

VI. DILATATIONS AND DIVERTICULA.

Stenosis of the gullet is followed by secondary dilatation of the tube above the constriction and great hypertrophy of the walls. Primary dilatation is extremely rare. The tube may attain extraordinary dimensions—30 cm. in circumference in Luschka's case. Regurgitation of food is the most common symptom. There may also be difficulty in breathing from pressure.

Diverticula are of two forms: (a) Pressure diverticula, which are most common at the junction of the pharynx and gullet, on the posterior wall. Owing to weakness of the muscles at this spot, local bulging occurs, which is gradually increased by the pressure of food, and finally forms a saccular pouch. (b) The traction diverticula situated on the anterior wall near the bifurcation of the trachea, result, as a rule, from the extension of inflammation from the lymph glands with adhesion and subsequent cicatricial contraction, by which the wall of the gullet is drawn out.

VI. DISEASES OF THE STOMACH.

I. METHODS OF CLINICAL EXAMINATION.

The stomach normally occupies the left upper quadrant of the abdomen, one quarter of the organ only lying to the right of the median line; it is bordered above by the diaphragm and liver, below by the intestine and transverse colon; on the left it reaches the spleen, and on the right it touches the gall-bladder; anteriorly it lies against the ribs and the abdominal wall. The longitudinal axis extends from the left above downward and backward to the right.

The cardiac orifice is about opposite the sternal border of the sixth or seventh left costal cartilage. The highest point of the fundus reaches the level of the fifth rib, or even that of the fourth interspace, while the lowest point is 3 or 4 cm. above the navel. The pylorus lies on a level with the tip of the xiphoid cartilage at a point midway between the right sternal and parasternal lines; it is normally covered by the left lobe of the liver. With the stomach moderately filled with air the upper limit of resonance reaches the fifth interspace in the left mammary line, while the lower limit is several cm. above the navel.

The greatest vertical diameter of gastric resonance varies, according to Pacanowski, from 10 to 14 cm. in the male, and is about 10 cm. in the female.

Methods for determining the Position and Size of the Stomach.—

(1) Inflation by bicarbonate of soda and tartaric acid. Dissolve a teaspoonful of each separately in as small a quantity of water as possible,

and let the patient drink the one solution immediately after the other.

(2) Inflation by means of a bulb-syringe apparatus which can be attached to a stomach tube already introduced.

(3) As a makeshift the patient may be given 250 to 500 c. c. of water on an empty stomach in divided doses and the lower limit of the stomach determined by percussion after each drink. The normal stomach sinks gradually to a point a little above the navel, while the dilated and atonic stomach falls rapidly to a much lower level.

The first method is the simplest and most practical, and is generally one of the first steps in the physical examination; the tube is not introduced until the test-meal has been given. The method has the objection that the amount of air introduced cannot be so well regulated and that one may not in a given case fill the stomach to the entire capacity, while occasionally a spasmodic contraction of the cardia and pylorus may give the patient for a time some discomfort.

Auscultation of the Deglutatory Murmurs.—On listening at the tip of the xiphoid cartilage as the patient swallows a mouthful of water one hears normally two murmurs. (1) The primary murmur is heard synchronously with the act of deglutition and sounds as if water were injected into a space containing air. (2) The secondary murmur is heard up to twelve seconds later and is a coarser gurgling sound. It is well while listening to place one hand on the trachea, as the first murmur may be absent. In oesophageal and cardiac stenosis the second sound is delayed and altered in character.

The following description of methods is merely a rough summary. For fuller particulars see the works of Ewald, Boas, Leo, Wesener, etc.

Examination of the Contents of the Stomach.—Various forms of test-meals have been proposed. The simplest and most satisfactory is that of Ewald. His test breakfast (*Probefrühstück*) consists of one roll (*Brödcchen*)—about thirty grammes of white bread—and one glass of water or a cup of tea without milk or sugar. One hour later the contents are to be expressed.

The contents should not be more than 20 to 40 c. c. The filtrate should be a clear yellow or yellowish-brown fluid. The fluid should contain free hydrochloric acid; it should not contain sufficient lactic acid to be recognized by the ordinary tests. Pepsin and pepsinogen, the curdling ferment and its zymogen, should be present.

Albuminoids should be almost entirely converted into peptones; propeptones, if present at all, should be recognizable only in traces. Starches should be so far converted into achroödextrin, dextrose, or maltose that the reaction for starch or erythrodextrin with Lugol's solution should be no longer present.

Chemical Examination of the Gastric Contents.

(1) *Acidity* may be determined by litmus paper.

(2) *Presence of Free Acid.*—(a) Tropæolin O. O. The brownish-yellow color of the alcoholic solution is turned by the addition of a fluid containing free acid to a deep mahogany brown or brown-red or deep red, according to the strength of the acid. This is most commonly used as tropæolin paper—strips of filter paper soaked for some time in an alcoholic solution. The paper must not be kept too long. It is best to make up a new quantity monthly at least.

(b) Congo red. Solutions of Congo red of a brick-red color are turned blue by the addition of a fluid containing pure acid. This is best used as Congo paper, which is a very delicate reagent, and, on the whole, the most satisfactory. Many other reagents have been used (methyl violet, fuchsin, malachite green, benzopurpurin), but the two above-mentioned tests are probably as satisfactory as any.

(3) *Presence of Free HCl.*—The best and simplest test is that of Günzburg: Phloroglucin, 2; vanillin, 1; absolute alcohol, 30. To a drop of the gastric contents (better filtered) add a similar quantity of the reagent on a porcelain plate. On evaporation gradually to dryness over a flame, a beautiful rose-red color begins to appear at the edges if HCl is present. This is merely a test for a free mineral acid, but HCl is the only one present in the gastric juice.

(4) *Presence of Lactic Acid.*—The best test is that of Uffelmann. Add 1 to 2 drops of tinctura ferri chloridi to 10 to 20 c. c. of a 5-per cent solution of carbolic acid and dilute with water till it assumes an amethyst-blue color. On the addition of a few drops of a solution containing lactic acid to about 1 c. c. of this solution the color changes to a clear lemon-yellow. The test may be simulated in the presence of phosphates, mineral acids in concentration, grape sugar, alcohol, etc.; hence in cases of doubt it is always prudent to shake 20 c. c. of gastric juice with 10 c. c. of ether three times and then evaporate the ether to dryness over a water bath. To the ether residue, which contains any lactic acid present, add several drops of water. On the addition to this of an equal quantity of the reagent a reliable test for lactic acid may be obtained.

(5) *Butyric acid* gives with Uffelmann's reagent a result very similar to that with lactic acid. The color is, however, more brownish. The odor is sufficient evidence of its presence for practical purposes, which is also true of

(6) *Acetic Acid.*

Quantitative Tests.—(a) Test for the total acidity. This test is practically a test for the HCl, where this is present to any extent, as, under these circumstances, other acids are present usually in unappreciable quantities. To 5 to 10 c. c. of filtered gastric contents, a one-tenth normal solution of sodic hydrate is added from a burette till neutralization. This point can be determined by adding a drop of an alcoholic solution of phenolphthalein to the gastric juice. The solution remains colorless in acid or neutral solution, but turns red in alkaline. This test estimates not only the

free HCl, but that in combination. Normally 4 to 6 to 6.5 of the one-tenth solution is required. Each c. c. of this one-tenth solution = .003646 HCl.

(b) *Test for Free HCl.*—If one desires to estimate more accurately the free HCl, the simplest method is Boas's modification of that of Mintz. From 10 c. c. of the gastric contents all organic acids are removed by shaking with 100 c. c. of ether, and then the test performed as above until Congo shows no longer a grayish-blue discoloration.

Quantitative tests for organic acids are complicated and in practice unnecessary.

Tests for Pepsin and Curdling Ferment and their Zymogens.—In the presence of free HCl it is unnecessary to examine for these elements, as they may be safely assumed to be present.

(1) *Test for Pepsin and Pepsinogen.*—(a) In presence of HCl the presence of pepsin may be determined by adding to 5 to 10 c. c. of the gastric contents a small piece of egg albumen and observing digestion at 37° to 40° during several hours.

(b) In the absence of HCl, pepsinogen alone is found. Add to 10 c. c. of the filtered gastric contents 1 to 2 drops of a 25 per cent HCl solution; add, as before, a small shaving of egg albumen, and see if it is dissolved. The HCl turns the pepsinogen into pepsin.

(2) *Test for the Curdling Ferment and its Zymogen.*—(a) Test for the curdling ferment. Neutralize exactly 5 to 10 c. c. of the filtered gastric contents with one tenth normal NaOH solution and mix with an equal quantity of neutral or amphoteric milk. If the ferment is present curdling will occur in from ten to fifteen minutes at 37° to 40°. One may proceed more simply by adding 3 to 5 drops of the filtered gastric juice to 10 c. c. of milk, when curdling will occur as above.

(b) Test for the zymogen. To 10 c. c. of filtered gastric juice add CaO_2H_2 till slightly alkaline. This sets the zymogen free, and, on mixing with an equal quantity of milk, coagulation will occur as above.

These tests are of much value in the absence of HCl to determine the condition of the mucous membrane. For HCl alone may be absent for a greater or less length of time from various nervous causes, while the absence of pepsin and its curdling ferment at the same time would suggest a serious impairment of the secretory functions.

Tests for the condition of the albuminoids in digestion are complicated, and not necessary in an ordinary clinical examination (directions can be found in the books of Ewald, Boas, Leo, von Jacksch, Wesener, etc.).

Tests for the Condition of the Starch.—If, after an hour of digestion, the addition of a drop of Lugol's solution to the filtered gastric juice is followed by the reaction for starch (blue) or erythroextrin (purple), we may know that the digestion of starch has been hindered. This is usually due to a hyperacidity.

Tests for the Motive Power of the Stomach.—There are various methods, but practically perfectly good results can be obtained by observation

of the amount of fluid obtained after a test breakfast. More than 40 c. c. is a sure indication of motor insufficiency. Large quantities are always suggestive of dilatation.

Test for the Absorptive Power of the Stomach.—Kali iodidi (pure), 0.2 gramme, is taken in a perfectly clean capsule when the stomach is empty. The sputa, tested every two or three minutes with starch and HNO_3 , give the blue reaction inside of fifteen minutes in normal cases. The conclusions to be drawn from this test are, however, of little value.

II. ACUTE GASTRITIS

(Simple Gastritis; Acute Gastric Catarrh; Acute Dyspepsia).

Etiology.—Acute gastric catarrh, one of the most common of complaints, occurs at all ages, and is usually traceable to errors in diet. It may follow the ingestion of more food than the stomach can digest, or it may result from taking unsuitable articles, which either themselves irritate the mucosa or, remaining undigested, decompose, and so excite an acute dyspepsia. A frequent cause is the taking of food which has begun to decompose, particularly in hot weather. In children these fermentative processes are very apt to excite acute catarrh of the bowels as well. Another very common cause is the abuse of alcohol, and the acute gastritis which follows a drinking-bout is one of the most typical forms of the disease. The tendency to acute indigestion varies very much in different individuals, and indeed in families. We recognize this in using the expressions a "delicate stomach" and a "strong stomach." Gouty persons are generally thought to be more disposed to acute dyspepsia than others. Acute catarrh of the stomach occurs at the outset of many of the infectious fevers.

Lebert described a special infectious form of gastric catarrh, occurring in epidemic form, and only to be distinguished from mild typhoid fever by the absence of rose spots and swelling of the spleen. Many practitioners still adhere to the belief that there is a form of *gastric fever*, but the evidence of its existence is by no means satisfactory, and certainly a great majority of all cases in this country are examples of mild typhoid.

Morbid Anatomy.—Beaumont's study of St. Martin's stomach showed that in acute catarrh the mucous membrane is reddened and swollen, less gastric juice is secreted, and mucus covers the surface. Slight hæmorrhages may occur or even small erosions. The submucosa may be somewhat œdematous. Microscopically the changes are chiefly noticeable in the mucous and peptic cells, which are swollen and more granular, and there is an infiltration of the intertubular tissue with leucocytes.

Symptoms.—In mild cases the symptoms are those of slight "indigestion"—uncomfortable feeling in the abdomen, headache, depression,

nausea, eructations, and vomiting, which usually gives relief. The tongue is heavily coated and the saliva is increased. In children, there are intestinal symptoms—diarrhoea and colicky pains. The pulse may be slightly increased, but in some instances is less frequent than normal; there is usually no fever. The duration is rarely more than twenty-four hours. In the severer forms the attack may set in with a chill and febrile reaction, in which the temperature rises to 102° or 103° . The tongue is furred, the breath heavy, and vomiting is frequent. The ejected substances, at first mixed with food, subsequently contain much mucus and bile-stained fluids. There may be constipation, but very often there is diarrhoea. The urine presents the usual febrile characteristics, and there is a heavy deposit of urates. The abdomen may be somewhat distended and slightly tender in the epigastric region. Herpes may appear on the lips. The attack may last from one to three days, and occasionally longer. The examination of the vomitus shows, as a rule, absence of the hydrochloric acid, presence of lactic and fatty acids, and marked increase in the mucus.

Diagnosis.—The ordinary afebrile gastric catarrh is readily recognized. The acute febrile form is so similar to the initial symptoms of many of the infectious diseases that it is impossible for a day or two to make a definite diagnosis, particularly in the cases which have come on, so to speak, spontaneously and independently of an error in diet. Some of these resemble closely an acute infection; the symptoms may be very intense, and if, as sometimes happens, the attack sets in with severe headache and delirium the case may be mistaken for meningitis. When the abdominal pains are intense the attack may be confounded with gall-stone colic. In discriminating between acute febrile gastritis and the abortive forms of typhoid fever it is to be borne in mind that in the former the temperature rises abruptly, the remissions are slighter, and the drop is more sudden. The initial bronchitis, the well-marked splenic enlargement, and the rose spots are not present. It is a very common error to class under gastric fever the mild forms of the various infectious disorders.

Treatment.—Mild cases recover spontaneously in twenty-four hours, and require no treatment other than a dose of castor oil in children or of blue mass in adults. In the severer forms, if there is much distress in the region of the stomach, the vomiting should be promoted by warm water or the simple emetics. A full dose of calomel, eight to ten grains, should be given, and followed the next morning by a dose of Hunyadi-Janos or Carlsbad water. If there is eructation of acid fluid, bicarbonate of soda and bismuth may be given. The stomach should have, if possible, absolute rest, and it is a good plan in the case of strong persons, particularly in those addicted to alcohol, to cut off all food for a day or two. The patient may be allowed soda water and ice freely. It is well not to attempt to check the vomiting unless it is excessive and protracted. Recovery is