PERFORATED PEPTIC ULCER.
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INTRODUCTION.
Peptic ulceration is a crippling disease judged from the stand-point of morbidity, and is also dangerous to life on account of serious complications, such as hæmorrhage or perforation which may supervene during the course of the disease. These complications may occur in any patient and there are no criteria which will indicate whether or not an ulcer will bleed or perforate. When the treatment of peptic ulceration is under review it must be remembered that from 20 to 30 per cent. of these ulcers perforate. In a large series of cases I found that the incidence of perforation was 27 per cent. It is thus essential that patients suffering with peptic ulcer should be kept under continuous careful observation. Unfortunately, however, a small percentage of patients give no previous history of the peptic ulcer syndrome and perforation of the ulcer is the first indication of its presence.

Recently, when considering the rôle of surgery in the treatment of chronic peptic ulcer, Joll stated that there has been a rise in the incidence of perforation as a complication of peptic ulcer since medical treatment has become systematized in the treatment of this disease. It must also be remembered that medical treatment of peptic ulceration carries a considerable mortality contributed by hæmorrhage and perforation. In a series of 222 cases of gastric ulcer I found this mortality to be 6.5 per cent., and in a series of 132 cases of duodenal ulcer 5.3 per cent.

If careful clinical histories are taken from patients with perforated peptic ulcer, it is found that certain of them experience premonitory symptoms of perforation. Important points are exacerbation of the abdominal pain which the patient usually experiences following the ingestion of food. Such exacerbations may occur during several weeks preceding perforation. Pain may also be referred to the shoulders and may be accompanied by attacks of vomiting. Bleeding is another clinical sign which is indicative of increased activity in the ulcerative process. Hæmorrhage may manifest itself by repeated attacks of mælæna or by hæmatemeses.

SOME AETIOLOGICAL FACTORS.
1. Sex Incidence. When a large series of cases is studied, a striking fact is the preponderance of males over females. The usual proportion of males to females is 10:15 to 1. Factors in the mode of life of the male, such as his anxieties, habits, hurried and irregular meals, may contribute to the development of peptic ulceration.

2. Age Incidence. The majority of patients with perforated gastric ulcer are in the 4th to the 6th decades of life. After the age of 60 years and before 20 years, the incidence is low. Sandell, in a series of 5,740 cases considered according to age incidence, found that only 57 patients were over 60 years of age. Patients with perforated duodenal ulcer tend to be of younger age. When considering the prognosis regarding recovery from operations, the age factor is of importance—the operative mortality increases with each decade of life.

3. Occupational Incidence. Perforation is more liable to occur in patients engaged in heavy manual work. The complication may supervene in a patient during the process of lifting a heavy weight. Such exercises cause the intra-abdominal pressure to rise.
SOME PATHOLOGICAL CONSIDERATIONS.

1. **Perforated Gastric Ulcer.** The majority of perforated gastric ulcers belong to the chronic variety, although a perforating acute ulcer is sometimes encountered. Girling Ball has reported the post-mortem findings in a series of 34 cases with only one example of an acute ulcer. In the majority of cases the perforation will be found in a chronic ulcer in the vicinity of the pylorus, although it is not uncommon to find a perforation in an ulcer half way, or more, along the lesser curvature and sometimes in a saddle-shaped ulcer. Grey Turner has called attention to the type of case presenting two ulcers—a chronic ulcer in the posterior wall of the stomach, and an acute 'contact ulcer' immediately opposite in the anterior wall. Frequently it is the acute 'contact' ulcer which perforates. The size of the perforation in the ulcer varies from $\frac{1}{2}$ to $\frac{3}{4}$ inch.

2. **Perforated Duodenal Ulcer.** The majority of these ulcers belong to the chronic variety. Usually they are situated in the anterior or antero-superior wall of the first part of the duodenum. I have recorded 3 cases in which there was a perforation in an ulcer situated in the second part of the duodenum. 'Contact ulcers' may occur as in the stomach, with the perforation in the anterior ulcer. The size of the perforation varies from $\frac{1}{10}$ to $\frac{3}{10}$ inch, and is smaller than in a gastric ulcer. Coexistent lesions may be encountered in patients with perforated duodenal ulcer. Thus there may be accompanying cholecystitis and appendicitis, and fat necrosis may be seen in the omentum.

SYMPTOMATOLOGY.

1. **Perforated Gastric Ulcer.** Perforation occurs with dramatic suddenness leaving no doubt in the mind of the observer that an abdominal crisis exists. It is of fundamental importance that the underlying cause of the crisis should be recognised in order that appropriate surgical treatment is instituted with the least delay possible. The primary responsibility for the ultimate outcome in perforated peptic ulcer rests with the practitioner who is first summoned to the patient. To postpone seeking surgical advice until peritonitis manifests itself is to court disaster.

A previous history of symptoms constituting the gastric ulcer syndrome will be given by a large number of patients. At the time of perforation there is sudden severe abdominal pain which generally causes the collapse of the patient. The pain is usually situated in the epigastrium, but may be generalised in the abdomen. Pain may also be experienced in the shoulder and back. Vomiting is often a marked symptom. Another important symptom is inability to inspire deeply.

Physical signs vary according to the time interval between perforation and examination. The general attitude of the patient is fairly typical of the condition. Usually he lies on his back, afraid to move, with or without flexion of the lower extremities. It is important to remember that a small number of patients exhibit restlessness and roll about as in biliary colic. The facies betray an inward terror, instanced by the staring eyes, facial pallor, and beads of perspiration on the forehead. The skin is cold and clammy and cyanosis may be noticed. The positive findings are discussed according to the time interval between onset and examination.

(a) **Under 1 hour**—The temperature may be a little subnormal, but the pulse and respiration rates do not exhibit much abnormality. The sign of paramount importance is the presence of rigidity of the upper half of the abdomen, which does not yield to continuous gentle pressure. The abdominal rigidity seen in cases of
lobar pneumonia, acute appendicitis or cholecystitis is not so intense or persistent. Movement of the abdominal wall with respiration is absent, and breathing is of the thoracic type. Tenderness is present to the right or left of the mid-line, according to the position of the perforation in the stomach.

(b) Under 3 hours—The pulse-rate is quickened, together with the respiration-rate. The anterior abdominal wall is retracted and immobile. The board-like rigidity has become generalised, and tenderness is elicited all over. The tenderness may be most marked in the upper half or in the right iliac fossa. On account of this sign, the abdomen in certain cases has been opened for appendicectomy. The liver dullness may be diminished or absent, and there may be shifting dullness in the flanks. If these latter signs are present, the diagnosis is confirmed, but if absent, this must not negative the diagnosis of perforated gastric ulcer.

(c) Under 6 hours—At this stage the physical signs have not altered markedly. The temperature is usually below 99° F., and it may even be sub-normal. The pulse-rate is usually below 100 per minute, and the respiration-rate is always quicker than normal.

(d) Over 12 hours—The pulse-rate rises with some rapidity. The rigidity of the anterior abdominal wall decreases, together with the tenderness. The abdomen becomes distended. At this stage generalised peritonitis has supervened.

2. Perforated Duodenal Ulcer. The majority of patients give a history of digestive disorder extending over varying periods of time. At the time of perforation, the patient is seized with acute abdominal pain, which may be localised to the epigastrium or upper half of the abdomen, or it may be generalised. There may be referred pain in the right shoulder, and vomiting is often present. There is inability to inspire deeply.

The patient is usually in a state of collapse. The face is generally of the long, thin, intelligent type, and looks anxious, with beads of perspiration on the forehead. The skin is cold and clammy. Cyanosis may be a feature. The patient usually lies on his back, afraid to move, with or without flexion of the lower extremities. Sometimes the patient is unable to lie still, and rolls about in agony; some patients may get up and walk about. The movements of the abdomen are diminished or absent; the abdomen is retracted until the latter stages of general peritonitis and intestinal obstruction. Tenderness may be generalised or localised to the epigastrium or right hypochondrium. Board-like rigidity is always present until the later stages of peritonitis. This rigidity may be general or limited to the upper half of the abdomen. The liver dullness may be absent and there may be shifting dullness in the flanks.

The same variations occur in the physical signs with the increase in the time interval between perforation and examination, as in perforated gastric ulcer.

The main points to be remembered when considering the diagnosis of perforated peptic ulcer are: (1) a previous history of abdominal discomfort or pain, which may, or may not, be related to food, extending over a variable period; (2) the onset of severe abdominal pain, generally associated with vomiting; (3) definite rigidity of the upper half of one or both recti abdominis muscles, together with tenderness in this region, and a point of maximum tenderness to the right or left of the mid-line; (4) the temperature may be normal or subnormal, and the pulse-rate not much increased, but there is often an increased respiratory rate.
TREATMENT.

In the presence of this abdominal crisis, surgical treatment must be instituted at the earliest possible moment in order to save the patient's life. The treatment must be directed so as to tide the patient over the dangerous period, and then later, if necessary, to cure his disease.

Suture of the Perforation. This operation is advocated in the majority of cases as a primary measure. Several interrupted Lembert sutures of catgut are passed over the ulcer from side to side through the sero-muscular coats. In the duodenal variety the sutures are inserted parallel to the long axis of the duodenum, in order to prevent stenosis of the lumen. The number of sutures inserted varies with the size of the ulcer which is infolded. A superficial continuous layer of sutures of catgut may be superimposed in order to invaginate the Lembert sutures, and a piece of omentum is then applied to the invaginated ulcer as an added precaution.

Suture of the Perforation combined with Gastro-jejunostomy. Considerable controversy has raged around the problem as to whether gastro-jejunostomy should be performed as a routine with suture of the perforation. In America, Deaver performs gastro-jejunostomy with suture of the perforation as a routine measure in the case of perforated duodenal ulcers. Claims have been made that gastro-jejunostomy does not increase the operative mortality of perforated peptic ulcer; that it relieves the tension on the suture line closing the perforation, and is a prophylactic measure against subsequent hæmorrhage and perforation. Moreover, it is claimed that suture alone does not result in a large percentage of cures. In view of the nature of this surgical emergency, it appears advisable to perform the simplest and quickest operation which is adequate for saving the patient's life, and suture of the perforation fulfils these criteria. An operation such as gastro-jejunostomy which is calculated to cure the ulceration can be postponed to a later date.

Excision of the Ulcer and Pyloroplasty. By this method the ulcer is removed either entirely or to a great extent, and by performing a plastic operation on the pylorus, subsequent stenosis is obviated. There is no doubt that the application of this operation is very limited. In many cases the perforated ulcer is in such a position as to make access very difficult, and if there is fixation to the posterior abdominal wall, the operation cannot be performed.

Partial Gastrectomy. This operation is performed by those surgeons who seek to do two difficult things at once—namely to save the patient's life in a crisis, and to eradicate his disease. Advocates of this method of treatment point to the success of the operation in non-perforating peptic ulcer, and stress the importance of removing the ulcer-bearing area in order to save the patient from the future complications of hæmorrhage, perforation, stenosis and carcinoma.

It appears unjustifiable to perform a severe operation such as partial gastrectomy in a patient so ill from a condition of perforated peptic ulcer, when his life can be saved by a simpler and safer method. If necessary, and the indications are present, partial gastrectomy may be performed at a later date, when the patient is adequately prepared for the severe ordeal, and made reasonably safe for operation.

Temporary Gastrostomy. In the case of a patient in a very poor condition, owing to the long interval allowed to elapse before operation was undertaken, Grey Turner has advocated performing temporary gastrostomy.

THE PROGNOSIS OF PERFORATED PEPTIC ULCER.

The Operative Mortality. In a series of cases which I reviewed recently, the operative mortality proved to be 23 per cent. It is of interest to compare the
operative mortality during recent and more remote years. These figures are set out in the following table, and concern patients treated at St. Bartholomew's Hospital:

**PERFORATED PEPTIC ULCER OPERATIVE MORTALITY.**

<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Perforated Gastric Ulcer</th>
<th>Perforated Duodenal Ulcer</th>
</tr>
</thead>
<tbody>
<tr>
<td>W. Girling Ball</td>
<td>1901-1922</td>
<td>Total No. operated</td>
<td>Total No. operated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R. W. Raven</td>
<td>1924-1928</td>
<td>36.9%</td>
<td>40.8%</td>
</tr>
<tr>
<td>R. W. Raven</td>
<td>1929-1932</td>
<td>29.8%</td>
<td>16.4%</td>
</tr>
</tbody>
</table>

It is seen that the operative mortality in perforated gastric and duodenal ulcers has decreased to a marked extent. In spite of this improvement, it is still too high, and it will probably decrease still further with a better understanding of the disease and its treatment.

**THE LATE RESULTS.**

**Perforated Gastric Ulcer.** In a series of cases which I reviewed recently, it was found that 81.9 per cent. of patients were in a satisfactory condition of health. In 9.7 per cent. of cases the health was unsatisfactory, and 8.1 per cent. were classed as late deaths. After the operation of suture of the perforation 79 per cent. of patients were in a satisfactory condition of health, the remainder were in an unsatisfactory state of health, and in 50 per cent. of these posterior gastro-jejunostomy or partial gastrectomy was carried out later. It is seen therefore, that the operation of suture of the perforation gives satisfactory end-results in the majority of patients, but in a certain small number further surgical treatment may be necessary at a later date on account of persistent symptoms.

**Perforated Duodenal Ulcer.** In a series of cases which I reviewed recently it was found that 80.2 per cent. of patients were in a satisfactory condition of health. In 10.5 per cent. of cases the health was unsatisfactory, and 9.2 per cent. were classed as late deaths. After the operation of suture of the perforation 65 per cent. of patients were in a satisfactory state of health. In 28 per cent. the health was unsatisfactory, and 72 per cent. of these patients required posterior gastro-jejunostomy later. After this secondary gastro-jejunostomy 83 per cent. of patients were found to be well, but in 12 per cent. of cases there was no improvement in health. In this series of cases the operation of suture of the perforation gave a smaller number of successful end-results, and when performing this operation for perforated duodenal ulcer it must be remembered that a certain proportion of patients will require further surgical treatment at a later date.

**CONCLUSION.**

Perforation in a peptic ulcer is a serious abdominal emergency, carrying with it a high mortality. Diminution in this mortality will occur when all patients are submitted to operation immediately after the perforation has occurred. The symptomatology of the condition is discussed with reference to the time interval between the onset of perforation and examination of the patient, and it is shown that the clinical picture alters with the lengthening of this interval. The various surgical procedures are discussed together with the immediate and late results.

**REFERENCES.**

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Turner, G. Grey, "The Perforation of Gastric and Duodenal Ulcers and After," Lancet, 1925, i. 183.