

Objective Signs.—But little is gained from an examination of the stomach. A localized tender spot, often no larger than 2 to 3 cm. in diameter, may be present, and is felt often "through to the back" on deeper pressure. It is found most often just below the xiphoid cartilage. Very frequently, however, the tenderness is not so localized, and a more diffuse soreness is felt in the epigastrium on palpation. No tumor is palpable in fresh ulcers. In older ulcers, where scarring has occurred at the pylorus, the signs of stenosis may be present; peristaltic movements, and even a tumor, may be seen on inspection, while palpation may reveal the latter as a more or less movable mass situated at some part of the upper right quadrant of the abdomen.

Diagnosis.—In making a diagnosis of ulcer of the stomach one should first exclude the possibility or likelihood of gall-stones, simple gastralgia, simple hyperacidity, cancer, renal calculus, aneurism of the aorta, and spinal disease. The points which favor this diagnosis are: sex (female), pain after taking food, tenderness over the region of the stomach, hyperacidity, vomiting, usually preceded by pain, and hæmatemesis.

A diagnosis of the seat of the ulcer is usually impossible. The ordinary evidences mentioned by many writers are now known to be quite unreliable. Then again, there may be several ulcers present at the same time, and we may overlook this in laying stress on the site of one which gives evidences of being located at a certain spot.

The Use of the Stomach Tube for Diagnosis of Ulcer.—The contraindications are: Recent hemorrhage, or where an ulcer at the cardiac orifice is suspected, or where there is but little doubt in regard to the existence of a gastric ulcer.

Riegel asserts that when the introduction of the tube is "carefully done" there is but little danger. At all events severe efforts at vomiting are dangerous, and expression is an unwise method; but if the tube is readily taken it may be safe to resort to this procedure.

Prognosis.—Recovery takes place in most cases in which perforation has not occurred. Fatal hemorrhage occurs in less than five per cent. of all cases. One sees post mortem twice as many scars as fresh ulcers. In men the mortality is twenty-two per cent., in women six per cent.; in both together eight and one-half per cent. for all cases. Older ulcers are more favorable. Relapses are frequent, and may occur after several years. Sometimes a new ulcer forms alongside of an old and chronic one. Cancer may form on top of an ulcer.

Complications.—Perforative peritonitis; perigastritis, suppurative and adhesive; subphrenic abscess; fistula between stomach and adjacent organs; abscess of liver and chronic hepatitis; acute and chronic pancreatitis; pressure on or constriction of main bile ducts, with jaundice; contraction of scar followed by the development of a cancer; hour-glass stomach; pyloric stenosis; dilatation of stomach; cardiac stenosis.

Perforation is one of the most serious complications in gastric ulcers, and occurs in about fifteen per cent. of all cases. It takes place from the deeper extension of the ulcer, and is most common on the anterior wall, where there is greater mobility of the part and less tendency to the formation of adhesions. It may, however, and often does, occur in the posterior wall.

Partial or general peritonitis may follow. Partial peritonitis is usually confined to the epigastrium and left hypochondrium and is usually purulent, or pus may collect in the lesser omentum if the perforation is located posteriorly. General peritonitis occurs chiefly when the perforation takes place rapidly and before any previous adhesions have formed.

The perforation may extend directly or indirectly (*i. e.*, after adhesions have formed) into adjoining organs or tissues; no serious results may follow, or the affected organ may show more or less serious symptoms and signs. Perforation into the pancreas or liver may cause abscesses or chronic inflammation in either organ. Subdiaphragmatic abscess sometimes develops. If the perforation extend into the gall bladder, gall-stones may fall

into the stomach through the fistulous opening. The intestines may be penetrated and severe diarrhoea occur, with bloody or purulent faeces, or faecal vomiting may take place instead. Rarely, the ulcer perforates the abdominal wall itself, penetrating muscles and skin and leaving an external fistula. The pleural cavity is sometimes invaded, with the formation of a pyopneumothorax; more rarely, the lung is penetrated and the sputum may then contain stomach contents. Rarely, too, the pericardium is penetrated.

The Symptoms and Signs of Perforation.—The onset is usually sudden; indeed, it may be the first and only sign of the ulcer. The patient need not be overcome and incapacitated at once; oftentimes he is able to walk into hospital with such a perforation. It commonly follows some strain (vomiting, exertion, etc.) or trauma, or a hearty meal. Pain is the earliest sign; it is usually referred to the epigastrium, spreading soon to the right and left, but not leaving its original site. There is no pain or difficulty during micturition. Dyspnoea soon follows and deep breathing causes pain about the diaphragm, so that these cases are sometimes mistaken for acute pleurisy.

Collapse and prostration supervene, although in some cases remarkably little prostration is observed—a fact which is apt to mislead, all the more so as the general signs may greatly improve after a few hours, before graver symptoms develop. The face then is anxious, often pinched, and there is apt to be great restlessness. The pulse is usually accelerated, though sometimes it is normal, and the temperature may be but little altered immediately after perforation has occurred; usually there is slight fever. The abdomen may be flat and tense; sometimes it is distended; the muscles are rigid. Tenderness is chiefly in the upper abdominal zone, mostly about the epigastrium. Percussion may or may not give dulness here, and the liver dulness need not be obliterated. On auscultation a friction rub can often be heard over the diaphragm, and sometimes the gurgling of fluid through the perforation.

Though it is commonly taught that vomiting never occurs after a perforation, this cannot be relied upon, as experience teaches the fallacy of too strict an adherence to this rule. Attention should be paid to the base of the thorax on the left side, where one often obtains restricted movement, localized pain and tenderness with dulness in the lower axillary region, and other signs of fluid. Fluid may collect beneath the diaphragm, about the anterior and external surfaces of the spleen, or in the lesser peritoneum. Later on, one may obtain the usual signs of general peritonitis.

TREATMENT.—Rest in bed is essential for at least four weeks after the diagnosis has been established and the treatment commenced. After this, the transition from bed to walking about must be very gradual, and the patients should be made to rest after every meal. This precaution should be observed for some months. It is true that even this does not always suffice, and a much longer period may be necessary; but apart from active operative interference, rest to the body and to the stomach are the main essentials in the present state of our knowledge.

Dietetic.—In all cases it is well, during the first few (three to eight) days, to depend exclusively upon rectal alimentation. In this way the stomach is given a complete rest. Every six hours the patient should receive (by way of the rectum) six ounces of broth with egg, and if necessary a little whiskey. Each enema should contain a little salt; the bowel should each time be first washed out. Any other diet is apt to cause distention, to increase the hyperacidity, to induce vomiting, and thus directly or indirectly to prevent healing of the ulcer. At most, a little water or chopped ice may be taken.

When food is admitted by the mouth it is best to commence with milk and lime-water, strained oatmeal gruel, or albumin-water—at first in small quantities (a few ounces)—every two hours, and to combine this as required with the nutrient enemata. Then, while gradu-

ally increasing the amount of food furnished to the stomach, one may reduce the rectal feeding. At the end of four weeks one may add finely divided albuminous food, minced white flesh, chicken, partridge, pounded fish and tender beef, and light puddings. *The greatest care should be taken in changing to a more solid diet, and it is always safer to go very slowly at this stage.* After six weeks, red meats may be given. One must, however, take special care with the diet for several months after there is an apparent cure, and all coarse, irritating, spicy, and rich foods must be avoided.

Medicinally, Carlsbad salts in small doses (one drachm), given in hot water in the early morning, will often be found beneficial, and bismuth, especially the subgallate, in doses of twenty to thirty grains, three times daily, affords great relief. Again, with other patients, the combination of sodium bicarbonate and calcined magnesia assuages the pain and the burning.

The constipation may not be relieved by the Carlsbad salts; in which case enemata of soapsuds should be administered. Lavage may be used where there is a very intractable stomach, and sodium bicarbonate may be added to the water used.

Pain, if severe, may need morphia; a wet compress over the epigastrium is often soothing.

For **vomiting,** ice, bismuth, and nitrate of silver (gr. ʒ). For the **hæmatemesis,** absolute rest and quiet, ice to suck, and small doses of adrenalin chloride in solution of 1 to 1,000, may be effective. For the restlessness one may use morphia hypodermically. For severe recurrent hemorrhage surgical intervention may be necessary and is often most successful.

Surgical Treatment.—If the bleeding be of a very serious character, recourse should be had to operation. The indications for surgical interference in gastric ulcer are briefly:

Repeated, profuse and dangerous hemorrhage. Scars which have resulted in tumor formations, which greatly interfere with the motor function. In these cases gastro-enterostomy is recommended. The operation is also indicated where active ulceration exists, inasmuch as draining the stomach suffices to heal the ulcer. It can be performed, too, very quickly. In some of the cases, however, pylorotomy is required or advisable, and in others pyloroplasty.

Purulent perigastritis, especially if subphrenic or thoracic.

Perforation into the abdominal cavity. In this condition operation must be done early, otherwise the case is almost certain to end fatally. Early operations are followed by more than fifty per cent. of recoveries, in some institutions the proportion being even greater. Dr. James Bell's cases at the Royal Victoria Hospital, Montreal, numbered ten, with nine recoveries.

In hour-glass contraction one of three operations is employed, viz.:

Gastroplasty, gastro-enterostomy, or gastro-gastrotomy.

[For further details concerning these operations consult the article on *Stomach and Oesophagus (Surgical).*]

IX. CANCER OF THE STOMACH.

CARCINOMA VENTRICULI.

This is a malignant epithelial neoplasm of the stomach. About one-half of all cancers arise in the stomach.

ETIOLOGY.—It occurs chiefly between the ages of forty and seventy, and most of all between the ages of fifty and sixty. Lebert's statistics show that only 1 per cent. occur under 30 years, 17.6 per cent. between 30 and 40 years, 60.7 per cent. between 40 and 60 years, 16.3 per cent. between 60 and 70, and 4.4 per cent. over 70 years of age.

It is a little more common in males than in females. There are no climatic conditions of importance, except perhaps the fact that it is more rare in tropical countries. Such, at all events, is the evidence given by physicians residing in those lands.

VOL. VII.—33

Heredity seems to acquire a more and more doubtful value in the etiology of cancer.

Parasites have not yet been proven as a direct cause, nor has irritation as such been definitely associated with the disease as its chief etiological factor. Chronic ulcer of the stomach, however, is a frequent antecedent.

MORBID ANATOMY.—Cancer of the stomach is a typical epithelial overgrowth extending to the other coats of the organ, and thence to neighboring glands and to other organs by continuity and by way of lymph and blood channels. It is nearly always primary in this part of the body, rarely secondary.

The Situation of the Growth.—The pylorus is the most common place of origin, the growth often starting at the tubercle, while next in frequency come the lesser curvature and the cardia; the fundus is nearly always free. The statistics of Hahn on this point show that out of 170 cases 60 were at the pylorus, 27 at the lesser curvature, 40 at the cardia, 7 in the anterior wall, and 7 in the posterior wall; in 8 cases the disease began in the greater curvature, and in 21 the whole organ was diffusely involved.

Orth's statistics differ somewhat from Hahn's. He found that in 60 per cent. of all cases the pylorus was involved chiefly, while in 20 per cent. the lesser curvature was the seat of origin; the cardiac orifice was involved in only 10 per cent. of all his cases, while the remaining 10 per cent. were distributed more or less unevenly over the other portions of the organ.

The Neoplasm.—This is either circumscribed or diffuse in character. When circumscribed it projects as a villous or fungoid growth, with or without central degeneration and ulceration; when diffuse it extends along the submucosa, causing thickening and rigidity of the wall and a roughening of the mucosa, which may be ulcerated in various portions, while the rest of the mucosa shows either a chronic inflammation or hemorrhage.

Orth distinguishes four forms:

1. The cylindrical-celled, *i. e.*, the soft fungous-like growth, which often forms papillary projections on the surface. These projections show microscopically an adeno-carcinomatous arrangement. Such growths are oftenest at the pylorus, where they are sharply delimited toward the duodenal end. Necrosis, ulceration, and hemorrhage are apt to occur, and perforation may result.

2. The medullary or soft form, which is mainly ulcerative, and shows a projecting wall. Degenerative processes are common, and the growths may extend to the serosa or through it. Extension to the glands is especially common in this variety, and it is very rapid in growth.

3. The scirrhous form, with carcinoma simplex as its subvariety. This is the hard form of carcinoma ventriculi. Instead of being circumscribed, it shows a more diffuse thickening of the whole wall. The mucous membrane may be superficially ulcerated, but there is a tendency to scar formation on the surface which may be either rough or smooth. Here the cancer extends gradually into the surrounding parts, more especially into the muscles, and the microscopic appearances are such as to render the differential diagnosis from chronic simple ulcer, or from simple cirrhosis of the stomach, either difficult or impossible without a microscopical investigation. These cancers tend to shrink, and, inasmuch as they are most common at the pylorus, stenosis of that orifice is apt to follow; moreover, adhesions are very commonly found between the pylorus and the surrounding parts, which tends further to increase the liability to stenosis.

4. The colloid variety. In this form there is a diffuse thickening of the wall due to the presence of a jelly-like, translucent material, brownish-gray in color, the result of colloid degeneration of the cancer cells. Shallow ulceration accompanies this extension and secondary nodules are frequent. Here, too, the pylorus is the commonest seat of origin, and from this point the cancer may spread far and wide. In some cases, however, the stomach is really smaller than normal.

These different forms of cancer of the stomach are apt to be combined in one and the same case, and the name

carcinoma simplex is given to that form in which the medullary and the scirrhous varieties are more or less evenly mingled.

The Shape of the Stomach.—This depends upon the situation and upon the variety of the tumor. Where the pylorus is involved there is apt to be dilatation; where the cardia is the original site, the stomach may be smaller than normal; and where the body is involved, there may be either a diminution in size or, if much scarring has taken place, there may be an hour-glass contraction or some other perversion of the original form.

The Position.—There may be ptosis of the stomach, or, if the growth at the pylorus be heavy and free, the stomach may assume a more vertical position, while in other cases there is no alteration whatever from the normal.

Extension.—The advance of the disease may be confined to the stomach, in which organ it causes degeneration and hemorrhages, great or small, and such hemorrhages may be fatal. There may be perforation with general peritonitis, or merely a local peritonitis with adhesions. This, however, is evidently a rare event, for out of forty cases at the Johns Hopkins Hospital only six were found to have such a condition. The perforation may result, however, in establishing an abnormal communication with other organs or cavities of the body, or with the spaces in between the various organs and tissues of the abdominal cavity.

The cancer again may extend to the œsophagus, or by contiguity to any other part in the vicinity. It may extend by way of the lymph channels, getting into the glands, chiefly those about the portal vein and cœliac axis, and eventually it may reach the thoracic duct, whereby it will involve (by retrograde progression) the left supraclavicular gland as well.

The liver is involved in more than twenty-five per cent. of all cases, chiefly by way of the blood or lymph channels; and inasmuch as growth in the liver is easy, from the nature of its tissue and constituent parts, the secondary nodules there may be much more extensive than was the original disease in the stomach.

The peritoneum and omentum may likewise be involved through extension by the lymph channels; so, too, may the pancreas, in which case sugar is usually present in the urine.

Secondary Cancer of the Stomach.—This is a rare condition, and is due to direct contact, the disease extending from the pancreas, liver, œsophagus, etc., or, as in one case recorded, by implantation from a primary cancer of the tongue. Another method by which it may arise is through metastases from the blood. Welch has collected 37 cases in all; of these, 17 were secondary to cancer of the breast, 8 to cancer of the œsophagus, 3 to cancer of the mouth.

In the recent series of the Johns Hopkins Hospital, reported by Osler and McCrae, three cases were found—two associated with primary cancer of the pancreas and one with primary cancer of the uterus.

The morbid anatomy is in all respects similar to that of other cancers. So far as the other organs are concerned, it may be stated that brown atrophy and fatty degeneration are often observed.

SYMPTOMS AND COURSE.—*The Onset.*—This is usually insidious, and shows mainly a persistent dyspepsia, more or less progressive, with pain in the abdomen and loss of flesh. As time goes on, vomiting occurs and cachexia gradually develops, until after some months, or perhaps at the end of two or even three years, the patient succumbs to the disease.

Examination of such patients in the fairly advanced stage shows profound weakness, an earthy hue to the skin, emaciation, and vomiting of more or less undigested food and coffee grounds, which show on chemical examination the presence of abundant organic acids, and especially lactic acid.

Examination of the abdomen shows, in the majority of cases (because the majority are pyloric in origin), a marked dilatation of the stomach with succussion splash, tenderness in the epigastrium, and perhaps a tumor.

The symptoms, of course, vary according to the stage of the disease, the extent and the pathological nature of the growth, its site, and its direction of progression.

The Individual Symptoms.—The onset may be latent entirely, and development may occur under the picture of senile marasmus, or a chronic gastritis, or a primary cancer of the liver; or the condition may be found accidentally at autopsy in death from other causes.

In nearly all cases the onset is insidious. In the majority of cases there has been previously no dyspepsia, and the patient may seem to be suffering from a mild gastritis, though without apparent cause. There are loss of appetite, a sensation of fulness after taking very little food, and flatulence. Sometimes indeed the onset is sudden, after an acute indigestion or influenza. This is less marked in young persons, as has been shown in the cases of Osler and McCrae.

There is, however, one set of cases in which the onset is exceptional—viz., those in which the cancer is engrafted upon a previous ulcer with all its classical signs. Even when there is cancer of the cardiac end the onset is gradual, except perhaps that the pain comes earlier, and is present not only after meals but at any time during the day.

The Appetite. The appetite becomes gradually worse; very little satisfies the patient, and there is rarely a good appetite for any length of time. As a rule there is anorexia; meat is especially abhorred. That anorexia is more marked in young persons cannot be considered as an infallible statement.

Pain. Pain is rarely absent. In Dr. Osler's series thirteen per cent. ran a painless course, but even when present the pain as a rule is not intense; not so severe, at all events, as in ulcer. There are a painful distress and a dull ache in the stomach region rather than true pain, and the symptoms are rarely localized. It cannot be said that any relation exists between the absence of pain and the site or nature of the tumor, nor can it be said that there is any relation between the presence of the tumor and the site of the pain.

Food often increases the pain, especially late in the digestive period, unless the cancer be at the cardiac end. Sometimes the pain has no relation to the ingestion of food, but is continuous. It may radiate, more especially to the back, or, if the cancer be at the cardiac end, it will be referred to the vicinity of the sternum. There is nothing characteristic about it. It is less acute, as has been said, than it is in ulcer of the stomach, and if there be great tenderness a complication may be suspected. With pyloric stenosis especially, there is a sense of gastric unrest; cramp-like pains due to the peristalsis may be present.

Vomiting. This is a very frequent symptom, occurring in from eighty to ninety per cent. of all cases. It usually appears late in the disease, and is especially common in cancer of the pylorus. In such cases there are dilatation of the stomach and stagnation of food. As a result the vomiting is often severe and consists of coarse, undigested acid food with a foul odor or one of feces (in the latter case even when there is no communication with the bowel).

Much mucus is present when the cancer is at the cardia, and in such cases the vomiting is more of the nature of a regurgitation of œsophageal origin than a true vomiting.

In some cases there is no vomiting at all, more especially when dilatation is absent, or when the cancer is on the greater curvature or on the posterior wall of the stomach. Absence of vomiting does not depend upon the presence or absence of ulceration. Sometimes, again, vomiting, which has been very severe, may cease more or less suddenly, as, for example, when the pyloric stenosis breaks down and gives a new exit for the food into the duodenum.

As to the time of its appearance, the vomiting usually occurs late in the afternoon or evening; it is sometimes more or less periodical, every two or three days only, in which cases the matter vomited is often copious (several

litres), and its appearance depends chiefly upon the nature of the food ingested.

Hæmatemesis. Hæmatemesis occurs in less than half of all cases of gastric cancer. It is associated with small parenchymatous hemorrhages from degeneration of an ulcerated tumor, or, more rarely, with the erosion of a larger vessel, in which case a fatal result may ensue, though this is rare. The amount of blood is usually small; it oozes slowly and remains a long time in the stomach. For this reason it becomes rapidly changed in color and nature, and assumes the appearance of chocolate or of coffee grounds, and the blood cells in it are more or less altered and much pigment is formed.

Bowels. These are at first costive; constipation indeed is much more common than is diarrhœa, though sometimes diarrhœa and constipation alternate. There is no relation between the growth itself and the regularity of the bowels.

Objective Signs.—Nutrition. At first the nutrition is good, and it should be remembered that a good nutrition is not necessarily incompatible with the presence of a cancer of the stomach, unless the disease has been of a year's duration. Again, the patient may, after being emaciated for a certain length of time, regain his weight for a brief period under the employment of lavage, a proper diet, etc. As a rule, emaciation follows soon upon the onset. The skin becomes lax and assumes an earthy color, the muscles waste, and the patient becomes dried up and cachectic. Loss of strength goes hand-in-hand with loss of weight.

Fever. Fever occurs probably in about one-half of the cases; it is usually very slight and manifests itself at varying intervals. The type varies; it may be slight and intermittent, or very irregular, or sometimes—more especially when ulceration and metastases are present—there may be periods of high fever following sudden rigors. Such a condition is usually associated with absorption of toxins, where fever is persistently high, and one is justified in suspecting an inflammatory complication, such, for example, as peritonitis or pleurisy.

The Tongue.—The tongue is apt to be thickly coated, though this varies very much with the condition of the mouth and teeth, and one may find for months a tongue that is perfectly clean while the cancer is progressing.

Taste is apt to be much altered in various ways, and the patient, if an habitué of tobacco, loses a desire for smoking.

The neck may show evidences of swollen glands, as may also the left axilla. Swollen glands, however, are not common; they are associated with involvement of the thoracic duct, and when present form a valuable sign of gastric carcinoma. And yet their absence is in no wise of value as a proof against cancer.

The Abdomen.—Inspection. This is of great importance in the examination for gastric carcinoma, and Osler has drawn especial attention to this fact. One should examine the abdomen for unevenness in the furrows below the ribs, for fulness in the epigastrium, for nodules in the skin or about the umbilicus, for peristalsis and antiperistalsis; this last especially is of great importance in the diagnosis of pyloric stenosis. One may even see a tumor when present, as well as gastrectasis and gastropnoia. Such an evidence of tumor implies either its large size (because if at the pylorus or cardia it would be covered over by liver or ribs), or else a gastropnoia which exposes the otherwise covered portion of the stomach.

The mobility of the tumor may also at times be ascertained by inspection, both when adhesions are present and when there are no adhesions. Various positions of the body too may alter its situation, while artificial inflation may cause it to become more prominent or to disappear. It is to be remembered that a full stomach sometimes pushes tumors up underneath the liver and makes them thus temporarily disappear. Pyloric tumors are the most movable of all, and they are especially so when they are circumscribed and solid.

Percussion is of but little importance in the examination for gastric cancer. When the tumor is present

there may be a dull tympany; when gastrectasis exists percussion reveals the enlarged size of the organ and aids in its proper delineation.

Auscultation and auscultatory percussion have practically no value in the physical examination for gastric cancer. Occasionally, when the cancer is obscure and involves the cardiac end of the stomach, one finds the deglutition sounds delayed or lost.

In the absence of a tumor the diagnosis often remains doubtful, though other signs are valuable positive aids.

The Functional Signs.—It must be remembered that there is no pathognomonic sign of cancer. Each item of evidence must be considered in connection with others, and only from the combination of signs and symptoms is one able to make a positive diagnosis.

The Motor Power.—This is usually greatly diminished; it depends to a large extent on the site of the neoplasm. When the tumor is at the cardiac end of the stomach, the motor power is but little impaired until extension has occurred to other parts of the stomach wall, or until a concurrent catarrh of the mucous membrane is present. When the cancer arises at the pyloric end, however, the motor power is rapidly impaired, and often to an extreme degree. This is more especially the case when there is complete obstruction without a sufficient compensatory hypertrophy of the gastric muscular coats. Hence we have pyloric stenosis with gastrectasis and atony of the wall.

When the cancer involves the body of the stomach, the motor power is impaired in more than one-half of all the cases. It is altered mainly in two ways: firstly, by infiltration of the walls with cancer; and, secondly, by simple weakness of the muscular tissue due to a toxæmia and to cachexia.

Motor insufficiency appears early, especially in the case of pyloric cancer, and increases progressively till marked retention of food occurs. Indeed, the retention is often extreme, and foreign bodies remain for weeks and even months in the stomach without finding an outlet.

The Secretory Power.—The secretory power of the stomach is likewise disturbed, and there is diminution of the hydrochloric acid and subsequently of the peptone and rennet ferments.

With regard to the presence or absence of hydrochloric acid in cancer of the stomach, the following facts are important:

1. Hydrochloric acid secretion usually diminishes with the development of the cancer until free hydrochloric acid is ultimately permanently absent. This occurs in from eighty to ninety per cent. of all cases, very often early in the disease. It should be remembered that one examination alone does not suffice, inasmuch as hydrochloric acid may be only temporarily absent in this as in other diseased conditions of the stomach.

2. Combined hydrochloric acid is also quite often absent.

3. Hydrochloric acid is not always absent; indeed, it may be present up to the end. This is usually coincident with either a very localized tumor, where the rest of the mucous membrane remains more or less intact, or it may occur when the cancer develops upon a previously formed chronic ulcer. In this latter case the hydrochloric acid may be increased. The presence of hydrochloric acid in a test meal is no proof against the presence of cancer in the stomach.

4. The absence of hydrochloric acid in the stomach contents is no proof in itself of the presence of cancer. Such a condition arises in many ways: for example, in neuroses of the stomach, cardiac disease, gastritis, febrile conditions, amyloid disease, atrophy of the gastric glands, etc.

The presence of organic acids is a frequent sign in cancer of the stomach. The chief organic acids found are lactic, butyric, and acetic acids, which arise as a result of fermentation, which occurs so frequently in cancer in association with the presence of hydrochloric acid, of subacidity, and of motor insufficiency. Butyric and lactic

acids are the most common, both being present with about equal frequency, though the latter is more constant and thus more characteristic of cancer, though by no means pathognomonic. The following facts are of importance in regard to lactic acid in cancer of the stomach:

1. Its presence is not pathognomonic of cancer. The requirements necessary for the production of lactic-acid fermentation are merely these: subacidity, stagnation of food in the stomach, and a lessened digestion of albuminous foods. It may be present in the stomach in a case of intestinal obstruction, sometimes even in pyloric obstruction from benign growths, where the hydrochloric acid is diminished; also in severe gastritis, in atrophy of the mucous membrane, in fat-necrosis of the pancreas, in cardiac and renal disease, in gall-bladder carcinoma, in pernicious anemia, etc.

2. Lactic acid is introduced preformed into the stomach, under normal conditions, with the food. For this reason Boas recommends a test breakfast consisting of oatmeal and water, such a meal being free from lactic acid. It is prepared by adding a tablespoonful of Knorr's oatmeal, with a little salt, to one quart of water. This may be introduced at night into a previously washed out stomach, and the remains removed in the early morning. When cancer of the stomach exists, the bacilli present can form lactic acid, even after such a meal, more promptly than when lack of hydrochloric acid and a motor insufficiency are present.

3. Lactic acid is formed only in the absence of free hydrochloric acid. Even a little combined hydrochloric acid sometimes suffices to prevent lactic-acid fermentation, unless there also be a very marked atony.

4. In cancer of the stomach lactic acid usually appears early, often long before gastrectasis appears, though, according to Kuttner and Lindner, not before the tumor is palpable.

5. The presence of lactic acid merely implies three circumstances: (a) subacidity, (b) motor insufficiency, (c) lessened digestion of ferments, all three of which happen to occur most commonly in cancer of the stomach, though they may be present in other conditions.

Lactic acid, then, is not pathognomonic and may be entirely absent. Statistics show it to be present, however, according to Strauss, in ninety-one per cent. of all cases, according to Rosenheim in seventy-eight per cent., and in Kuttner's cases in sixty per cent.

The Microscopical Examination of the Contents of the Stomach.—This reveals at times the presence of blood cells and pigment, though these have no special significance *per se*. Particles of cancer formation are very rare in cancer. At the Royal Victoria Hospital this occurred but once in eighty-five cases in which the stomach contents were examined, but the event proved here of great value inasmuch as the diagnosis was otherwise in doubt.

The Boas-Oppler bacilli, which are long, thread like, non-motile bacteria, occur chiefly where lactic acid is present, but are of no other diagnostic value so far as carcinoma of the stomach is concerned. Sarcinae are uncommon unless free hydrochloric acid is present—therefore, as a rule, they are found only in those cases of cancer in which the neoplasm has been engrafted on a previous ulcer. It should be remembered, however, that the presence of sarcinae is no proof against the presence of cancer. Yeast cells sometimes occur. Inasmuch as the digestion of proteid is delayed, meat fibres in abnormal quantities are usually found, while the starchy foods show more evidence of digestion.

Cancer of the Cardiac End of the Stomach.—In this condition dysphagia is a prominent symptom. At first there is a sense of the food stopping in the oesophagus, especially after solids have been taken, and liquids are ingested to assist in the deglutition of the solids. The symptoms are progressive, and water is now essential to carry down the solids, and discomfort and oppression follow. The food is then ejected by retching. Liquid diet alone is then possible. Later on, even very little of this, and still later none, can be taken without its being rejected.

There is regurgitation of much mucus, with or without food particles, and more especially at night. As already said, the deglutition sounds may be delayed or absent, though this is an unreliable sign. The passing of the tube meets with resistance and tubes of various sizes must be tried. It should be remembered that this resistance is not always a sure sign. However, the repeated finding of blood, commonly in a fresh state, on the tube after it has been withdrawn is a matter of grave significance, even if there are no signs whatever of stricture.

Cancer of the body of the stomach is associated with atrophy of the organ. This usually reveals a smaller stomach than normal, and its capacity becomes progressively less. The tumor is usually felt on the left side beneath the ribs. The passing of the stomach tube in such a case aids the diagnosis, and inflation either causes vomiting at once, or, at all events, no marked increase in the gastric tympany.

The metastases which occur in cancer of the stomach vary in size; they involve, of course, most commonly the glands and the liver. The thorax may be invaded, and the pleurae, more especially the left; the lungs and the mediastinal glands may all be involved, as also, though more rarely, the peritoneum and the heart itself. There is practically no organ in the body which may not be secondarily involved by metastases, and under certain conditions these develop so much more rapidly than the original growth as to mask the primary seat of the disease. This is a most common occurrence where the liver is involved, or the peritoneum.

The metastases which occur upon the abdominal wall are of special interest, and attention has been chiefly called to them in recent publications by Dr. Osler. These occur subcutaneously as small nodules of various sizes, in and about the umbilicus, which itself may become very hard. The nodules may extend up over the chest, also over the area of the liver, and often their removal and examination constitute the necessary final step in establishing the diagnosis of carcinoma ventriculi.

Complications. Perforation of the stomach is not very common: most statistics agree in placing it at four per cent. There is usually a walled-off abscess cavity, which often progressively increases. Tracks may be made into the other viscera or the neighboring tissues.

Jaundice often occurs and may be due either to an obstruction of the main bile ducts, a secondary involvement of the liver, or, more rarely, to a simple catarrh of the common duct. As a rule, the jaundice persists when once present, though this is not always the case.

General anasarca, more or less slight in degree, may appear in the late stages of the disease. It is due to the cachexia and anæmia, or more rarely to a peripheral thrombosis.

Ascites may be present, and is associated usually with a cancer of the peritoneum, or an occlusion of the portal vein from the pressure of glands or the extension of the cancer into the part. The ascites may be a prominent feature, masking the original cause of the disease. When the ascites is associated with a cancer of the peritoneum, the fluid is usually hemorrhagic in character.

Multiple thrombi may occur, usually associated with marasmus, more rarely with occlusion caused by the neoplasm.

DIAGNOSIS.—The earliest possible diagnosis is essential to a rational treatment of the condition, and a diagnosis should be established before a tumor is evident, either to palpation or to inspection. To establish such a diagnosis one must depend largely upon early evidences of functional disorder. It must be remembered that there is no single pathognomonic sign of cancer of the stomach. The disease of course may be latent, but the absence of gastric symptoms is an important negative sign. When the gastric signs are present and no tumor is evident, one must rely upon the age, the history, hæmatemesis, emaciation, gastrectasis, the chemical signs in the stomach contents, etc. When the tumor is palpable its loca-

tion must be determined to be gastric, and this fact must be weighed in connection with the history and the general features, above described.

In the *differential diagnosis* one must consider mainly: (1) Those diseases in which hydrochloric acid is diminished or absent, and in which a tumor is not evident upon physical examination; (2) those general diseases in which the gastric evidences of disease are unsatisfactory, but in which the general signs warrant the suspicion that there is a latent gastric carcinoma; (3) the necessity, in the cases in which a tumor is present, of differentiating between (a) one which is located in the stomach and (b) one which is located outside that organ, in the immediate neighborhood.

1. Diseases with diminished or absent hydrochloric acid. These are mainly (a) chronic gastritis, (b) atrophy of the mucous membrane, and (c) gastric neuroses.

(a) Chronic Gastritis. Here the course and duration of the disease are important. The insidious onset with remissions and exacerbations, the local rather than the general features, the fact that hydrochloric acid is not always completely and permanently absent, and the probable cause (alcohol, etc.), all may be placed against a history in which there has been a previously healthy digestion with an unexpected and unexplained dyspepsia, not relieved by diet or drugs; with a probable hæmatemesis, severe general signs, and stomach contents which show persistent and progressive diminution of the hydrochloric acid and the presence of more or less lactic acid. Difficulties indeed arise where the gastritis is accompanied by atrophy of the mucous membrane and where the course is rapid and characterized by emaciation. Vice versa, it must be remembered that cancer sometimes develops slowly, and only with a mild dyspepsia.

(b) Atrophy of the Mucous Membrane. This may be associated with pernicious anemia, with the terminal stage of a chronic gastritis, with achylia gastrica, with benign pyloric stenosis, or with cancer elsewhere.

In pernicious anemia the nutrition is usually maintained, and there is an absence of hæmatemesis, gastrectasis, lactic acid, etc. The blood-changes, too, in pernicious anæmia are, as a rule, more marked than are those which occur in cancer of the stomach, though at times, it is true, the conditions of the blood may be incidental in each case. As a rule, however, there are more nucleated red cells of the blood, the poikilocytosis is greater, the color index may be higher, and there is more likelihood of the presence of megaloblasts when pernicious anæmia is present. Exacerbations and remissions too are more apt to occur in pernicious anæmia than in carcinoma.

Chronic gastritis has already been considered. Achylia gastrica, considered by Einhorn and some others as an independent disease, implies a total absence of gastric juice. It is not associated in any way with cachexia or with progressive emaciation. The general condition of the patient is usually good, the digestive power excellent, even when there is no motor insufficiency, and examination of the stomach contents does not necessarily show the presence of lactic acid. More probably, as many suggest, achylia gastrica is merely a symptom associated with some other primary disease, such, for example, as cirrhosis of the liver. (Such a case has come under my personal observation.)

Benign pyloric stenosis, *vide antea*.
Cancer elsewhere, *vide infra*.

(c) Gastric Neuroses. In gastric neuroses in elderly people there is at times considerable difficulty in arriving at a proper diagnosis, though as a rule the general condition of the patient, frequent examination of the stomach contents, and the course of the disease soon lead one to a conclusion in the right direction. In such cases, as already mentioned, one must consider the age of the patient, the history, the presence of hæmatemesis, gastrectasis, lactic acid, etc., as well as the effect of treatment, both general and dietetic.

2. Those general diseases in which the gastric evidences

are indefinite, but in which the general signs lead one to suspect a latent gastric carcinoma.

I have seen, for example, such difficulties arise in cases of suspected Addison's disease in which the general malaise, progressive weakness, dyspeptic signs, and general condition aroused a suspicion of the possibility of latent gastric cancer. As a matter of course, valuable aid may be derived from the examination of the stomach contents, where possible, and from a proper examination of the mucous membrane for the presence or absence of the usual pigmentary changes which accompany Addison's disease. To this may be added the injection of tuberculin, a reaction to which would render the presence of Addison's disease somewhat more likely.

3. The differentiation between (a) gastric and (b) non-gastric tumors calls for a careful weighing of the symptoms and signs presented and for a determination of the exact situation of the tumor.

The gastric tumors must be mainly differentiated as to their nature and situation. The signs and symptoms accompanying cancer of the cardiac end of the stomach and of the body of the stomach have already been mentioned (*vide antea*). As regards the nature of a tumor of the pylorus, there are four possibilities to be considered: It may be (1) a malignant growth; or (2) a scarred ulcer of the pylorus with stenosis; or (3) a simple hypertrophic stenosis of the pylorus; or, finally, (4) some other form of benign tumor, such as lipoma, fibroma, etc.

The symptoms connected with a cancerous growth of the pyloric end of the stomach have already been sufficiently considered. A scarred ulcer of the pylorus can be diagnosed as such only by the previous history of ulcer and especially of hemorrhages from the stomach, and by the finding—as happens in nearly all the cases—of free hydrochloric acid in the contents of the stomach. In other respects there are the usual signs of motor insufficiency associated with any pyloric obstruction, but there is not, as a rule, the same degree of wasting of the gastric muscle wall. Unless the general condition of the patient has suffered very greatly from malnutrition, the muscle wall remains hypertrophied for a great length of time, and peristalsis and anti-peristalsis may very frequently be seen even in spite of extreme dilatation.

The vomiting occurs, as in other cases of motor insufficiency with obstruction, at long intervals, is very copious and explosive in character, but as a rule, in contradistinction to what is observed in pyloric cancers, the proteids are well digested and the starches more or less unaffected.

Hypertrophic stenosis of the pylorus is usually slow in growth. It is very often congenital, and there is a history of many years of gastric symptoms without evidence of metastases; there are intervals, too, of good digestion, and the tumor which is found is usually smooth, not large, without adhesions, and therefore very movable.

Examination of the stomach contents will show the presence of hydrochloric acid and the absence of lactic acid.

The presence of some other form of benign tumor is rather to be inferred than accurately diagnosed. When it causes obstruction, the symptoms and signs resemble very much those of hypertrophic stenosis.

Growth Located Outside the Stomach.—The tumors simulating gastric growths, but existing in reality outside the stomach, are mainly:

1. The pancreas, either normal or pathological. When normal it is usually found deeply situated in the median line, fixed and immovable with respiration, and absent upon inflation of the stomach. When it is diseased, and especially when it is the seat of a cancerous growth, one may find clayey, fatty stools, even when there is at the same time no jaundice. Jaundice may, however, be present from pressure of the growth upon the common duct. The portal vein may be pressed upon and the resulting obstruction may give rise to ascites. There may also be glycosuria, and as a rule the course is a rapid one.