GASTRIC ULCER: A PLEA FOR GASTRECTOMY.

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WITH A NOTE ON X-RAY DIAGNOSIS

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THERE has been in the past, and still is, so much confusion as to what a gastric ulcer is, that it is necessary, before discussing the subject, to state definitely the condition to which this paper applies. We refer to a localized inflammatory lesion in the stomach, which results in a loss of tissue of at least the full depth of the mucosa, and which, if it heals, does so by fibrous tissue. There is, therefore, a permanent thickening in the stomach wall. This definition excludes the chaps, fissures, and superficial erosions which have swollen the statistics of gastric ulcer. The clinical manifestations of these—digestive disturbance, vomiting, and hæmatemesis—resemble those attributable to gastric ulcer, but there is not destruction of the whole depth of the gastric mucosa, and so they can, and do, heal without scarring.

One would think that, if gastric ulcers were as common as they are reported to be, they, or the scars left after healing, would be met with frequently at operation, or on the post-mortem table, whereas, as a matter of fact, this is not the case. During seven years at the Leeds General Infirmary, 1078 cases of duodenal and gastric ulcers were operated on; only those with visible or palpable evidence were accepted. Of these, 749 were duodenal and 329 gastric, that is, about two and a half of the former to one of the latter. During the same period there were 980 gall-stone operations. The relative frequency of these three conditions was, therefore, six gall-stones to five duodenal ulcers and two gastric ulcers.

The gastric ulcers which come to operation are usually of considerable chronicity, and it might be said that surgeons do not see the acute ulcers. This is undoubtedly true to some extent; but if it is a fact that every ulcer, even an acute one, leaves permanent traces, which I think cannot be denied, and as the scars are so seldom found at operation or post mortem, one is driven to the conclusion that all gastric ulcers are uncommon. The clinical diagnosis of gastric ulcer is so beset with difficulties that it cannot be accepted as proof of the existence of the lesion. Figures compiled from this source show gastric ulcer to be more common than all the cases of gall-stones and duodenal ulcers put together. Moreover, they give a large preponderance of females over males. The reason is that gastric disturbances—especially when associated with hæmatemesis—occurring in young anæmic women are ascribed to ulceration. Such cases, when submitted to operation, show no sign of ulcer according to the definition given. As regards sex, duodenal ulcer is four times more common in men than women, and gastric ulcer occurs in two males to one female.

Causation.—The fundamental factor in the development of gastric ulcer, as in all ulceration, is infection. Rosenow¹ has done some interesting work in this connection. He has found that certain organisms have an elective affinity for the tissues in which they grow, when re-injected into the blood-stream; for example, streptococci can be found in, and isolated from, the base of a gastric ulcer, and, when injected into the blood-stream of another animal of the same species, settle, in about 70 per cent of experiments, in the corresponding organ, and produce a similar lesion. The same applies to the appendix, to the gall-bladder, and in fact to most tissues. This is merely an extension of the observation that pneumococci, for instance, usually choose the lungs for the site of their activities. But Rosenow has gone a step further, and shown that

the same organism, in a different state of virulence, will attack another organ more or less consistently, if kept at this new virulence. He has shown that the streptococcus which ordinarily has an elective affinity for the appendix, will, if the virulence be slightly increased, produce after injection into the blood-stream, not an appendicular lesion, but necrosis of the gastric tissues.

According to Bolton² the initial lesions which can give rise to ulcer of the stomach are localized necrosis of the mucous membrane, localized hæmorrhage, and inflammation of the lymphatic follicles of the stomach wall. The common cause of necrosis is bacterial infection, or bacterial toxins circulating in the blood-stream, and, the cells of the gastric mucosa being primarily attacked, the damaged area is destroyed by digestion by the gastric juice. Necrosis may arise in this way without preceding hæmorrhage or lymphatic inflammation ; but hæmorrhage is an actual and frequent cause of ulcer, and is likewise due to bacterial toxins circulating in the blood-stream, which, destroying the endothelial cells of the capillaries, pave the way for the local destructive action of the gastric juice. Finally, inflammation of one or more of the lymphatic follicles, so thickly studded along the lesser curvature, may give rise to a submucous abscess which, by rupture into the stomach, allows the juice to act on the base of the ulcer thus exposed. Bolton has also shown that a gastric juice of abnormally high acidity will cause a much more rapid ulceration, under experimental conditions, than one of normal acidity.

Lansdown and Williamson³ have demonstrated that lymph follicles are closely associated with the pyloric type of glands, and that these occupy chiefly an area mapped out by an annular band 2 to 2½ inches to the gastric side of the pylorus, and about 1 inch distal to it, and on the gastric side this band is continued up along the lesser curvature some 2 inches towards the cardiac end over a strip of about 1 inch in width. This is, in fact, the chief ulcer-bearing area according to surgical experience. At least 75 per cent of gastric ulcers occur along the lesser curvature, and 80 per cent in the pyloric half of the stomach.

All recent theories of causation show clearly that gastric ulcer is a secondary lesion ; that is, due to infection manufactured at some other part. It is not easy to prove where the factory is in all cases ; but Rosenow's experiments and clinical observations suggest that the appendix is responsible in some cases at least. Of 260 cases of gastric and duodenal ulcers in which the appendix was removed, it was definitely stated to be chronically inflamed in 210 ; many of these were verified microscopically. That is to say, in 80 per cent the appendix was a possible source of infection. Whether the appendix is really the source, or whether the appendicular condition and the gastric lesion are both the result of a common cause, has not been finally settled. But that a chronically inflamed appendix has a marked effect on the stomach is shown in cases of appendix dyspepsia. The symptoms resemble those displayed by gastric ulcer, and at operation the pyloric half of the stomach is found to be much redder than normal, easily thrown into spasm, and there are always enlarged lymphatic glands along both curvatures ; these are particularly large and noticeable along the greater curvature. Test meals show hyperacidity in a large percentage of these cases. In properly selected cases appendicectomy brings absolute relief. It is, however, true that all these patients are not cured by appendicectomy.

There seems to be a general consensus of opinion that both acute and chronic ulcers have an identical etiology ; in fact, it is probably true that every chronic ulcer was in the first instance more or less acute in onset. Whether an ulcer will heal, spread, or settle down into a chronic state depends upon factors with which we are not yet familiar. Bolton's work, however, seems to show that pyloric stenosis, represented by his experimental ligation of the pylorus, is one means of making an ulcer extend. It seems to me that those cases associated with hyperacidity and secondary pylorospasm are in a rather similar condition.

The sequence of events may be as follows : First of all there is a chronically inflamed appendix ; this is brought about by the double action of those two malefactors, obstruction and infection, which, working hand in hand, produce most of the lesions to which the abdominal organs are liable. Following on the chronic appendicitis, so produced, there

comes a secondary hyperacidity of the gastric juice. If the organisms in the appendicular wall are of a certain virulence, necrosis of the gastric tissues may occur as a result of infection carried by the blood-stream attacking them in the rear, and the hyperacid juice

FIG 366.—Ulcer crater on lesser curvature. Large incisure. The ulcer was adherent to the left lobe of the liver.

promptly digests this damaged area. The commonest situation for an ulcer is the lesser curvature, and this is, I believe, due to infection of the lymphoid tissue, which is thickly strewn here. The result is an acute ulcer. Prompt and efficient medical treatment—rest and alkalies—will usually promote healing. But if the causes which determined the formation of the ulcer persist, the ulcer will extend or the attacks will recur.

Even if an ulcer heals under medical treatment in the first attack, it is more than probable that sooner or later the gastric juice will again digest the scar. I have already said that I believe all chronic ulcers are at first acute, and I am not at all sure that it is not true to say that most acute ulcers ultimately become chronic. It is the reappearance again and again

in definite attacks which justifies the diagnosis of chronic gastric ulcer. As the attacks recur, the ulcer becomes more definitely chronic in appearance: it displays a crater of varying depth with a necrotic base, and is surrounded by hard, and at times almost cartilaginous, edges. There is usually a considerable degree of inflammatory oedema all round, and the actual cavity measures across its diameter somewhere between a threepenny and a sixpenny piece. Occasionally the crater is large enough to take the tips of all the fingers of one hand, and may still be simple, but W. J. Mayo says it is a good working rule to regard ulcers with a crater larger than a sixpenny piece as malignant.

These chronic, thick-edged ulcers never heal. It is true the edges may, unless prevented by adhesions, become more or less approximated by contraction of the fibrous base, and may fill in with granulation tissue, which subsequently develops into fibrous tissue; but the mucous membrane is unable to grow over the base, which is in a necrotic state. Such an ulcer is not healed; and some time or other the fibrous tissue will become

FIG. 367.—Specimen from case radiographed in Fig. 366.

digested by the gastric juice, under conditions which are not understood. It is only normal gastric mucous membrane that can withstand this digestive power. There is no regeneration of muscular fibres, and the whole thickness of the scar consists of fibrous tissue. Ulcers in this condition may remain quiescent for months or years, or they may extend in depth and perforate into the abdominal cavity, or into some neighbouring organ or structure—such as the pancreas, liver, or diaphragm ; or again, they may become malignant. The contracting scar tissue deforms the organ in various ways, causing pyloric or cardiac stenosis, or hour-glass stomach ; or the shortening lesser curvature approximates the two openings. Such deformities may occur although the ulcer is unhealed.

Symptoms.—Chronic gastric ulcer reveals itself by a series of attacks, separated by intervals of total or comparative freedom from symptoms. These latent periods may last a few weeks up to many months or even years, even though the ulcer is not healed, and most foods may be taken during this time with relish and impunity. Patients may, however, get reminders in these intervals that the ulcer is merely quiescent. Eventually, with absolute certainty, an attack reappears, often quite suddenly, and sometimes preceded by a state of great mental irritability. The actuating cause may be a dietetic indiscretion, a chill, over-work, mental worry, etc., probably, in some cases at any rate, owing to the production of a hyperacid gastric juice.

The average duration of symptoms in those patients who come to operation is between five and ten years. Each attack lasts about three or four weeks, and displays the same sequence of events in any one individual, vaguely spoken of by the patient as indigestion, but in reality characterized by a very definite cycle. I emphasize 'in any one individual,' because gastric ulcer in one patient may have quite a different history from that presented by another—depending probably on the position of the ulcer. But for one particular patient there is always strict repetition and regularity in the several attacks.

Pain.—There is always pain at some stage of digestion, usually one to two hours after food, relieved by more food for the same period, and also by taking alkalies, and especially by vomiting. The pain is felt in the epigastrium, and also somewhat to the left of this, and is described as burning, dull, heavy, gnawing, flatulent, or definite pain of a colicky nature. Flatulence and heartburn with acid eructations are very common. This is the usual type of attack, and may be considered as *the* type case of gastric ulcer. In another type food induces pain, the ulcer being then near the cardia, and causing cardio-spasm. Curiously enough, however, an ulcer near the pylorus, especially if beginning to obstruct, may cause pain almost immediately after food. In yet a third type pain comes on two, three, or more hours after food, when it becomes practically impossible to differentiate, by symptoms alone, between gastric and duodenal ulcers. The important point is that each is a type to itself, is reproduced exactly in every attack, and disappears for varying periods, during which the patient feels quite well.

It is this regularity and periodicity which distinguishes ulcer from a multitude of conditions which otherwise closely resemble it. Such conditions are particularly dyspepsias due to appendicitis, gall-stones, cirrhosis, abdominal tuberculosis in the mesenteric glands and lower ileum, etc. This prominence of similar stomach symptoms in such apparently diverse conditions is probably accounted for by a protective spasm of the pylorus ; and when the close embryological relationship of these organs is remembered, the motherly interest displayed by the stomach is not, perhaps, very surprising. If a careful anamnesis be taken, frequently it will be discovered that there have been quite definite symptoms of a chronic, grumbling appendix for years before. This is at least suggestive of cause and effect.

As time goes on, the attacks of gastric ulcer tend to become more severe, more frequent, and the character of the pain may alter. This indicates the onset of some complication. For example, severe pain in the back, usually to the left, denotes erosion of the pancreas : this occurs in some 20 per cent of long-standing ulcers. Pain which persists some time beyond the normal duration of an attack, means an imminent perforation or the supervention of carcinoma. Pain which was at first one to two hours after

food, and in the later attacks almost directly after meals, indicates pyloric stenosis or an hour-glass contraction.

As regards perforation, though it is true some acute ulcers perforate in the first few days of the initial attack, over 90 per cent of acute perforations occur during the acute exacerbations of a chronic ulcer, and so this complication is a preventable one in many cases. Yet of sixty-two gastric ulcers on which I have operated during the last two years, ten were admitted for acute perforation.

The cause of pain in gastric ulcer is probably due, not so much to food passing over the ulcer, as to spasm induced by the irritation of the ulcer by acid. The incisura which is invariably found opposite an active ulcer after a barium meal shows clearly that there is a very severe degree of spasm at this point. Hence the pain at the height of digestion, and the later onset of pain in duodenal ulcer, which is due to a similar cause. Probably pain in muscular organs, when the lesion is strictly limited to the organ, is always due to spasm and disordered motility; and this accounts for the relief brought

by vomiting, as this act induces a marked degree of general muscular relaxation. Pain may arise from tethering adhesions, either because of the pull exerted on the sensitive parietal peritoneum, or again, from interference with normal motility.

Other less important symptoms of gastric ulcer are vomiting and hæmorrhage.

Vomiting is present in over half the cases. It is not a symptom of gastric ulceration unless it occurs at fixed intervals after meals, is definitely caused by the pain, and is promptly followed by relief. Patients not infrequently develop the habit of inducing

FIG. 368.—Large ulcer crater on lesser curvature, penetrating into the lesser omentum. Well-marked incisura.

FIG. 369.—Specimen from case radiographed in Fig. 368.

vomiting, because of the instant relief which results. The vomiting can be lessened or prevented by a liquid diet, or absolute rest ; vomiting which cannot be so controlled is not due to a gastric ulcer.

Hæmorrhage, as hæmatemesis, occurs in under 40 per cent of all cases. It usually shows itself in moderate and repeated amounts, and is often associated with a very severe attack. Frequently the symptoms subside rapidly afterwards. Fatal bleeding is rare ; when it does occur it is due to erosion into a large artery, such as the gastric. Hæmorrhage as obvious mclæna is rather more frequent than hæmatemesis. The profuse hæmatemesis in anæmic girls is due to causes other than gastric ulceration. There seems to be great difficulty amongst some people to believe that hæmatemesis can occur apart from gastric ulcer in these girls. But surgeons, who see the state of the stomach in the living, can, by mere inspection, frequently say there is no ulcer in the organ, but that there will be found a chronically inflamed appendix. The profound blush over the pyloric end of the stomach is almost pathognomonic of this appendicular state. There is no more difficulty in explaining a hæmatemesis arising from this highly injected pyloric compartment than there is in explaining epistaxis—which not infrequently, in many people, occurs during the days when a common cold is subsiding—or hæmorrhage from any other acutely hyperæmic mucosa.

Physical Signs.—Except in the presence of complications, these are of little help in diagnosis. Epigastric tenderness is common to many abdominal conditions, and muscular rigidity only arises when perforation is impending or has actually taken place. Hyperalgesic skin areas can be elicited at times, but they are too inconstant to be reliable.

It is rare that a tumour can be felt in a case of simple ulcer ; the mere presence of a palpable tumour is strongly suggestive of cancer. However, in the region of the pylorus even a simple ulcer, if accompanied by much induration, may give rise to a distinctly palpable indefinite mass, which will be tender. Also an ulcer on the anterior wall of the stomach may, when adherent to the abdominal parietes, be felt as a tender indefinite tumour.

Test meals give very varied results as to acidity, blood, etc., and the small amount of assistance obtained does not justify the extreme discomfort to which the patient has to be subjected. Some 60 per cent of gastric ulcer cases are accompanied by hyperacidity, and 40 per cent by hypo-acidity.

Having said all this about the symptoms and signs, it is nevertheless true that a clinical diagnosis of gastric ulcer is wrong in nearly two cases out of three. It is computed that 60 per cent of gastric disturbances owe their origin to a source outside the stomach, and Sir Berkeley Moynihan's epigram, that the commonest site of a gastric ulcer is in the right iliac fossa, should be constantly in the mind of everyone who thinks rashly that he can diagnose one in the stomach. There are only two methods of arriving at a certain diagnosis during life : one is by the *x* rays, concerning which Dr. Scargill has written the notes which follow ; the other is by operation. But as in competent hands *x* rays give conclusive evidence in a very high proportion of cases, operation for diagnostic purposes is not often necessary.

Treatment.—Until more is known of the actual course of *acute* ulcers, medical treatment is the proper means to adopt. But there is a surgical aspect even at this stage, for three reasons :—

1. The ulcer is a secondary manifestation of some distant infection, frequently, I believe, in the appendix ; and when the acute attack is over, the primary source should be sought for and treated.

2. There is no doubt that an acute ulceration is a potential source of acute peritonitis by perforation ; several cases have been reported.

3. An acute attack does not always mean an acute ulcer. The initial attack probably does, but the recurrent attacks of a chronic ulcer are frequently quite acute.

The treatment of *chronic* gastric ulcer and its complications is always surgical. There cannot be any hesitation in accepting this. There is not unanimity, however, as to the operation that should be performed.

Such operations as gastroplasty and the like are defunct ; but there still remain quite a multitude, viz., gastro-enterostomy (anterior and posterior), excision, trans-gastric excision, excision and gastro-enterostomy, gastrogastrostomy, Balfour's operation, jejunostomy, and partial gastrectomy. The mere number shows that the results are not all that could be desired. This is in marked contrast to the one and only operation for duodenal ulcer.

I think, however, when all the facts are considered, it must be conceded that there ought to be only one operation for the majority of gastric ulcers, viz., partial gastrectomy. Excision alone has been almost finally abandoned ; if excision is to be done at all it should be combined with gastró-enterostomy. Most surgeons merely do a gastro-enterostomy and infold the ulcer. Any method of excision is, in my opinion, more difficult than gastrectomy.

GASTRECTOMY.

For the following reasons gastrectomy should be the operation of choice :—

1. In quite a large percentage of cases of gastro-enterostomy there is a persistence of the ulcer. I have been unable to get figures for the Leeds General Infirmary showing the after-results of the operation. But at the Middlesex Hospital,⁴ of 65 cases of gastric ulcer treated by gastro-enterostomy, 46 per cent were cured, 20 per cent relieved, 11 per cent slightly benefited, and 23 per cent total failures. Of 67 cases treated at St. Mary's Hospital,⁴ 42·2 per cent were cured and 38 per cent gave bad results. The cases in which gastro-enterostomy can be relied on to do much good are those where the ulcer is situated close to the pylorus, being associated with stenosis. But even here the ulcer may subsequently give trouble.

As regards the after-results of gastrectomy, it is not possible to speak with great assurance, owing to the comparatively small number of cases that have been treated by this method. During the first five of the seven years reviewed for the purposes of this paper, there were only 13 cases of gastric ulcer treated by gastrectomy at the Leeds General Infirmary. During the last two years I have myself done over 70 gastrectomies, 44 of them for gastric ulcer. I have written to about half the number, or their doctors, and 16 have replied. This is not a large number from which to draw conclusions, but, taken for what they are worth, the replies are distinctly encouraging. Of these 16 cases, one says he is no better, though he admits he has not such severe indigestion as before ; 3 feel uncomfortable after food, but have no actual indigestion. The other 12 are quite well ; they all say they have never been better in their lives, can eat anything, can take normal-sized meals, and have no discomfort afterwards. They are all back at work, one a miner working at the coal face.

Gastrectomy cases probably require more careful feeding for a considerably longer time after operation than gastro-enterostomy patients. The loss of a considerable part of the stomach must be a condition requiring time for readjustment of function. Probably the discomfort some of the patients have had is due to eating freely and the food going rapidly into the jejunum and causing an unwonted distention there. Sir Berkeley Moynihan, who is the only other surgeon in the British Isles who has regularly practised this operation for gastric ulcer over some three years, has a larger series of cases, and his results are excellent.

2. The secondary advantage of gastrectomy over any other operation has reference to carcinoma of the stomach. Carcinoma in other situations so commonly follows prolonged irritation—for example, in the tongue, breast, and indeed in most parts where it occurs—that it is probable, on the face of it, that cancer should arise at times in such chronic ulcers as those in the stomach. But there is more convincing evidence than mere probability. At least 6 per cent of the ulcers of my series have proved, on microscopic investigation, to be early carcinoma. This percentage almost certainly under-estimates the frequency of this change, because all the stomachs were not examined. One case was very interesting in this respect. The man had had attacks of gastric ulcer for five years ; the pain in the last attack had persisted for three months instead of disappearing in as

many weeks, as had previously happened. At operation it was thought the ulcer was simple, and indeed all the characteristics of a simple ulcer were presented on inspection of the specimen afterwards ; on microscopical examination, however, it was pronounced a definite early carcinoma.

According to Kocher, 5 per cent of gastric ulcers treated by gastro-enterostomy become malignant sufficiently long afterwards to make it improbable that the ulcer was malignant in the first instance. Taking the cases of well-established carcinoma of the stomach, about 60 per cent are computed to have originally been simple ulcers : Mayo says 65 per cent, Moynihan 60 per cent, Wilson and McCarty 71 per cent, Sherren 40 per cent.

This is a very strong argument for gastrectomy as the routine operation for gastric ulcer, and also for the treatment to be undertaken at a much earlier date in the history of the disease than surgeons are in the habit of seeing them at present.

3. The third point for gastrectomy relates to the other complications : hæmorrhage, perforation, and stenosis. I distinctly remember a case at the Leeds General Infirmary which died after gastro-enterostomy as a result of profuse hæmorrhage, and at the post-mortem the open end of a vessel was found in the base of the ulcer. Several others have been reported.

As regards stenosis, in the form of hour-glass stomach, the usual operation has been gastrogastrostomy. According to Walton, 30 per cent of these cases after this operation receive no benefit or relapse. It is, perhaps, not surprising, when it is remembered that there is usually still an active ulcer present.

Perforation of the ulcer is another complication which is known to occur after gastro-enterostomy. Sir Berkeley Moynihan has operated on such a case recently. The patient was a woman who had an acute perforation of a gastric ulcer ; this was sutured, and she recovered. Within a few months another acute perforation occurred of another ulcer ; this was sutured, and a posterior gastro-enterostomy was performed. After this another acute perforation took place of a fresh ulcer ; this was sutured, and she eventually developed a jejunal ulcer. Perforation is very dangerous, and only occurs in a small percentage after operation, but it is not right that the risk should be run when it can be altogether prevented. Taking all cases of gastric and duodenal ulcers, before operation, there is about an equal liability to acute perforation ; but the death-rate is much higher in the case of a perforated gastric ulcer. Amongst my own cases, the death-rate in duodenal perforation is 24 per cent, in gastric it is over 40 per cent. This is due to the greater amount of extravasated material from the stomach, and to the higher septicity of the stomach contents causing a more rapid and severe general peritonitis.

It cannot be said that the best is being done for one's patients if an operation is chosen which leaves so much to chance as gastro-enterostomy has been shown to do, when there is another method of operation which is free from these risks, unless this alternative method has greater shortcomings, or as great. The only serious objection that can be made against gastrectomy that I know of is the slightly higher operative mortality. The difference is very small. During the seven years under review, the operative mortality of gastro-enterostomy for gastric ulcer was 5 per cent. To this must be added that due to the onset of carcinoma and the other complications after an apparently successful operation. This number is difficult to estimate, but it probably more than makes up the slight difference, for the operative mortality of gastrectomy is only 7 per cent. In addition to this, the many failures after gastro-enterostomy must be weighed against the results of gastrectomy, which up to the present indicate a much higher percentage of absolute cures. Gastrectomy is undoubtedly a more serious operation in some cases, but in the majority, though it takes rather longer to do, it is not any more difficult. Four-fifths of all gastric ulcers begin in the pyloric half of the stomach, and are, therefore, easily removable. It is the unusual position near the cardiac end which creates the extra risk, and it is precisely in these cases that gastro-enterostomy is most likely to be followed by a poor result.

The Operation of gastrectomy consists in removing as much of the stomach as is necessary to get about 1 inch of healthy mucosa beyond the ulcer on the cardiac side, and

anastomosing the side of the jejunum to the cut end of the stomach. The resection is begun by dividing the duodenum just beyond the pylorus, and freeing the stomach to beyond the ulcer. Doing the operation this way allows of the stomach being used as a retractor when the more inaccessible cardiac end is being dealt with. If the pancreas be adherent, as it is in 20 per cent of cases, a piece of it should be cut away, leaving it attached to the ulcer. This makes no difference to the mortality, but it is surprising how easy an apparently difficult case becomes after dividing this tethering adhesion. It is essential to investigate the stomach for more than one ulcer, for though it is unusual to find more than one, yet it does occur in a small percentage. The appendix should be removed as a routine, provided the patient is able to stand the extra manipulation. This organ has possibly something to do with the causation of the ulcer, and in any case it is better away. Gall-stones are present in 1.5 per cent of gastric-ulcer cases; and duodenal ulcers are associated with gastric in 2.5 to 3 per cent. The former should be dealt with as circumstances permit; the latter can easily be included in the resected area by placing the clamp on the duodenum a little more to the right.

There is one point of practical importance in the differentiation of gastric and duodenal ulcers. Ulcers well on the body of the stomach are easily recognized as gastric, but near the pylorus confusion may arise. Indeed, some surgeons, especially the Swiss, say it is impossible to be sure on which side of the pylorus the ulcer is. There is no occasion for this confusion, except in those uncommon cases when the ulcer is actually at the pylorus. The exact position of the pylorus is marked on the surface of the stomach by a thin white line; just to the gastric side of this is an unmistakable branching vein, which ascends from the lower margin of the pyloric region. These two landmarks do not coincide exactly, but for practical purposes they may be considered to do so. The white line cannot always be seen; the vein invariably can. Any ulcer to the left of this is gastric, and of course one to the right is in the duodenum. It is of importance to differentiate the site of the ulcer, because the treatment of the two conditions should be quite different.

There is one position in which gastro-enterostomy has the advantage over gastrectomy, and that is when the ulcer is high up on the lesser curvature. In some of these cases it is impossible to get sufficiently beyond the ulcer for resection, especially when there is much surrounding induration, and then the operation devised by Sir Berkeley Moynihan is an excellent substitute. This consists in doing an anterior gastro-enterostomy en Y, and stitching a catheter into the jejunum as it comes from the duodenojejunal flexure to the entero-anastomosis. This gives absolute rest to the stomach for as long a period as may be desired. It may be used, too, for ulcers which by their size are unsuited to gastrectomy. Sir Berkeley Moynihan has reported one such case; the patient had neither a bite nor drink by mouth for two and a half years. The subsequent closure of the jejunostomy only narrows that part of the intestine, which acts to all intents and purposes merely as a common bile-duct. The opening in the stomach is made so high up that, if an hour-glass contraction develops as a result of healing of the ulcer, exit from the proximal compartment is adequately provided for.

It may be said that gastrectomy removes an unnecessarily large amount of the stomach, but I think I have shown clearly that the part removed is the chief ulcer-bearing area; that once an ulcer has formed, the possibility of carcinoma being grafted on to it is a very real one; that so far as we know at present no functional disability results; that the return to health is practically as quick as, and certainly more sure than, after any other operation; and that with a proper technique, such as has now been evolved, the operation is no more difficult than any of the other usual methods of treatment.

THE X-RAY EXAMINATION FOR GASTRIC ULCER.

It is ten years since Reich, a German radiologist, first demonstrated the presence of a gastric ulcer by means of a bismuth meal, and his diagnosis was proved at operation. For some years following this, the results of bismuth-meal examinations were uncertain

and unreliable; each observer had his own method of observation and technique, and interpreted the various signs differently.

During the last four or five years great progress has been made. Apparatus has been improved, technique has been developed by the experience gained, and, most important of all, the various *x*-ray signs have been analyzed and sifted, the information obtained has been orderly arranged, and the whole subject put on a proper foundation.

For these advances in our knowledge we are greatly indebted to some of the American radiologists, and especially to Carman, of the Mayo clinic. A keen and original observer, a lucid writer, with a great amount of material to work on, he has caused the whole radiological world to follow his technique and teaching. His results were at first received by many with scepticism. To-day the diagnosis of gastric ulcer by *x*-ray examination is far more certain than the clinical diagnosis. Nine-tenths of all ulcers give definite *x*-ray signs (*Figs. 366, 368*); and in the great majority of cases the signs are pathognomonic.

The Method of Examination now almost universally employed is that originally introduced by Haudek in 1912. The day previous to examination the bowels are thoroughly opened, and light diet only is taken. On the day of examination, six hours before the patient comes to the *x*-ray room, a bismuth or barium meal is given, on an empty stomach. The stomach must be empty; the importance of this is not fully realized; food residue may cause deformity of stomach contour simulating deformity due to disease. The meal given must be of thin consistency; a thick stodgy meal, of porridge or bread and milk, is useless for the diagnosis of gastric ulcer.

At the time of examination the position of the six-hour meal is located, any residue in the stomach being noted: a normal stomach should empty itself of the amount given (16 fluid ounces) in three to four hours. There is considerable latitude in the emptying-time of a normal stomach; any opaque material left in the stomach at the end of six hours is definitely abnormal. The great advantage of the six-hour-meal method of examination is that it obviates the repeated examinations that are made by some radiologists to determine exactly when the stomach empties. It is impossible to do this in hospital practice. If there is no opaque material present after six hours, the motility of the stomach may be considered normal. The second meal is given—sufficient to fill the stomach completely—and the examination proper of the stomach is made.

X-ray Signs of Gastric Ulcer.—(1) The direct or primary sign—the demonstration of the actual ulcer cavity. (2) The indirect or secondary sign—the spasm caused by the ulcer.

The Direct Sign.—A small erosion of the mucous membrane only will not show a projection from the lumen of the stomach and cannot be demonstrated. If the ulceration has penetrated into the wall of the stomach, or further, into the lesser omentum, and is possibly adherent to, or has penetrated, the liver or pancreas, the cavity formed can be demonstrated filled with the opaque material.

The great majority of ulcers occur on the lesser curvature, or on the posterior surface close to the lesser curvature; these can be seen either in anteroposterior or semilateral view. A small percentage of ulcers occur on the posterior surface. These can usually be seen when the stomach is emptying. Ulcers occurring on the anterior or posterior surface close to the pylorus cannot easily be demonstrated.

The Indirect Sign.—*The incisura or spasmodic hour-glass.* In a majority of gastric ulcers there is to be seen a remarkable spasmodic contraction of the circular fibres of the stomach opposite, or very nearly opposite, the ulcer, producing an indentation of the greater curvature of varying degree. The contraction may be so strong as to produce an apparent bisection of the stomach—a spasmodic hour-glass. These incisuræ occur also in the stomach reflexly from extrinsic causes, chiefly in conjunction with disease of the appendix, lower ileum, gall-bladder, kidney, and duodenum. The intrinsic incisura may persist for a few seconds, or until the stomach is nearly empty, almost always the latter. If due to reflex causes outside the stomach, the incisura can be made to disappear by injecting atropine hypodermically. This is not practicable as a routine method, as doses have to be given sufficient to produce physiological effect before the inhibiting effect on

the stomach is produced, and severe poisoning may occur. It is only safe to use this test if one is quite certain that there is no personal idiosyncrasy to atropine.

The presence of an incisura may be taken as strongly presumptive of gastric disease. If the stomach is examined when too full and distended, the incisura may be obliterated by the upper and lower portions of the stomach coming in contact with each other. Palpation along the greater curvature will sometimes demonstrate it when not at first visible.

An ulcer in the pyloric portion of the stomach will sometimes cause a spasmodic contraction of the greater curvature so strong, and to such a depth, that it causes a kind of pseudo-pylorus. This is an important point to bear in mind, for it strongly simulates pyloric stenosis due to duodenal ulcer.

If an incisura is seen on the greater curvature, and on the lesser curvature a projection of varying size is seen, an absolutely definite diagnosis of gastric ulcer can be made. The whole diagnosis is made by the fluoroscopic-screen examination; a radiograph records only what is seen at one stage of the examination.

With efficient apparatus, careful attention to modern technique, and correct interpretation of the signs given, the *x*-ray examination is the most valuable means of diagnosing the presence of an ulcer, short of laparotomy.

REFERENCES.

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² BOLTON, *Ulcer of the Stomach*.

³ LANSDOWN AND WILLIAMSON, *Brit. Jour. Surg.* Vol. ii, 306.

⁴ BOLTON, *Loc. cit.*