NEW VIEWS ON THE PATHOLOGY, DIAGNOSIS, AND TREATMENT OF GASTRIC AND DUODENAL ULCER.

A BRITISH MEDICAL ASSOCIATION LECTURE DELIVERED BEFORE THE TUNBRIDGE WELLS DIVISION ON JANUARY 20TH, 1920.

BY

ARTHUR F. HURST, M.A., M.D. OXON., F.R.C.P.,
PHYSICIAN AND NEUROLOGIST TO GUY'S HOSPITAL.

THE GASTRIC ULCER AND DUODENAL ULCER "DIATHESSES."

THE exciting conditions which give rise to gastric and duodenal ulceration are common to many people who never develop an ulcer, so that the question arises, What is it about one individual that makes him liable to gastric ulcer, about a second that makes him liable to duodenal ulcer, and about others—the majority of people—that save them from being liable to either?

I propose to offer an answer to this question, which will in turn suggest methods of prophylaxis and of after-care which should render the patient treated by the most approved medical means even less liable to relapse than the patient who has undergone an operation, but without running the small but undoubted risks inseparable from the latter.

Although there is a certain shape and position which may be regarded as the average normal stomach (Fig. 1), considerable variations occur in two directions. Whereas with a standard opaque meal the greater curvature of the average or orthotonic stomach reaches the umbilicus or just below it in the erect position, in some normal individuals the stomach is hypertonic, and in others it is hypotonic. In the former the stomach curves obliquely to the pylorus, which is almost its lowest point, and the greater curvature is situated some distance above the umbilicus (Fig. 2); in the latter the stomach is hook-shaped, and the greater curvature is situated more than an inch below the umbilicus, the upper level of the gastric contents being correspondingly low (Fig. 3). The hypertonic stomach generally empties itself more rapidly than the average normal one, and the hypotonic stomach generally, but not so constantly, empties itself less rapidly.

Rehlfuss has recently introduced a method of gastric analysis which is destined, I believe, to have a profound influence on our knowledge of the physiology and pathology of the stomach. Instead of passing a tube an hour after a meal and then emptying the stomach, a perforated metal bulb is swallowed just before the meal; attached to it is a fine rubber tube, the end of which remains hanging out of the patient's mouth. The stomach is emptied of its fasting contents; the test meal is then taken and a small quantity is aspirated through the tube every quarter of an hour until digestion is finished. By means of this "fractional test meal" a curve can be constructed showing the quantity of free and active hydrochloric acid present at each period of digestion. Rehlfuss and Crohn of New York have found three types of curve in normal individuals—the average normal or isosecretion, hypersecretion, and hyposecretion.

Although comparative investigations of the motor functions, as ascertained with the *x* rays, and of the secretory functions, as determined by the fractional test meal, have not yet been carried out on a large scale, there is reason to believe that the hypertonic stomach generally shows hypersecretion. The hypotonic stomach generally shows hyposecretion, but it may—and this is a very important fact—also show hypersecretion.

Barclay and I, working independently, found that the stomach in cases of duodenal ulcer is hypertonic (Fig. 4) and empties with unusual rapidity, the onset of pain corresponding with the moment when the stomach has almost entirely emptied itself. More recently it has become recognized that the stomach in cases of gastric ulcer is generally somewhat hypotonic, and almost invariably empties itself more slowly than the average normal.

One of the earliest discoveries resulting from gastric analysis was the frequent association of hyperchlorhydria with gastric and duodenal ulcer. The more accurate investigations of Crohn by means of fractional test meals show that hypersecretion and hyperchlorhydria are constantly present in both of these conditions.

I have had several opportunities of examining patients who have recovered from duodenal ulcer as a result of medical treatment, occasionally after many years of complete freedom from symptoms. The hypertonic, rapidly emptying stomach has always been found to be still present. One of the group of six patients with symptoms of duodenal ulcer upon whom Sir Berkeley Moynihan operated when I visited his clinic for the first time in 1909 was found at the operation to have no trace of an ulcer,

and therefore nothing more was done. This was his first attack, and the symptoms had only been present a few months. But I had previously demonstrated with the *x* rays that his stomach was hypertonic and emptied rapidly, just like the other five cases in which an ulcer was found. These observations prove, I think, that the characteristic *x*-ray appearance of the stomach in duodenal ulcer is not due to the ulcer, as it is present before it develops and persists after it has healed.

The same thing is true with regard to secretion, as Crohn has found that the curve shows the same hypersecretion and hyperchlorhydria after a gastric or duodenal ulcer has healed under medical treatment as it did before treatment began.

The conclusion which can, I think, be reasonably drawn from these facts is that there is one type of stomach in which a gastric ulcer will develop and another type which is likely to lead to ulceration of the duodenum, if the necessary exciting causes are present, but the latter will not give rise to ulceration at all in an individual with the average normal type of stomach.

I have seen a number of cases in which two or more brothers and sisters have suffered from gastric and from duodenal ulcer, and still more in which brothers and sisters of a patient with a gastric or duodenal ulcer have had symptoms of a similar character,

but so much less severe that it seemed impossible that actual ulceration was present. In the most remarkable duodenal ulcer family I have met with the father and two out of nine children were dyspeptic, and four others had typical symptoms of duodenal ulcer, one dying from a perforation. It is a remarkable fact that I have never seen one member of a family with a gastric ulcer and another with a duodenal ulcer. This suggests that the types of stomach which predispose to the development of gastric and of duodenal ulcer respectively are congenital, and either one or the other may exist in several members of a family.

THE EXISTING CAUSES OF GASTRIC AND DUODENAL ULCER.

An ulcer of the peculiar type found in the stomach occurs nowhere else in the body except the first part of the duodenum and the part of the jejunum immediately adjoining the stoma of a gastro-enterostomy. The one

FIG. 1.—Average normal stomach.

FIG. 2.—Hypertonic type of normal stomach.

FIG. 3.—Hypotonic type of normal stomach.

(A) Vertical position. (B) Horizontal position.
FIG. 4.—Duodenal ulcer with thirty years' history. Hypertonic stomach hides duodenal cap.

common feature of these three situations is the presence of gastric juice. But gastric juice will not digest the normal mucous membrane. Only if a small area of mucous membrane has had its vitality so lowered that it can no longer resist digestion does a superficial erosion form, which may develop into an acute ulcer and ultimately into the typical chronic gastric or duodenal ulcer. The vitality is most likely to be lowered by the action of toxins, which are generally of bacterial origin. The two most important sources are the teeth and the appendix. Bacterial toxins produced by chronic periodontitis (pyorrhoea alveolaris) and by root infection may be excreted by the gastric or duodenal mucous membrane after absorption into the blood stream, and may lead to local necrosis, just as the toxins produced by burns may in rare instances damage the duodenal mucous membrane, and those of uraemia may cause ulcerative colitis. In twenty-four hours very large quantities of pus are produced by the ulcerated areas in pyorrhoea alveolaris, and as all of this is swallowed, it can hardly be doubted that it leads to irritation of the gastric and duodenal mucous membrane, especially in the night, when it is no longer diluted by the food, and when the bacteria are no longer destroyed by acid gastric juice. Some organisms are probably absorbed from the mucous membrane, particularly if it has been damaged as a result of any of the other factors which will be mentioned. The minute submucous lymphoid follicles thus become inflamed, and may finally break down and open into the stomach, producing minute erosions, the precursors of definite

the physiological characteristics already described as predisposing to the production of gastric or duodenal ulcer. The explanation of this is clear. In the gastric ulcer type not only is the acidity high but the emptying of the stomach is slow, so that an exceptionally strong gastric juice remains in contact with the gastric mucous membrane for an exceptionally long period, and the passage of acid chyme through the duodenum is so slow and intermittent that the alkaline duodenal contents are capable of neutralizing it to a great extent. On the other hand, in the duodenal ulcer type the first part of the duodenum is kept constantly filled with exceptionally acid chyme, and neutralization with the alkaline duodenal juice is impossible; even when the stomach is empty gastric juice continues to be secreted, and passes rapidly into the duodenum without being diluted and partially neutralized by admixture with food.

I am convinced that the tendency to develop a duodenal ulcer is increased by excessive smoking; the nicotine apparently acts through the autonomic nervous system, and increases the hypertonus and hypersecretion of the stomach.

DIAGNOSIS.

We owe most of the accurate knowledge we possess concerning the symptoms of gastric and duodenal ulcer to the pioneer work of a number of surgeons, chief of whom should be mentioned Sir Berkeley Moynihan in England and the Mayo brothers in America. A diagnosis can generally be made from an accurate history of the

FIG. 5.—Spasmodic hour-glass stomach, due to a gastric ulcer.

FIG. 6.—Spasmodic hour-glass stomach, due to a gastric ulcer.

ulcers. Septic foci in the pharynx and nasal sinuses probably act in the same two ways.

The association of chronic appendicitis with both acute and chronic gastric and duodenal ulcer is too common to be a coincidence, and the greatly diminished tendency to relapse, especially of acute ulcers, following removal of the appendix without interfering with the ulcer, shows that the appendicitis is the primary condition. It probably leads to ulceration in much the same way as the first of the two channels described in connexion with dental infection.

Chemical irritants, such as alcohol, especially when taken on an empty stomach, vinegar, the acids of unripe fruits, and mustard, pepper, and curry, taken in excess, may irritate the mucous membrane to such an extent that it becomes less capable of resisting digestion by the gastric juice. Insufficiently masticated food, and hard indigestible particles, such as pips and skins of fruit, fibres of raw vegetables, such as celery, and nuts have a still greater effect. When the movements of the stomach are watched with the *x* rays it is seen that the peristaltic waves at the pyloric end are so deep that they divide the extreme distal end of the stomach almost completely from the rest, and as the wave passes on, some of the contents are pushed forcibly through the very narrow pyloric canal, whilst the rest is pushed back into the body of the stomach through the equally narrow channel in the centre of the ring formed by the advancing wave of contraction. The muscular coat of the pyloric end of the stomach thus does the mechanical work which should have been done by the muscles of the jaws and tongue, and the hard particles of food are consequently rubbed against the delicate mucous membrane. It is not surprising that minute erosions develop, which may form the starting point of ulcers; this no doubt explains why ulcers are so much more common in the pyloric end of the stomach than elsewhere.

The occurrence of ulceration is rare in comparison with the frequency of the various exciting causes just described, because it is unlikely for the injured mucous membrane to be digested by the gastric juice unless the stomach has

symptoms, together with the results of an *x*-ray examination, which gives much information obtainable in no other way. A fractional test meal and the examination of the faeces for occult blood are of some value; direct inspection and palpation of the abdomen rarely give much information.

I presume that you are all familiar with the writings of Sir Berkeley Moynihan on the symptoms of gastric and duodenal ulcer. I need only briefly summarize his description, to which I can add little of importance. The symptoms tend to appear in attacks which are generally brought on by an indiscretion in diet, overwork, especially if associated with worry, or exposure to sudden changes of temperature. The attacks are more common and generally more prolonged in winter than in summer. This periodicity is more constantly observed with duodenal than with gastric ulcers.

The one constant symptom is pain. It differs from the pain in all other abdominal disorders in the regularity of its relation to meals. In a given case the pain comes on at a definite interval after a meal of a given size, so that if a patient has pain an hour after dinner one day, he will have pain at exactly the same time every day if his dinner is of approximately the same size. The pain comes on immediately after taking food if the ulcer is close to the cardia; the onset is progressively later as an ulcer approaches the pylorus, and with a pre-pyloric ulcer it generally begins from an hour and a half to two hours after a meal of moderate size. In duodenal ulcer the onset of pain is still later, the usual time being between two and three hours after a meal; it is very characteristic for the pain in duodenal ulcer to be delayed after the last meal so as to wake the patient at 1 or 2 a.m. The pain is always in the epigastrium, and tends to be higher up the nearer the ulcer is to the cardia. In gastric ulcer it may spread towards the left and in duodenal ulcer towards the right, but this is by no means constant. The pain may radiate to the back, especially if the ulcer is on the posterior wall of the stomach and eroding the pancreas. The pain is always relieved by food unless the ulcer is at the cardiac orifice.

The relief is more marked and more prolonged the nearer the ulcer is to the pylorus, and particularly when the ulcer is in the duodenum. The pain is also relieved immediately by alkalis, and there is no doubt that, whatever its actual cause may be, it is associated with the presence of free acid in the stomach, and food acts by diluting and to some slight extent by neutralizing the acid. Localized deep tenderness is almost always present when spontaneous pain is actually felt, but in the intervals it may be completely absent. When the ulcer has penetrated so deeply that local peritonitis is produced, the situation of

Some residue after six hours is therefore strong evidence that actual ulceration has occurred in the hypotonic or hypertonic stomach, although the latter has probably existed since childhood or even since birth.

In gastric ulcer spasm of part of the stomach is frequently present. The spasm may be confined to a very narrow segment corresponding with that in which the ulcer is situated; it then gives rise to a characteristic "incisura" (Fig. 5). In other cases a wider area is involved (Fig. 6), and the appearance may suggest the presence of an organic hour-glass constriction, but the upper segment

FIG. 7.—Hour-glass stomach, due to cicatrization of a gastric ulcer. A, Half an hour after opaque meal. B, Six hours after opaque meal. C, Three weeks after gastro-gastrostomy by Mr. R. P. Rowlands.

FIG. 8.—Gastric ulcer, producing "niche," N, in hypotonic stomach.

the tenderness is found with the x rays to correspond precisely with that of the ulcer.

Vomiting is not uncommon in gastric ulcer, but is rare in duodenal ulcer. Its presence in the later stage of either generally indicates that the ulcer is invading the pylorus and producing obstruction, or, in the case of gastric ulcer, that an hour-glass contraction is developing. The pain is at once relieved by vomiting, which removes the acid contents of the stomach.

Haematemesis is far less common than is generally supposed. It is important to exclude such conditions as cirrhosis of the liver and splenic anaemia, which may also give rise to it, but its association with ulcer symptoms clinches the diagnosis. Much more commonly traces of occult blood, which can only be found by chemical means, are present in the stools, but the test is so delicate that this is only of importance if the patient is on a diet which contains no flesh food. The presence of melaena is of the same significance as haematemesis. It should be remembered that if the blood in the stools is bright red it cannot come from a gastric or duodenal ulcer.

In every case in which the possibility of gastric or duodenal ulceration exists an x-ray examination should be carried out. A standard opaque meal is given when the stomach is empty, and a second examination should be made six hours later, nothing having been eaten or drunk in the interval. The type of stomach present can at once be recognized, whether it has the average normal orthotonic appearance, or whether it is hypotonic or hypertonic—the types which are likely to be associated with gastric and duodenal ulcer respectively. The activity of peristalsis and the rate at which the contents of the stomach pass into the duodenum are next observed, the slow rate characteristic of a gastric ulcer being in marked contrast with the rapid rate characteristic of a duodenal ulcer.

Although both hypotonic and hypertonic stomachs in healthy individuals without symptoms are invariably empty within six hours, and the latter generally within a couple of hours, some residue is frequently found after six hours when a gastric ulcer and occasionally when a duodenal ulcer is present, even in the absence of organic pyloric obstruction. This is due to the occurrence in the later stages of gastric digestion of pylorospasm, or more frequently to pyloric achalasia—absence of the normal relaxation of the pyloric sphincter when each peristaltic wave reaches it in the later stages of gastric digestion,

never sags below the neck joining it to the lower one, as is invariably the case in organic hour-glass stomach (Fig. 7).

The same two varieties of gastric spasm sometimes occur in duodenal ulcer, and still more frequently in chronic appendicitis and gall stones. But in these conditions it is only present intermittently, and may come and go during the course of the x-ray examination; it disappears when the stomach is gently massaged and on injection of gr. $\frac{1}{100}$ atropine sulphate, whereas the spasm in a case of gastric ulcer is generally unaffected under these conditions.

The x-ray signs so far described are present in acute as well as in chronic ulcer. The former is so shallow that no direct evidence of its presence can be expected, but the latter almost invariably gives rise to a highly characteristic picture. In gastric ulcer this consists in the production of a minute diverticulum or "niche," which represents the crater of the ulcer filled with the opaque salt (Fig. 8); in duodenal ulcer there is a more or less definite deformity of the duodenal cap, which is partly caused by the ulcer itself, and partly a result of spasm (Fig. 9). The

visualized ulcer is often found to be the seat of considerable tenderness, strictly localized to the area of ulceration, especially in the case of the stomach, as duodenal ulcers are more deeply seated and less accessible to palpation.

The x rays also give quite definite

evidence of the existence of organic hour-glass contraction (Fig. 7), the appearance of which is quite distinct from that caused by spasm, though the two are often associated together so that the degree of narrowing found at operation may be much less than what the x rays would suggest. Dilatation, even with a history of duodenal ulcer, and marked delay in evacuation in spite of abnormally vigorous peristalsis, which may be associated with occasional antiperistaltic waves, prove that pyloric obstruction is present.

PROPHYLAXIS.

I have already referred to a patient with all the symptoms of duodenal ulcer as well as the characteristic hypertonus and rapid evacuation of the stomach in whom nothing abnormal was found at operation. The symptoms had only appeared a few months before, and it is highly probable that a pre-ulcerative condition was present, which would have led to the development of an ulcer if no prophylactic treatment had been undertaken. It is not at

FIG. 9.—Duodenal ulcer. P.C., Pyloric canal. P.S., Pyloric sphincter. D.C., Duodenal cap. C, Crater of ulcer. A, Diagram of normal x-ray appearance of pyloric end of stomach. B, Duodenal ulcer, deforming duodenal cap and invading pylorus. (Reproduced from skiagram by Mr. Reitz.) C, Section of pyloric end of stomach and duodenal cap, reconstructed from B, to show extent of ulceration.

all uncommon to find people suffering from slight symptoms, which have either been present for only a short time, or, if for longer, have been intermittent and have rarely lasted for more than a few days at a time, but which are otherwise quite characteristic of gastric or of duodenal ulcer. In all such cases the type of stomach characteristic of gastric or duodenal ulcer is found, but no deformity of stomach or of duodenal cap, which alone proves conclusively the presence of an actual ulcer, can be seen with the x rays; there is no residue of food six hours after the barium meal, and no occult blood is present in the stools.

These patients are, I believe, suffering from a pre-ulcerative condition, which will certainly lead to actual ulceration in time unless all the exciting causes I have already described are removed. The teeth should, therefore, be put into perfect order, and the patient should in the future have his teeth thoroughly overhauled every six months. The pharynx and nasal sinuses should be examined for possible sources of infection, which should be dealt with if any are discovered. The appendix should be removed if there is evidence of chronic inflammation. The stomach, duodenum, and gall bladder should be inspected at the same time, but a gastro-enterostomy should not be performed unless, after all, an ulcer of considerable size in the immediate neighbourhood of the pylorus is found, but this is not likely to occur under the conditions described, especially in the absence of any six-hour food residue.

The patient should be made to realize the danger he runs of an ulcer developing unless he eats slowly and chews his food very thoroughly. He should take nothing which is chemically irritating to the stomach, such as alcohol, vinegar, unripe fruit, mustard, pepper, clutney, pickles, and curry; a little well-diluted whisky is, however, permissible, but only if taken with meals. Very hot and very cold drinks should be sipped, and ices allowed to melt in the mouth before swallowing. Any food which cannot be chewed to a fluid consistence should be avoided; this includes tough meat, new bread, raw vegetables in the form of salads, and indeed all green vegetables unless prepared as purées, pips and skins of fruit, whether raw, cooked, in jam or marmalade, nuts, and especially currants and raisins in cakes and puddings. Smoking should only be permitted in strict moderation.

With the gastric ulcer type of stomach, which empties slowly, three good meals without any intermediate feeds, such as afternoon tea, should be taken. But with the duodenal ulcer type of stomach, which empties itself too rapidly, a tablespoonful of olive oil, which delays the evacuation, should be taken before each of the three chief meals; this has the further effect of diminishing the secretion of gastric juice, as Craven Moore has conclusively proved. Some milk should also be taken about three hours after breakfast, and afternoon tea should be taken at 4.30 or 5 p.m. More milk should be drunk just before going to bed, and a little should always be kept at the bedside to drink if the patient should wake in the night.

Care should be taken to avoid exposure to sudden changes of temperature, and if the patient is accidentally chilled he should as quickly as possible get thoroughly warmed, and, if necessary, have a hot bath and go to bed. It is quite unnecessary for patients of this kind to stay in bed or have a period of stricter dieting than what I have described, but the precautions mentioned should be continued for an indefinite period. The patient should also be given a powder containing equal quantities of oxide of magnesia, calcium carbonate and bismuth carbonate, which he can take whenever he has the least discomfort, in frequently repeated but very small doses—just sufficient to keep himself completely comfortable. He should also be careful to keep his bowels regular by means of paraffin, which has the advantage of being entirely devoid of irritant action, and, if necessary, with oxide of magnesia after each meal, as this has the additional advantage of neutralizing the excessive gastric secretion without irritating the mucous membrane.

MEDICAL TREATMENT.

As a preliminary to the treatment of the actual gastric or duodenal ulcer the teeth should be put into perfect condition, and any infected focus in the nose or throat should be treated. Throughout the treatment the mouth should be kept absolutely clean, and the tongue frequently scraped with a wooden spatula if any fur accumulates on

it. If chronic appendicitis is present the appendix should be removed, but a gastro-enterostomy should not be performed unless the ulcer is very large, or is giving rise to mechanical difficulties owing to hour-glass contraction or pyloric obstruction.

The patient should be kept warm in bed throughout the treatment, but he should get up every day to have a bath and to open his bowels, the difficulties with which are greatly reduced if a bed-pan can be avoided.

The object of treatment is to reduce the secretion of gastric juice as much as possible, and to keep the hydrochloric acid in the stomach completely neutralized throughout the day, and, what is almost invariably neglected, throughout the night. The evidence is conclusive that free hydrochloric acid prevents an ulcer healing, whatever additional factors may have contributed towards its production in the first instance. At the same time as much food as possible is required to maintain the patient's nutrition, especially when he has lost much weight, as is often the case with gastric, though rarely with duodenal, ulcer. Finally, the food should be as unirritating in its mechanical and chemical characteristics as possible.

These are the commonly accepted principles of treatment, but several years ago I realized how inadequately it was carried out by the various methods in use both in England and abroad. I tried in various ways to fulfil these principles more satisfactorily, but it was not until I read a paper by Dr. Sippey of Chicago just before the war that I realized how far short of perfection my improved methods still remained. I had the good fortune to meet Dr. Sippey during my recent visit to America, and I have now adopted his method of treatment with certain modifications based on my previous experience.

Five ounces of milk (or preferably milk and cream in equal quantities) are given every hour from 8 a.m. to 8 p.m. inclusive. To each feed gr. x of sodium citrate, which combines with the lime in the milk, and consequently prevents the formation of irritating clots by the rennin of the gastric juice, dissolved in 2 drachms of emulsion of magnesia are added; the latter contains gr. v oxide of magnesia to the drachm. This has the advantage over sodium bicarbonate in having four times its neutralizing power, in giving off no carbon dioxide, which is liable to distend the stomach on reacting with the hydrochloric acid, in having a mild aperient action, and in producing a very much smaller secondary increase in secretion after the initial neutralization than sodium bicarbonate, which Crohn has shown by the fractional test meal to be the most powerful stimulant of gastric juice in existence.

Immediately before alternate feeds, beginning at 7.30 a.m., half an ounce of olive oil is taken. This inhibits the secretion of gastric juice; at the same time it supplies a digestible and absolutely unirritating food of very high nutritive value in a concentrated form. Immediately before the remaining feeds m v tinct. belladonnae, which has a similar inhibiting effect, is given, as oil before each feed sometimes gives rise to nausea and is more than can generally be digested.

Half an hour after every feed, and at 9, 9.30, and 10 p.m. a powder containing gr. x calcium carbonate and gr. xxx bismuth carbonate is taken in a little water. The former has two and a half times, the latter only one-third the neutralizing power of sodium bicarbonate, but neither gives rise to any secondary hypersecretion, and they neutralize the acid so slowly that the carbon dioxide set free is dissolved in the gastric contents as rapidly as it forms. At 6 a.m. half an ounce of bismuth carbonate, shaken up but not suspended in five to ten ounces of water is swallowed, and the patient then lies on his right side, or in such a position that the powder is likely to come in contact with the ulcer. This forms a protective covering to the ulcer, and at the same time neutralizes any acid present, and calls forth a local secretion of protective mucus.

By these means the contents of the stomach are kept neutral or alkaline from 6 a.m. to 10 p.m. If the ulcer is in the neighbourhood of the pylorus, and especially if it is giving rise to any obstruction, continuous hypersecretion of gastric juice will occur throughout the night. It is then impossible for the ulcer to heal, and in the past it has been supposed that such cases must be operated upon. But the obstruction is generally due entirely, or in great part, to surrounding oedema and inflammatory swelling

and pylorospasm, and in such cases, if the ulcer can be caused to heal by medical or surgical treatment, any scarring produced is insufficient to give rise to obstruction.

Sippey has shown that by preventing the accumulation of acid in the stomach during the night these ulcers heal, and a cure can be obtained in most cases without resorting to surgery. At 11 p.m. the stomach is completely emptied by Senoran's evacuator; if not more than two ounces of fluid are present on two consecutive nights, this can be discontinued. If half a pint or more is removed at 11 p.m., the stomach should be evacuated again at 1 a.m. At 11 p.m. atropine sulphate is injected subcutaneously in order to inhibit the further secretion of gastric juice; the largest dose which does not produce unpleasant dryness of the mouth should be given, beginning with gr. $\frac{1}{10}$. At the same time the alkaline powder should be given; and if more than two ounces of fluid were evacuated it should be repeated every two hours through the night. In most cases the continued nocturnal secretion is rapidly controlled by this treatment.

If the patient is constipated the dose of magnesia should be increased, and if the bowels are not opened on two consecutive days an enema should be given. If diarrhoea occurs some magnesia should be replaced by an equivalent amount of bismuth carbonate.

The strict treatment just described should be continued until for three weeks the patient has had no spontaneous pain, no trace of tenderness has been present, no occult blood has been found in the stools, not more than two ounces of fluid have been removed on any one evening, and the x rays show no evidence of active ulceration. The pain and tenderness generally disappear within forty-eight hours; the other signs of healing appear considerably later, the exact time depending upon the size and age of the ulcer and its proximity to the pylorus.

The diet can now be rapidly increased until at the end of a week everything is taken with the exceptions I mentioned in discussing prophylaxis.

Before returning to his ordinary occupation the patient should be given written instructions as to how he is to prevent a recurrence of his ulcer on the lines laid down under prophylaxis. With large and chronic ulcers he should in addition take a small quantity of the alkaline powder as nearly as possible at hourly intervals between meals for at least six months, but in the case of duodenal ulcer a small feed is equally or more efficacious.

SURGICAL TREATMENT.

Everyone must agree that the surgical treatment of gastric and duodenal ulcer is a confession of failure. If the prophylaxis I have spoken about could become universal, or even if ulcers were adequately treated at a sufficiently early stage in their development, operations would only be required for such rare emergencies as the perforation of an ulcer which had previously given few if any signs of its presence. It is not as if a gastro-enterostomy was completely without danger, invariably cured an ulcer, and never gave rise to unpleasant after-effects. I can recall three patients who died as a direct result of a gastro-enterostomy, although all the conditions appeared to be most favourable for success. I have seen a small number both of gastric and duodenal ulcers which have not improved as a result of the operation, or have recurred later, and several surgeons have recorded cases in which cancer has developed in the scar of an ulcer several years after the performance of a gastro-enterostomy. A jejunal ulcer is the most serious sequel; I believe it always heals eventually under the complete neutralization régime I have described. More frequently a certain amount of discomfort after meals, often associated with diarrhoea, which is occasionally very severe, follows the operation, sometimes only after several years of freedom from symptoms. It is true that the worst results follow gastro-enterostomy, when it has been performed for indigestion in spite of no ulcer being found at the operation. Excluding these cases, which all agree should never have been operated upon, a gastro-enterostomy is most likely to be successful when an ulcer is producing definite pyloric obstruction; equally good results follow a gastro-gastrostomy for organic hour-glass contraction. Moynihan has become so convinced that a gastro-enterostomy is unsatisfactory for gastric ulcers not causing obstruction that he now performs a partial gastrectomy instead, simple excision of the ulcer being in his

opinion insufficient. Although this operation or destruction of the base of the ulcer by a cautery, combined, if the ulcer is very large, with a jejunostomy, may occasionally be indicated, the operation is such a serious one that it should never be resorted to until the most thorough and prolonged medical treatment has failed.

Indications for Operation.

There must thus still be some uncertainty as to the exact indications for operation, but at present I would state them as follows:

1. At the earliest moment after a perforation.
 2. For pyloric obstruction without symptoms of active ulceration.
 3. For pyloric obstruction with symptoms of active ulceration, if the x rays still show well marked stasis after ten days of the complete neutralization treatment.
 4. For gastric ulcer causing organic hour-glass contraction.
 5. When the symptoms recur after one or more courses of thorough medical treatment followed by adequate after-treatment. The number of such courses which should be tried depends upon such circumstances as the age, social position, occupation, and place of residence of the patient; thus, the older a patient, the better his social position, the less strenuous his occupation and the less important occasional absences from business, and the warmer and more equable the climate, the less urgent is the necessity for operation.
 6. If severe haemorrhage occurs more than once, especially in patients past middle age, when it probably comes from a sclerotic vessel which cannot contract. An attempt should then be made to excise the ulcer, or, if this is impossible, to ligature the bleeding point; failing this a series of sutures should be tied round the ulcer so as to cut off as much as possible of its blood supply. Whenever possible it is best to wait until the patient has got over the initial collapse following a severe haemorrhage.
 7. When for any reason—such as the persistence of pain or of occult blood in the stools in spite of treatment—it appears possible that a growth is present, the abdomen should be explored, and unless a growth can be excluded with certainty partial gastrectomy should be performed.
- After any operation for gastric or duodenal ulcer the patient should follow exactly the same after-treatment as after medical treatment, or various ill results, which I have already mentioned, may ensue.

In conclusion, I think we may look forward with confidence to a time when not only the medical treatment of gastric and duodenal ulcer will have become so efficient that operations will no longer be required for them, but prophylaxis will be brought into play so early and so adequately that actual ulceration will be regarded as a rare condition which should never be allowed to occur.

An Address

ON

SURPRISES IN DIAGNOSIS.

DELIVERED TO THE ROYAL MEDICO-CHIRURGICAL SOCIETY OF GLASGOW.

BY

EDMUND I. SPRIGGS, M.D., F.R.C.P.

THE late Dr. Gee has recently been quoted as having said: "Medicine has three parts: the first is diagnosis; the second is diagnosis; and the third is diagnosis." Which is an allegory. If we look back on the progress of the art of diagnosis we observe that for centuries able minds had given themselves to the study of symptoms and signs, checking their deductions by the later development of the disorder. In the nineteenth century, to which Gee belonged, the study of morbid anatomy became general, with the result that enormous strides were made in the recognition and classification of diseases. No one can say how much more is to be learned by these methods as time goes on, though we must admit that we cannot hope to excel, if indeed to equal, those who have gone before in acuity of observation and reasoning. The introduction of aseptic surgery led to another great advance in the knowledge of disease by allowing the study of morbid anatomy during life. An exploratory operation is often a most valuable means of diagnosis, though all will agree that,