes by mechanical removal. For continuous use enemata are not to be advised, for larger and larger quantities are required to produce the effect.

Medicinal treatment.—This is the least important part of the management of chronic constipation. No plan is worse than to give some active purgative every third or fourth day and trust matters to take care of themselves the rest of the time. The most valuable drugs are those which stimulate the muscular walls of the intestine, such as cascara, nux vomica, belladonna, and hyoscyamus. These are particularly useful in atonic constipation associated with rickets and following diarrhœal diseases, but they are valuable in all cases. With most drugs the prolonged use of small doses is better than the occasional use of large ones. Calomel is indicated in cases attended with dry, very white stools and marked flatulence; one fourth to one half grain of the tablet triturates may be given for two or three successive nights in conjunction with other means. Cascara may be used either in the form of the elixir, dose from one half to one drachm, or the fluid extract, from one to five drops. Rhubarb, either in the form of the syrup or the mixture of rhubarb and soda, may be given occasionally, but it is not adapted to continuous use. Of salines, phosphate of soda is best for continuous use in infants. All the preparations of malt possess slight laxative properties, and are useful in conjunction with dietetic and other medicinal means; either Trommer's extract of malt or maltine may be employed. Castor oil should seldom be given for chronic constipation. The frequent use of small quantities of olive oil is often a good means of treatment in the case of young infants, the oil being added to the food.

Summary.—The treatment of constipation is palliative and curative. The palliative measures are drugs, suppositories, injections, and enemata. Cure is accomplished only by diet, massage, exercise, and the formation of regular habits. An average case of chronic constipation in a child four years old may be managed as follows: Massage for eight minutes, morning and night; the juice of half an orange and a glass of Vichy immediately upon rising; a breakfast of oatmeal with one ounce of cream, dried bread with butter, an egg, half a glass of milk with cream and water added; a dinner of soup, one starchy vegetable—e. g., potato with cream, and one green vegetable, beef-steak, baked apple or prunes, dried bread and butter, and water to drink; for supper, cream-toast, egg, dried bread and butter, or Graham crackers, half a glass of milk with cream and water added; a suppository containing nux vomica and hyoscyamus given at bedtime.

Hypertrophy and Dilatation of the Colon.—It is probable that in many cases of chronic constipation, especially among rachitic infants, a considerable degree of dilatation of the colon occurs. However, it seems to be but a temporary condition, disappearing by the third or fourth year.

There is another form of dilatation which may be permanent; it is associated with a marked degree of hypertrophy of the muscular walls of the colon. The reported cases thus far are few in number, but have been observed both in infants (Hirschsprung,* Mya†) and in older children (Osler, Hughes‡). The prominent symptoms are two: obstinate constipation, which in most of the cases has continued from early infancy, and is sometimes so severe that the patients have gone for two weeks without a movement of the bowels; and distention of the abdomen, which may be extreme, but which may disappear and the abdomen become perfectly flat after the fæces and flatus have been discharged. There is usually emaciation, and from time to time there may be diarrhœa. Death may occur in infancy, or the patients may live to adult life.

In the cases which have come to autopsy there has been found an enormous dilatation of the large intestine, chiefly of the transverse colon and the sigmoid flexure. In one case (Hughes'), in a boy of three years, the colon was four inches in diameter, and held fourteen pints of water. In none of the cases was there stricture at any point. The mucous membrane has invariably been found ulcerated, this clearly being a secondary process. The muscular walls have been greatly hypertrophied. The condition is without doubt a congenital one. Treatment is palliative only. In some of the cases the condition seems to have been aggravated by the use of large enemata.

INTUSSUSCEPTION.

Intussusception consists in the invagination of one portion of the intestine into another. It occurs most frequently in infancy, being at this age the most common cause of acute intestinal obstruction. The accident is not a common one, but the life of the patient generally depends upon its prompt recognition.

Varieties.—Usually the upper part of the intestine is invaginated into the lower, although the reverse is occasionally seen. Intussusceptions may occur at any point in the intestinal tract. Those of the small intestine are called *enteric*; those of the colon, *colic*; and those occurring at the ileo-cæcal valve, *ileo-cæcal* (Fig. 60). Of 90 cases under ten years of age, in which the variety was determined by autopsy or operation, 75 were ileo-cæcal, 9 colic, and 6 enteric. In the ileo-cæcal form a few inches

* Hirschsprung, Jahrbuch für Kinderh., Bd. xxvii, p. 1.

† Mya, Revue Mensuelle des Maladies de l'Enfance, vol. xii, p. 633.

‡ Osler, Archives of Pædiatrics, vol. xi, p. 112.

of the ileum pass through the ileo-cæcal valve, and then invagination of the colon occurs. Cases in which the ileum passes through the valve, but without invagination of the colon, are sometimes classed separately as an *ileo-colic* variety.

Intussusceptions of the dying, as they have been called, are met with in my experience in about eight per cent of all autopsies made upon infants; they are not often found in children over two years of age. They are distinguished by the fact that they are always descending, enteric, and

Fig. 60.—Ileo-cæcal intussusception. A specimen removed from a child in the New York Infant Asylum.

multiple—usually from eight to twelve invaginations being present. They are more frequently in the jejunum than in the ileum. They usually involve but two or three inches of the intestine, but may include ten or twelve inches. They are found in autopsies upon patients dying of all varieties of disease, and are probably produced in the death agony. These intussusceptions are without symptoms, and are of no clinical importance.

Etiology.—Of 385 collected cases under ten years, the following are

the ages reported: under four months, 28 cases; from four to six months, 113; seven to nine months, 71; ten to twelve months, 18; one to two years, 32; two to ten years, 96. Three fourths of the cases which occur in childhood are, therefore, in the first two years, and one half of them between the fourth and ninth months. The greater frequency in infancy is attributed to the thinness of the intestinal walls, the greater mobility of the cæcum and ascending colon, and the presence of other intestinal derangements at this age.

Males are more often affected than females. Of 268 cases in which the sex was mentioned, there were 174 males and 94 females. For this fact there is no explanation. The exciting causes of an attack are extremely obscure. The great majority of cases occur in children who were apparently in perfect health. Some previous intestinal disorder was present in about three per cent of the cases I have collected—diarrhœa, dysentery, colic, chronic indigestion, and constipation, all being mentioned. In four cases the intussusception was ascribed to injury of the abdomen. The association with the general diseases is too infrequent to be of any importance.

Lesions.—Nothnagel's vivisection experiments * have shown conclusively that intussusceptions are formed by the irregular action of the muscular walls of the intestine. They can be produced or released at will by varying the application of the electrical current. In the artificial intussusception there is first a contraction of a certain part of the intestine, and if this ceases abruptly the normal gut below this point turns upward and folds over upon the contracted portion, thus forming a minute intussusception (Fig. 61). When once begun, the intussusception increases solely at the expense of the external layer (Fig. 62). Thus, while the apex of the tumour D remains un-

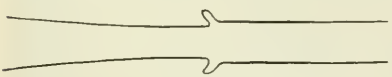


Fig. 61.

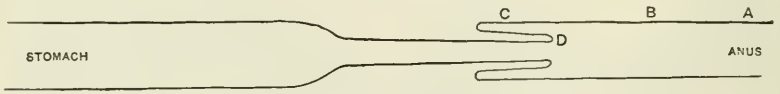


Fig. 62.—Mechanism of intussusception. (Treves.)

changed, the part of the sheath at A passes to B and then to C, so that the lower part of the intestine is drawn over the upper, rather than the upper crowded into the lower. The mechanism of the invagination was apparently the same when a part of the intestine was first paralyzed by

* Beiträge zur Physiologie und Pathologie des Darms, Berlin, 1884. A full abstract is to be found in Treves's Intestinal Obstruction, London, 1884, to which I am indebted for many points in this article.

crushing, as in the cases in which a spasm of the intestine was first produced.

There is no doubt that pathological intussusceptions are produced in the same way as in these experiments. As the invagination takes place, the mesentery is drawn in with the bowel, and always lies between the sheath and the inner layer. To allow intussusception to occur, the mesentery must be unduly long, stretched, or lacerated. Its attachment to the spine causes the intussusception to describe an arc of a circle, the concavity of which is always toward the spine. It also causes a puckering of the tumour. Invagination does not necessarily produce either obstruction or strangulation, but usually both are present, and are the chief causes of the symptoms. Traction upon the mesentery leads to obstruction in its vessels, causing congestion, œdema, hæmorrhages, and even gangrene. Obstruction is chiefly due to swelling. It may be due to dragging of the mesentery, which brings the apex of the tumour against the side of the gut, or to bending of the intussusception.

The great cause of irreducibility in the first two or three days is swelling. I have several times seen at autopsy or operation the intussusception easily reduced, except the last two or three inches of the cæcum or ileum, which was swollen to the thickness of from a fourth to half an inch. Adhesions may prevent reduction, but rarely before the fourth day; they are often absent as late as the sixth or seventh day. They are usually between the internal and middle layers of the intussusceptum, and are due to local peritonitis. In chronic cases, however, they form the principal obstacle to reduction. Other causes of irreducibility are twisting of the tumour and pinching of the prolapsed intestine, especially of the ileum by the ileo-cæcal valve.

Gangrene and sloughing of the gangrenous portion of the intestine occur much more often in acute than in chronic cases. Portions of intestine were passed *per anum* in 24 of 362 cases under ten years, or about six per cent; but only two of these were in infants. Toward the end of the second week is the time when the separation of the sloughs is to be looked for. The amount of intestine discharged, varies from a few inches to several feet. Two cases are on record in which the entire colon was passed, the patients recovering, but dying several months later from other causes. At the autopsies the ileum was found attached to the lower part of the rectum just above the anus. In acute cases gangrene occurs about the upper end of the tumour, and the intestine usually comes away in one large mass. In chronic cases shreds of intestine may be discharged for several weeks.

Symptoms.—The clinical picture of a case of intussusception is a striking one, and when acute the symptoms are so uniform that, once seen, they can scarcely be overlooked a second time. The patient, usually between six and twelve months of age, is taken suddenly ill

with severe pain and vomiting; the pain recurring paroxysmally every few minutes, and the vomiting being first of the contents of the stomach, and afterward bilious. There may be one or two loose fæcal stools, then only blood or blood and mucus are passed without any admixture of fæces. The general symptoms are those of great prostration, or even collapse—pallor, feeble pulse, apathy, and normal or subnormal temperature. The abdomen is relaxed. A tumour is present in the left iliac fossa, or it is felt *per rectum*. Later there is tympanites; the vomiting and pain continue; there is a steady increase in the prostration, and toward the end a rapidly rising temperature, which may reach 105° or 106° F. before death occurs from collapse. If the symptoms continue longer the signs of peritonitis are added. In subacute cases the onset is less abrupt, and pain, vomiting, and constipation less constant and less severe; but the same symptoms are present. In chronic cases the onset is with vague, indefinite intestinal symptoms; pain, vomiting and bloody discharges are usually wanting; there are progressive wasting and more or less diarrhœa, but only the presence of the tumour leads to the recognition of the disease.

Onset.—Of 193 cases under ten years in which data upon this point could be obtained, the onset was sudden in 181 and gradual in 12 cases. By far the most frequent symptoms of onset are pain and vomiting. In a smaller number of cases the initial symptom is diarrhœa or a discharge of blood and mucus.

Pain.—This is rarely continuous, but is intermittent, recurring in paroxysms like those of ordinary colic, but of great severity. No pain in infancy is to be compared with it. The child often shrieks so as to be heard all over the house. Pain is a prominent symptom in over three fourths of the cases, and is very rarely absent. It is generally more marked for the first two days, but may continue throughout the attack. In a few cases the pain is localized, being usually referred to the region of the umbilicus.

Vomiting is more marked at the onset, but may continue throughout the disease. Like pain, it is more frequent in the acute cases. It is due to intestinal obstruction. Vomiting is present in fully four fifths of all cases. Usually it is persistent and uncontrollable; it is often projectile. If food is given, vomiting often occurs as soon as it reaches the stomach. Stercoraceous vomiting occurs in about fifteen per cent of the cases in children under ten years, but is not common in infancy. It is rarely present before the third or fourth day. Although a bad sign, it is not by any means a fatal one, as nearly one half the cases in which it has been noted have recovered; it is to be regarded as indicating complete intestinal obstruction rather than strangulation.

Tumour.—This is one of the most important symptoms for diagnosis because of its frequency and its peculiar character. It is present early in

the disease, often in a few hours after the initial symptoms. The following table shows the frequency with which a tumour was present in the different varieties, and the position which it occupied in each. The anatomical variety was determined either by autopsy or operation.

The Relation between the Tumour and the Different Varieties of Intussusception in 188 Cases under Ten Years.

Seat of Tumour.	Seat of Intussusception.					
	Ileo-cæcal.	Ileo-colic.	Colic.	Enteric.	Not stated.	Total.
Region of cæcum	..	3	..	1	7	11
" " ascending colon	1	..	..	..	12	13
" " transverse colon	3	..	..	..	13	16
" " descending colon	3	..	..	..	18	21
" " sigmoid flexure	4	..	1	..	8	13
Rectal	25	1	7	..	28	61
Protruding from anus	9	..	1	..	12	22
Umbilical region	..	..	..	1	..	1
Movable	..	..	..	1	2	3
Site unknown	1	..	..	..	..	1
Total	46	4	9	3	100	162
No tumour felt	10	2	..	1	13	26

Tumour was thus made out during life in eighty-six per cent of the cases; and in the great majority of these it was discovered at the first careful examination.

It will be noted that in one half of the cases the tumour was either felt in the rectum or protruded from the anus, and that in over two thirds it had advanced as far as the descending colon or beyond. The tumour may reach the rectum in a surprisingly short time, even when the invagination begins at the ileo-cæcal valve. In one of my own cases it was felt in the rectum in less than twelve hours from the onset. The usual description, "sausage-shaped," is accurate when the invagination is large, the tumour then being from four to six inches long and about an inch and a half in diameter. It is often curved.

During manipulation, or during an attack of pain, the tumour may become more prominent and may be distinctly erectile. To the touch the rectal tumour closely resembles the os uteri, the central opening being the apex of the intussusception. When protruding from the body, the tumour is rarely more than two inches long. It is usually of a deep purplish colour, and may be gangrenous. It has been mistaken for prolapsus ani, polypus, and even hæmorrhoids. In a case which came subsequently under my observation, the tumour was discovered by the mother before the physician had suspected the condition.

Condition of the bowels.—Bloody stools are a very constant symptom. Of 186 cases under ten years in which this condition of the bowels was

noted, blood in the stools was present in seventy-six per cent. There are very often two or three thin, diarrhœal movements, and then only blood and mucus are passed with no trace of fæces and with no fæcal odour. The amount of blood varies from a quantity sufficient to stain the mucus to an ounce of semifluid blood. It rarely occurs without some mucus. Such discharges frequently follow attacks of severe colicky pain, and may occur several times in an hour. They may continue, or after a day or two they may be succeeded by absolute stoppage. Diarrhœa throughout the attack is rare in children, particularly so in infants. It belongs generally to chronic cases. Constipation is complete in most of the acute cases, neither gas nor fæces being passed; a fact which the discharge of blood and mucus may lead one to overlook.

Tenesmus is very common if the tumour is rectal. Relaxation of the sphincter is met with in a considerable proportion of the cases when the tumour is in the sigmoid flexure, or rectum.

During the first twenty-four or forty-eight hours the *abdominal walls* are soft and relaxed, and may even be retracted. Usually there is then little resistance to abdominal palpation. After the second or third day there is tympanites; but this does not necessarily mean that peritonitis exists. Localized tenderness is a symptom of some importance when a tumour is absent. Scanty urine has been noted in a few cases, but is of no special value in showing the seat of obstruction.

In the acute cases the *general symptoms* are very striking. They are the ordinary ones of severe shock—marked prostration, pallor with an anxious expression of the face, general muscular relaxation, cold extremities, cold perspiration, and often a subnormal temperature. Early there is marked restlessness, and even convulsions may occur. Later there are apathy, dulness, and semi-stupor. The temperature during the first twenty-four hours is usually not elevated, and is frequently subnormal. Toward the close of the disease it rises rapidly to 103°, 104° F., or even higher, quite independently of peritonitis. A rapidly rising temperature is always a bad symptom, and usually betokens death within twenty-four hours. Wasting is seen in the chronic cases, and may be quite rapid.

Course, Duration and Termination.—Of 198 cases under ten years, 155 were classed as acute, lasting less than seven days; 33 as subacute, lasting from one to four weeks; 10 were chronic, lasting over four weeks. Nearly all the cases occurring in infancy are acute. The duration of the disease in 92 fatal cases was as follows: less than twenty-four hours, 2 cases; two to four days, 44 cases; five to seven days, 22 cases; one to two weeks, 18 cases; two to three weeks, 6 cases. Thus one half the cases died upon the third, fourth, or fifth day. Of 57 cases terminating in recovery, 66 per cent were reduced in the first or second day. (See table, page 386.)

Spontaneous reduction is, without doubt, possible in intussusception.

Treves and others are of the opinion that this happens much more frequently than is generally supposed, and that many cases of severe colic are really cases of slight intussusception. There are seen in both conditions the tendency to vomit, the paroxysmal pain, the constitutional depression, and often the sudden cessation of the symptoms, especially under the influence of opium; but to make a positive diagnosis of invagination in such cases is impossible. Intussusception may be cured spontaneously by sloughing of the invaginated part, the continuity of the intestine being preserved by adhesions. Such a result is rare at all ages, and is almost never seen in infancy. Even though recovery from the attack takes place, complete restoration to health is very rare.

The most frequent cause of death in acute cases is shock. Peritonitis is not found at autopsy or operation so often as might be expected. In 58 autopsies, it was seen but twenty times, and in seven of these it was limited to the intussusception. In but 7 cases was there perforation. In chronic cases death is usually from exhaustion or complications.

Diagnosis.—This usually presents no difficulty in acute cases provided the physician has the condition in mind. The great majority of such cases present nearly all the classical symptoms—viz., sudden onset, recurring colicky pains, frequent vomiting, bloody and mucous stools without fæcal matter, general prostration or collapse, and low temperature. The records show that the most common error is to regard the case for the first few days as one of gastro-enteritis or ileo-colitis, the physician's attention being engrossed by the vomiting and bloody stools. Given the other usual symptoms, the presence of the characteristic tumour is conclusive evidence of intussusception. Unless the patient is very much relaxed, a satisfactory examination is possible only under full anæsthesia. In any case of acute obstruction in infants, intussusception should first be considered. Chronic cases present no diagnostic symptoms except the tumour. In both acute and chronic cases the rectal examination is most important for diagnosis, and often settles the question at once.

Prognosis.—The prognosis of intussusception depends upon the age of the patient, upon the variety of the disease—whether acute, subacute, or chronic—and upon the time when proper treatment is begun.

There were collected by Pilz* in 1870, 94 cases under one year, the mortality being 84 per cent. Of 135 cases of the same age reported between 1870 and 1891 the mortality was 59 per cent. In Pilz's table, of 51 cases between one and ten years of age, the mortality was 68 per cent; while of 82 cases between one and ten years of age, from 1873 to 1891, the mortality was but 46 per cent. Formerly recovery was rare, except in cases of sloughing; but with earlier diagnosis and a better understanding of the proper methods of treatment, the mortality has been very

* Jahrbuch für Kinderh., Bd. iii, p. 6.

much reduced. Combining the figures of Pilz with my own, there are 362 cases with 231 deaths, or 63·5 per cent.

The following table shows the duration of the disease in 57 cases that were reduced either by injection or inflation, or which recovered after laparotomy:

The Duration of Invagination in 57 Acute Cases which were reduced.

Cured on 1st day by injection,	8;	inflation,	8;	laparotomy,	5;	total.	21 cases.				
" " 2d "	"	9;	"	6;	"	2;	"	17	"		
" " 3d "	"	3;	"	0;	"	2;	"	5	"		
" " 4th "	"	6;	"	5;	"	2;	"	13	"		
" " 5th "	"	1;	"	0;	"	0;	"	1	case.		

In two thirds of the cases, therefore, reduction was effected on the first or second day. After this time the chances of success are much reduced.

Treatment.—In the management of a case of intussusception almost the same rules may be applied as in strangulated hernia—viz., first, a thorough attempt at reduction by mechanical means, with the assistance of taxis, and, this failing, an early resort to laparotomy. Only two methods of mechanical reduction can be relied upon, inflation and injections.

Inflation should always be done under an anæsthetic, unless there is extreme relaxation. The position is not of great importance; preferably the child should lie upon the back, with thighs flexed. From time to time inversion may be practised, to get the assistance of traction of the intestine above upon the seat of invagination. An ordinary hand bellows with a catheter attached is the best apparatus for inflation. It should be done very slowly, and the air prevented from escaping by pressing the buttocks tightly together. It is well to continue a gentle manipulation of the tumour through the abdominal walls during inflation. The amount of air which it is safe to inject must be left to the judgment of the physician. The best guide to the amount which has been introduced is the tension of the abdominal walls. A thorough trial of this method should occupy from fifteen to thirty minutes.

Reduction is sometimes indicated by rumbling sounds, and by the abdomen resuming its normal contour because the whole of the colon is filled, in place of the unequal distention before present. In several instances a distinct change in the expression of the features has been noted. In some cases a gush of fluid fæces has followed disinvagination. Not infrequently all such decisive symptoms are absent, and the physician may be in doubt whether or not reduction has taken place. The air is allowed to escape, best by introducing the catheter high into the colon, so that careful palpation of the abdomen can be made while the patient is still under chloroform. The right iliac fossa should be examined with the greatest care, as it often happens that all the tumour except the last few inches has been reduced, this being impossible because of swelling. If the

examination is negative, the question of reduction must be decided by the general symptoms. If vomiting continues, if no gas or fæces pass the bowels, if there is no improvement in the pulse or the general condition, and, most of all, if the temperature rises, it is certain that reduction has not been effected, and a second attempt should be made. In a very acute case two or three hours' delay is all that should be permitted. Inflation may be repeated or an injection of water tried, but in either case consent to immediate laparotomy should be obtained if this effort does not succeed. In cases not so acute, where three or four days have passed without symptoms indicating strangulation, it is admissible to make further attempts at reduction and delay laparotomy a little longer.

Injections of fluids.—The patient is prepared as for inflation and the abdomen manipulated during the injection. Plain water may be used, a saline solution, milk and water, or thin gruel. The other substances possess some advantages over plain water in being rather less irritating. The temperature should be from 100° to 105° F. for the relaxing effect. The fluid is placed in a fountain syringe suspended four or five feet above the patient's bed. The injections should be made through a catheter, the escape of the fluid being prevented as in inflation. From time to time the flow of water should be interrupted, the pressure being maintained continuously. It may be desirable to increase the pressure by raising the syringe to the height of six or eight feet, but more is rarely advisable. The occurrence of reduction during injections is not usually quite so evident as during inflation, and herein consists one of the advantages of the latter procedure. After from ten to twenty minutes the water is allowed to escape, and the abdomen examined. In making further attempts at reduction by injections one should be governed by the same considerations as in inflation.

The choice between inflation and injection depends somewhat upon individual experience. My own preference is for inflation, mainly for the reasons given above, that it is easier to determine whether reduction has taken place both during and after its use. The danger of rupturing the intestine belongs alike to both; but that it is not likely to occur in either is conclusively shown by the fact that in a series of 225 collected cases, all in children, and including nearly all those reported between 1870 and 1891, this accident has been recorded only once. In rare cases the symptoms may continue after reduction. Pick records a case in which laparotomy was done subsequently to inflation, with the belief that reduction had not been effected. No intussusception was found, and the continuance of the symptoms was attributed to paralysis.

The treatment after reduction consists in keeping the patient absolutely quiet and moderately under the influence of opium for two or three days, to allay the excessive irritability of the intestinal walls. The diet

should be very light. Cathartics especially should be avoided for several days.

Recurrence of the invagination is not uncommon. It was noted in 13, or about six per cent, of my collected cases under ten years; of this number nine recovered and four died. Recurrence is more likely to happen in the first twenty-four hours after reduction; this was the time in nine of the thirteen cases. It may, however, be as late as a month, rarely later. In one half the cases there was but a single recurrence, but three, four, and even six recurrences in the course of a few weeks have been seen. Ludwig reports a case in an infant eight months old in whom twenty-two recurrences were seen in one month. This was of the colic variety; it could hardly happen in any other form.

Laparotomy is indicated as soon as a thorough trial of reduction by inflation or injection has been made without success. In the very acute cases the operation should not be delayed an hour after such failure is evident. Needless delays have caused death in many instances. The operation should not be looked upon as a last resort in hopeless cases, but as a measure which, if employed reasonably early, offers a fair prospect of success where disinvagination can not be accomplished by any other means. I have collected 72 cases in which the abdomen has been opened for the relief of intussusception in children. In 35 of these the operation was done at so late a period that reduction of the invagination was impossible owing to swelling, adhesions, gangrene, or other causes. In every instance the child died. In the 37 cases in which reduction was effected at the operation, 14, or thirty-eight per cent, recovered. More than half the cases were under one year, and all but three were under two years, showing that early infancy is no barrier to the operation. In over one third of the cases the operation was done in the first twenty-four hours, and in half of them on the first or second day. The time of operation has therefore more to do with the result than any other factor. Of 16 operations in the first and second days there were 7 recoveries, or forty-four per cent. Of 44 operations on or after the third day there were 7 recoveries, or sixteen per cent, and two of these were chronic cases.

Summary.—Cathartics are absolutely contra-indicated in all circumstances. Opium is to be administered as soon as the diagnosis is made, for the relief of pain and to prevent the increase of the intussusception, also in all cases after reduction by mechanical means or operation. Inflation and injection are to be tried successively, preferably under an anæsthetic, combined with manipulation of the abdomen, sometimes with inversion of the patient. Not more than two trials should be made in acute cases. The abdomen should then be opened without an hour's unnecessary delay.

CHAPTER X.

DISEASES OF THE INTESTINES.—(*Continued.*)

APPENDICITIS.

The terms *typhlitis*, *perityphlitis*, and *perityphlitic abscess* were formerly much used to denote certain forms of inflammation occurring in the right iliac fossa. Of late these terms are but little employed, as it has been shown that these conditions are almost invariably due to disease of the vermiform appendix. The existence of typhlitis as a separate and independent disease is exceedingly rare, if indeed it ever occurs except as a result of fæcal impaction.

Inflammation of the appendix may be catarrhal, ulcerative, or perforative, and it may be acute, chronic, or recurrent.

Etiology.—The predominance of the male sex holds even in childhood. Of 101 collected cases under fifteen years, 72 were males and 29 females. This difference has never been satisfactorily explained. Appendicitis is exceedingly rare before the fourth year, but from this time it is of quite frequent occurrence throughout childhood, especially after the tenth year. Of 104 cases, 3 were under three years, 47 between the fourth and ninth years, and 54 between the tenth and fourteenth years. The youngest recorded case is in a child of seven weeks, reported by Demme. The exciting cause is nearly always a foreign substance; this is usually a fæcal concretion, which is moulded by the appendix into the form of a date-stone, and often regarded as such. Small seeds, however, may form the nucleus of a fæcal concretion, or less frequently they may be the only foreign body. In one of my own cases a pin was found in the appendix, and I have found references to two similar cases. Given the presence of a foreign substance, it is easy to see how inflammation may sometimes be excited by a blow, fall, strain, or other slight accident. Chronic constipation is a factor of considerable importance. The micro-organism usually found in abscesses due to appendicitis is the bacterium coli commune, sometimes associated with other pyogenic germs, but very often in pure culture.

Lesions.—The position of the appendix is extremely variable. It may be found in the pelvis, in the region of the kidney, and sometimes near the umbilicus. This anatomical peculiarity accounts for the variation seen in the situation of abscesses due to appendicitis. According to Treves, the appendix is covered by peritonæum at every point.

Catarrhal appendicitis.—In this form there is thickening of the walls of the appendix from infiltration of its coats with cells. Its communication

with the cæcum is temporarily or permanently shut off. The appendix is distended with mucus, pus, and usually some foreign substance, so that it may be as large as the thumb, or even larger. There is congestion of the peritoneal surface. This inflammation may subside without any serious consequence, or it may result in ulceration and perforation. These may follow the first attack, but more frequently not until several attacks have occurred.

Ulcerative or perforative appendicitis.—Ulceration of the appendix may be found in cases of typhoid fever and in tuberculosis. In severe tuberculosis of the intestine I have nearly always found ulcers here. These ulcers rarely perforate, and as a rule they give rise to no clinical symptoms.

The important form of ulceration is that due to an inflammation excited by a foreign body, and this variety is apt to perforate. The inflammation may result in the gradual production of a small perforation by a process of ulceration, or the appendix may be distended by inflammatory products, and gangrene take place with the sudden production of a large opening. The nature of the perforation varies with the intensity of the preceding inflammation. The consequences will depend upon whether this occurs slowly or suddenly, and whether or not the appendix is in such a situation that adhesions readily form. If ulceration takes place slowly, lymph is usually thrown out about the appendix, effectually protecting the general peritoneal cavity. If perforation occurs suddenly, the first effect is usually an intense congestion of the whole peritonæum, and there may even be beginning inflammation. If the situation of the appendix is favourable for the production of adhesions, the inflammation in a very short time is limited by the plastic exudation, and remains as a local peritonitis. If perforation in either of these varieties has carried infectious materials into the peritoneal cavity, there usually results a peritoneal abscess. If not, there is simply a localized plastic peritonitis with adhesions. I have said that these abscesses are in the peritoneal cavity. This is the view which is now almost uniformly adopted, although it was formerly held that the abscesses were extra-peritoneal, being situated in the cellular tissue about the cæcum (perityphlitic abscess). The situation of the abscess will depend upon the location of the appendix. It is usually in the iliac fossa, but may be in the lumbar region or in the pelvis. When left to itself it may open externally, or into any of the neighbouring viscera, usually the rectum; or it may rupture into the general peritoneal cavity, setting up a diffuse peritonitis. Rarely, a large abscess may excite general peritonitis without rupture. If the appendix is so situated that adhesions can not readily form about it, or if these fail or are incomplete, sudden perforation of the appendix excites general peritonitis, usually of a septic variety, which runs a rapid and intense course. Among the secondary lesions which

have been met with in children, are suppurative pylephlebitis, abscesses of the liver, general pyæmia, empyema, and pneumonia.

Symptoms.—*Catarrhal appendicitis* in many cases is not diagnosticated. Often, a positive diagnosis is impossible. The symptoms by which it is recognised are local pain, tenderness, and fever; there may also be vomiting and constipation. Both pain and tenderness are moderate, but persist for several days. The tenderness is generally at McBurney's point. The elevation of temperature is usually slight, 100° to 101° F. These symptoms are often so mild that the child makes but few complaints, and is usually up and about. Very frequently they are passed over by young patients without any notice whatever, and recovery may take place without any diagnosis having been made. How frequently such cases occur we have no means of knowing positively, but they are undoubtedly much more common than was formerly believed

Perforative appendicitis usually follows after several days the somewhat indefinite symptoms of the catarrhal form, the patient perhaps having been hardly sick enough to go to bed. In rare cases the first symptoms may be those of perforation. These are usually severe and characteristic. There is sudden and intense pain in the right iliac fossa, accompanied by vomiting. The pain is acute, lancinating, and continuous; the vomiting is repeated, sometimes being persistent; it is first of the contents of the stomach and then bilious. Occasionally there is a chill. There is always much prostration, and the child from the outset has the appearance of being very seriously ill. With such an onset the disease may follow one of three courses, according as the perforation is followed by localized plastic peritonitis, localized suppurative peritonitis, or general peritonitis.

1. With localized plastic peritonitis.—The symptoms in these cases usually last about a week. They are severe only for the first two or three days, and then gradually pass away. At the onset there are severe pain and tenderness, usually localized in the region of the appendix. There are vomiting, constipation, and slight fever, the temperature being from 100° to 102° F. The temperature gradually falls to normal; the tenderness becomes less acute; and the somewhat diffuse infiltration in the iliac fossa, which was at first present, gradually lessens in area, until there is only a nodular tumour about the size of a hen's egg. This may be slow in disappearing, often lasting for weeks, and sometimes for months. These patients are always liable to recurrent attacks.

2. With localized suppurative peritonitis.—In some of the cases with early symptoms like those above mentioned there is a continuance of the fever, pain, and tenderness, with the rapid formation of an abscess. A distinct tumour may be noticed in the course of two or three days, and pus may be found by aspiration or exploratory incision as soon as the third or fourth day from the onset. At other times the early stage is like that of the cases which terminate in resolution, and marked improvement takes

place after two or three days of severe symptoms. The temperature does not, however, quite reach the normal. After a variable period of quietude, lasting from two or three days to as many weeks, the temperature gradually rises; the pain and tenderness become more severe and are felt over a larger area; the induration, which has been stationary, enlarges and becomes more prominent, and the existence of abscess is unmistakable. In a small number of the cases terminating in abscess the onset is very gradual, without any of the acute symptoms mentioned. It may be accompanied by slight pain only, retraction of the right thigh, and moderate fever. Whether the formation of the abscess is rapid or slow, the subsequent course may be the same. The sac is gradually distended with pus, which may accumulate in immense quantities; as much as five pints have been evacuated. At the present time but few abscesses are allowed to open externally, incision being commonly made before that time. Large abscesses in the lumbar region or in the pelvis, may be mistaken for some other disease, or may be overlooked. Pelvic abscess may be easily recognised by rectal examination. The termination in a single abscess is a favourable one, for with proper surgical treatment these cases almost invariably recover.

3. With general peritonitis.—In these cases the early symptoms of pain, tenderness, vomiting, and fever are followed by those of general peritonitis. The vomiting continues; the tenderness and pain are rapidly diffused over the abdomen; there are constipation, tympanites, and very great prostration. The temperature is variable, and its height is no guide to the severity of the attack; it usually ranges from 101° to 102·5° F., but may be normal or even subnormal. The general prostration is very great; the pulse is rapid and feeble; and in the worst cases there are cold perspiration, hiccough, stercoraceous vomiting, collapse, and death. The duration of these cases may be but two or three days, but it is oftener from five to seven. The symptoms usually go on steadily from bad to worse. Sometimes, after the first intense onset, there may be a lull in the acute symptoms for a day or two, to be followed by a recurrence of the agonizing pain, vomiting, and collapse. Such symptoms indicate that the first perforation was followed by some limiting adhesions, which subsequently gave way, causing all the symptoms of a new perforation. The symptoms of perforative peritonitis may come on late in the disease, when it is due to the rupture of an abscess into the peritoneal cavity. In a small number of cases the early symptoms of perforation are slight, or entirely wanting, the patient passing gradually into a state of great prostration and profound sepsis, with the symptoms of general peritonitis. In a few cases general peritonitis complicates large abscesses without rupture. This termination is the most serious one, and is what occurs in nearly all the fatal cases.

The frequency of the different varieties.—Of 98 cases in children

under fourteen years in which the exact variety was known, 10 terminated in resolution, 50 in abscess, and 38 in general peritonitis. These figures certainly do not represent the actual proportion terminating in resolution, for such cases are much more likely to be overlooked, or, if diagnosticated, they are not so commonly reported. Of the cases terminating in abscess, all but six were operated upon; four of these opened into the rectum with a favourable result, one was allowed to open externally, and one caused death by rupture into the peritonæum. From these statistics it would appear that general peritonitis is of more frequent occurrence in children than in adults.

Prognosis.—Of 112 cases, there were 62 recoveries and 50 deaths—a mortality of 45 per cent. General peritonitis was the cause of death in eighty per cent, pyæmia in eight per cent, all of them being protracted cases. The statement has been made (Matterstock, in Gerhardt's Handbuch) that the majority of cases of peritonitis in children terminate fatally within the first three days. This is not borne out by my statistics. Of 43 fatal cases, nearly all of them from general peritonitis, only 6 died during the first three days, 19 from the fourth to the seventh day, 13 in the second week, and 5 in the third week. Recurrent attacks do not appear to be quite so common in children as in adults. They were noted in but two cases of this series.

Cases terminating in the formation of a single abscess usually recover when properly treated. If general peritonitis occurs, whether early or late, the chances of recovery are small. In three cases recovery took place where general peritonitis was stated to be present at the time of operation.

Diagnosis.—The diagnostic symptoms of appendicitis are a sudden severe pain in the right iliac fossa with localized tenderness and vomiting. Persistence of such tenderness is especially significant, as is also an unnatural resistance of the abdominal walls. Constipation is much more frequent than diarrhœa. There is usually some elevation of temperature, but rarely high fever. The catarrhal and perforative forms can not always be distinguished from each other. In some of the catarrhal cases the onset may be sudden and severe, while, on the other hand, perforation may take place without any of its characteristic symptoms. The exploring needle, it is now generally agreed, should be used only when a tumour is present.

Appendicitis may be confounded with colic, indigestion, and, in infants, with intussusception; in older children, with abscesses due to psoitis. Colic is distinguished by the absence of localized tenderness and fever, by its short duration, and by the fact that the pain is generally less intense. Severe colic in older children should, however, always be regarded with suspicion. From acute indigestion the diagnosis is often difficult at the onset, and it may be impossible for twenty-four hours. Very many of the cases of appendicitis have been regarded in the beginning as attacks of

indigestion. Here, however, the pain is rarely so severe, but in children the fever is higher. The pain is not usually localized; and, if so, it is more apt to be in the epigastrium or at the umbilicus. But it should be remembered that the pain is not always localized in appendicitis. The presence of pain, vomiting, and localized tenderness, and the greater severity of the constitutional symptoms, indicate appendicitis. Indigestion is more likely to be accompanied by diarrhœa than by constipation, while the opposite is true of appendicitis.

I have twice known pneumonia at the right base to be mistaken for appendicitis. There was severe localized pain in the iliac fossa, which was evidently to be explained by pleurisy implicating the lower intercostal nerves.

Intussusception, from its intense pain, colic, and vomiting, may suggest appendicitis, but it is very rare except in infants. Tenesmus and bloody stools are very constant; the temperature is not elevated in the beginning; if a tumour is present it is usually in the left side of the abdomen.

Between the various forms of local suppuration in the right iliac fossa and appendicitis the diagnosis is rarely difficult. It should always be borne in mind that acute or subacute suppuration in this region is usually due to appendicitis. Abscesses, however, should not be confounded with those due to Pott's disease, or with a psoitis, which is, however, generally traumatic and accompanied by deformity due to the retraction of the thigh, which may be so severe as to lead to the diagnosis of hip disease. The constitutional symptoms of appendicitis are wanting.

Treatment.—Absolute rest in bed should be insisted upon in every case, no matter how mild it may appear, and all patients should be closely watched. As a local application the ice-bag is to be preferred, unless strongly objected to by children, when hot fomentations should be substituted. Morphine should be given in sufficient quantities to relieve pain, but the effect should not be carried further than this. An unnecessary use of opium is objectionable, as obscuring important symptoms. The colon should be kept empty by the daily use of large enemata. All cathartics are to be avoided. Blisters, though formerly so much in vogue for the purpose of promoting resolution, with the better understanding of the nature of the disease, are now very seldom employed.

Appendicitis is in the great majority of cases a surgical disease, and surgical advice should be sought early. It is undoubtedly true that in the past many lives have been needlessly sacrificed because surgical interference was too late resorted to. Operation is clearly indicated in two conditions: first, as soon as there is positive evidence of the existence of abscess; secondly, when the symptoms point to perforation into the general peritoneal cavity. In such cases immediate operation should be done, as offering the only chance of recovery. Regarding other cases surgical opinion is at the present time divided. One group of surgeons advise

exploratory incision in every case as soon as the symptoms are definite enough to indicate the existence of appendicitis, whether catarrhal or ulcerative, with the hope of anticipating sudden perforation with its resulting dangers. There is no doubt that by these surgeons a good many cases will be operated upon which might terminate in resolution. But it is claimed first, that the dangers of the operation *per se* are at the present time very slight, while in cases which resolve the danger of subsequent attacks is always present; and secondly, that we have no means of knowing which of these cases may suddenly develop symptoms of perforative peritonitis. The other group of surgeons advocate deferring operation until there is evidence of the formation of pus, except when symptoms point to perforation into the general peritoneal cavity. It must remain for future experience to decide which of these two plans will receive the general sanction of the profession. Regarding recurrent attacks of appendicitis opinion is also divided. For the details of the surgical management the reader is referred to surgical works.

INTESTINAL WORMS.

Judging by published reports, intestinal worms are much more common in Europe than in this country. In 10,000 patients treated for medical diseases in my dispensary service, there was positive evidence of worms in but 79 cases. Of these, 9 had tapeworms, 40 roundworms, 27 threadworms, and 3 both round and threadworms. In private practice among the better classes, worms are certainly rare. I have not seen more than a dozen cases in ten years.

Cestodes—Tapeworms.—Cestodes are usually introduced into the body by the ingestion of some form of food containing larvæ (cysticerci). The larva of the *tænia solium* is most frequently found in pork; that of the *tænia mediocanellata* in beef; that of the *bothriöcephalus latus* in fish; that of the *tænia cucumerina* inhabits dog or cat lice, being introduced into the intestinal tract accidentally by the hands.

In the intestine the larvæ develop into the mature tapeworms, usually in from three to three and a half months; after which the terminal segments becoming mature, separate, and are discharged in the fæces, sometimes singly, sometimes connected. New segments continually form next to the head as the terminal ones are cast off, so that the length of the worm is not diminished. The duration of life of the worm is estimated to be from ten to thirty years. Each mature segment is provided with both male and female sexual organs, and contains ova in great numbers. The ova escape after the rupture of the segment outside the body. They find their way into the stomach usually of herbivorous animals with their food. Here the thick shells of the ova are dissolved by the gastric juice and the embryo set free. By means of the hooklets with which it is pro-

vided, it migrates from the stomach or intestine and may be found in the muscles or in any organ of the body, even the brain and eye. When it reaches its final resting place it loses its hooks and gradually becomes transformed into a vesicle, from the inner surface of which there projects something resembling the head of the future tapeworm. In this stage it is known as the bladderworm or cysticercus. The cysticerci of the *tænia solium* are sometimes found in man, but the other varieties very rarely. For the further development of the larval form it must be taken into the stomach of man or some carnivorous animal. This occurs when pork, beef, or fish containing cysticerci is eaten. The vesicle wall is now dissolved, and the head passing into the intestine develops into the mature tapeworm. Several varieties of tænia are found in the human intestine:

Tænia Saginata or Mediocanellata—Beef Tapeworm (Fig. 63). This is the most frequent form found in children, all others being rare. Infection results from eating raw or partially cooked beef containing cysticerci. The worm is from twelve to twenty feet in length, and has a square pigmented head without hooks but provided with four suckers. The full-sized segments are from one half to three fourths of an inch long and about half as wide.

Tænia Solium—Pork Tapeworm (Fig. 64). This is a rare form in children, and comes from eating raw or partially cooked pork or sausage. It is from six to ten feet in length, the segments being nearly square.

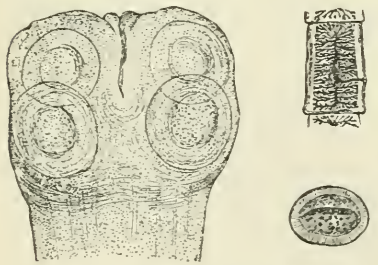


Fig. 63.—Tænia saginata; head, segment, and egg. (Jaksch.)

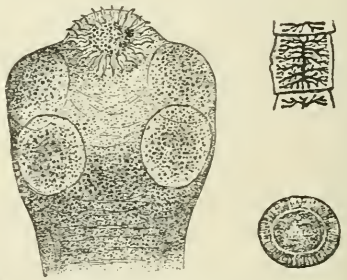


Fig. 64.—Tænia solium: head, segment, and egg. (Jaksch.)

The head is about the size of a mustard seed and is pigmented. It also is provided with four suckers and a proboscis, surrounding which is a circle of about twenty-six hooks.

Tænia Cucumerina or Elliptica (Fig. 65). The larvæ of this form develop in a louse found on the skin of dogs and cats. Children who play with infected animals are the ones affected, the parasite being conveyed to the mouth usually by means of the hands; it may thus be found even in young infants. Most of the tapeworms in infants are of this variety. This form of tænia is much smaller than either of the preceding varieties, the full length being only from six to twelve inches.

Bothriocephalus Latus (Fig. 66). This is a rare form except in the sea countries of northern Europe and Switzerland, where it is said to be

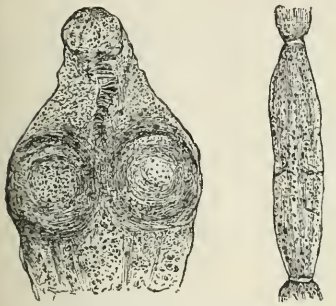


Fig. 65.—Head and segment of tænia cucumerina. (Jaksch.)

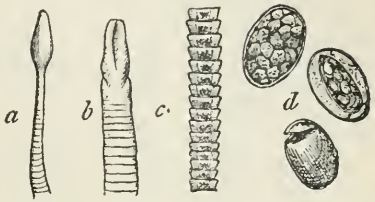


Fig. 66.—Bothriocephalus latus; *a*, *b*, front and side views of head; *c*, segments; *d*, eggs. (Jaksch.)

very common. The larvæ are harboured by certain fish, through which they are introduced into the body. The full-grown worm is from twenty-five to thirty feet in length.

Tænia Nana and Tænia Flava Punctata. These are two rare varieties that have been found in children in a few instances.

Usually but a single worm is present, although as many as five or six have been found. Rarely tæniæ have been associated with round and also with threadworms.

Symptoms.—The only positive evidence of tapeworm is the discharge of the separated segments, either singly or in groups. Occasionally worms pass into the stomach and are vomited. Various abdominal symptoms may be associated with worms, but most of these are very indefinite in character and are more often due to other causes. The most frequent symptoms are bad breath, various annoying sensations, colicky attacks, inordinate or capricious appetite, and diarrhœa. Usually, if the patient is in good health, no constitutional symptoms are seen. Sometimes, particularly with the bothriocephalus latus, there is a very grave degree of anæmia. Many cases are now on record, some of them in children, in which the symptoms of pernicious anæmia have been present and have disappeared after the expulsion of the tapeworm. Nervous symptoms are not so often seen as with roundworms, and will be discussed in connection with them.

Treatment.—Prophylaxis requires the cooking of meat to a sufficient degree to destroy the cysticerci. There is especial danger in eating raw pork or sausage; that from rare beef is much less. The list of drugs used for the expulsion of the worm is a long one; probably the most satisfactory is the oleoresin of male fern, which should be given in capsule, in ℥xv doses to a child of ten years, four capsules usually being administered at hourly intervals. The vermifuge should be preceded by several hours' fasting, and the bowels should be previously opened by a laxative.

The following plan of administration has been found satisfactory: A light supper of milk, and in the morning a saline laxative on rising, but no breakfast; after the saline has acted freely the capsules are to be given, and following the last one, half an ounce of castor oil or some other active purge. Only milk should be given that day. The fragments passed should be carefully examined to see if the head has been expelled, as the worm is very likely to be broken at the neck. If this occurs it will grow again, and in about three months segments will appear in the stools. Other drugs useful for tænia are infusion of pomegranate root, turpentine, and chloroform.

Nematodes.—Two varieties are found in the intestinal canal, the *ascaris lumbricoides* and the *oxyuris vermicularis*.

Ascaris Lumbricoides—Roundworm.—This worm occupies the small intestine. It is much more frequently met with in children than the tapeworm. It is exceedingly rare in infancy, but is usually seen between the third and tenth year. In over one thousand autopsies upon infants I have only once found a roundworm in the intestine.

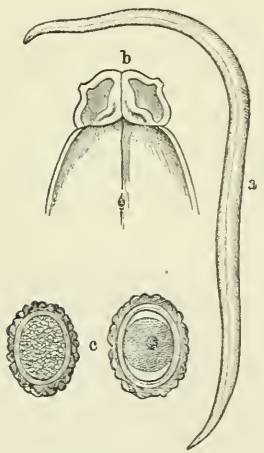


Fig. 67.—Ascaris lumbricoides; *a*, entire worm; *b*, head; *c*, eggs. (Jaksch.)

The roundworm is from five to ten inches long, the female being longer than the male. It is of a light gray colour with a slightly pinkish tint, cylindrical, and tapering toward the extremities (Fig. 67). The eggs are oval in form, about $\frac{1}{400}$ inch in diameter, and are numbered by millions. These worms rarely exist singly; usually from two to ten are present, but there may be hundreds, and even thousands. When very numerous they coil up and form large masses, which may cause intestinal obstruction.

The life history of the roundworm is not yet perfectly understood. Epstein cultivated outside of the body eggs taken from the stools, and found that under favourable conditions of sun and air five weeks were required for the development of the embryo. These were then fed to children. In three months the ova appeared in the stools, and after the administration of santonin many worms were discharged. From these experiments it would appear that no intermediate host is required, although this was previously supposed to be the case. It was believed that the ova were swallowed by some worm or insect, and in this form were taken into the intestinal canal with green vegetables, fruit, or drinking water.

The migration of these worms is curious, and in some instances truly remarkable. They frequently enter the stomach and are vomited. Occa-

sionally one may appear in the nose. They have been known to pass through the Eustachian tube into the middle ear and to appear in the external meatus. Entering the larynx they have produced fatal asphyxia. It is not very rare for them to enter the common bile duct and produce jaundice. They may even enter in great numbers the smaller bile ducts and produce hepatic abscesses. They have been found in the pancreatic duct, in the vermiform appendix, and in the splenic vein. It has long been known that they would perforate an intestine which was the seat of ulceration, but well-authenticated cases have been reported in which they have perforated an intestine previously healthy, setting up a fatal peritonitis. In Archambault's case they perforated the stomach. In cases of a persistent Meckel's diverticulum, worms have been discharged from an umbilical fistula. They have been found in umbilical abscesses. Considering, however, the frequency of roundworms, migrations are rare.

Symptoms.—The symptoms of roundworms are of the most indefinite kind. Often there are none until the worm is discovered in the stools. It is then fair to assume that others are also present. The most frequent abdominal symptoms are colic, tympanites, and other symptoms of indigestion, loss of appetite, restless, disturbed sleep, grinding of the teeth at night, and picking the nose. These symptoms are much more frequently due to other causes than to worms, but when all are present the existence of worms should be suspected.

A great variety of nervous symptoms may be associated with intestinal worms. They are more often seen with lumbricoids than with either of the other varieties. The symptoms may be of the most puzzling character, and may simulate very closely those of serious organic disease. There may be chills, headache, vertigo, hallucinations, hysterical seizures, epileptiform attacks, convulsions, tetany, transient paralyses such as strabismus, and even hemiplegia and aphasia. All these have been observed in connection with intestinal worms, and from the fact that the symptoms disappeared completely after the worms were expelled there seems to be but little doubt that they were the cause of the symptoms. As in the case of the abdominal symptoms, however, intestinal worms are only one of the causes of such nervous disturbances, and certainly not the most frequent; but the possibility that they may depend upon worms should not be overlooked.

The only positive evidence of the existence of roundworms is the discharge of a worm from the body, or the discovery of the ova in the stools. A microscopic examination of the stools is a valuable means of diagnosis, and one that is too infrequently employed. When worms are present the ova may be found in great numbers. Their continued presence after the discharge of one worm, indicates that other worms remain.

Treatment.—Altogether the most efficient agent for the removal of the worms is santonin. The same plan of administration may be fol-

lowed as in the case of the tapeworm—viz., to give the drug on an empty stomach, preceded by a laxative. Santonin is best given in powdered form mixed with sugar. For a child of five years six grains are usually required. This amount should be given in three doses at intervals of four hours, followed by a purge of calomel or castor oil.

Oxyuris Vermicularis—Pinworm—Threadworm. The oxyuris (Fig. 68) resembles a short piece of white thread. The female is about one third of an inch long, the male about one half that length, but is less frequently seen. The worm tapers toward the tail. The ova are of slightly irregular size, and are considerably smaller than those of the roundworm.

The oxyuris inhabits chiefly the rectum and lower colon; less frequently it may be found as high as the cæcum. These worms have been seen in the stomach, and even in the mouth. If present they are usually discovered by separating the folds of the anus. The number of worms is usually large. The irritation to which they give rise, causes a great production of mucus, and frequently leads to a chronic catarrh of the colon of considerable severity. The worms are imbedded in the mucus; often they form with it small balls. According to Leuckart, they are incapable of multiplying *in situ*. For development, the ova must be swallowed by the patient or some other individual. They as well as the worms are passed in enormous numbers with the stool. They attach themselves to the folds of the skin, the hairs about the anus, and even to the genitals. The patient may, through lack of cleanliness of the parts, continually re-infect himself. After discharge from the body, the ova may be carried by flies and deposited upon fruits, vegetables, or in drinking water.

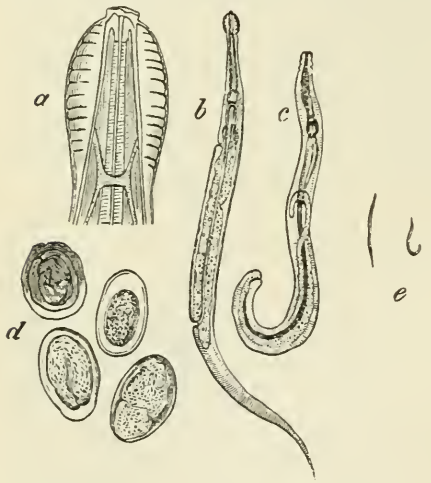


FIG. 68.—Pinworms. *a*, head; *b*, female; *c*, male; *e*, female and male, natural size; *d*, ova. (Jaksch.)

Symptoms.—The principal symptom caused by the oxyuris is itching of the anus or the genitals. This is caused by the migration of the worms from the bowel, and usually comes on at about the same hour at night, generally soon after the patient has retired. It is sometimes so intense as to be almost intolerable. It leads to frequent micturition, to incontinence of urine, in the male to balanitis, and in the female to vaginitis or vulvitis, and in both, but especially in the latter, it may be the cause

of masturbation. Owing to the catarrhal colitis which is excited, there is discharged a large quantity of mucus. The irritation may lead to prolapsus ani. Nervous symptoms are not so frequently associated as with the other varieties of worms, although I have seen at least one case of chorea in which they were almost certainly the cause. They have been known to excite convulsions.

Treatment.—This is usually spoken of as a very simple matter, and no doubt in recent cases, or where the number of worms is small, this is true; but where the number is large, and considerable catarrhal inflammation of the colon is present, it is often a matter of the greatest difficulty to rid the bowel of these parasites. Cases often resist the most approved methods of treatment for months, even though carefully and thoroughly applied. The reason for this difficulty is, that the whole colon is doubtless infected, and that the upper part is very imperfectly reached by injections. While, therefore, injections are important and indeed invaluable, they can not be relied upon exclusively. The most scrupulous attention to cleanliness is an absolute necessity as the first step in the treatment of all cases. It is well to bathe the parts about the anus after each stool, and even two or three times a day, with a bichloride solution, 1 to 10,000. Itching is best controlled by the application of mercurial ointment to the folds of the anus at bedtime, this effectually preventing the escape of the worms from the bowel. The local application of cold will sometimes have the same effect. The most efficient of the injections is probably the bichloride. The colon should first be thoroughly cleansed by an injection of lukewarm water containing one teaspoonful of borax to the pint, in order to remove the mucus. When this has been discharged, half a pint of the bichloride solution mentioned should be injected high into the bowel through a catheter, and retained as long as possible. This should be repeated every second or third night. On other nights a simple saline injection may be employed. The infusion of quassia, asafœtida, aloes, and garlic are also useful.

When the worms are high in the colon, drugs by the mouth must be combined with injections. The worms must be dislodged by the use of saline cathartics, and simple bitters, especially quassia and gentian, should be given by the mouth. I have known one case, which resisted for over two years everything which had been tried, cured in two or three weeks by injections of a decoction of garlic, in connection with which garlic was given in large quantities by the mouth.

CHAPTER XI.

DISEASES OF THE RECTUM.

PROLAPSUS ANI.

Under this term are included two conditions. In the first, or partial prolapse, there is simply an eversion of the mucous membrane which protrudes beyond the sphincter. In the second, or complete prolapse, there is invagination of the rectal wall for a variable distance, usually two or three inches.

Etiology.—Prolapse is most common in children during the second and third years. Its frequency in early life is partly due to the lack of support furnished by the levator-ani muscles. It also occurs very readily when the ischio-rectal fat is scanty; it is therefore often seen in children suffering from marasmus. The exciting cause may be anything which provokes severe and prolonged straining. This may be either the tenesmus accompanying inflammation of the rectal mucous membrane or chronic constipation. It may come from phimosis or stricture of the urethra, and it is a very frequent symptom of stone in the bladder.

Symptoms.—Prolapse usually occurs during the act of defecation. It is generally easily reduced, but shows a great disposition to return with every stool. In obstinate cases the bowel comes down at other times. The appearance of the tumour varies with its size. In the slighter form there is simply a ring composed of a fold of mucous membrane surrounding the anus. In the more severe form there is a flattened, corrugated tumour, usually about the size of a small tomato (Fig. 69). The mucous membrane covering the tumour is of a deep purplish-red colour, and bleeds readily. It may be the seat of catarrhal or membranous inflammation. The diagnosis in most cases is easy, although the tumour has been confounded with polypus and intussusception.

Treatment.—In most cases reduction is easily accomplished by laying the child upon its face across the lap, and making gentle pressure upon the tumour with oiled fingers. The application of cold, either by means of ice or cold cloths, is of assistance in cases which are not at once reduced by pressure. After reduction, in the milder cases the child should be kept upon its back for at least an hour. Where the tumour tends to come down with every stool, special attention should be given at this time. If an infant, the bowels should always move while the child lies upon its back, and during defecation the buttocks should be pressed together by a nurse. Older children should use an inclined seat placed at an angle of about forty-five degrees, but should never sit upon a low chair or assume

any position in which straining is easy. After defecation the patient should lie down for at least half an hour. Where there is constipation, the bowels should be kept free by means of laxatives. If there is a diarrhœa,

Fig. 69.—Prolapsus ani.

tenesmus may be overcome by frequent sponging with ice water, or by the use of small injections of ice water and tannic acid, in the proportion of twenty grains to the ounce. In more severe cases it may be controlled by the use of suppositories of opium or cocaine. Where the bowel tends to come down frequently, this may be prevented by the use of an adhesive strap two or three inches wide, placed tightly across the buttocks. This is better in the milder cases than a T-bandage. The great majority of the cases are cured by these means in the course of a few weeks.

In the most severe cases the bowel not only protrudes during defecation, but also in the interval, and it may be down for weeks at a time. Such cases are rarely seen except in infants who have very flabby muscles, and but little adipose tissue at the floor of the pelvis. Reduction is sometimes difficult in cases where the prolapse has lasted a long time. It is often facilitated by painting the protruding part with a 4-per-cent solution of cocaine, and then dilating the sphincter by passing the finger into the central opening of the tumour. After reduction, suppositories containing from one fourth to one grain of cocaine may be inserted. They are more efficient than those containing opium or belladonna. A firm pad should be applied over the anus, held in position by a T-bandage. The tone of the levator and sphincter-ani muscles is often greatly improved by local injections of strychnia. For a child two years old $\frac{1}{100}$ grain may be used twice a day. Where these measures fail, the protruding part may be touched with the Paquelin cautery, linear markings being made at intervals of an inch. Amputation or excision is not required in children.

FISSURE OF THE ANUS.

This is not a very uncommon condition in children. The most frequent cause is the passage of a large, hard, fæcal mass. Sometimes it results from traumatism inflicted with the nozzle of a syringe while giving an enema. It may be produced by the scratching excited by pinworms. In the beginning there is a simple tear at the margin of the anus. The laceration which is produced usually heals promptly; but if the cause is repeated, healing is prevented, and there is finally produced a linear ulcer, or a true fissure, which may last for some time and be a source of great annoyance.

A fresh fissure has the appearance of any other tear at a muco-cutaneous orifice. One of longer standing has a gray base, slightly indurated edges, often discharges a small amount of pus, and bleeds a drop or two with nearly every movement of the bowels. The most constant symptom is pain, which usually occurs with the act of defecation, and continues for some time afterward. It is most severe when the fissure is just at the margin of the sphincter, and leads the child to resist every inclination to have the bowels move, so that it becomes a cause of chronic constipation, which condition again greatly aggravates the fissure. The pain is often referred to other parts in the neighbourhood.

The treatment is simple and usually efficient. It consists in cleanliness, overcoming the constipation, and touching the fissure with nitrate of silver, preferably with the solid stick. If the case is not speedily relieved by such measures, the sphincter should be stretched as in adult patients.

PROCTITIS.

Proctitis, or inflammation of the rectum, usually occurs with inflammation of the rest of the large intestine, but it may occur alone. It is to the cases in which only the rectum is involved that the term is generally applied.

The causes are for the most part local. A frequent one in infants is the use of irritating injections or suppositories, either for the relief of constipation or as a means of administering certain drugs. I have seen one obstinate case in an infant a year old, following the prolonged use of glycerin suppositories. It is sometimes caused by traumatism, especially by the careless giving of an enema. It accompanies pinworms. In certain cases it may result from direct infection through the anus. This may be from a gonorrhœal inflammation extending from the vagina or urethra, or from an infection due to other bacteria, particularly in cases of measles, scarlet fever, and diphtheria; or finally, it may be due to syphilis. The varieties of inflammation are the same as in the rest of the intestine. Proctitis may thus be catarrhal, membranous, or ulcerative.

Catarrhal Proctitis.—The pathological conditions are the same as in ordinary catarrhal inflammation of the intestinal mucous membrane. By the introduction of a speculum, or by simply everting the mucous membrane, it is seen to be reddened, swollen, and bleeds easily. There is a copious secretion of mucus. In cases of long standing there may be superficial ulceration appearing as a white or yellowish-white surface, usually just inside the sphincter.

The symptoms are chiefly local, although a condition of general irritability may result from the local condition. There is heightened reflex action, so that the stool often comes with a squirt. There is pain with defecation, and mucus is discharged, usually as a clear, jelly-like mass, and sometimes in the form of a cast, but not generally mixed with the stool. There are usually traces of blood, but rarely large hæmorrhages. In the most acute cases, tenesmus is always present both during and after the stool. There may be prolapsus ani. The skin in the vicinity is irritated by the discharges, most frequently so in infants. If the cause is pinworms, there may be intense itching. The duration of the disease is indefinite, depending upon the cause. It may be a few days or many months. The inflammation may extend from the rectum to neighbouring parts, leading to ischio-rectal abscess.

Membranous Proctitis.—It has been customary to describe this as a complication of diphtheria, usually occurring with diphtheria of the external genitals. As very few of these cases have been studied bacteriologically, it is impossible to say what proportion of them, if any, are to be regarded as true diphtheria. It is probable that the great majority are due to infection by streptococci. When the infection is from the intestine above, the rectum is never affected alone. When it is from below, this may be the case. The lesions are the same as in membranous inflammation occurring higher in the colon. The symptoms resemble those of the catarrhal variety, with the addition that the stools contain pieces of pseudo-membrane. This can be made out only by repeatedly washing the discharges with water. If accompanied by prolapse, the pseudo-membrane may be seen. Membranous proctitis may be complicated by a membranous inflammation of the genitals or the perinæum. Although it is usually acute, it may last for weeks.

Ulcerative Proctitis.—Ulcers of the rectum may be the result of a catarrhal inflammation; these, however, are usually superficial, affecting the mucous membrane only, and in most cases heal rapidly. Sometimes they extend more deeply into the submucous or even the muscular coat. They are then chronic, often very obstinate, and may last indefinitely. Follicular ulcers of the rectum are nearly always associated with the same condition in the sigmoid flexure. These are always multiple and usually small, rarely being more than a quarter of an inch in diameter. Sometimes the small ones coalesce, producing much larger ulcers. Membranous

proctitis is rarely followed by ulceration, although this is a possible result where sloughing has occurred. Single ulcers may be of tuberculous origin. Steffen reports two cases of tuberculous ulcer of the rectum in children of seven months and three years respectively. I have seen one in a young infant, which was fully three fourths of an inch in diameter, and was not associated with other tuberculous disease of the large intestine. Syphilitic ulcers are extremely rare in children.

The symptoms of ulcer of the rectum are mainly two—pain and hæmorrhage. The pain is of variable intensity, and may be referred to the coccyx, or to any of the neighbouring parts. The amount of bleeding may be small, the blood coming in clots, or it may be fluid and in so large a quantity as to produce general symptoms. It usually accompanies every stool. In addition the stool contains more or less pus, particularly in chronic cases. When the ulcer is low down, tenesmus is present and may be a prominent symptom. A positive diagnosis of ulcer can be made only by examination with a speculum.

Treatment.—In cases of acute catarrhal proctitis injections of some bland fluid should be employed, such as a starch-water, limewater, a mixture of oil and limewater, or a warm one-per-cent saline solution. The local cause, if one is present, should be removed. Where the stools are excessively acid, alkalies may be given by the mouth. The disordered digestion, when present, is to be treated according to its special symptoms. In the most acute cases the patient should be kept in bed. Where the tenesmus is severe, suppositories of opium or cocaine may be used. In the more chronic cases saline injections should be given, and followed by a mild astringent like tannic acid, ten grains to the ounce, or a one-per-cent solution of hamamelis. Cases associated with pinworms are especially obstinate. Here the treatment is first to be directed to the worms, and afterward to the proctitis.

In the membranous cases the same measures are to be employed, and in addition the injection of a warm boric-acid solution two or three times a day.

Cases of ulcer require the most careful treatment. In many there is but little tendency to spontaneous recovery. An examination with the speculum should be insisted upon in all cases of chronic proctitis, to make sure of the diagnosis. Rest in bed is essential to a rapid improvement. The patient should be put upon a bland diet, especially of milk, and the bowels kept freely open by the use of laxatives, and injections twice a day of a saturated boric-acid solution. Locally there should be applied a solution of nitrate of silver, one grain to the ounce, the bowel having previously been washed with tepid water. If a stronger solution than this is used, it should be neutralized after half a minute by the injection of a salt solution.

ISCHIO-RECTAL ABSCESS.

This is not a very rare condition even in infancy. Infection from the rectum, usually through the lymph channels, seems to be the most common cause, although sometimes the abscess may be traced directly to traumatism. In a single year I have seen six cases. All but two were small, circumscribed abscesses and quite superficial, apparently starting as an acute inflammation of the lymph glands of the region. They are analogous to a similar process in the lymph glands of the neck, seen in infancy. These cases healed promptly after incision. In other instances there is seen a disposition to burrow, as in adults. Only once have I met with diffuse suppuration in the ischio-rectal region, terminating in sloughing and death, and this was in an infant only three months old.

Essentially the same varieties of inflammation are seen in early life as in adults. Most of these cases recover promptly after simple incision and cleanliness, fistula being a rare sequel.

HÆMORRHOIDS.

These, fortunately, are not often seen in children, although they may occur even in those as young as three or four years. The principal cause is chronic constipation. The tumours are generally small and external, the chief symptom complained of being pain on defecation. Bleeding sometimes accompanies the pain, but the hæmorrhages are usually small. The treatment is to be directed toward the underlying cause. In most of the cases this suffices to cure the condition. I have never yet seen in a young child a case requiring operation, although neglect may make this procedure necessary.

INCONTINENCE OF FÆCES.

Inability to control the fæcal evacuations is seen in certain cases of paraplegia due to myelitis, in injury of the lumbar portion of the spinal cord, and in spina bifida. It is also seen in the coma of meningitis, and occasionally in the typhoid condition and in extreme adynamia, no matter in the course of what diseases they develop. In all these conditions incontinence of fæces is a symptom giving rise to much annoyance and needing careful attention. Uncleanliness with reference to excreta, seen in idiocy, can hardly be classed as incontinence.

Besides these familiar forms, the condition is sometimes seen from causes somewhat resembling those of incontinence of urine. The tone of the sphincter becomes so feeble that it does not resist even the slightest impulse to evacuate the rectum. The discharge may take place with but little warning, and may occur either by day or night. In some cases a local cause exists, such as stretching of the sphincter by a rectal prolapse

or by impaction of fæces; more frequently, however, the causes relate to the general nervous condition of the patient. Fowler* (New York) has reported two very typical cases of this variety, and I have seen one. They are, however, very rarely met with in practice. Of the cases reported in literature, the majority have occurred in highly nervous, anæmic children. Fowler's cases were cured by the use of ergot given by the mouth and by suppository. In cases not relieved by this treatment, strychnia should be injected locally as described under Prolapsus Ani. In all cases the general condition should receive careful attention.

CHAPTER XII.

DISEASES OF THE LIVER.

The liver is not often the seat of disease in infancy and early childhood. Nearly all the forms seen in adult life are occasionally met with in later childhood, although even then they are quite rare.

Size and Position.—The weight of the liver in the newly-born child, from one hundred and seven observations of Birch-Hirschfeld, is 4·5 ounces (127 grammes), or about 4·2 per cent of the body weight. The following table gives the results of one hundred and seventy-four observations upon the liver in infancy in the autopsy room of the New York Infant Asylum:

Weight of the Liver in Infancy.

Age.	Average.		Per cent of body weight.
	Ounces.	Grammes.	
3 months	6·3	180	3·1
6 "	7·5	212	3·0
12 "	11·0	311	3·40
2 years	14·0	397	3·37
3 "	16·0	453	3·26

In adults, according to Frerichs, the weight of the liver is about 2·5 per cent of the weight of the body.

The upper border of the liver is best made out by percussion. In the child, the upper limit of the liver dulness in the mammary line is found in the fifth intercostal space; in the axillary line, in the seventh space; posteriorly, in the ninth space. The lower border is best determined by palpation. This, as a rule, in the mammary line is found about one half an inch below the free border of the ribs. According to Steffen, the left lobe is relatively larger in the child than in the adult. The liver may be

* American Journal of Obstetrics and Diseases of Children, October, 1882.

displaced downward by contraction of the chest, as in rickets, or by an accumulation of fluid in the pleural cavity. It is frequently found lower than normal in conditions of great emaciation, owing to relaxation of the abdominal walls and its ligamentous supports. Upward displacement is much less frequent, and depends usually upon ascites or abdominal tumours.

Malformations and Malpositions.—Congenital malformations relate chiefly to the bile ducts. These have been considered in the chapter devoted to Icterus in the Newly Born (page 76).

The liver may be found upon the left side in cases of general transposition of the viscera. In fissure of the diaphragm it has been found in the thoracic cavity.

ICTERUS.

Icterus, or jaundice, occurs in children, as in adults, from two general classes of causes. The first includes those cases in which there is some obstruction of the flow of bile from the liver into the intestine, or obstructive jaundice. In the second group, in which the jaundice is classed as non-obstructive, it depends upon certain changes in the blood itself. This is seen in the physiological jaundice of the newly born, in that associated with septic conditions and as the result of certain poisons.

Obstructive jaundice from pressure upon the bile ducts is extremely rare in children. Obstruction by a roundworm entering the common duct has been recorded, but is also very rare. The principal form of obstructive jaundice seen in early life, is catarrhal. This has already been considered in connection with Gastro-duodenitis (page 297).

FUNCTIONAL DISORDERS.

Functional derangements of the liver are undoubtedly exceedingly common in childhood. They are as yet but little understood, and it is almost impossible to separate them from the other symptoms of intestinal indigestion with which they are associated. These are described in the chapter upon Chronic Intestinal Indigestion. Some of these symptoms depend upon a diminution in the quantity, or the impoverished quality of the biliary secretion. There are gray or white stools, flatulence, and other evidences of increased intestinal putrefaction. These in all probability depend upon imperfect absorption in consequence of the absence of bile, rather than upon the absence of some antiseptic property, as recent experiments seem to show that the bile is not an intestinal antiseptic. The other functional disturbances of the liver relate to its effect upon the proteid substances which undergo destructive metamorphosis in this organ. The nature of this change, and the symptoms which result from this disturbance are as yet but imperfectly understood. It is quite probable that many of the nervous functional disorders of children—for example, attacks of migraine or of cyclic vomiting—may depend upon such a cause.

ACUTE YELLOW ATROPHY.

This form of hepatic disease, although rare in adults, is still more rare in children. Greves* has reported a well-marked case in an infant of twenty months, and has collected seventeen other cases under ten years of age; the youngest was in an infant three months old. The causes are obscure. The symptoms and course of the disease are essentially the same as in adults.

CONGESTION OF THE LIVER.

This occurs from the same cause as in adults. Acute congestion is not often seen. It may result from a malarial fever and from certain poisons, particularly phosphorus. Chronic congestion is more common, and is usually secondary to general venous obstruction dependent upon congenital or acquired heart disease, atelectasis, or other pulmonary conditions, particularly chronic pleurisy, chronic interstitial pneumonia, and emphysema. Chronic congestion of the liver causes no characteristic symptoms except a moderate enlargement of the organ. The disturbance of its functions is not of such a nature as to be diagnostic. In acute congestion, there may be in addition to the swelling of the liver, some localized pain or tenderness. The treatment is that of the original disease upon which the congestion depends.

ABSCESS OF THE LIVER—SUPPURATIVE HEPATITIS.

In 1890 Musser † found but thirty-four recorded cases of abscess under thirteen years. Since that time a few additional cases have been reported. This suffices to show how rare the disease is in early life. In the above collection, there have not been included cases of suppurative hepatitis occurring in the newly born.

As in adults, abscess of the liver may result from traumatism, or it may be secondary to suppurative pylephlebitis, which depends upon a focus of infection in the umbilical vein, or in some part of the abdomen from which the branches of the portal vein arise. Pylephlebitis may follow appendicitis (Bernard's case), it may follow typhoid fever directly (Asch's case), or be due to suppuration of the mesenteric glands or peritonitis following typhoid. In seven of the cases collected by Musser the disease was due to migration of roundworms from the intestine into the hepatic ducts. Menger (Texas) has reported one case following dysentery, the only one, I think, on record in this country. In quite a number of cases no adequate cause can be found. A striking example of this was

---

* Liverpool Medico-Chirurgical Journal, July, 1884.

† Keating's Cyclopædia, vol. iii, p. 466.

reported to the New York Pathological Society by Swift, in 1882, where an abscess occupying nearly the whole right lobe occurred in a child three years old.

In the cases occurring in pyæmia and in those associated with pylephlebitis there are usually several abscesses; in traumatic cases generally but one. The abscesses of early life do not differ very much from those of adults. If untreated, the majority of cases prove fatal either from exhaustion or from rupture into the pleura or peritonæum. In Asch's case spontaneous cure took place by rupture into the intestine.

Symptoms.—Occasionally abscess in the liver is latent, but in most of the cases the symptoms are marked and sufficiently characteristic to make the diagnosis a matter of no great difficulty. The most constant general symptoms are chills, which may be single, but are usually repeated; fever, which is commonly of the hectic variety and followed by sweating; prostration, vomiting, diarrhœa, and cachexia. Jaundice is present in less than half the cases, and is rarely intense. The liver is almost invariably sufficiently enlarged to be easily made out by palpation or by percussion; the enlargement in most cases is chiefly downward. Tumours on the surface of the liver are often present; these may be recognised as abscesses by the presence of fluctuation. Pain is quite constant, and frequently intense, but not always in the region of the liver. It may be in the epigastrium, at the umbilicus, in the lower part of the abdomen, and occasionally in the right shoulder. Tenderness over the liver is usually present. A positive diagnosis of hepatic abscess is to be made only by aspiration and the withdrawal of a fluid having the characteristics known as "liver pus." Pulmonary symptoms usually exist with an abscess occupying the convexity of the right lobe. There may be cough and dyspnœa from pressure, or pleurisy from extension of the inflammation through the diaphragm, or from rupture into the pleural cavity. The usual duration of abscess of the liver after the beginning of the symptoms is from one to two months. The prognosis will depend upon the cause of the disease. The pyæmic cases are usually fatal. In Musser's collection, the proportion of recoveries was about thirty per cent. At the present time, with improved methods of treatment and earlier diagnosis, the outlook is somewhat better than this.

Treatment.—This is purely surgical. Without operation the chances of recovery are very slight. A small number of cases have been cured by aspiration, but in the vast majority only incision and drainage are to be depended upon, and, if the abscess is accessible, should be resorted to as soon as the diagnosis is established.

CIRRHOSIS.

This is exceedingly rare in early life, although quite a number of cases are now on record between the ages of seven and fourteen years. Sixty-

five have been collected by Howard* and fifty-three by Laure and Honorat.† Nearly all the cases in these collections were between nine and fifteen years. Cirrhosis in infancy is usually of syphilitic origin. Two thirds of those in Howard's collection were males. The etiology in most of the cases is obscure; in over half of those reported no cause could be discovered. Fifteen per cent of Howard's cases were traced to alcoholism, eleven per cent to syphilis, and eleven per cent to tuberculosis. Laure and Honorat believe that the eruptive fevers sometimes play an important part as an etiological factor, and that at other times the cause is possibly malaria.

The anatomical features of cirrhosis in early life are essentially the same as in adults. The liver is sometimes enlarged, but usually it is smaller than normal. The connective tissue may be distributed around the lobules, along the bile ducts, in irregular patches, or in striations through the organ. Associated with this there are atrophy and fatty degeneration of the liver cells. In some of the cases reported there has been also a similar increase in the connective tissue of the spleen and kidneys.

Symptoms.—These are very much the same as in adult life. In the beginning there are the indefinite disturbances referable to the digestive organs, and the liver may be found to be slightly enlarged; later there are ascites, enlargement of the spleen, and dilatation of the abdominal veins. Ascites is a pretty constant symptom, and is generally marked. Slight icterus is often present, but a marked amount is rare. There may be hæmorrhages from the stomach, from the nose, or from other organs; in a few cases there is slight fever. The late symptoms are a small liver, marked ascites with the consequent embarrassment of respiration, cachexia, and sometimes general dropsy. Diarrhœa is a much more constant symptom than in adults. Death usually takes place from exhaustion. The course of cirrhosis in children is commonly more rapid than in adults, and the progress is steadily downward.

Treatment.—Medicinal treatment is of avail only in cases which are syphilitic. These should be put upon mercury and large doses of the iodides. The treatment in other respects is symptomatic and palliative. As largely as possible patients should be kept upon a milk diet. The ascites may require aspiration or puncture, as in adults.

AMYLOID DEGENERATION (WAXY, LARDACEOUS LIVER).

This condition results from prolonged suppuration in connection with chronic bone and joint disease, especially of the hip, knee, or spine. More rarely it is seen with chronic empyema, tuberculosis, or hereditary

* American Journal of the Medical Sciences, 1887, p. 350.

† Revue Mensuelle des Maladies de l'Enfance, 1887, p. 97, 159.

syphilis. Amyloid degeneration of the liver is associated with similar changes in the spleen and kidneys, and sometimes in the villi of the small intestine.

The liver is generally very much enlarged; in extreme cases a weight of six or seven pounds may be reached. It is of a glistening, waxy colour, very firm and hard. With a solution of iodine, a mahogany-brown reaction is obtained. The amyloid degeneration affects first the arterioles, and finally the hepatic cells.

Amyloid liver *per se* produces few symptoms. Ascites is rarely present except in cases in which the liver is very large, and jaundice does not occur. In addition to the symptoms of the original disease in the course of which the amyloid degeneration occurs, there is the peculiar waxy cachexia which is seen in no other condition, but resembles somewhat that belonging to malignant disease. The face has the appearance of alabaster, and the skin has a singular translucency. The liver may be so large as to form a tumour, sometimes nearly filling the abdominal cavity. Not infrequently it extends to the umbilicus, and even to the crest of the ilium. The surface is smooth and hard, and the edges usually sharp. There is no localized pain or tenderness. The spleen is invariably enlarged. As a result of the amyloid degeneration of the kidney, there may be dropsy and albuminuria. Dropsy may occur from pressure of the large liver upon the vena cava, apart from the condition of the kidney. So many complicating conditions are usually present that it is almost impossible to say which of the other symptoms are due to the changes in the liver.

Amyloid changes take place slowly, the whole course of the disease being marked by years, the patient dying from slow asthenia, from nephritis, or from some acute intercurrent disease. As a rule, cases go on steadily from bad to worse; but sometimes, after the disease has reached a certain point, the condition is stationary for a long time.

The prognosis is always bad, although in a few cases improvement, and even cure, are stated to have occurred after the excision of the diseased joints upon which the amyloid degeneration depended. This, however, is a result which is not often met with. In cases of amyloid degeneration dependent upon syphilis, the usual anti-syphilitic remedies should be given. In other cases, no treatment is of any avail except that directed toward the removal of the cause.

FATTY LIVER.

This consists in an accumulation of fat in the liver cells. It is generally a secondary condition in childhood, and causes no symptoms by which it can be positively recognised.

Fatty liver is found at autopsy chiefly in children dying of marasmus, general tuberculosis, and in the other varieties of wasting disease, especially

those associated with the digestive tract. In such patients it is particularly common, but under other conditions it is quite rare. It is found in children of all ages, being frequent in infants.

The liver is moderately enlarged, smooth, with rounded edges, of a yellowish-red or a lemon-yellow colour, and can be indented with the finger. A warm knife becomes coated with oil after cutting. Microscopically there is seen an accumulation of fat in the liver cells, usually irregularly distributed.

Jaundice, ascites, and the other peculiar symptoms of hepatic disease, are absent. The liver is moderately increased in size and its functions are interfered with, but not in such a way as to be recognised by the symptoms.

The treatment is that of the original disease.

HYDATIDS.

Echinococcus disease of the liver, while rare among adults in this country, is almost unknown in children. I have been able to find but two recorded cases in America.

From twenty-two European cases collected by Pontou (Paris, 1867), it appears that unilocular cysts are especially frequent in young subjects. The disease may be latent for months or years. The earliest symptoms are localized pain, jaundice, and occasionally fever. Later there is enlargement of the liver, particularly of the right lobe. If the upper surface is affected, pulmonary symptoms, cough and dyspnœa, are usually present; if the under surface of the organ, there is pressure upon the portal vein, the vena cava, bile ducts, stomach, and intestines. This pressure may cause icterus, dilatation of the superficial abdominal veins, and sometimes ascites. The local signs are enlargement of the liver with a tumour, which is easily recognised in children because of the thin abdominal walls. The hydatid fremitus is usually obtained. By aspiration a clear fluid is withdrawn, showing under the microscope the presence of the hooklets, which establishes the diagnosis. Occasionally cure may take place by spontaneous rupture or suppuration of the cyst, but in most cases, when left to itself, the disease proves fatal. The treatment is surgical, and consists in aspiration or in incision, and the evacuation of the cyst.

BILIARY CALCULI.

Up to the age of puberty calculi are extremely rare. Walker* has reported a case in a child dying at three months, who had symptoms from the age of one month. Parrot has put on record one case in an infant twelve days old. Frerichs records one in a child of seven, and Simon one at six years. In the cases reported the symptoms have been like those of adults—colic and icterus, and finally the passage of the stone by the bowels.

* British Medical Journal, 1882.

CHAPTER XIII.

DISEASES OF THE PERITONÆUM.

Inflammation of the peritonæum is not very frequent in childhood, because at this time most of the causes which are operative in later life either do not exist at all or are very infrequent. An analysis of 187 collected cases of peritonitis—not including those associated with appendicitis—gave the following results, which are of some interest as showing the relative frequency of the different forms in early life:

	Acute.	Chronic.	Total.
Fibrinous	22	10	32
Serous	22	15	37
Purulent	46	16	62
Tuberculous	18	38	56
Total	108	79	187

We shall consider separately acute, chronic, and tuberculous peritonitis.

ACUTE PERITONITIS.

Acute peritonitis may occur at any period of infancy or childhood. It may even exist in intra-uterine life. In the newly born, peritonitis is quite frequent. After this time it is exceedingly rare during infancy, only four cases, including all varieties, being met with in 726 consecutive autopsies in the New York Infant Asylum. After the fifth year the disease is relatively much more common. Of the 187 cases above referred to, 25 per cent occurred in the newly born, 21 per cent between one and five years, and 54 per cent between the fifth and the sixteenth years.

Etiology.—In the newly born, peritonitis is seen as one of the most frequent lesions of acute pyogenic infection (page 81). It is usually due to direct infection through the umbilical vessels. In infancy and childhood, peritonitis occurs both as a primary and secondary inflammation. The primary form is rare. It may be due to traumatism, such as falls or blows, or to surgical operations upon the abdomen; it has occurred after an injection for the cure of a congenital hydrocele. In a very small number of cases the inflammation seems to have been excited by cold or exposure, and it may follow severe burns.

The secondary form is more common. The most frequent of all causes is appendicitis. These cases are, however, considered separately elsewhere. Extension of inflammation from the viscera to the peritonæum is very much less frequent in children than in adults. It was met with but once in my autopsies (about 130 in number) in acute intestinal diseases.

It is also rare in typhoid fever, being noted but twice among my collected cases. It is occasionally due to abscess of the liver, ulcer of the stomach, acute intestinal obstruction from internal strangulation, intussusception, volvulus, or congenital atresia. It may extend from inflammation of the pleura. This may be in the form of empyema which burrows through the diaphragm, or, without burrowing, the infection may take place through the lymph channels. It is not very infrequently due to infection through the female genital tract, especially in gonorrhœal vulvo-vaginitis in young girls. Extension of inflammation from the male genital organs is not common. In one case at the New York Infant Asylum, fatal peritonitis in an infant originated in a suppurative inflammation of the tunica vaginalis of unknown origin, the infection extending into the peritonæum through the inguinal canal. Any abscess in the neighbourhood may rupture into the peritonæum and excite peritonitis. The most frequent in children are those connected with Pott's disease, perinephritis, and cellulitis of the abdominal wall.

Of the acute infectious diseases, peritonitis is most frequently seen with pneumonia and scarlet fever. In four cases occurring in the New York Infant Asylum the disease was twice secondary to pneumonia, in both complicated by extensive pleurisy. It may be accompanied by pericarditis, and even by meningitis.

The bacteria most frequently associated with acute peritonitis in children are: the streptococcus, especially in the newly born; the micrococcus lanceolatus (pneumococcus), in cases complicating pneumonia or empyema; and the bacterium coli commune in those following intestinal perforation. These may be associated with other pyogenic bacteria, or less frequently the latter may occur alone.

Lesions.—In the fibrinous form we have changes similar to those occurring in inflammation of the pleura and the other serous membranes. The peritonæum is injected and lymph is thrown out in considerable quantity, usually accompanied by a small amount of serum. The process may be localized or general. It is more frequently general in the child than in the adult. The peritonæum lining the abdominal wall, as well as that covering the coils of intestine and the solid viscera, is covered by patches of yellowish-gray lymph, causing adhesions between the various viscera and often matting the intestines together. In recent cases these adhesions are soft, and easily broken down; in old cases they are quite firm, and they may result in the formation of connective-tissue bands which are the source of subsequent trouble.

In the serous form there is a moderate amount of lymph, generally less than in the plastic variety, and, in addition, an outpouring of serum in considerable quantity. This is usually clear, but may be turbid from flakes of lymph, or it may even be bloody. In most cases the amount is

not very large, usually varying from half a pint to two pints. In cases going on to recovery the serum is absorbed, but there may result adhesions as in the preceding variety.

In the purulent form the products are serum, lymph, and pus. When peritonitis results from perforation it is, as a rule, purulent from the outset, and the pus is foul and stinking. The amount of pus is generally larger than in adult cases. When the disease proves fatal in a few days there is found an extensive exudation of plastic lymph, with the formation of small pockets containing pus among the coils of intestine. Occasionally there may be larger collections of pus in the peritoneal cavity. In cases which have lasted a longer time—generally those of localized inflammation—the process results in the formation of a peritoneal abscess. This consists in a collection of pus in some part of the peritoneal cavity, the situation depending upon the cause, but it is usually in one iliac fossa or in the pelvis. The abscess is shut off from the rest of the peritoneal cavity by a thick wall of fibrin. If left alone, such abscesses may open into the rectum, vagina, bladder, pelvis of the kidney, or externally, usually at the umbilicus. After the discharge of pus the cavity may contract and fill up by granulations, and the patient recover.

Inflammations of the other serous membranes, especially the pleura, are often associated with peritonitis.

Symptoms.—The symptoms of acute peritonitis in older children, as in adults, are usually well marked and sufficiently characteristic to enable one to recognise the disease easily; but not so in the case of infants. In them the symptoms are often obscure, and the disease may be found at autopsy when not suspected during life. The onset is nearly always abrupt, with fever and vomiting. As a rule, the temperature is high—from 103° to 105° F. Vomiting may be only at the onset, but it often continues throughout the disease. Older children complain of pain, which may be localized or general; and in younger ones this is indicated by restlessness, crying, and fretfulness. The abdomen very soon becomes swollen and tympanitic, this being one of the most constant features of the disease. The distention is generally uniform, but it may be irregular. It is very rare in acute cases that there is a sufficient amount of fluid present to give the sensation of fluctuation. There are tenderness on pressure, and usually marked rigidity of the abdominal walls. The position assumed by the patient is generally dorsal, with the thighs flexed. The bowels are in most cases constipated, but diarrhœa is by no means rare. The abdominal distention causes dyspnœa and thoracic breathing. There may be retention of urine or frequent micturition.

The general symptoms almost from the beginning, are those of a serious disease. The pulse is small, rapid, and compressible. The prostration is great, from the very outset. The face is pinched, the mouth is drawn, and the features indicate pain. In bad cases there may be hic-

cough, cold extremities, clammy perspiration, and collapse. The mind is usually clear.

In the most severe forms of general peritonitis the course is short and intense, and the disease goes on rapidly from bad to worse until death occurs. In infants this is often on the second or third day. The most severe forms of general peritonitis in older children run the same rapid course. In other cases the course is slower, lasting a week or ten days. If the patient lives longer than this the case is more hopeful, because the process is more apt to be localized. The development of peritoneal abscess is indicated by the continuance of the temperature, which may assume a hectic type, and be accompanied by chills and sweating. There are the local signs of an abdominal tumour.

Prognosis.—Acute general peritonitis, whatever its cause, is a very serious disease in childhood. Of eighty cases of all varieties under sixteen years of age, sixty-nine per cent died. In the newly born and in infancy the disease is almost invariably fatal. In older children the outlook is not quite so hopeless, and depends upon the exciting cause. It is better in localized than in general inflammation; also in the fibrinous than in the purulent form; but the most favourable cases are those with a serofibrinous exudation.

Treatment.—The treatment of acute peritonitis in infants and young children is very unsatisfactory, since it is almost invariably fatal. In older children it is to be conducted along the same general lines as in adults. For a local application, cold is usually to be preferred if it is well borne. It may be applied either by an ice-bag or by Leiter's coil. Many children, however, rebel against cold applications, and for them heat must be substituted. The most satisfactory way of applying heat is by spongiopiline, which is wrung out of very hot water and applied over the whole abdomen. It may be sprinkled with spirits of turpentine if counter-irritation is desired, or a light poultice may be used. Feeding and stimulation are especially difficult on account of vomiting. The diet should be milk whenever this can be retained, which preferably should be peptonized. Kumyss may be tried when milk is rejected. Brandy with ice may be used as a stimulant, or, if this is vomited, champagne. No effort should be made to overcome the constipation except at the very outset, when a saline cathartic may possibly be admissible, but never at a later period. The treatment by opium is the only one upon which any dependence can be placed as influencing the disease. This is preferably given hypodermically, on account of the vomiting. The dose must be regulated by the condition of the patient. Enough should be administered to control pain and peristalsis. The amount required must be determined by the conditions in each case. An initial hypodermic dose of morphine for a child of five years should be from $\frac{1}{16}$ to $\frac{1}{24}$ grain. This will ordinarily need to be repeated every two or three hours. There is great tolerance of opium in

cases of peritonitis, but there is no advantage in pushing the drug further than is required to relieve the symptoms mentioned. There are comparatively few cases in children in which the question of operation arises during the acute stage, except in those depending upon appendicitis. The cases of acute perforative peritonitis are almost certain to die under any treatment. Surgical interference is always indicated in peritoneal abscesses which have passed the active stage. These should be opened and drained in accordance with general surgical principles. Aspiration is not to be depended upon, and should be used only as a means of diagnosis.

CHRONIC (NON-TUBERCULOUS) PERITONITIS.

Peritonitis may occur in fœtal life with the production of extensive adhesions, which may interfere with the development of the intestine and result in various malformations. These cases have been ascribed by Silbermann * to syphilis.

Chronic peritonitis may follow the acute form, in which there are left adhesions which slowly increase owing to the production of new connective tissue. Such cases are sometimes chronic from the beginning.

The peritoneal abscesses which follow the suppurative form may run a chronic course. Chronic localized peritonitis may occur in connection with disease of any of the organs covered by the peritonæum. This is most commonly with the spleen, liver, and kidney.

Chronic Peritonitis with Ascites.—In most cases this is chronic from the outset and independent of the above causes. By far the most frequent form of inflammation is that due to tuberculosis, and by some writers the opinion is still held that this form is always tuberculous. After the observations reported by Henoch, Vierordt, Fiedler, and others, there seems to be no longer any room for doubt regarding the existence of a chronic non-tuberculous form of peritonitis with ascites, although it must be considered a rare disease. In its pathological and clinical aspects it is to be compared to subacute or chronic pleurisy with effusion.

Etiology.—Nearly all the cases thus far reported have occurred in children over six years. The causes are for the most part obscure. The disease has been attributed to exposure, rheumatism, and injury. In a few instances it has followed measles. It may be associated with disease of the intestines or the solid viscera of the abdomen, especially with new growths of the kidney, liver, etc.

Lesions.—The post-mortem observations thus far have been few. In the reported cases there has been found a large amount of greenish serum in the general peritoneal cavity, with a very moderate amount of fibrin and adhesions, which are sometimes few and sometimes very numerous. Chronic pleurisy may be associated.

---

* Jahrbuch für Kinderh., Bd. xviii, 420.

Symptoms.—The early symptoms are of a very indefinite character, such as a decline in the general health, or dyspeptic symptoms; but often nothing whatever is noticed until the swelling of the abdomen begins. The enlargement comes on rather gradually in the course of a few weeks. Pain is slight, or wanting altogether. There may be some abdominal tenderness, but this is rarely marked. The bowels are irregular; sometimes there is diarrhœa and sometimes constipation. The abdomen is usually distended with fluid, the umbilicus protruding, and the superficial veins prominent. The enlargement is generally regular and symmetrical, and the wave of fluctuation is readily obtained. The general symptoms are very few. In some cases there is a slight evening rise of temperature of one or two degrees. There may be general weakness, loss of appetite, and moderate anæmia.

The usual course of the disease is for the fluid to remain for a time and then undergo slow absorption, the case going on to complete recovery. Occasionally relapses are seen. The results are not always so favourable, for in some instances there is no tendency to absorption of the fluid, the general health is gradually undermined, and the patients die from exhaustion or from some intercurrent disease. The diagnosis rests upon the presence of ascites, developing gradually without any signs or symptoms of disease in the heart, liver, or other organs. The points which distinguish it from tuberculous peritonitis are considered under that disease. In the cases which recover, the fact that no other signs of tuberculosis subsequently develop is an important point in diagnosis. The prognosis is in most cases favourable, but must be guarded on account of the difficulty in making a positive diagnosis from the tuberculous form. Recovery is usually complete and permanent.

Treatment.—It is important that the patient should be kept at rest, preferably confined to bed. The best results are usually obtained by the adoption of a general tonic plan of treatment. If absorption of the fluid does not begin with such means, saline diuretics should be given and the amount of fluid allowed the patient limited. When there is no tendency to absorption after a thorough trial of the above measures, and especially when the patient's general health begins to suffer, the fluid should be removed by aspiration. If it continues to accumulate after repeated aspirations, laparotomy may be performed, for in some cases this has the same beneficial effect as in tuberculous peritonitis.

TUBERCULOUS PERITONITIS.

The peritonæum is quite frequently the seat of tuberculous inflammation in early life; but not so often in infants as in older children. Of 56 collected cases, 7 were under three years of age, 26 from three to eight years, and 23 from eight to sixteen years. In 119 autopsies upon tuberculous patients, most of them under three years old, of which I have records,

the peritonæum was involved in 8·5 per cent. In 105 autopsies, for the most part upon older tuberculous children, Ashby found the peritonæum involved in 36 per cent. In 883 collected autopsies upon tuberculous children of all ages, Biedert * found the peritonæum involved in 18·3 per cent. These figures do not represent the number of cases of tuberculous peritonitis, as in many of them only a few miliary tubercles were present.

It is no doubt possible for peritonitis to occur as the primary lesion of tuberculosis, but in the great majority of cases it is secondary. It may, however, appear as the most important tuberculous lesion in the body. The peritonæum may be infected directly from the intestine, the mesenteric glands or the pleura, or from more distant parts, like the lungs, the bronchial glands, the cervical, or other external glands. In a small number of cases some local exciting cause is present, such as a fall or blow upon the abdomen. It may follow exposure, or occur as a sequel to one of the exanthemata.

Tuberculous peritonitis may be acute or chronic. It presents several varieties quite distinct from one another, both in their pathological and clinical features.

1. **Miliary Tuberculosis of the Peritonæum accompanying General Tuberculosis.**—The peritonæum may be involved as one of the lesions in acute or subacute general miliary tuberculosis. This is the most common form seen in infants. The lesions consist in a deposit of miliary tubercles, which are generally rather sparsely scattered over the peritonæum. The evidences of inflammation are very slight, or they may be absent altogether. These cases do not come under observation as cases of peritonitis, as there are no abdominal symptoms.

2. **Miliary Tuberculosis of the Peritonæum with Ascites.**—Although not the most common variety in children, these cases form an important group. The peritonæum is thickly sown with miliary tubercles, both discrete and in conglomerate masses. They are found in the omentum and the mesentery, upon the surface of the intestines and the solid viscera. The peritonæum shows in varying degrees the changes of acute or subacute inflammation. There is congestion, with the production of a moderate amount of fibrin and a large amount of serum. In the most acute cases the fluid is in the general peritoneal cavity. In those of longer duration it may be sacculated. The fluid is usually abundant, but not excessive. It is most commonly an olive-coloured serum, but it may be seropurulent, and even bloody. There are commonly other lesions of tuberculosis in the body, but they are less marked than those of the peritonæum.

These ascitic cases generally run an acute or subacute course, the usual duration being from four to eight weeks. Clinically they present the

* Jahrbuch für Kinderh., xxi, 178; see also Osler, Johns Hopkins Hospital Reports, vol. ii.

symptoms of a moderate grade of peritoneal inflammation with ascites. The onset is rather gradual, with indefinite general symptoms. There is usually some fever—100° to 101·5° F. There are general weakness, prostration, and loss of flesh, but not rapid emaciation. Vomiting is not prominent, and pain and tenderness are rarely very marked. There may be nothing distinctive until distention of the abdomen is seen. This at first is due to gas, but later to fluid, which may accumulate in sufficient quantity to fill the general peritoneal cavity. The bowels are constipated, or there may be diarrhœa.

The usual course, when untreated, is for the disease to go on to a fatal termination from exhaustion. Less frequently the fluid is absorbed, and the case becomes one of the fibrous type, with a tendency to relapses; rarely it is followed by the ulcerative form.

3. **The Fibrous Form.**—This, in its general characters, may be compared to the fibroid form of pulmonary tuberculosis. There is a tuberculous inflammation, the products of which have undergone transformation into fibrous tissue. This may in a certain sense be regarded as a method of cure. The essential feature of the lesion in these cases is the production of extensive organized adhesions between the intestinal coils, and between the intestines and the abdominal walls. The intestines may be compressed against the spine by bands. Ascites may be present, but it is frequently absent altogether. If there is fluid, it may be in the general peritoneal cavity, or it may be sacculated, and it may consist either of serum or of sero-pus. There is no tendency to caseation or breaking down.

Clinically these cases are distinguished by their slow, irregular course. They are the most chronic of all the forms. The disease may be chronic from the outset, or it may follow the variety previously mentioned. The onset is generally insidious; fever is slight, or entirely absent. There is rarely vomiting. The bowels may be constipated or loose. For a long time the general health may remain good. The only characteristic symptom is the enlargement of the abdomen. In the early part of the disease this is chiefly from the tympanites, but later it may depend wholly or in part upon an accumulation of fluid. Ascites usually develops very slowly, but may be abundant. The adhesions of the intestines may give rise to irregularities in the outline of the abdomen. Ascites may be present for a time and then disappear spontaneously, and the general health may so improve that the patient is considered quite well. There may even be a permanent cure. In other cases, after symptoms have been absent for some time, relapses occur, and more fluid is poured out. In addition to these symptoms, others are present depending upon the mechanical effects of pressure from the contracting adhesions. There may be more or less constriction of the intestine, pressure upon the vena cava, the renal or portal veins, the thoracic duct or its branches, or upon the

stomach. These may give rise to dyspeptic symptoms, emaciation, œdema of the lower extremities, and albuminuria.

In some cases the disease is entirely latent, and it is discovered at autopsy when there have been either no abdominal symptoms during life, or only colicky pains of an indefinite character. The course of this form is slow and irregular; it generally lasts for from three to twelve months, although with intermissions and exacerbations it may extend over several years. The fatal result may be due to an acute exacerbation, to exhaustion, or to the development of tuberculosis elsewhere.

4. **The Ulcerative Form.**—This is an inflammation associated with large tuberculous deposits which go on to caseation and softening. It may be compared to ulcerative phthisis. In point of chronicity it is midway between the two preceding varieties. It is one of the most frequent forms seen in children, and, while it may be localized, it is usually general.

There is commonly a very abundant fibrinous exudate, matting the coils of intestine together and causing them to adhere to the solid viscera and to the abdominal walls. In this exudate there are seen tuberculous deposits consisting of small, yellow nodules and larger caseous masses, often broken down at the centre. These caseous deposits are also found in the mesentery and in the omentum, which may be very greatly thickened. Pockets are formed by the adhesions which sometimes contain clear serum, but more frequently pus or a brownish fluid. The tuberculous deposits are found upon the peritoneal surface of the intestine, and infiltrate the intestinal walls, often leading to perforation, and sometimes to fistulous communication between adherent intestinal coils. There may also be tuberculous infiltration of the abdominal walls, accompanied by cellulitis, resulting in abscesses, which open externally, usually in the neighbourhood of the umbilicus.

The ulcerative form may succeed either the miliary or fibrous form, or the inflammation may be of this type from the outset. Tuberculous lesions are always found in the other organs, especially in the lungs, where they are usually advanced.

Clinically the ulcerative cases are characterized by well-marked constitutional symptoms, which are due partly to the peritonitis and partly to the general tuberculosis. Fever is regularly present, the temperature usually ranging from 99° to 103° F. Sometimes it assumes a distinctly hectic type. There are progressive emaciation, anæmia, prostration, and sweating. Diarrhœa is frequent and the intestinal discharges may at times be bloody. The abdomen is large, but not so much distended as in some of the other forms; the superficial veins are often prominent. It is rare that ascites can be made out by palpation, although fluid can usually be found by puncture. Areas of dulness and tympanitic resonance are irregularly distributed over the abdomen. Nodular masses from one to two inches in diameter may be felt on palpation. The epigastric and umbilical regions

may be occupied by a smooth, hard, and board-like tumour, which is the thickened omentum. There may be the signs of phlegmonous inflammation of the abdominal wall in the neighbourhood of the umbilicus, and even an abscess, which, after opening, may leave a fistulous communication with the peritonæum. There are signs of disease in the lungs, and the pulmonary symptoms may mask those of the abdomen. The course of the disease is steady and progressive, the usual duration being two or three months. Death results from the pulmonary disease, from tuberculous meningitis, from exhaustion, and occasionally it is due to accidents associated with perforation.

5. **Peritonitis associated with Tuberculosis of the Mesenteric Lymph Nodes.**—These nodes may be tuberculous in any of the preceding varieties. In certain cases this is the principal lesion, and it is accompanied by localized peritonitis, which results in the formation of a large, irregular, nodular mass lying close against the spine. It is usually associated with tubercular ulcers of the intestine. There may be no symptoms except those depending upon the pressure of the glandular masses upon the great vessels. This may lead to œdema or to thrombosis of the vena cava, and may give rise to an abdominal tumour. There may be diarrhœa due to the intestinal lesions.

Diagnosis of Tuberculous Peritonitis.—In children, chronic ascites with fever usually means tuberculous peritonitis. If the abdominal effusion is sacculated instead of diffuse, the probabilities of peritonitis are much increased. If there are added the physical signs and symptoms of disease of the lungs, the diagnosis is almost certain. Cirrhosis of the liver is much more chronic in its course, and is very rare previous to the ninth year, being almost unknown in infancy and early childhood. In it there is often a history of syphilis, and jaundice may be present. If ascites is absent, tuberculosis of the peritonæum may be suspected if there are irregular nodules or tumours in various parts of the abdomen, with tenderness, emaciation, moderate pain, and slight fever. Chronic abscess in the neighbourhood of the umbilicus is always suspicious. The ulcerative form is almost invariably accompanied by evidences of advanced disease in the lungs and other organs, and is easily recognised. The fibroid form may be suspected if, with tuberculosis of other organs, there are irregular colicky pains and abdominal tenderness. From the abdominal symptoms alone it can not be recognised unless there is ascites. In all doubtful cases an exploratory incision should be made.

Between tuberculous and non-tuberculous chronic peritonitis a diagnosis is at times impossible. If there is a good family history; if there are no signs of tuberculosis in the lungs or elsewhere; if abdominal tenderness is slight or absent; if there are no nodular tumours; if fever and marked emaciation are wanting; and if the amount of fluid is excessive, the probabilities are in favour of a simple inflammation. There are, however,

some cases in which the diagnosis can be made only by an exploratory incision, and sometimes not even then without an examination of the fibrous nodules by the microscope or by inoculation. In doubtful cases the chances are always in favour of tuberculous inflammation on account of its greater frequency.

Prognosis.—This depends most of all upon the form of the disease. Cases of the ulcerative type are absolutely hopeless. In the ascitic and fibrous forms the prognosis is quite good, especially since the general adoption of laparotomy as a means of treatment. Life is prolonged in nearly all cases by the operation, and a considerable number are permanently cured. Exactly in what proportion a permanent cure results, it is at present impossible to say, for most of the reported cases were not under observation long enough to make it certain that relapses did not occur.

Treatment.—The general treatment of tuberculous peritonitis is the same as that of tuberculosis in other parts of the body. In the acute cases the local symptoms are to be relieved by the same means as in other forms of acute peritonitis. The only local treatment which can be considered in any way curative is surgical. Nothing is to be said in favour of aspiration except for purposes of diagnosis. The results of laparotomy are so satisfactory that the question of operation should be considered in every case. The most favourable cases for operation are those of the ascitic variety. Aldibert,* in his monograph, gives the indications and contra-indications for operation as follows: Laparotomy is indicated in all forms accompanied by ascites, although in acute cases it may be only palliative; in suppurative forms which are diffuse, or with a unilocular cyst; in all cases of intestinal obstruction in the course of tuberculous peritonitis; and in all cases of doubtful diagnosis. Operation is contra-indicated in the fibrous form not attended by pain, this usually tending to spontaneous recovery; in the dry ulcerative form, except at the outset; in the suppurative form with multilocular cysts. The existence of other foci of tuberculosis does not contra-indicate operation except when these are chiefly intestinal, or when there is general tuberculosis with extensive and rapidly progressing lesions.

Aldibert has collected statistics of fifty-two operations for tuberculous peritonitis in children, with seven deaths and forty-five recoveries. Nine patients were reported well one year after operation. It is possible that among these cases some of simple inflammation have been included; of eighteen cases, however, in which the diagnosis of tuberculosis was established by the microscope or inoculation experiments, all recovered, and six were well one year after operation. Why it is that the operation of opening the abdomen and draining or washing out the peritoneal cavity should have such an influence in arresting the disease, has not yet

* De la Laparotomie dans la Péritonite Tuberculeuse chez l'Enfant, Paris, 1892.

been satisfactorily explained. For the surgical aspect of the treatment the reader should consult works upon surgery.

ASCITES.

Ascites consists in an accumulation of fluid, usually clear serum, in the general peritoneal cavity. It is a symptom of the various forms of peritonitis, especially the chronic varieties described in the preceding pages. It may be due also to portal obstruction from cirrhosis of the liver, or pressure upon the portal vein by peritoneal adhesions or large lymphatic glands. It is occasionally seen in all forms of abdominal tumours. Ascites may occur in general dropsy from cardiac disease, chronic pleurisy, or interstitial pneumonia, and from any condition causing pressure upon the vena cava. It is also seen in the general dropsy of renal disease. A moderate amount of ascites is often met with in extreme anæmia or leucæmia.

Small accumulations of fluid in the peritoneal cavity are difficult of detection. Large amounts are generally easily made out. There is a uniform smooth distention of the abdomen and dilatation of the superficial veins, especially about the umbilicus. On palpation, the wave of fluctuation can be obtained by placing one hand against the abdomen upon one side and giving the opposite side a sharp tap. A similar wave may be felt when there is tympanitic distention. The two are, however, readily distinguished by having an assistant make pressure with the edge of the hand along the linea alba while the test is being made; this obstructs the wave transmitted through the abdominal wall, but does not affect that through the fluid. On percussion in the sitting posture, there are dulness below and resonance above. When the patient is recumbent, there are resonance in the median line and dulness or flatness in the lateral portion of the abdomen.

The prognosis and treatment of ascites will depend upon its cause.

Chylous Ascites.—This term is applied to certain cases in which the abdominal fluid contains fat. The colour may be milky-white or light brown, and the fluid, after standing, may have at its surface a thick, creamy layer. The amount of fat present has been as high as five per cent. This condition is rare in childhood. In 1884, Letulle* could find but seven cases on record. The exact pathology is as yet not well understood. In the cases which have thus far come to autopsy there has usually been found chronic peritonitis, sometimes simple, sometimes tuberculous. The lymph vessels in some of the cases have been empty, and often no obstruction of the lymph circulation could be discovered. The fat is believed by some to be derived from fatty degeneration of the products of chronic inflammation, but this seems hardly sufficient to explain the large

* Revue de Médecine, 1884, No. 9.

amount of fat sometimes found. In some of the cases it has been due to a wound of the thoracic duct. The amount of fluid is frequently very large. The prognosis is usually bad, although Pounds has reported (British Medical Journal, 1892) a case in a girl of ten years, where recovery followed laparotomy. Tuberculous peritonitis was present.

SUBPHRENIC ABSCESS.

In the group of cases of localized peritonitis or peritoneal abscess must be included subphrenic abscess. This is a rare condition in childhood, and consists in an accumulation of pus just beneath the diaphragm and above the liver. Its cause may be either in the thorax or in the abdomen. It may complicate acute pneumonia, usually of the right lower lobe, by a direct extension of infection through the lymph channels. Sometimes it has been associated with phthisical cavities. In the abdomen it may be associated with disease of the liver. The accumulation of pus is sometimes very great, so that the diaphragm is crowded high into the thorax.

The symptoms and physical signs closely resemble those of empyema, and most of the cases have been operated upon with the belief that the surgeon was dealing with empyema. Meltzer* has reported a case in a child of two years which followed pneumonia of the right base. At the operation only a few drops of pus were found in the pleural cavity; but there was discovered a pinhole opening in the diaphragm, from which the pus had escaped from a large subphrenic abscess. This was evacuated, and the patient recovered perfectly. Subphrenic abscesses may contain air; they are then likely to be mistaken for pneumothorax. These abscesses require incision and drainage like other forms of peritoneal abscess.

---

* New York Medical Journal, June 24, 1893. In this article will be found references to the recent literature.

SECTION IV.

DISEASES OF THE RESPIRATORY SYSTEM.

CHAPTER I.

NASAL CAVITIES.

ACUTE NASAL CATARRH—CORYZA.

Although the symptoms of this disease are nasal, the principal seat of the pathological process is the rhino-pharynx.

Etiology.—Certain children are predisposed to attacks of acute nasal catarrh. This predisposition, as it sometimes extends to entire families, may be inherited; but more frequently it is acquired, and usually by the following mode of life: It is seen in children who get very little fresh air, because they are kept indoors unless the weather is perfect; who live in houses always overheated; whose sleeping rooms are kept carefully closed at night for fear they may take cold; who are for the same reason so overloaded with clothing that they can not engage in any active play without being thrown into a profuse perspiration. This condition after a time results in a great sensitiveness of all the mucous membranes, but especially those of the nose and pharynx. A small adenoid growth is very often present. Infants under three months old, and those who are rachitic, are frequent sufferers from acute nasal catarrh. It may be seen as a complication of dentition. Attacks are often brought on by insufficient covering for the head, by wetting the feet, by cold and exposure, especially to the raw winds of spring, accompanied by the dampness which occurs with melting snow. In susceptible children the exciting cause is often a very trivial one. A draught of cold air for a few minutes may be sufficient to excite sneezing and a nasal discharge. Atmospheric conditions are probably not the only cause of acute nasal catarrh. Micro-organisms certainly play an important part, particularly in the purulent variety. Although pyogenic germs are always present in the nose, they do not excite an attack of acute catarrh without the vascular changes which are produced by other causes. Acute catarrh may be sporadic or epidemic; it is probably contagious, being communicated by children using the same handkerchief or occupying the same bed.

Acute nasal catarrh may be a symptom of measles, nasal diphtheria, or influenza, and it may accompany erysipelas of the face.

Symptoms.—The changes in the mucous membrane of the nose are not great, and are usually secondary to those of the rhino-pharynx, being in a large measure due to the discharge. There are redness and slight swelling. The nasal passages may be for the time quite occluded by the discharge, which is usually profuse, at first sero-mucous, and finally, if the attack is severe, muco-purulent. The symptoms may be very transient, sometimes passing away in a few hours, in which cases there is only a vaso-motor disturbance; or they may continue and develop into a true inflammation. The discharge excoriates the nostrils and the upper lip. At the onset there is usually sneezing, and in infants often a slight fever. In older children there is no rise of temperature except in the most severe cases. The obstruction to nasal respiration causes mouth-breathing, and the dryness and discomfort which result from it produce disturbed sleep, snuffling and difficulty in nursing, this being in severe cases almost impossible. The inflammation may extend to the lachrymal duct, involving the eyes in a mild conjunctivitis. There may be closure of the Eustachian tubes, causing deafness and otalgia. There may also be secondary otitis. The process often extends to the larynx and bronchi, with hoarseness and cough.

In infants, severe cases may be followed by inflammation of the lymph glands of the neck or of the retro-pharyngeal region; in either it may terminate in abscess. Less frequently these catarrhal colds are accompanied by disturbances of the digestive tract, and there is vomiting, or diarrhœa with large mucous stools.

Attacks of acute nasal catarrh are stated by some writers to cause death in young infants by interfering with respiration. I have never seen dangerous symptoms, and believe them to be exceedingly rare, if, indeed, they ever occur as a result of a simple coryza. In the mild form the attack lasts from two to three days; in the severe form from one to two weeks. Repeated attacks are frequently followed by the development of the chronic form of the disease.

Diagnosis.—It is important to distinguish between a simple acute catarrh and one due to measles, influenza, nasal diphtheria, or hereditary syphilis. Measles and influenza cause more fever and general constitutional disturbance than does simple catarrh. Nasal diphtheria is characterized by the appearance of membrane in the anterior nares and by patches upon the tonsils. These may be wanting, however, and there may be only a very profuse discharge tinged with blood. When persisting for two or three weeks this is always to be regarded with suspicion, even though the constitutional symptoms may be very slight. The only positive means of excluding diphtheria is by cultures. A persistent acute nasal catarrh in a young infant should always suggest syphilis, and the patient should be carefully watched for the development of other symptoms.

Treatment.—A child suffering from acute coryza should always be kept indoors in a room with an even temperature of about 70° F., the bowels

freely opened, and the amount of food somewhat reduced. The only drug which seems to have much influence upon the secretion is belladonna. This may be given in the form of atropine, gr. $\frac{1}{800}$ every hour to a child of six months. For older children a good combination is that known as the "rhinitis" tablet (camphor gr. $\frac{1}{4}$, quinine gr. $\frac{1}{4}$, fluid extract of belladonna ♏ $\frac{1}{2}$); one half a tablet may be given every hour to a child of five years.

Locally, either plain sweet oil or albolene may be applied by means of a medicine dropper, a brush, or a spray (page 55), an alkaline spray (page 56) having been first used to clear away the secretion. If the nasal obstruction causes great interference with nursing, a two-per-cent solution of cocaine may be applied with a brush, or with a probe and cotton, or dropped into the nostril just before each nursing. This is not to be advised unless the symptoms are severe, as infants are quite susceptible to cocaine. In all cases the upper lip and nostrils should be protected by vaseline or some simple ointment. Under no circumstances should irritating or astringent injections be given. In older children inhalations of spirits of camphor or fumes of carbolic acid may be used with advantage.

Prophylaxis consists in solving the perplexing question, so often put to the physician, of how to prevent children from "taking cold." This is a matter of the utmost importance, and follows what has been previously said under the head of Etiology. No amount of cod-liver oil and iron will remove this tendency to catarrh so long as bad hygienic conditions continue. Sleeping rooms should be large and well ventilated, and a window should be kept open at night, except in very severe weather or during acute attacks. The temperature of the house during the day should be from 68° to 70° F., but never above this. Children should be accustomed to go out of doors unless the weather is especially bad. So firmly rooted in the minds of the laity is the idea that acute catarrhs come from cold, that the habit of coddling delicate children is always likely to be carried to an extreme.

With every delicate and "catarrhal" child one should begin in the summer by having him live in the open air as much as possible, sleeping in a room with free ventilation, with moderate covering, and continuing the same practice into the fall and early winter. If begun gradually in this way there is little difficulty in continuing throughout the winter.

The next point to be insisted on is cold sponging immediately upon rising in the morning, especially about the chest, throat, and spine (page 55). The use of chest protectors, cotton pads, and extremely thick clothing should be prohibited. Flannel underclothing should be worn upon the chest throughout the year, and upon the legs also in winter; the very lightest in summer, and only a medium weight in winter.

Frequently repeated attacks point to the presence of adenoid vegetations in the pharynx, and no measures are of much avail until these are removed.

CHRONIC NASAL CATARRH.

This term is rather loosely used to designate a chronic nasal discharge. Such a discharge is frequent both in infancy and childhood. It is a condition much neglected by the general practitioner. Patients are too often subjected to routine constitutional treatment by cod-liver oil and preparations of iodine, with the idea that such cases are "scrofulous," while local treatment is either neglected altogether, or consists only of the use of the nasal douche or syringing with a saline solution. Sometimes, when suggested by parents, local treatment is opposed by the physician in the case of young children, and a great amount of harm follows. Permanent damage to the organs of hearing, smell, speech, and respiration may result from neglecting or ignoring chronic nasal catarrh in childhood.

Chronic nasal catarrh is not to be regarded as a disease, but only as a symptom which may be due to any one of a variety of pathological conditions, each of which requires very different treatment—viz., adenoid growths of the pharynx, foreign bodies in the nose, polypi, deviation of the septum or any other congenital deformity of the nasal passages, the various forms of chronic rhinitis, and syphilis, which causes a form of rhinitis peculiar to itself.

Adenoid Growths of the Pharynx.—These are more fully discussed elsewhere (page 263). They are by far the most frequent cause of chronic nasal discharge in infants and young children, and should be the first cause suspected. Every general practitioner may easily familiarize himself with the method of digital exploration of the rhino-pharynx, by which means these growths can in most cases be easily recognised. The nasal discharge accompanying adenoid growths is due to a chronic rhinopharyngitis. Treatment is without avail unless the growths are removed. After this is done the nasal discharge usually disappears quite promptly.

Foreign Bodies in the Nose.—This condition should be suspected whenever there is an abundant muco-purulent discharge limited to one nostril. Foreign bodies in the nose are quite frequent in young children. Peas, beans, beads, or shoe buttons are most frequently lodged there. The efforts at removal on the part of the child, or even of the mother, generally result in pushing the body farther into the nose. It first sets up a mechanical irritation, accompanied by pain, swelling, sneezing, and sometimes hæmorrhage. This is followed by a catarrhal inflammation, which in the course of a few days becomes purulent, and may last indefinitely. The discharge is generally quite abundant. The symptoms point to an obstruction of one nostril, and an examination with the probe readily detects the presence of the foreign body.

In recent cases the removal of the foreign body may sometimes be accomplished by compressing the empty nostril and having the child blow his nose strongly. Often the sneezing which the body excites is sufficient

to remove it. Before any attempt is made to seize the body with forceps cocaine should be used, not only for the purpose of preventing pain, but in order to shrink the mucous membrane so as to allow better manipulation. In many cases chloroform is necessary. In most circumstances ordinary foreign bodies can with proper forceps be extracted without difficulty. No subsequent treatment is required, except to keep the nose clean for a few days, as the inflammation quickly subsides after the removal of the cause.

Nasal Polypi.—These are among the infrequent causes of chronic nasal discharge in childhood. They are especially rare before the seventh year, but both mucous and fibrous polypi are seen. The symptoms are those of a chronic nasal catarrh with partial or complete obstruction of one or both sides. Polypi increase in size with the occurrence of every acute coryza, and are always especially troublesome in damp weather. They may be accompanied by reflex symptoms, such as cough, sneezing, and even by attacks of asthma. There may be headache, and sometimes disturbances of smell, taste, and hearing. The symptoms are of much longer duration than in the case of obstruction from a foreign body, the discharge is not so abundant, and is not purulent. The diagnosis is made only by examining the nose with the mirror and nasal speculum.

Polypi may be removed with the forceps, but this is best accomplished by the use of the wire snare. When they have been present for a long time the accompanying chronic rhinitis may require subsequent treatment.

Deviation of the nasal septum, and other congenital deformities which cause narrowing of the nasal respiratory tract, are conditions which belong to the specialist.

CHRONIC RHINITIS.

Three forms of chronic rhinitis are recognised—simple, hypertrophic, and atrophic.

Simple Chronic Rhinitis.—Simple chronic rhinitis, existing alone is of very doubtful occurrence in young children. In the cases so classed the symptoms are due to rhino-pharyngitis, which almost invariably depends upon an adenoid growth.

The growth may be a small one, so that the symptoms of obstruction are slight or absent. A frequent complication is chronic enlargement of the cervical lymph glands.

The only constant symptom is an excessive nasal discharge, which is usually mucous, but which may be muco-purulent. It is easily removed by blowing the nose, if the child is old enough to be taught to do this. Children too young to clear the nose in this way, suffer from almost constant discomfort. The amount of discharge depends upon the severity of the case. It frequently causes irritation of the upper lip, which may be

the seat of eczema or impetigo, especially in infants. The lip may be swollen and prominent. The condition of the external parts is aggravated by the constant disposition to pick the nose, which may be overcome by the application of a short anterior splint to each elbow. This condition is often the cause of epistaxis. The duration is indefinite; it may last for months or even for years, the symptoms in summer being insignificant, but returning every cold season. It may terminate in recovery, or in children with flabby tissues and delicate constitution, it may be followed in later childhood by hypertrophic rhinitis.

Treatment.—Prophylaxis is very important. The main purpose should be to prevent attacks of acute nasal catarrh by the measures mentioned in the discussion of that disease. The general treatment should not be routine, but directed according to the indications of each case. There should be careful attention to diet and to the condition of the bowels. Iron and arsenic are needed when there is anæmia. A general tonic treatment is required in most cases. Cod-liver oil and the syrup of the iodide of iron are both useful, but are not specifics, and must be intelligently combined with other measures.

Local treatment consists first in cleanliness, and, secondly, in the use of astringents in the form of powder or solution. For cleansing, a solution which is both alkaline and antiseptic is desirable. This may be used in the form of a spray, after which the nose is cleared by blowing; or in infants, if the discharge is abundant, the only efficient method of getting rid of it is by nasal syringing. This is attended by some risk of forcing materials into the middle ear; but if carefully done, the danger seems to me to be less than that of allowing the discharge to remain. Syringing should always be done with the mouth open and the head inclined forward. All solutions are to be made with sterilized water and used warm. But little force should be employed, and it may be well to have a syringe the nozzle of which does not completely fill the nostril. Either Dobell's or Seiler's solution (page 56) may be employed, diluted with an equal amount of water. As a spray the following may be used:

℞ Listerine *..... ʒ ss.
Sodii bicarb.,
Sodii biborat..... āā ʒ ss.
Aquæ ..... ʒ iv.

If this is to be used with a syringe, twice as much water should be added. Ordinarily, the nose must be cleansed thoroughly twice a day, more frequently in very severe cases. Once a day, after the nose has been cleansed, an astringent solution or powder should be applied. One of the best solu-

* Listerine is a combination containing the essential oils of thyme, eucalyptus, baptisia, gaultheria, and mentha arvensis.

tions is sulpho-carbolate of zinc (gr. v to water ℥ j). This may be used as a spray, or, better, dropped into the nostril with a medicine dropper, the head being held far back. A good powder is a combination of salicylic acid gr. iij, tannic acid, gr. xxx, and stearate of zinc ℥ j, which may be used with an insufflator once daily.

Hypertrophic Rhinitis.—This is a chronic inflammation of the nasal mucous membrane, accompanied by a marked hypertrophy of all its normal structures, particularly its blood-vessels. The parts chiefly affected are those covering the inferior turbinated bones. The mucous membrane and submucous tissue are so thickened and relaxed that they may greatly encroach upon the nasal respiratory space, and when these venous sinuses are filled with blood, may entirely occlude the passage. There is usually associated with this condition some degree of hypertrophy of the adenoid tissue at the pharyngeal vault.

In young children hypertrophic rhinitis is a very infrequent disease, if, indeed, it ever occurs. It is fairly common in moderate degree in older children, although its severe forms are rare. It usually follows, repeated attacks of acute nasal catarrh in children who have the diathesis "lymphatism." A frequent local cause is a deflected nasal septum.

The *symptoms* are those of nasal catarrh with bilateral nasal stenosis. The discharge is usually abundant, thick, and tenacious, being increased by dust and dampness. All the symptoms of nasal obstruction are present in varying intensity—the "wooden" voice, mouth-breathing, disturbed sleep, etc. There may be reflex cough, catarrh of the larynx or bronchi, accompanied by muscular or vaso-motor spasm, giving rise to spasmodic croup or asthma. Rhinoscopic examination shows the large pendulous masses of mucous membrane, usually red and irregular, more or less completely blocking the nasal passage. It is only by this examination that the disease is differentiated from adenoids of the pharynx, with which, however, it is frequently associated. In infants and young children the adenoid growth is much the more frequent, and throughout childhood generally the more important factor in producing these symptoms.

The *treatment* of these cases falls largely to the specialist, although very much can be done by the general practitioner if he will learn to use intelligently a few remedial agents. Constitutional treatment is indicated as in simple rhinitis, but if employed alone it accomplishes little or nothing. The purpose of local treatment is the reduction of the hypertrophied tissue by cauterization under cocaine anæsthesia, by glacial-acetic or chromic acid, or by the galvano-cautery. Each has its advantages and its advocates. If the hypertrophied tissue forms pendulous tumours, it may be removed by the wire snare. Both nostrils should not be operated upon at the same time. In most cases cauterization must be repeated several times at intervals of a few weeks. In the meantime one of the cleansing solutions mentioned on page 56 may be employed.

The following formula of Lefferts is an excellent one for a spray to be used in this condition :

℞ Iodi..... gr. iv
Potass. iodidi..... gr. x
Zinci iodidi,
Zinci sulpho-carbolat..... āā gr. xx
Listerine..... ʒ j
Aquæ..... ʒ iv
To be used as a spray once daily.

Atrophic Rhinitis (*Fetid Catarrh*).—This is unknown in young children, and only occasionally seen in those over twelve years old. It is characterized by the formation of crusts in the nose, which decompose and produce the horribly fetid odour. By some writers the term *ozæna* is applied to this disease, but usually this term is limited to rhinitis associated with disease of the bones. Atrophic rhinitis has been regarded by some as the late stage of the hypertrophic form. This view, however, is strongly combatted by Bosworth, who considers it the result of a purulent form of acute rhinitis. The changes consist in an atrophy of the mucous membrane and the destruction of many of the secreting glands. The nasal fossæ are large and roomy. The voice is not affected, but the sense of smell may be much impaired. There are no symptoms of obstruction. The discharge is scanty, and tends to accumulate between the bones, forming large crusts, which are expelled with difficulty by blowing the nose.

In the severe cases the *treatment* is only palliative, yet this is of the utmost importance for the comfort of the patient and those about him. The object of treatment is to prevent as much as possible the formation of crusts by the frequent use of an oil spray, such as albolene, in order to coat the dry mucous membrane. For the removal of crusts they must first be macerated by a prolonged nasal douche as hot as can be borne. This should be thoroughly used morning and evening as a part of the patient's toilet. In employing the douche, a bag containing from one to two pints should be suspended a few inches above the patient's head. One of the alkaline and antiseptic fluids mentioned on page 56 may be added to the douche. The head should be slightly inclined forward and the mouth kept open during the douche. The mechanical removal of the crusts may be necessary if they are large, hard, and impacted. Benefit may be derived in some cases from the daily use of a stimulating spray containing ten grains of menthol to one ounce of albolene. One of the very best deodorizers for general use is listerine, which, diluted with two or three parts of water, may be employed as a spray several times a day, in addition to the other measures mentioned.

Syphilitic Rhinitis.—Rhinitis is seen both in early and late hereditary syphilis. Coryza, or snuffles, is one of its earliest and most constant

symptoms. It usually begins between the third and sixth weeks of life, rarely after the third month. The pathological condition is a subacute catarrhal rhinitis, sometimes with the formation of superficial ulcers or mucous patches. The disease is attended by a profuse discharge of sero-mucus or muco-pus, occasionally tinged with blood. It may continue from a few weeks to two or three months. It usually requires only constitutional treatment, and protection of the nostrils and lips by the use of the ointment of the yellow oxide of mercury diluted with four parts of vaseline. This may be introduced with the finger or brush for some distance into the nostrils. When the discharge is very abundant, any one of the cleansing solutions previously mentioned may be used as a spray.

The rhinitis of late hereditary syphilis is a very different pathological condition. There are here gummatous deposits which break down, and form ulcers of the mucous membrane and deeper tissues. There is also periostitis, with extension of the disease to the cartilages and bones of the nasal fossæ, particularly of the septum. There may be perforation of the triangular cartilage, necrosis of the vomer or nasal bones, perforation of the hard or soft palate, and at times extensive ulceration of the alæ nasi and the face. This may be followed by cicatrization, causing stenosis of the nostril. These lesions in the nose are generally accompanied by deep ulceration of the pharynx and soft palate. They usually occur in children who have presented the early symptoms of hereditary syphilis, but are occasionally seen when no such history can be obtained. Such was the case in a patient recently under observation in the Babies' Hospital, who had perforation of the nasal septum and of the floor of the nasal fossæ, causing a free communication with the mouth. These are cases of true ozæna. The odour from the discharge is at times almost intolerable. When neglected, these cases go on from bad to worse, and may continue for years, producing unsightly deformities.

The *treatment* is, to bring the patient fully under the influence of mercury, first by means of the mercurial ointment or by small doses of calomel—i. e., one tenth grain four or five times a day. Later the biniodide or the bichloride should be substituted, and iodide of potassium given in doses of ten to twenty grains three times a day. Tonics are needed in most cases, as the general health is frequently undermined and the patients are usually anæmic.

Locally there may be used a spray of one of the cleansing solutions already mentioned, or black wash, or a solution of bichloride, 1 to 10,000. For purposes of deodorization, listerine is one of the best remedies. Although improvement may take place quite promptly, the results of treatment are often unsatisfactory, as the disease has usually progressed so far before treatment is begun that some deformity of the nose results, usually a sinking in of the bridge and flattening of the alæ, giving rise to the so-called "saddle-back" deformity.

MEMBRANOUS RHINITIS.

The results of bacteriological examinations have shown that these cases, whose etiology was formerly the subject of considerable controversy, are nearly always due to the Loeffler bacillus, and hence are to be regarded as true nasal diphtheria. It has been difficult, from clinical features alone, to establish this relationship, as the disease differs in several important particulars from diphtheria of the pharynx and rhino-pharynx—viz., its prolonged course, the absence of glandular enlargements, and the presence of very mild constitutional symptoms, which are sometimes altogether wanting. These peculiarities are due to the very slight absorption which takes place from the nose, which is in striking contrast with that from the rhino-pharynx. The importance of recognising such cases as true diphtheria can not be overestimated, as they have often been the means of spreading infection in schools and institutions before their true nature was determined. The possibility of membranous inflammation of the nose arising from other micro-organisms than the Loeffler bacillus is not to be denied, but such cases are extremely rare.

The most striking clinical feature of primary nasal diphtheria is a nasal discharge of serum or sero-mucus, frequently streaked with blood. It is sometimes very abundant, at other times slight. There are also the symptoms of moderate nasal obstruction. The false membrane can in most cases be seen in the anterior nares as a gray or whitish exudation. It may cover the whole inner surface of the nose. It often remains for two or three weeks, when it may loosen and come away *en masse*, sometimes forming an entire cast of the nose. After forcible removal it may reform. The disease in very many cases remains limited to the nose, but it may at any time extend to the rhino-pharynx or to the larynx. When such an extension takes place it is accompanied by an increase in the constitutional symptoms, glandular swellings, etc. A positive diagnosis can be made only by means of cultures.

In addition to the general treatment for diphtheria, the nose in these cases should be syringed frequently with a warm saturated solution of boric acid, or bichloride 1 to 10,000, with 5 per cent of glycerin. Such cases must be isolated, like ordinary cases of diphtheria.

EPISTAXIS.

The hæmorrhage may come from any part of the nasal fossa, but it is generally from the anterior nares, and most frequently from the vessels of the septum. Epistaxis is a rare symptom in the hæmorrhages of the newly born, and when present indicates syphilis. It is infrequent throughout infancy, but in childhood it is quite common, occurring in boys more frequently than in girls. In the latter it is especially common

about the time of puberty. Children who are kept much indoors in overheated apartments, and who have susceptible mucous membranes and flabby tissues, are particularly prone to it. The exciting cause may be a local one, like a fall or blow; it may be due to picking the nose, or to any kind of mechanical irritation; it may be associated with nasal catarrh; and it is often caused by an erosion upon the septum. An attack of bleeding may be brought on by mental or physical excitement. It occurs as an occasional, often an early symptom, in typhoid or malarial fever, in measles, or during severe paroxysms of pertussis. It is seen in the hæmorrhagic form of all the eruptive fevers, in certain cases of diphtheria, most commonly late in the disease, in hæmophilia and scorbutus, in grave anæmia, leucæmia, and in diseases of the heart and blood-vessels.

Symptoms.—Epistaxis is frequently preceded by a sense of fulness or pain in the head, which is relieved by the bleeding. The blood is usually from one nostril, and comes slowly by drops. The amount lost is generally small, but it may be large enough, when repeated, to produce a serious grade of anæmia even in strong children, and it has been the cause of death. Epistaxis may be overlooked if the blood finds its way into the pharynx and is swallowed. In most of the cases the hæmorrhage ceases spontaneously in from ten to twenty minutes, recurring at longer or shorter intervals, according to the nature of the cause. Hæmorrhage from adenoid growths of the pharynx may closely resemble that from the nose, but otherwise there can rarely be any difficulty in recognising epistaxis. In doubtful cases an inspection of the pharynx reveals the presence of blood-clots.

Prognosis.—This depends upon the cause. In the great majority of the so-called idiopathic cases it is not serious. Occurring early in the course of the infectious diseases it does not ordinarily affect the prognosis unless it is very severe. When it occurs late, however, it is always a bad sign, and particularly so in diphtheria. It may be serious in any of the hæmorrhagic diseases or in diseases of the blood, where it is not infrequently a cause of death.

Treatment.—To remove the predisposition, a child should receive general tonic treatment, especially plenty of outdoor exercise, and every means should be taken, by the use of cold baths, friction, and proper food, to tone up the vascular system.

An efficient means of arresting the hæmorrhage is compression of the nose between the thumb and finger. This may be combined with the application of ice over the root of the nose, and sometimes small pieces of ice may be introduced into the nostrils. The application of cold to the back of the neck or its use in the mouth may be of service by exciting reflex contraction of the capillary vessels. All tight clothing or bands about the neck should be loosened, and the patient kept quiet in the sitting posture. After the hæmorrhage has ceased the child should not blow

his nose for some time. The use of the compound tincture of benzoin or lemon juice, diluted, or a weak astringent solution, like alum or tannic acid, will sometimes arrest hæmorrhage which does not yield to cold or pressure. The insufflation of astringent powders often increases the hæmorrhage because of the sneezing excited. If bleeding continues in spite of all the above measures, the anterior nares should be plugged with styptic cotton, and if this does not control it, the posterior nares should be plugged. Usually very little effect is seen from drugs given internally, although in frequently recurring hæmorrhages where no local cause can be discovered ergot should be given a trial in full doses.

In severe cases of nasal hæmorrhage recurring at short intervals without any apparent cause, ulcer of the septum should be suspected, and, if present, should be touched with chromic acid.

CHAPTER II.

DISEASES OF THE LARYNX.

THE characteristic feature of laryngeal disease in infants and young children is the association of muscular spasm with all forms of the inflammation. Often it is the laryngeal spasm, rather than the inflammation, which gives rise to the principal symptoms. This spasm is only one expression of the great reflex irritability of young children.

CATARRHAL SPASM OF THE LARYNX.

Synonyms: Spasmodic laryngitis, spasmodic croup, catarrhal croup (sometimes improperly called laryngismus stridulus).

The term *catarrhal spasm*, first suggested, I think, by Goodhart, is fairly descriptive of this disease, which is characterized by a very mild degree of catarrhal inflammation associated with marked laryngeal spasm.

Etiology.—It is not often seen during the first six months, but is frequent from this time up to the third year. After five years it is rare. It occurs in children who are well nourished, as well as in those who are cachectic. Certain children have a predisposition to such attacks; those who have had one attack are likely to have others. Heredity seems to have some influence in producing this susceptibility. Catarrhal spasm of the larynx is frequently associated with enlarged tonsils and adenoids of the pharynx, sometimes with elongated uvula. The exciting cause may be exposure to cold, an attack of indigestion, or constipation.

Lesions.—The catarrhal inflammation of the larynx affects chiefly the parts above the cords; there is congestion and dryness, and later increased secretion of mucus. To this there is added a spasm of the muscles of the

larynx, especially the adductors. There is no submucous infiltration, and no tendency to œdema glottidis.

Symptoms.—The attack may be preceded for several hours by slight hoarseness, or by a nasal discharge. During the day the child may have appeared perfectly well. Usually there is heard during the evening a hollow, barking cough, at first infrequent and not severe. About midnight this is apt to increase in severity, and there is now difficulty in breathing. As soon as this becomes marked the child wakes, and presents the characteristic symptoms of an attack. In the mildest cases the dyspnœa is not sufficient to waken the child. In severe cases there is marked dyspnœa, especially on inspiration, and a loud stridor as the air is drawn through the narrowed opening of the glottis. This may often be heard even in an adjoining room. There is seen on inspiration deep recession of the suprasternal fossa, the supraclavicular spaces, and the epigastrium; also depression of the intercostal spaces, and even of the walls of the chest. The terror of the child or any excitement increases the spasm and aggravates the dyspnœa. The distress is very great; the breathing usually slow and laboured; the voice hoarse, but rarely lost; the cough stridulous, hoarse, and metallic; the pulse rapid; the temperature normal or slightly elevated, rarely over 101° F. The child sits up and struggles for breath, its forehead covered with perspiration. There may be slight lividity of the finger-tips and of the lips, and sometimes considerable prostration. In the course of three or four hours the attack slowly wears away and the child falls asleep. During the following day, aside from slight hoarseness and occasional cough, the child is apparently well. Most of the cases are not so severe as this; there are the croupy cough, hoarseness, and general discomfort, but not marked dyspnœa. On the second night there is a repetition of the experience of the first, usually quite as severe unless affected by treatment; and on the third day a remission similar to that of the day previous. On the third night the attack, if it occurs at all, is generally a mild one. Slight hoarseness persists for several days, but otherwise the child is apparently well. Many children have such attacks every few weeks in the course of the cold season, the slightest exposure or an indiscretion in diet being sufficient to induce one.

Prognosis.—This is good, the disease never, I think, proving fatal, although nothing is more alarming, at least to parents, than to witness for the first time one of these severe attacks of catarrhal croup.

Diagnosis.—Catarrhal spasm may be confounded with laryngismus stridulus and with membranous croup. Laryngismus stridulus is a rare disease, and occurs only in infancy. In it we have not simply stridulous breathing, but periods of complete cessation of respiration. These may be repeated many times during the day, and may continue for weeks, being often complicated by carpo-pedal spasm, sometimes by general convulsions.

From membranous laryngitis, catarrhal spasm is distinguished by its sudden onset, the mildness of the symptoms of inflammation, the spasmodic character of the dyspnœa, and the daily remissions. The history of previous attacks will often aid in diagnosis. In case of doubt, a positive diagnosis can often be made by allowing the child to inhale a little chloroform. This at once relieves dyspnœa due to spasm, while it has scarcely any effect upon that due to membrane.

Treatment.—The purpose of treatment during the attack is to produce relaxation of the laryngeal spasm. This is accomplished by the use of emetics, steam, and hot fomentations over the larynx. A favourite emetic is a tablet triturate of antimony and ipecac, gr. $\frac{1}{100}$ each. To a child of two years, one tablet may be given every ten or fifteen minutes, until free vomiting occurs; or a teaspoonful of the syrup of ipecac and fifteen drops of the wine of antimony at the same interval. When children do not vomit after two or three doses the antimony should not be repeated, as it may produce serious depression.

Emetics have a double value if the attack is due to indigestion. If there is constipation, an enema should be given. Following the free vomiting there is generally some improvement in the symptoms, but there may be a recurrence of the spasm unless other means are employed. To prevent this, antipyrine is one of the most useful drugs. Three grains may be given in divided doses to a child two years old. This may be repeated in four or five hours if necessary. Quite as much relief as that obtained from the drugs mentioned is seen from the use of steam inhalations. For this purpose the child should be placed in a closed tent, and steam introduced from a croup kettle (page 58). This may be used in conjunction with other measures, and continued as long as necessary. Poultices or hot fomentations over the larynx are often useful. In one case in which severe spasm had recurred for eight successive nights in spite of everything that was tried, the child being in great distress from the dyspnœa, I performed intubation, which gave instant relief. Tracheotomy, however, would scarcely be advisable.

During the day following the first night attack, it is well to continue the antimony and ipecac in doses too small to produce vomiting—e. g., gr. $\frac{1}{100}$ each, every four hours. After 6 P. M. the doses should be doubled, and at bedtime two grains of antipyrine given. If so treated, the symptoms may not recur upon the second night, or there may be only the cough without the severe dyspnœa. The child should be confined to the house for two or three days after one of these attacks, the drugs being gradually reduced; but the antipyrine should be given at bedtime for three or four successive nights.

To prevent a repetition of the attacks and remove the tendency to them, it is most important that the child should have plenty of fresh air and cold bathing, especially cold sponging about the neck and chest.

Everything which experience has shown to bring on the attack should be carefully avoided. Local causes, such as adenoid growths, hypertrophied tonsils, elongated uvula, etc., should receive appropriate treatment. Generally it is not necessary to exclude fresh air from the sleeping room. Although an open window for a single night may sometimes excite the attack, a persistence in this direction tends rather to diminish the susceptibility. If the child's condition is poor, general tonic treatment is to be employed.

ACUTE CATARRHAL LARYNGITIS.

This is not nearly so frequent as the disease just described, although it is much more severe, and may even be fatal. It occurs especially in children from one to five years of age, usually in the cold season. Predisposition to attacks is induced by the same conditions as in the case of acute rhinitis. Catarrhal laryngitis may be primary, when it is usually excited by cold or exposure,* or it may be secondary to measles, influenza, scarlet fever, or other infectious diseases. It may also be of traumatic origin, from the inhalation of steam or irritating gases.

Lesions.—There is a moderately intense congestion of the laryngeal mucous membrane, sometimes general and sometimes localized. This may be seen with the laryngoscope, but is not always visible after death. With the congestion there are swelling and dryness, followed by increased secretion. In the milder cases the process is limited to the mucosa. In the more severe cases it involves the submucosa also, which is congested, œdematous, and may be infiltrated with cells. The changes are especially marked in the lymphoid tissue of the subglottic region. The swelling may be sufficient to produce a very marked degree of laryngeal stenosis. In many mild and in all the severe cases there is associated catarrhal inflammation of the trachea, and often of the larger bronchi. In young children there is very little tendency to œdema glottidis, so frequent a complication in adults.

Symptoms.—In the mild form, such as that which is usually seen in older children, there are hoarseness, or even loss of voice, and a laryngeal cough which is sometimes hard and teasing, always worse at night. There may be pain and soreness over the larynx. Constitutional symptoms are mild or absent, the patient not usually being sick enough to go to bed, and often rebelling even at being kept indoors. The duration of the dis-

* The following case is a good illustration of a severe attack excited by cold: A rather delicate infant, eight months old, an inmate of the New York Infant Asylum, was taken out on a raw December day with very slight covering. In a few hours hoarseness and stridor were noticed, and the temperature was 101° F.; three hours later it was 103°, and in spite of the usual remedies which were employed the dyspnœa had reached such a degree as to require intubation. The tube was worn only three days and the case made a prompt recovery.

ease is from four to ten days, with a strong tendency to relapses from slight causes.

The severe form of catarrhal laryngitis is sometimes preceded by acute coryza, or there may be mild laryngeal symptoms for a few days before the development of the more severe ones. In other cases the disease develops rapidly and severe symptoms are present within a few hours from the onset.

When the case is fully developed the voice is metallic and hoarse, and occasionally but not usually lost. There is a hoarse, dry, barking cough, which is very distressing, and sometimes almost constant. The cough, like the voice, is stridulous, and more or less stridor is present on inspiration. There is a slight amount of constant dyspnœa, but this is scarcely noticeable unless the chest is bared. Severe dyspnœa occurs in paroxysms, usually at night. Then, we may get the signs of obstructive dyspnœa similar to those mentioned in severe attacks of catarrhal spasm. This dyspnœa is chiefly inspiratory, but in some cases it increases steadily from the beginning of the attack, and may be indistinguishable from that due to membrane. Constitutional symptoms are usually present and may be severe. The temperature ranges in most cases from 101° to 103° F., but may go to 104° or 105°. The pulse is rapid and full and respiration is accelerated. Older children sometimes complain of pain in the larynx and trachea, increased by coughing. The symptoms are severe for two or even three days, the fever continuing with moderate prostration and paroxysms of dyspnœa, sometimes even attacks of suffocation and cyanosis. Usually after two or three days there is a gradual subsidence of the dyspnœa and inflammatory symptoms, and the case goes on to recovery. At other times the inflammation extends downward to the large and then to the small bronchi, and finally results in broncho-pneumonia. The attack may prove fatal from laryngeal obstruction due to swelling and spasm.

Diagnosis.—This disease is chiefly to be distinguished from membranous laryngitis. The onset of the two diseases may be very similar, and for the first twelve hours we have no absolute means of distinguishing between them, except possibly by the use of the laryngoscope, which is often conclusive in older children but not usually so in infants. All cases, therefore, should be looked upon with a degree of apprehension. The temperature in the catarrhal is usually higher than in the membranous form. The dyspnœa is mainly paroxysmal, with daily remissions and nightly exacerbations, and is chiefly inspiratory, while that of membranous laryngitis is constant, steadily and often rapidly increasing, and is present both on inspiration and expiration. In catarrhal laryngitis the voice is not usually lost, but in the membranous form this is the rule. There can be little room for doubt when there are enlarged glands, membranous patches on the tonsils, nasal discharge, and albumin in the urine. Very often, however, all these evidences of diphtheria are wanting, the

really difficult cases being those in which the process begins in the larynx. The prevalence of diphtheria and a known exposure count for something in favour of membranous laryngitis. If cultures from the pharynx show the presence of Loeffler bacilli, diphtheria of the larynx is highly probable; but no conclusion can be drawn when cultures give negative results. In catarrhal as well as in membranous laryngitis there may be extreme dyspnœa, cyanosis, pallor, prostration, and even death.

Prognosis.—This depends somewhat upon the cause of the disease and also upon the age of the patient. It is much worse when it is secondary to measles or scarlet fever. It is better in children over three years of age than in infants, also when the general condition of the child is good. The prognosis in severe catarrhal laryngitis should always be guarded, not only on its own account, but also because it is impossible to be certain that the case may not be one of membranous laryngitis.

Treatment.—In all cases children affected are to be kept in bed; and the temperature of the room should be between 70° and 72° F. The diet should be light and fluid, and the bowels should be freely opened by calomel or a saline. A hot mustard foot bath should be given at the outset; also, benefit may sometimes be derived from aconite, given in one-quarter-minim doses every fifteen minutes for the first five or six hours. Antipyrine (two grains every four hours to a child two years old) is useful if there is much spasmodic dyspnœa. For this symptom emetics are beneficial, given as in catarrhal spasm. The use of ipecac and squills in smaller doses than is required for emesis (five drops each of the syrups of ipecac and squills every two hours) may give relief, especially in the early stage, when the cough is dry, hard, and severe.

All the remedies mentioned are to be regarded as accessories to the essential treatment, which consists in the use of inhalations. The child should be placed in a tent (page 58) into which steam is introduced from a croup kettle or vapourizer. Simple steam may be used, or turpentine, limewater, or creosote may be added. In moderately severe cases inhalations should be used for fifteen minutes every two hours; in very severe ones they should be continued the greater part of the time. Poultices or hot fomentations may be applied over the larynx. Relief is sometimes obtained by using counter-irritation by a mustard paste, but blistering should never be allowed. In my experience the local use of cold is very unsatisfactory, on account of the difficulty of applying it properly, and the objection to it on the part of young children. Stimulants may be required late in the disease, the amount of prostration being the guide to their use.

In cases of extreme dyspnœa operative interference may be needed. It is required more often in infants and young children than in those who are older, and especially in the subglottic form of the disease. Opinions will of course differ as to when the dyspnœa has reached the danger point.

One should not wait for general cyanosis. If pallor, marked prostration, and steadily increasing dyspnœa are present the case should not be allowed to go on without interference. Intubation has, to my mind, every advantage over tracheotomy, and is always to be preferred in these cases. One should not hesitate to operate, even though he may be perfectly sure that the case is one of catarrhal inflammation only. The severity of the dyspnœa is the only guide, and more than once I have seen cases shown at autopsy to be catarrhal, which were regarded during life as undoubtedly membranous. If intubation is done, the tube can usually be dispensed with in two or three days. Convalescence is usually rapid, but there is danger of recurring attacks during the remainder of the cold season.

MEMBRANOUS LARYNGITIS.

Synonyms: Membranous croup, true croup, laryngeal diphtheria.

Bacteriology has settled many questions long debated with reference to this disease. For nearly half a century the identity of membranous croup and laryngeal diphtheria has been contended for by some observers, and denied by others equally good. The extensive bacteriological researches made since 1890, both in this country and in Europe, have yielded results sufficiently uniform to warrant the following statements:

1. Membranous inflammation beginning in the larynx is almost invariably true diphtheria—i. e., it is due to the Loeffler bacillus.

2. Membranous laryngitis following a primary membranous inflammation of the tonsils, pharynx, or nose, is, in the great majority of cases, due to the Loeffler bacillus.

3. Membranous laryngitis following membranous inflammation of the tonsils, nose, or pharynx, occurring as a complication of measles, scarlet fever, or influenza, is more frequently due to another kind of infection (usually the streptococcus) than to the Loeffler bacillus.

The etiology, lesions, pathological relations, and bacteriological diagnosis of membranous laryngitis are considered in the chapter devoted to Diphtheria. In the present chapter there will be considered only the clinical aspect of the cases, especially of those in which the disease begins in the larynx; for even if the cause is in most cases diphtheria, the clinical picture is laryngitis.

In cases of primary laryngeal diphtheria there are wanting most of the characteristic clinical features which distinguish diphtheria of the pharynx. There are two reasons for this: one is the relatively rapid course of the disease, often producing death from local causes before the constitutional symptoms resulting from the absorption of the toxine have developed; the second reason is, that absorption of the poison by the laryngeal mucous membrane is very slow and feeble as compared with that which takes place from the pharynx. Hence it follows that glandular enlargements, albumi-

nuria, and asthenic symptoms are generally wanting; also, that in the cases which come to autopsy early, the parenchymatous degenerations in the heart, kidney, and other organs are seldom found, but instead only such lesions as are connected with the laryngeal disease. The feeble contagion is due to the fact that the course is much shorter, and that the discharge from the nose and mouth is slight, or absent altogether.

Symptoms.—In its onset, membranous inflammation of the larynx is indistinguishable from the catarrhal form. It is perhaps a trifle less abrupt, and apparently not quite so severe for the first twelve hours or even for a longer time. We have the same hoarse cough and voice, with a slight stridor, gradually increasing. The constitutional symptoms are usually not quite so marked, the temperature ranging from 99° to 101° F. The pulse is accelerated, but not weak or intermittent. It is the progress of the disease which indicates its character, usually during the first twenty-four hours. A child beginning in the morning with such symptoms as have been described, may by evening show a decided change for the worse, or the symptoms may increase with great rapidity during the night. At first the voice is hoarse; later it is entirely lost. Dyspnœa in the beginning is scarcely noticeable, but steadily increases hour by hour. At times of excitement it may be very great, but as the spasm subsides it diminishes. During the second twenty-four hours all the symptoms are usually well developed. The respiration is often somewhat accelerated, but it may be slower than normal. The face is pale and anxious. The alæ nasi dilate with each inspiration. The loud, "sawing," stridulous breathing is present. As the dyspnœa increases, all the accessory muscles of respiration are brought into action. There is now with every inspiration deep recession of the suprasternal fossa, the supraclavicular regions, and the epigastrium. The child tosses uneasily from side to side in its crib, at times struggling violently to get more air into the lungs. The pulse grows rapid and weaker. There is slight blueness of the finger nails and the lips; the face is usually pale; but later this too may be cyanotic. The skin is covered with clammy perspiration. On auscultating the chest, very rude respiratory sounds are heard, but no vesicular murmur. As the symptoms increase in severity the temperature usually rises gradually, in some very severe cases at the rate of a degree an hour, until shortly before death it reaches 104° or even 106° F. Late in the disease the intellect becomes dull, the violent struggles for air cease, and the child passes into a condition of semi-stupor which gradually deepens until death occurs, which may be preceded by convulsions.

Such is the usual course of the disease when unrelieved by treatment. Its progress is most rapid in infants, in whom death usually takes place in from thirty-six to forty-eight hours from the first symptoms. In older children the course is rather slower, and the attack may last from two days to a week, death occurring more frequently from bronchial croup or

pneumonia. These are indicated by continued high temperature, rapid respiration, cyanosis, and increased prostration.

The course of the disease is not always so regular. Occasionally for a week or more the symptoms are precisely like those of catarrhal laryngitis of moderate severity—hoarseness, laryngeal cough, little or no fever, and slight or occasional dyspnœa. Then there may be the sudden development of very severe symptoms, and death in a few hours. Great improvement may follow the dislodgment of the membrane by vomiting or coughing, although in most cases it forms again.

Prognosis.—The issue of every case of membranous laryngitis is doubtful. The prognosis depends upon the age of the patient, the character of the epidemic, but most of all upon the treatment. The latest results with antitoxine show a mortality of less than 25 per cent.

Diagnosis.—The points by which membranous laryngitis is distinguished from the catarrhal form have been considered in connection with the latter disease. It may be further confounded with retro-pharyngeal abscess, a foreign body in the larynx, and even with broncho-pneumonia. Inspection, or, better, digital exploration of the pharynx, usually makes the recognition of retro-pharyngeal abscess an easy matter. The mistake generally made is that of trusting entirely to the patient's objective symptoms for a diagnosis. With a foreign body there is usually a history of a very sudden onset and violent paroxysmal dyspnœa, without fever. Broncho-pneumonia is easily distinguished by its higher temperature, its physical signs, and the difference in the character of the dyspnœa. A mistake is hardly possible except when there is also present some degree of catarrhal laryngitis. In any of these conditions, if time is taken to obtain a careful history and to make even a moderately thorough examination of the throat and lungs, no mistake need be made. Yet such cases have often been operated upon by physicians anxious to give immediate relief to what they had hastily diagnosticated as membranous laryngitis.

Treatment.—All cases of membranous laryngitis should be isolated like those of diphtheria of the pharynx. Every case of membranous laryngitis should receive an injection of antitoxine upon a clinical diagnosis without waiting for this to be confirmed by a bacteriological examination. Nowhere else are the beneficial effects from antitoxine so evident and so striking as in these cases. That the serum, when properly used in the great majority of cases, prevents the spreading of diphtheritic membrane from the larynx to the lower air passages is now well established. For dosage and other details regarding the use of antitoxine the reader is referred to the article on Diphtheria.

Emetics, inhalations of steam, and solvents for the membrane, although they all sometimes give relief, are now little used, and are never to be relied upon alone. In fact, leaving out antitoxine and surgical operation, the only therapeutic measure that can be said to be of much avail is

calomel fumigation. This is in no sense a substitute for antitoxine, but may be employed where circumstances make the use of antitoxine impossible, and in the few cases of membranous laryngitis due to streptococci.

Calomel fumigations.—These were first advocated by Corbin, of Brooklyn, in 1881, although they did not come into general use until about 1891. The method consists in the vapourization of calomel in a confined space, the patient inhaling the fumes. For this purpose the child should be placed in a close tent (page 58), either sitting or lying down. A very simple arrangement for the purpose, and one that can be extemporized readily, is the following: A strip of tin, or any sheet metal two inches wide and ten or twelve inches long, is bent and placed across the top of a *pot-de-chambre*; upon this is placed the calomel, and beneath it, so that the flame will come close to the tin, an alcohol lamp. The lamp is then lighted and the apparatus placed beneath the tent. It should always be steadied by the hand of an attendant, otherwise there is danger of fire, as the lamp might be accidentally overturned by the child's struggles. In Fig. 70 is shown an apparatus which can be used with greater safety, as it is suspended by a wire. In a few moments the tent, which should be kept closed, is filled with the white fumes of the mercury. From ten to twenty minutes are required to vapourize the ordinary amount used, depending upon the size of the flame. It is well to have the child somewhat accustomed to the tent before the fumigation is begun; also to cover the body, except the face, so as to prevent any unnecessary exposure to the calomel fumes. The usual amount vapourized at once is ten or fifteen grains, and this is repeated every one, two, or three hours, according to the severity of the case. This amount is calculated for a tent which covers a child's crib. If a much larger one is used more calomel will of course be required. In extreme cases as much as twenty grains every hour have been used for days. After the calomel has all been vapourized the tent should be opened and the room thoroughly aired.

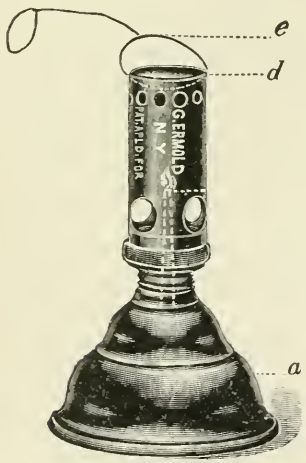


Fig. 70.—Ermold's apparatus for calomel fumigation.

a, alcohol lamp; *d*, plate on which calomel is placed; *e*, wire loop for suspension.

At times so much irritation is produced by the fumes that it may have the effect of increasing the dyspnœa. This may be due either to the fact that the calomel contains impurities, or that the vapour is too concentrated. The concentration of the vapour depends on the size of the

tent and the rapidity of the process of vapourization. It is rare that any unpleasant symptoms occur. Nurses should always be warned against the danger of fire. I have several times known serious accidents from carelessness. Salivation in a patient is rare, but care is always necessary to prevent it on the part of the attendants. They should not put their heads beneath the tent; the room should be kept as clean as possible, and thoroughly aired after each fumigation. The mouth, gums, and teeth of the patient should be kept clean with a wash of chlorate of potash.

The improvement is often very marked even after the first fumigation, and nearly always after the second or third. Fumigations should be begun as soon as the diagnosis of membranous laryngitis is made, without waiting for even a moderate amount of dyspnœa. This applies both to cases beginning in the larynx and where the disease is secondary to pharyngeal diphtheria.

Operative measures.—Opinions will always differ as to the time when operative interference is called for. One should never wait for general cyanosis, for often this does not occur until just before death. It is better to operate too early than too late. After a fair trial has been made of other measures, and if, in spite of all, the dyspnœa increases steadily and the temperature begins to rise, operation should not be deferred longer. When this has been decided upon, the physician has the choice between intubation and tracheotomy. During the last ten years intubation has grown steadily in favour, and, since the introduction of antitoxine, tracheotomy has been practically abandoned as a primary operation for the relief of membranous laryngitis, it being resorted to only in rare cases, after intubation has failed to give relief.

The general treatment of the child is important, and should not be overlooked. It includes careful feeding, and the use of alcoholic stimulants according to the amount of prostration present. All patients with membranous laryngitis should be closely watched, for marked changes may take place in the course of a few hours.

Results without antitoxine.—In November, 1892, McNaughton and Maddren (Brooklyn), in response to a circular letter, collected statistics of 8,383 cases of membranous laryngitis, occurring in the practice of 242 physicians. The following results were reported: Tracheotomy, 2,417 cases; recoveries, 586, or 24·2 per cent. Intubation, 5,546 cases; recoveries, 1,691, or 30·5 per cent.

In 1893, Ranke (Munich) published reports of 1,445 cases of intubation, collected from various German hospitals, with 553 recoveries, or 38 per cent. Bokai (Buda-Pesth), in 500 operations, reports 180 recoveries, or 36 per cent. In all the different series of cases above referred to, the percentage of recoveries has ranged from 30 to 40. Combining them, we have 7,491 cases of intubation for membranous laryngitis, with 2,424 re-

coveries, an average of 32·3 per cent. These figures may be taken to represent, as accurately as statistics can, the results from intubation prior to the use of calomel fumigations and before the introduction of antitoxine.

With the introduction of calomel fumigations the statistics of the operation from 1891 to 1895 were materially improved. Of the cases of intubation collected by McNaughton and Maddren, only 85 had received calomel fumigations, with 35·3 per cent recoveries. Although no large collection of cases so treated has been made, the experience of Dillon Brown may be taken as fairly representing the improvement in the results of intubation by the addition of calomel. Up to June, 1894, he reports his personal experience as follows: 490 intubations without calomel fumigations with 34·8 per cent recoveries; 279 operations with calomel fumigations with 49·4 per cent recoveries. Nearly all of the cases in both series were from private practice. In addition to this reduction of mortality in cases operated upon, it was a matter of common observation in New York and Brooklyn, that during the period mentioned a much larger number of cases than ever before recovered without operation.

Such were the results in laryngeal diphtheria prior to the introduction of antitoxine in 1895. They have been fully given, that they may be compared with those obtained since that date with the addition of antitoxine. The latter figures are given in the general article on Diphtheria.

INTUBATION.

Intubation is the introduction of a tube through the mouth into the larynx for the relief of laryngeal dyspnœa. For the operation as now performed the world is indebted to Dr. Joseph O'Dwyer, of New York.

A set of O'Dwyer's instruments (Fig. 71) consists of six gold-plated tubes, an introductor, an extractor, a mouth-gag, and a gauge. In his latest tubes the lower extremity is made somewhat bulbous, and not straight, as appears in the illustration. The operation is not very difficult, provided one has had previous practice on the cadaver. Without this it should not be attempted. The tube is selected according to the age of the patient, the length for the different years being indicated upon the gauge. The age is not the only guide, for a very large child will often require a tube of larger size than its age would indicate.

The introduction of the tube.—Two assistants are required, neither of whom need be skilled. The child is taken from the bed, wrapped in a large blanket, and held in a sitting position upon the lap of the first assistant, its head being inclined neither backward nor forward. The arms may be confined by the blanket or held by the assistant. The second assistant, standing behind the child, steadies the head, and with one finger holds the loop of braided silk with which the tube should be threaded. The tube is attached to the introductor, and the gag is inserted into the left angle of the mouth and opened as widely as possible. The slipping

of the gag and laceration of the mouth may be prevented by using a piece of rubber tubing to cover each arm of the gag where it comes in contact

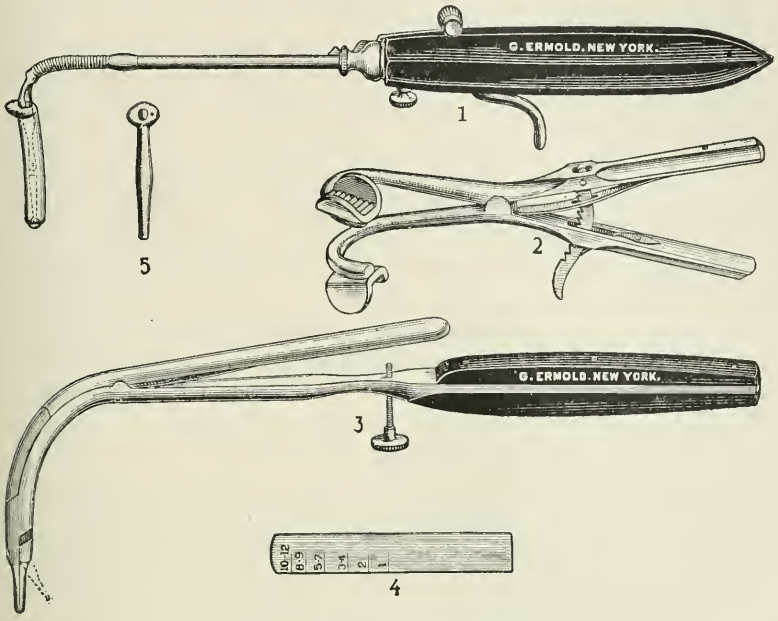


Fig. 71.—O'Dwyer's intubation set.
1, introductor; 2, gag; 3, extractor; 4, gauge; 5, tube.

with the gum. The attempts at introduction must be made quickly, for during them respiration is practically arrested. Several short attempts are always better than a single prolonged one. Very little force is ordinarily required in introducing the tube, that used in passing a catheter being a good general guide. In cases of subglottic stenosis, however, quite a little force may be necessary (Brown).

The index finger of the left hand is used as a guide in introduction. This is passed well back into the pharynx, then brought forward until a hard nodule—the upper border of the cricoid cartilage—is encountered. This is the best of all landmarks, since the soft parts are often distorted by swelling. Directly in front of the cricoid cartilage may be felt the epiglottis and the opening of the larynx, which are readily recognised after the touch has become somewhat educated. The tube is passed along the palmar surface of the left index finger, by which it is guided into the larynx; it is then pushed off the introductor by a thumb-piece attached to its handle. When it is certain that the tube is in position, and the patient breathes properly, the loop of silk attached to the head of the tube is cut off and pulled through, the removal of the tube being prevented by placing the left forefinger upon its head. The silk should not be left

attached unless there is evidence of loose membrane below the tube. It may then be fastened to the cheek by a piece of adhesive plaster. The tube is known to be in place, first, by the hissing breathing sounds, somewhat similar to what is heard when the trachea is opened; secondly, by a severe paroxysm of coughing, which is usually excited by a tube in the larynx; thirdly, by the relief of the dyspnœa. If this relief is not very apparent the physician may still be in doubt as to whether the tube is in the larynx or the œsophagus. If in the former, it can not be pushed down by the finger without depressing the larynx with it; and by introducing the finger into the pharynx, the posterior wall of the larynx can be felt between the finger and the tube. The most common mistake made is to pass the tube into the œsophagus. This sometimes happens because the position of the child's head is improper—too far forward or too far backward—but more often because the operator has not been quite sure of his landmarks. If this has occurred, there is no relief to the dyspnœa, no hissing sound, and the tube can be pushed down indefinitely. When this condition is recognised, the tube is withdrawn by the loop of silk and after a few moments a second attempt made.

False passages in the larynx are most frequently made because the operator has worked at the angle of the mouth instead of keeping in the median line. The tube usually goes into one of the ventricles, and may be pushed quite through the larynx into the cellular tissue. This is not likely to happen unless undue force has been used. The production of a false passage is recognised by the fact that, although the tip of the tube can be felt to enter the larynx, it does not descend, but projects above the epiglottis.

False membrane which has become loosened is sometimes crowded down by the tube and obstructs the larynx just below it. This is one of the most serious accidents that may occur, but fortunately it is not a frequent one. It is more liable to happen where the disease has existed for several days than in recent cases. The tube may be in place in the larynx as shown by all the signs above mentioned, except relief of the asphyxia. In such a case the immediate withdrawal of the tube is necessary; it being often followed by the discharge of masses of loose membrane. This is aided by the administration of a teaspoonful of pure whisky or brandy to excite a strong cough. Artificial respiration may be required, and if there is no relief by any of these means tracheotomy is indicated. Asphyxia is sometimes produced by prolonged and injudicious attempts at introduction.

After-treatment.—So far as the tube itself is concerned no treatment is required. The original disease is to be treated as before. The operation has removed only one danger from the patient, viz., that of asphyxia from mechanical obstruction of the larynx. A good expulsive cough should occur after the tube is in place. This is necessary to clear the tube of

mucus, as the pharynx and larynx are generally filled with it as a result of the manipulation.

The child should not be allowed to lie upon its face, nor should it be held over the nurse's shoulder face downward, for in either position a slight cough is enough to expel the tube. Nursing infants may continue at the breast after the operation; ordinarily they have but little difficulty in swallowing. Older children often experience considerable trouble in taking liquids. This may be overcome by the device suggested by Casselberry (Chicago), of having the patient's head lower than his body while he drinks. If there is still trouble in taking fluids, semi-solid articles, such as condensed milk, wine jelly, corn starch, or scrambled eggs, may be tried. Feeding is always easier after the first day or two, and patients who wear a tube for chronic disease soon experience no trouble whatever, showing that the difficulty depends more upon the inability to co-ordinate the movements of the muscles of deglutition when the tube is in place than upon mechanical causes, for the head of the tube is effectually covered by the epiglottis.

It sometimes happens that the tube is coughed out soon after its introduction, because too small a size has been used. In some cases this occurs repeatedly. It happened in a case of my own twenty-eight times during four days. Such cases are probably due to paralysis of the laryngeal muscles. The dyspnœa does not usually return for two or three hours after the tube has been coughed out, so there is ample time to notify the physician. It may happen that the tube is coughed up and not seen by the nurse, or it may be coughed up and swallowed by the child. When called because of dyspnœa after operation, the physician should make a digital examination of the pharynx to be sure that the tube is still in place. Swallowing the tube generally causes no harm to the child, for tubes have repeatedly passed through the intestines.

The entrance of food into the bronchi through the tube is a danger that does not exist, as has been shown by the extensive post-mortem observations of Northrup in the New York Foundling Asylum. My own experience in the New York Infant Asylum coincides in every particular with his statement, that the broncho-pneumonia following intubation does not depend upon the entrance of food into the bronchi.

Ulceration at the head of the tube very rarely occurs, provided properly made tubes are employed.* The tube rests not upon the vocal cords, but upon the inferior ventricular bands. When ulceration occurs, it is usually of the anterior wall of the trachea, at the lower end of the tube, and

* This and many other bad results obtained after intubation are due to improperly constructed instruments. Those made by George Ermold, 312 East Twenty-second Street, New York, are perhaps the most reliable.

appears to be produced by the movements of the tube during deglutition. With O'Dwyer's latest tubes there is much less liability of this occurring. The ulcers are usually small and superficial. Deep ulcers extending to the tracheal rings may be seen in ill-conditioned children, usually in connection with other complications severe enough to cause death.

Spontaneous descent of the tube into the larynx is impossible, and it can not be crowded down without using considerable force and severely lacerating the larynx.

Sudden blocking of the lower end of the tube by membrane loosened from the trachea or bronchi is an infrequent accident. The usual result of this is the immediate expulsion of the tube by coughing, the discharge of the loose membrane following. This condition is one of the safety valves of the operation. One of the strong points in favour of intubation is that the forcible cough which the patient is able to make on account of the narrow opening of the tube, often enables him to expel large accumulations of mucus, and even membrane, more readily than through a much larger tracheal opening.

In membranous laryngitis the tube is usually left in place from four to seven days, longer in very young children. Should the tube be coughed out at any time, its introduction should be delayed until dyspnœa returns. If this happens on the third or fourth day, a second introduction is often unnecessary.

The removal of the tube.—This is rather more difficult than its introduction. The general arrangement of the patient and assistants is the same as for introduction. The left index finger is placed upon the head of the tube, which is steadied externally by the thumb of the same hand. The beak of the extractor is introduced within the opening of the tube, its jaws are then separated by pressure upon the lever at the handle, and the instrument withdrawn, very slight force being required.

The tube is first removed tentatively, the physician waiting to see if dyspnœa returns. It is well to give an opiate an hour before the removal of the tube, since the contact with the air almost invariably excites a marked degree of laryngeal spasm which lasts for ten or fifteen minutes. To avoid the production of vomiting and the entrance of food into the larynx, food should not be given for two hours previously. If dyspnœa does not return in the course of three or four hours, the probabilities are that the tube will no longer be required. It is very exceptional that the patient has great difficulty in dispensing with the tube, as so often happens after tracheotomy.

The advantages over tracheotomy. — The advantages claimed by O'Dwyer for this operation over tracheotomy are conceded by most of those who have had any considerable experience in the operation, viz.: (1) It is quicker, simpler, and adds no danger to the original disease; (2) there is no shock or hæmorrhage; (3) no anæsthetic is required; (4) no

fresh wound is made which may prove an avenue of infection; (5) it gives an opportunity for a better expulsive cough, which is of great value in dislodging false membrane and mucus; (6) there are usually no objections on the part of the parents to be overcome—a point of great importance; (7) the air is warmed and moistened as it is normally, by passing over the nasal and buccal mucous membranes; (8) no skilled after-treatment is required: as the largest proportion of the cases of diphtheria are among the very poor, living under conditions in which the careful after-treatment required in tracheotomy is difficult or impossible to obtain, this is an important point; (9) in infancy, all who have had experience with both operations admit the great superiority of intubation; (10) the intubation tube can be dispensed with earlier than the tracheal canula, and also with much less difficulty; (11) if tracheotomy is subsequently required, the operation may be done upon the tube as a guide.

The only objection of much force urged against intubation is that asphyxia may be produced by crowding down loose membrane into the larynx. This is a very infrequent accident; should it happen, and the asphyxia not be relieved by coughing up the membrane, tracheotomy may be performed.

Experience has clearly proved that intubation relieves the dyspnœa due to laryngeal stenosis promptly, efficiently, certainly; it does this without many of the dangers and objectionable features of tracheotomy, while at the same time it does not deprive the patient of any essential advantage which tracheotomy affords.

The use of antitoxine in the treatment of diphtheria has so shortened the period of stenosis that tracheotomy as a routine operation is hardly justifiable. The great superiority of intubation is now generally admitted not only in America, but all over the continent of Europe, where it has practically displaced the older operation.

SUBMUCOUS LARYNGITIS—ŒDEMA OF THE GLOTTIS.

These two conditions are not quite identical, although they are closely associated and may be conveniently considered together. They are both rare in early life. In true œdema of the glottis there is simply a dropsical effusion into the submucous cellular tissue of the aryteno-epiglottic folds, causing them to project as large rounded swellings on either side of the superior isthmus of the larynx. They may be of sufficient size to cause serious or even fatal obstruction to respiration. With the laryngoscope they appear as pale red tumours, lying usually in contact near the base of the tongue. By the finger their presence can be quite as readily distinguished. Œdema of the glottis occurs principally in the late stages of nephritis.

In the inflammatory form of œdema, or true submucous laryngitis, there is the same sort of swelling of these structures, but in this case it is

due to some active inflammation in the neighbourhood. The swelling is partly from the œdema and partly from cell infiltration. Usually all the parts surrounding the upper opening of the larynx are in a state of acute inflammation. The epiglottis may be swollen to the thickness of a finger, and easily seen by depressing the tongue.

The *exciting causes* may be the mechanical irritation of foreign bodies, the inhalation of steam or irritating gases, erysipelas of the neck, primary catarrhal laryngitis, or retro-pharyngeal abscess.

The *symptoms* in both cases consist in great inspiratory dyspnœa with attacks of suffocation, while expiration may be quite easy. In true œdema there are in addition the symptoms of the original disease. In the inflammatory form there are the evidences of local inflammation—hoarseness, cough, pain, and difficulty in swallowing. A positive diagnosis may be made by a digital examination. The symptoms develop with great rapidity in either variety, and frequently prove fatal in a few hours.

The *treatment* of true œdema consists in scarification or multiple puncture, the application of ice externally, and even the swallowing of ice; in the inflammatory form, in addition, local blood-letting by leeches and, as a last resort, tracheotomy. Intubation is useless in either form.

CHRONIC LARYNGITIS.

The following varieties are seen: (1) a simple form usually associated with adenoid vegetations of the pharynx; (2) tuberculous; (3) syphilitic; (4) that associated with new growths.

1. **With Adenoid Vegetations of the Pharynx.**—This is not very uncommon. The larynx is kept in a state of chronic congestion by the adenoid growth, and there finally develops a sight superficial catarrhal inflammation. The symptoms may continue for many months. These cases are often treated for a long time unsuccessfully by the use of sprays, inhalations, etc., but the symptoms disappear rapidly after the removal of the adenoid growth. Similar symptoms may be associated with hypertrophic rhinitis. In this also the treatment should be directed to the primary condition.

2. **Tuberculous Laryngitis.**—This belongs to later childhood, and is rare even then. In infancy it is almost unknown. Rheindorf * has reported a case in a child of thirteen months, which was regarded during life as syphilitic, but was shown by autopsy to be tuberculous. Of sixteen cases in children, reported by Rilliet and Barthez, none occurred during the first three years, and only four before the seventh year. The larynx alone may be affected, or the larynx and trachea, or the larynx, trachea, and lungs. Pulmonary tuberculosis is usually found to be present at autopsy,

* Jahrbuch für Kinderh., Bd. xxxiii, p. 71.

even though there may have been no pulmonary symptoms. Demme has reported a case of tubercular laryngitis in a boy of four years, whose lungs were healthy, death resulting from tuberculous meningitis.

The *symptoms* are hoarseness, aphonia, laryngeal cough, and muco-purulent, sometimes bloody, expectoration. The sputum may contain tubercle bacilli. With the laryngoscope tubercular deposits may be seen, but more frequently tuberculous ulceration of the mucous membrane. In children this is usually superficial, the deep destructive ulceration seen in adults being very rare.

It is to be differentiated from syphilis chiefly by the general symptoms, as the laryngoscopic appearances may be very similar. The *treatment* consists in keeping the ulcers as clean as possible by the use of sprays and the local application of astringent powders, like nitrate of silver and sulphate of zinc or iodoform.

3. **Syphilitic Laryngitis.**—In the early stage of syphilis the larynx is often the seat of a catarrhal inflammation, which presents nothing especially characteristic except its protracted course. The laryngitis of late hereditary syphilis is quite rare, and is liable to be overlooked because of the difficulties in the way of a thorough examination, and because the disease is usually painless.

Strauss* has collected fourteen cases between the ages of three and fifteen years, and added three of his own. He states that deep-seated processes are much more rare than among adults. The parts most frequently affected are, first, the epiglottis; secondly, the aryteno-epiglottic folds; thirdly, the posterior laryngeal wall. The epiglottis was involved in twelve of fourteen cases. Usually there was only perichondritis; in the more severe cases there was partial or complete destruction of the cartilage. In four cases papillomatous masses were seen. In five cases the process extended from the epiglottis to the epiglottic folds of one or both sides. In several instances the superior vocal cords were thickened from hyperplasia, and occasionally small tumours were formed. In only one case was there ulceration of these folds. Changes in the vocal cords and the arytenoid cartilages were rare, occurring only with extensive inflammation. The symptoms are those of chronic laryngitis; hoarseness, sometimes aphonia, and in a few cases chronic laryngeal stenosis. The diagnosis can be made only by means of the laryngoscope. In most of the cases there are present ulcerations of the palate or uvula, or scars from previous ulcers; sometimes the disease extends into the nose. Serious symptoms often result when to old syphilitic lesions there is added acute laryngitis or œdema.

In addition to the usual constitutional remedies for tertiary syphilis, and to the means ordinarily employed for the relief of chronic laryngitis,

* Archiv für Kinderh., Bd. xiii.

intubation may be required in these cases for the relief of laryngeal stenosis. Nowhere are its advantages over tracheotomy more striking than here. The tube must usually be worn for many months.

NEW GROWTHS.

New growths of the larynx are not very rare in children. Excluding the granulations which follow the use of the tracheal canula, the only one that is likely to be met with is papilloma. This may occur even in infancy. According to Rauchfuss, the majority of the cases begin during the first year. Boys are more frequently affected than girls.

The *symptoms* depend upon the size and location of the tumour. The earlier manifestations are usually ascribed to chronic laryngitis. There is hoarseness, sometimes loss of voice, and a paroxysmal cough; later, dyspnœa develops. The symptoms are slowly progressive, and it may be several months before they are sufficiently severe to attract special attention. A positive diagnosis is made only by the laryngoscope. There is seen a whitish granular tumour, sometimes pedunculated, sometimes with a broad base, attached to any part of the larynx.

The *treatment* of these cases belongs to the specialist. Small pedunculated growths may be removed through the mouth by means of the forceps or snare. Larger ones require thyrotomy. The prognosis is generally unfavourable, on account of the danger of recurrence after operation. Operative measures may be followed by bronchitis or bronchopneumonia.

FOREIGN BODIES IN THE LARYNX.

The aspiration of foreign substances into the larynx is not a very rare accident in children. It usually happens from an attempt to cough, laugh, or cry while the child has something in its mouth. If the body is sharp and irregular, like a pin, the shell of a nut, or a fragment of bone, it is liable to become impacted in the larynx. If smooth, like a pea or a bead, it is usually drawn into one of the bronchi, generally the right.

When the body enters the larynx there is immediately excited a violent paroxysmal cough, with dyspnœa amounting almost to suffocation. Often the body is dislodged by this initial attack of coughing. If it becomes impacted in the larynx, it may cause sudden death by occluding the glottis; elsewhere it may excite acute laryngitis, usually of considerable severity.

The impaction of a foreign body in one of the primary bronchi, or one of the lobar divisions, is indicated by cough and a severe localized pain in the chest. There may be expectoration of blood. On auscultating the chest, there is found an absence of respiratory murmur over one lung or one lobe, according to the situation of the foreign body. Percussion gives

increased resonance, which may even be tympanitic, owing to emphysema which rapidly develops. If the foreign body remains impacted in one of the bronchi, it usually excites a localized inflammation, which extends to the surrounding lung and terminates in the formation of an abscess. This may result fatally, or there may follow a prolonged illness, with hectic symptoms resembling pulmonary tuberculosis; and finally, after weeks or months, the foreign body may be expelled by an attack of coughing, and the patient recover completely.

The *diagnosis* of a foreign body in the larynx is made by the suddenness of the attack and the violence of the early symptoms. In older children the body may be seen with the laryngoscope, but in young children this is very difficult. The prognosis is always doubtful, and depends upon the nature of the foreign body and the point at which it has been arrested.

Treatment.—The first thing to be tried is inversion of the patient. By this means, assisted by the cough, the foreign body is not infrequently expelled, even though it has passed below the larynx. The symptoms of laryngeal obstruction may call for immediate tracheotomy or laryngotomy, intubation not being applicable to these cases. If, after tracheotomy, the foreign body can be located in the larynx, but can not be extracted through the tracheal wound, the thyroid cartilage should be divided in the median line. The removal of a foreign body from the bronchi or the tracheal bifurcation should be attempted only by a skilled surgeon.

CHAPTER III.

DISEASES OF THE LUNGS.

THE PECULIARITIES OF THE LUNGS IN INFANCY AND EARLY CHILDHOOD.

Thorax.—The general shape of the thorax is somewhat cylindrical, the conical or dome-shape of the adult not being attained until puberty. The antero-posterior and the transverse diameters are nearly equal in the newly born, but after the third year the transverse diameter is always greater, the difference increasing steadily up to adult life. On account of the shape of the chest, the lungs are situated rather more posteriorly in the infant than in the adult.

The thoracic walls are very elastic and yielding, owing to the cartilaginous condition of a large part of the framework. They are relatively thinner than in the adult, chiefly owing to the imperfect development of the thoracic muscles. The greater part of the thickness of the thoracic walls is due to the deposit of fat, generally abundant in well-nourished infants; but where the fat is scanty the walls are extremely