connexion with it, may be eradicated in accordance with those principles now generally held to be necessary in dealing with any form of carcinomatous disease.

After a study of all the factors, we are in a position to lay down the lines upon which an operation for the removal of a malignant growth beginning in the pyloric region of the stomach should be based. It is essential that the whole growth should be taken away, and such a margin beyond the visible and palpable tumour as shall ensure that the outlying nodules are within the lines of section; that all the lesser curvature, that one-half of the greater curvature, and that an inch at least of the duodenum should be removed; that all the "primary" glands at least should be taken (these are the lower and upper coronary, the right paracardial, the suprapyloric, the right suprapancreatic, the right gastro-epiploic upper and lower, and the retropyloric). The removal of all these parts is possible, and therefore the somewhat mournful view of the possibilities of the surgical treatment of cancer of the stomach taken by several writers are not justified. The difficulties to be encountered will chiefly lie in the removal of the right suprapancreatic glands, but that these difficulties are exaggerated is, I think, quite certain. In several cases I have, by using the "gauze stripping" method, removed the glands without any injury either to the hepatic artery or to the pancreas.

The following are the steps of the operation, as briefly outlined as possible:

1. The free opening of the abdomen in or near the middle line; the inspection of the parts; the packing of swabs around the area to be engaged in the operation, so as to avoid any soiling of the parts. Nothing except the viscera at the moment engaged in the operation should be visible.

2. Preliminary ligature of the pyloric, gastro-duodenal, and left gastro-epiploic arteries (not the coronary), division of the gastro-hepatic omentum close to the liver.

3. Division of the duodenum between clamps, and the use, on the distal side, of a suture to close the duodenum by infolding. On the proximal side the exposed mucosa is well sealed with the cautery, and a stitch taken round the clamp to prevent it slipping.

4. Ligature of the gastro-hepatic omentum below all glands in the greater curvature. The most important point is now to see that the middle colic artery is not wounded. The omentum is ligatured up to a point just beyond the middle of the greater curvature, so that all glands are removed.

5. The stomach is now turned well over to the left and the coronary artery ligatured at its origin from the coeliac axis. At once the lesser curvature is freed, and the stomach can be pulled lower. In this way all the coronary glands remain with the stomach.

6. Performance of posterior gastro-enterostomy. This is done before the stomach is cut away, being then far easier.

7. Division between clamps of the stomach from the oesophagus at its right margin to a point a little to the left of the middle of the greater curvature.

8. Cauterization of the exposed mucosa of the stomach and closure of the cut end of the stomach by a double suture.

9. Toilet of the peritoneum and closure of the parietal wound.

The size of the growth at or near the pylorus has no influence upon the extent of the resection. For the very smallest growth a resection to this extent is needed. If the growth invades the body of the stomach it may involve the removal of all of the stomach but the isolated area, after the manner described by me several years ago.

REFERENCES.

¹ BRITISH MEDICAL JOURNAL, 1906, i, p. 370. ² *Annals of Surgery*, 1908, xlvii, p. 889.

A COMMUNICATION which has reached our hands records the aspirations formally expressed at the annual meeting on March 21st of a body entitled l'Association médicale internationale pour aider à la suppression de la Guerre. This, as we have mentioned on a previous occasion, is a peace society, claiming to be both international and medical, and having its head quarters at 25, Rue des Mathurins, Paris. The only "vœu" of a novel character was a hope that the progress of science represented by aéro-navigation will not be turned to the purposes of war.

ON THE SURGICAL TREATMENT OF GASTRIC ULCER, ITS COMPLICATIONS AND SEQUELAE.

WITH SIXTY ILLUSTRATIVE CASES.*

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OF all the advances in modern surgery none is more striking than that which has taken place in the treatment of gastric ulcer. Patients suffering from this disease, or some of its dire results, need no longer drag out the miserable existence they used, for surgery holds out every hope of restoring them to good health. During the last seven years it has been my lot to operate upon 60 cases of gastric ulcer, its complications or sequelae, and it is proposed in the present paper to give some account of them. The various conditions met with have been:

- (a) Active ulcer of the stomach, with and without adhesions to neighbouring viscera.
- (b) Cicatrized ulcer, with and without adhesions.
- (c) Hour-glass contraction of the stomach.
- (d) Subphrenic abscess.
- (e) Tumour after perforation of the stomach.
- (f) Perforating ulcer of the stomach.

The operative procedures adopted for the relief of the above-mentioned conditions may be divided into two main groups, namely, deliberate operations and emergency operations. They will be dealt with in this order.

A.—DELIBERATE OPERATIONS.

The deliberate operations have been:

- 1 case of ligature of ulcer.
- 1 case of pyloroplasty.
- 1 case of excision of ulcer and suture.
- 2 cases of drainage of subphrenic abscess.
- 1 laparotomy for tumour after perforation.
- 34 gastro-enterostomies, alone or combined with other operations.
- 1 case of gastro-gastrostomy.
- 1 case of lateral anastomosis.

The case of ligature of ulcer occurred among the earlier operations, and was performed on November 16th, 1901, in a young woman, 21 years of age, in whom an ulcer the size of a sixpence was found on the posterior wall of the stomach, at the extreme cardiac end, close to the lesser curvature. Here the ulcerated surface was invaginated by two layers of Lembert sutures, after which an opening was made in the anterior wall, the invaginated ulcer seized with forceps, pulled up, and a ligature applied beyond the base of the ulcer, the opening in the anterior wall being thereafter closed. The case did remarkably well and remained so for several years, after which she was lost sight of. On account of the awkward situation of the ulcer, the method of treatment mentioned was deemed safer than excision and suture.

In one case of cicatrized ulcer of the pylorus in a female patient, also one of the earlier cases, a pyloroplasty was performed. Here, although distinct improvement followed the operation, the result I am satisfied would have been better had gastro-jejunostomy been done.

In a male patient it was found that an ulcer the size of a two-shilling piece on the anterior wall of the stomach close to the greater curvature had contracted an adhesion to the abdominal wall well down in the left lumbar region. On breaking down the adhesions it was discovered that the ulcer had eaten through the stomach walls completely, its base being formed by the parietal peritoneum. In this case the margin was excised and the gap on the stomach wall sutured. On the completion of this operation, the stomach receded up into the abdomen and lay so naturally that no further operative procedure was deemed necessary. The operation was performed in January, 1905, and I believe the patient has had no further stomach trouble.

Two cases of subphrenic abscess following perforation of a gastric ulcer were met with. The first, a young married woman, was so bad when put upon the operating table that the administration of a general anaesthetic was out of the question, and the drainage, which was by the transpleural route, was under local anaesthesia. Although she caused grave anxiety for a few days, she ultimately recovered

* Read at the November meeting of the Aberdeen Medico-Chirurgical Society.

after a tedious convalescence. The second case is interesting and worth giving in more detail.

Subphrenic Abscess following Perforation of the Stomach: Operation: Rupture of Abscess into Colon: Recovery.

H. R., aged 25, was admitted to the Royal Infirmary on November 9th, 1905. A month previously she began to suffer pain in the left epigastric region. This continued fairly constantly until 1 a.m. on October 22nd, when she awoke with excruciating pain in her left upper abdomen which soon spread all over and was accompanied for a few hours by sickness and vomiting. After a few days, during which the symptoms gradually subsided in severity, she began to progress satisfactorily, but four days previous to admission to hospital her temperature ran up and she again developed general abdominal distress. On admission her temperature was 102.6° F., pulse 128, respirations 28. There was acute tenderness and rigidity in the left epigastric and hypochondriac regions. Four days later this tenderness became less pronounced, but she complained of pain in her left shoulder and arm, extending down to the hand. By and by an area of dullness could be elicited in the left hypochondrium at the site of tenderness, and extending round into the left axilla.

Operation.

On November 18th a longitudinal incision was made over the dull area and deepened until pus was struck. This had an exceedingly offensive odour, was small in quantity, and lay in a cavity bounded behind and below by the stomach and transverse colon, above and in front by the abdominal wall, liver, and diaphragm. A drainage tube was lodged.

Evidently by the time operation was performed, the abscess had almost penetrated the wall of the colon, for, on the following night, about 4 oz. of pus were discharged per anum. The subsequent history is that pus discharged from the tube and at intervals from the rectum until December 17th, when it ceased. The tube track rapidly healed, and the patient made a speedy recovery.

Doubtless in this case Nature alone, unaided by operation, would have effected a cure, although more slowly. In another case, with a history of acute abdominal symptoms grafted on to a chronic stomach trouble, a tumour developed in the umbilical region. On opening the abdomen this was found to be a mass of plastic exudate binding down nearly the whole of the posterior wall of the stomach to the upper surface of the transverse mesocolon. The abdomen was closed, and the tumour mass gradually disappeared. Dyspeptic symptoms developed after her discharge from hospital, I believe, but so far she has not sought relief.

The most gratifying cases have been those in which gastro-jejunostomy has been performed. They were carefully selected, all, with one exception, having definite gastric lesions. These lesions consisted of ulcers unhealed and cicatrized, either non-adherent or having procured attachment to neighbouring viscera. While the vast majority have done exceedingly well, those cases in which the operation was performed for stenosis of the pylorus stand out pre-eminent among the good results. Patients suffering from this distressing sequela of gastric ulcer at once cease vomiting after gastro-jejunostomy, become perfectly comfortable and put on several stones of weight in a surprisingly short time. A typical illustration of the good results of gastro-jejunostomy in pyloric stenosis is the following:

Pyloric Stenosis: Dilatation of Stomach: Posterior Gastro-jejunostomy: Recovery.

J. P., aged 52, a scavenger, was admitted to the Aberdeen Royal Infirmary on June 17th, 1903, with a history of stomach trouble of ten years' duration. Briefly stated his symptoms had been: pain commencing in his lower dorsal region, radiating round his right side to his epigastrium, and vomiting. The quantity of vomited material was sometimes exceedingly large, and not infrequently he observed in it food taken the previous day. Also on occasions the vomitus was either very dark brown or black. All sorts of medical treatment had been tried, and eventually lavage had been carried out with only partial relief. He was a thin, sallow man, weighing 9 st. 3 lb. The evidences of dilatation of the stomach were pronounced, but no tumour could be palpated. The gastric contents contained free HCl.

Operation.

On opening the abdomen (June 20th, 1903), a hard, rounded tumour at least 1½ in. in diameter was found at the pylorus, almost completely obstructing the orifice. There were no enlarged lymph glands. A posterior gastro-jejunostomy was performed. After operation his vomiting ceased, he put on 2 st. in weight in a few weeks' time, and he is now, after a lapse of over five years, pursuing his work in perfect comfort, and asserts that he can "eat anything."

This case also well illustrates the tumour formation often found in gastric ulcer. In old-standing cases the growth is due to fibrous tissue developed during cicatriza-

tion, and is permanent, but in recent cases it is to be accounted for to a large extent, in some instances wholly, by oedema, and when this is so, it is remarkable how quickly and completely it disappears after invagination, etc. Doubtless, the cases of so-called malignant tumour which were published as disappearing after laparotomy, were merely instances of inflammatory induration. In the example just given no tumour could be palpated through the abdominal wall. Tumours of the pylorus, in my experience, often escape detection on palpation, and the explanation is that the gastro-hepatic omentum becomes involved in the inflammatory process, or in the cicatrization; so that it is shortened, and the pylorus with its tumour is dragged up under the shelter of the liver and costal arch, and so escapes detection through the abdominal wall.

Ulcerated stomachs are very prone to contract adhesions to adjacent viscera, but exceptionally they go further afield for their attachments, as in the case quoted above, where the cardiac end of the stomach was anchored to the abdominal wall in the left lumbar region. These adhesions are at once the safety and the distress of the patient. But for the timely attachment of the peritoneal covering over the ulcerated area the patient would not seldom be plunged into the disasters of perforation and peritonitis. As it is, while preventing this complication, these adhesions give rise to much pain and interference with the mobility of the stomach, with all its disagreeable consequences. The following are illustrative cases:

Gastric Ulcer adherent to Liver and Diaphragm: Gast olysis Posterior Gastro-jejunostomy: Recovery.

J. F., aged 23, a domestic servant, was admitted to the Royal Infirmary on June 10th, 1905, with a history of indigestion for seven years. Her symptoms had been epigastric pain, sickness, and vomiting. She was high coloured, fairly well nourished, and complained of great pain in the upper left epigastric region, where also there was distinct resistance, and possibly slight fullness on palpation. No sickness and vomiting took place during the period of observation prior to operation, but her pain was so persistent and so consistently referred to the same spot that it was decided to operate.

Operation.

On opening the abdomen (July 1st, 1905) through the left rectus muscle in the epigastrium, the anterior wall of the stomach opposite the middle of the lesser curvature was found adherent to the under surface of the liver, anterior edge of the diaphragm, and abdominal wall in the left epigastric region, by a dense irregular mass of adhesions. These, which were evidently the result of old ulceration, were severed and a posterior gastro-jejunostomy performed. There was hardly any post-operative sickness, and convalescence was quite smooth. Before leaving hospital she could take ordinary diet and had no pain. When last heard of she had continued well and was able to work.

Gastric Ulcer adherent to Pancreas: Posterior Gastro-jejunostomy: Recovery.

J. C., a cattleman, aged 58, was sent to the Aberdeen Royal Infirmary on November 14th, 1905, suffering from what was believed to be malignant disease of the stomach. Ten years previously he had had an attack of dyspepsia lasting six weeks. He continued well after this illness until March, 1905, when again he began to suffer from epigastric pain, at first continuously, but later with daily periods of remission. There was no vomiting, and the taking of food did not intensify his pain. On several occasions he noticed melaena. After having been confined to bed for four or five weeks he recovered, and was well again until September 17th following, when he had an attack of pain and vomited a quantity of blood. After that he was never quite free from pain, but vomiting was infrequent. He was very thin, weighing 9 st., and markedly cachectic looking. He referred his pain to the epigastric region, where there was distinct tenderness, especially over the right half and at the umbilicus. No tumour could be felt, and the other abdominal organs appeared normal. The gastric contents showed a trace of free HCl.

Operation.

On November 18th, 1905, the abdomen was opened through the right rectus muscle, and on the posterior wall of the stomach, rather nearer the cardiac end and about 2 in. from the lesser curvature, was an ulcer about the size of a shilling with indurated margins. The ulcer and adjacent walls of the stomach had procured a tight adhesion to the pancreas, but below there was sufficient room to perform a gastro-jejunostomy, which was accordingly done. There was little post-operative vomiting, and convalescence was smooth. The patient left hospital on December 29th, 1905, feeling very well, and put on flesh every week for some time afterwards. He has, I understand, remained well.

Gastric Ulcer adherent to Abdominal Wall and Costal Arch: Gastrolysis: Posterior Gastro-jejunostomy: Recovery.

Mrs. J. G., aged 48, who was admitted to the Aberdeen Royal Infirmary on August 1st, 1907, had had good health until two

years previously, since which time she had suffered at frequent intervals from discomfort and pain in the epigastrium, culminating in sickness and vomiting, half an hour after meals. The vomitus consisted of the food taken at the previous meal, but occasionally she brought up dark-brown material. There was no distinct history of melaena. For six weeks prior to admission all her symptoms had become aggravated, and she had lost flesh considerably. She was thin and pale, and complained of pain in the left epigastric and hypochondriac regions. There was distinct resistance in the regions mentioned, and on deep inspiration an ill-defined rounded mass could be felt. The vomit contained abundant HCl.

Operation.

On August 3rd, 1907, the epigastrium was opened through the left rectus, and the stomach found anchored by a broad mass of adhesions extending from the anterior wall at the cardiac end near the lesser curvature to the left costal margin and adjacent wall of the abdomen. A posterior gastro-jejunostomy was performed, after which the adhesions were severed from the costal arch and abdominal wall. These were found to surround a funnel-shaped cavity leading down into the stomach, and were evidently the result of active ulceration. The fibrous structures and the ulcerated edges of the gap in the stomach were clipped away, after which the organ was closed by two layers of suture. There was very little post-operative vomiting, and her progress towards complete recovery was quite smooth. She left the hospital on August 30th, 1907, and up to the time of writing has been quite well.

Other examples of cases with gastric adhesions, as well as with simple ulceration at the pyloric end of the stomach, might be quoted, but the above may be taken as typical of what is often found and the relief experienced after operation.

Two cases of hour-glass contraction of the stomach have been operated upon.

The first occurred in a female patient, aged 31, in whom the symptoms of pain and vomiting had been so frequent and distressing for a number of years as to render her quite unfit to work for most of the time. At the operation the stomach was found divided into two pouches—a small pyloric and a large cardiac. As it was quite apparent that stagnation was taking place in the cardiac pouch it was decided that an anastomosis between it and the jejunum would best meet the necessities of the case. This was accordingly done, and has been followed by a completely successful result, for the patient has not had the slightest trouble since operation, which was done two years ago, has put on weight, and looks a different person.

In the other case I regret having to record a fatal result from haemorrhage on the sixth day after operation. Here the patient was 63 years of age, much reduced by pain and vomiting, which had troubled her for years. On opening her abdomen the stomach was found constricted by dense cicatrization, dividing it into two pouches about the same size. The pylorus seemed free. A gastro-gastrostomy was performed, an ample opening being provided. She did well until the sixth day, when she showed signs of severe internal haemorrhage, rapidly sank, and died. *Post-mortem* examination showed the constriction to have been due to old ulceration, leaving a passage between the two pouches just sufficient to admit an ordinary lead pencil. The haemorrhage was found to have come from a non-malignant ulcer on the posterior wall of the cardiac pouch, close to the lesser curvature, about an inch from the constriction. The anastomosis was found quite tight, with no sign of leakage or peritonitis.

Remarks on Results and Treatment.

No more gratifying results are to be obtained in surgery than those which follow gastro-jejunostomy in properly selected cases; but it seems to be all too true that it is an operative procedure which has been much "overworked." To perform this operation on neurotic patients with vague and indefinite gastric symptoms is calculated to bring discredit on surgery, for instead of being productive of benefit it may, on the contrary, graft very real and serious disability on to what was mainly an imaginary trouble. Further, the more recent developments of gastric surgery show that gastro-jejunostomy must not be looked upon as a universal panacea for all benign lesions of the stomach, better results being got from other operative procedures according as the lesion is at or near the pylorus, and so obstructing the passage of food, or further away towards the cardiac end. In malignant disease of the stomach also, gastro-jejunostomy has a very doubtful place, unless combined with the radical operation of excision. It is, however, by no means always an easy matter to decide between a benign and malignant lesion, but the presence or absence of free HCl in the vomitus, although not entirely reliable, has been found decidedly helpful. As regards the result of the 42 deliberate operations, all have been exceedingly satisfactory except 5. Of these 5, 3 died, 2 from haemorrhage after operation, and 1 from regurgitant vomiting. One of

the cases of haemorrhage is quoted above, and occurred after gastro-gastrostomy for an hour-glass stomach; the other took place in the case of a woman, 63 years of age, on the sixth day after a posterior gastro-jejunostomy for extensive ulceration of the posterior wall of the stomach, the base of the ulcer being formed by the pancreas. The pathological report was to the effect that the ulceration was non-malignant. The interest of these two cases lies mainly in the fact that fatal haemorrhage from a benign ulcer may follow operative interference even though the anastomotic openings are ample, as they certainly were in these cases, and although no mechanical appliance is employed. The death from regurgitant vomiting occurred on the eleventh day after posterior gastro-jejunostomy. Here the mesenteric side of the jejunum had become adherent to the opening in the stomach, dividing it into two, a small efferent and a large afferent opening. Thus kinking had occurred, and once more goes to prove that regurgitant vomiting is due to a mechanical obstruction at the efferent opening. In this connexion another case, which came under my care in 1902 on account of regurgitant vomiting may be mentioned.

He had had an anterior gastro-jejunostomy performed in 1897 for a stenosis of the pylorus, but had been much troubled with vomiting of bilious material since the operation. His vomiting generally took place from half to three quarters of an hour after food. I found that the proximal loop was short, and ascended to the stomach almost vertically, while the distal loop likewise left the anastomosis, which by the way was quite large, in a vertical direction. A lateral anastomosis between the loops was performed, and for several months he did well. The vomiting again returned, however, and he seemed to be almost as bad as ever. Curiously enough, after persisting for a considerable period it ceased, and he has remained well for several years.

In another case, of a woman aged 27, who for eleven years had suffered from pain, sickness, and vomiting, and in whom a puckered pylorus with dilatation of the stomach was found, a posterior gastro-jejunostomy was done. The vomiting still goes on, but the pain she suffered from is relieved.

Lastly, at the urgent request of a highly neurotic patient with some dilatation of the stomach and complaint of "heavy feeling" after meals and who had been advised by an eminent physician to have a gastro-jejunostomy performed for his trouble, I did the operation. No definite lesion to account for the dilatation could be found, and the procedure, although it did not aggravate the neurosis, led to no improvement.

With one exception all the gastro-jejunostomies have been posterior. In none of these was a proximal loop left, but in the earlier cases the jejunum was not drawn quite so tightly towards its anastomosis. The site selected in the stomach has been always the most dependent part and as close to the greater curvature as possible. As the greater curvature of the stomach at its most dependent part runs often quite horizontal for a short distance, the part of this horizontal portion nearest the duodeno-jejunal junction—that is, towards the left, has been selected. This permits the anastomosed jejunum to maintain its natural direction—namely, vertically, or almost vertically, downwards. Moreover, mutual dragging, and therefore possible kinking, is obviated. Where the distal portion of the intestine after anastomosis seemed to turn more to one side than another, a supporting suture was always inserted, so as to preserve this direction, also with the same object in view, that of avoiding kinking. Such supporting sutures seem to me to be essential when the anterior operation is performed. It is important also during the suturing not to embrace too much of the jejunal wall, otherwise the bowel is apt to become flattened against the opening in the stomach and the occurrence of vicious circle favoured.

B.—EMERGENCY OPERATIONS.

There are few intra-abdominal emergencies that appear with more startling suddenness than perforation of the stomach. It hurls its victim with a tragic swiftness from comparatively good health into a position of the greatest peril. Nor is its guise always certain, for although in the majority of cases it produces a clinical picture once seen never to be forgotten, in a certain number it simulates other abdominal disasters. The death roll from perforation must be enormous. Although Mikulicz was the first to suture a ruptured ulcer in 1880, it was not till 1892 that the operation was accomplished successfully by Kriege. Once the closing of a perforation was demonstrated to be a feasible procedure, many cases have been operated upon and many successful results published. In order to arrive at an estimate of the mortality after suture of perforated

ulcer, several investigators have collected large numbers of published cases, and drawn conclusions therefrom. But it is more than doubtful if these conclusions are to be relied upon, for the tendency has been to publish successful cases, while many unsuccessful ones are not heard of. The percentage of recoveries, therefore, in these collected cases is almost certainly too high. My own experience extends in all to 18 cases, which are appended in tabular form. The first occurred in March, 1902, and the eighteenth in March, 1908. They are given in chronological order.

Table of Operations for Perforation of the Stomach.

	Sex.	Age.	Duration.	Situation.	Result.
1	F.	17	18 hours	Prepyloric	D.
2	M.	45	28 "	Prepyloric	D.
3	F.	19	4 "	Cardiac*	R.
4	M.	33	30 "	Middle	D.
5	F.	28	9 "	Prepyloric	D.
6	M.	28	20 "	Prepyloric	D.
7	F.	19	23 "	Middle	D.
8	F.	39	8 "	Cardiac	R.
9	F.	46	3 "	Prepyloric	D.
10	F.	24	12 "	Cardiac	D.
11	F.	19	29 "	Prepyloric	R.
12	M.	28	12 "	Prepyloric	R.
13	.	24	8 "	Prepyloric	R.
14	F.	29	22 "	Prepyloric	D.
15	F.	25	20½ "	Pyloric	R.
16	F.	24	3½ "	Prepyloric	R.
17	M.	30	5 "	Pyloric	R.
18	F.	21	5 "	Pyloric	R.

* Posterior wall.

The percentage of recoveries among all cases works out at 50 per cent. exactly. If, however, they are divided into two groups—namely, those operated upon twelve hours or less after perforation and those over that time, the percentage of recoveries in the former is 70 per cent. and in the latter 25 per cent. Then, again, it will be observed that among the first 9 cases only 2 recovered, while among the second 9 cases 7 recovered. This is to be accounted for in various ways. In the first place, the average duration of the perforation in the first 9 cases is greater than in the second 9, and there has been a very distinct and steady improvement in the type of case sent for operation, especially latterly, as the advantages of early interference are becoming more and more recognized. A greater share of the credit in the reduction of the mortality must be given, I believe, to the improved technique which has been employed during the last few years in dealing with the acute abdomen. Rapid operating followed by the Fowler position and proctoclysis have done wonders in acute abdomens of all types.

Of the 18 cases, 14 were 30 years of age or under. Among the males the average age is 30, while among the females it is somewhat lower—namely, 26. Then, again, the proportion of females to males is 13 to 5, bearing out the well-known proneness of young females to acute ulcer of the stomach.

All the perforations with one exception were situated on the anterior wall of the stomach. No less than 10 of these were prepyloric, generally about 2 in. from the pylorus and midway between the two curvatures, while other 3 were actually on the pylorus itself. Of the remaining 5, 2 were on the middle of the organ and 3 at the cardiac end, the perforation on the posterior wall being among the latter.

Except in Case No. 1, in which the perforation was ragged and irregular, all the ruptures have presented the characteristic clean-cut, punched-out appearance, and have varied in size from the head of a pin to a large split pea. Round the opening a variable amount of induration has been the rule, with friability of the tissues

—a friability which increases with the duration of the perforation. In one or two an ineffectual attempt to wall off the rupture by adhesions has been observed.

Symptoms, Diagnosis, and Treatment.

A study of the symptoms of these 18 cases brings at many points of interest. First of all, as regards previous history, 17 had had chronic indigestion, the symptoms of which, however, were not always characteristic of ulcer. Only occasionally did one get a definite history of haematemesis. In 8 there was distinct aggravation of the pain prior to rupture. This period of aggravation varied in duration from three weeks to one hour, the average being about twenty-four hours. In one or two cases the symptoms seemed to have been entirely in abeyance, the patients apparently being in perfect health when perforation occurred. In Case No. 17 no chronic history of indigestion was present at all. His case is as follows:

Perforation of Gastric Ulcer: Operation Five Hours Afterwards: Recovery.

G. G., aged 30, a carter, had had absolutely no illness until January 12th, 1908, when he began to suffer from abdominal pain in the epigastric and right iliac regions. For three days this continued, and rendered him unfit to work, but it then subsided, and he resumed his occupation. Two days later, at 10 p.m., the pain recurred suddenly, and with such intensity as to cause him to roll about and groan with agony. The pain was felt sometimes in the epigastrium, sometimes over the area of the appendix. He was sent to the Aberdeen Royal Infirmary. When seen there, he lay on his back with his knees drawn up, and cried out with pain. His temperature was 96.4° F., pulse 80. Respirations 36, shallow and thoracic in type, the abdomen being quite still. The rigidity of the abdominal muscles was general, but most pronounced over the right half of the abdomen. Acute tenderness was present both in the right epigastric and iliac regions, more particularly the latter. The liver dullness was present and the flanks were resonant.

Operation.

Five hours after perforation the abdomen was opened over the appendix, and a quantity of thin, inodorous purulent material escaped, but the appendix itself seemed perfectly normal. The stomach was then explored through a central epigastric incision, and a quantity of gas and fluid escaped. A round, punched-out-like perforation, the size of a split pea, was easily found, situated exactly over the anterior aspect of the pylorus. This was invaginated, and closed by two layers of Lembert suture. A Keith's drain was lodged in the pelvis through a suprapubic incision, and then the abdomen flushed from the upper wound downwards, the saline solution carrying the purulent fluid with particles of food out at the Keith drain. He was propped up into the semi-sitting posture in bed, and his convalescence never caused anxiety.

The entire absence of gastric symptoms until five days before perforation in this case is certainly remarkable, more especially considering the situation of the ulcer. It is difficult to believe that the ulceration had not existed for some time in spite of the entire absence of symptoms.

The pain of a ruptured ulcer, as one would expect, is referred most often to the epigastrium. In 8 of my cases it was confined to this region, while in 5 others it radiated, in addition to (a) the lower part of the sternum and ribs, (b) between the scapulae, (c) the lower costal margin, (d) and (e) appendical area. In 5 cases pain was complained of away from the epigastrium, being referred to (a) the lower abdomen, back, and shoulders, (b) umbilical region, (c) appendical area, left shoulder, and arm, (d) and (e) appendical area. Thus it will be observed that in 5 out of the 18 cases the area of the appendix was implicated either in conjunction with other regions or alone. When the upper abdomen and the appendical region were both involved, it was found on careful inquiry that the pain began above first and then gravitated downwards to the right. The explanation which has been put forward of this is probably the correct one—namely, that when rupture takes place the extravasation is at first confined to the site of the perforation, and pain is referred there; but in the course of an hour or two, guided by the colon, the stomach contents, etc., track downwards to the right iliac fossa, carrying infection and inflammation to the peritoneum of that neighbourhood, with attendant pain. Why the pain of a perforation should from the beginning be referred to the right iliac region, as it was in 2 of my cases, is difficult to understand. In the following case (No. 5) the pain both prior to and after rupture was referred to this part of the abdomen.

Perforation of Gastric Ulcer: Operation Nine Hours Afterwards: Death on the Fourteenth Day from Pneumonia.

Mrs. K. E., aged 28, with a very indefinite history of several attacks of indigestion consisting of epigastric pain occurring about two hours after food, and accompanied by vomiting, but no haematemesis, was seized on November 29th, 1903, with pain over the region of the appendix. This pain remained of moderate severity until 2 p.m. on December 2nd, when suddenly it became intense, and she had to take to bed. Soon the pain radiated from the right iliac fossa over the rest of the abdomen, and she vomited several times, but no blood was observed in the vomitus. When admitted to the infirmary she looked pale and collapsed, her pulse was 128, temperature 98.4, respirations 36. There was general abdominal rigidity and tenderness, but the latter was most pronounced in the right iliac region.

Operation.

Nine hours after the sudden aggravation of the pain, the abdomen was opened over the appendix, and immediately there escaped a quantity of thin purulent fluid. The caecum and appendix were red and congested, and had small patches of exudate upon them. The appendix was rapidly removed, but it became evident on closer examination that it was not the offending organ—a conclusion confirmed by the inodorous nature of the pus. Immediate incision was therefore made in the epigastrium, and at once a circular punched-out-like perforation, about $\frac{1}{2}$ in. in diameter, revealed itself on the anterior wall of the stomach near the pylorus, and equidistant from the greater and lesser curvatures. The area around the opening was cleansed and invaginated by two layers of Lembert suture. The abdomen was flushed, and then closed with drainage. Although the respirations continued fast she did well until December 7th, when signs of pneumonia developed over the left base. From this complication she never recovered, and died on December 16th, fourteen days after operation.

Vomiting, never a marked feature after perforation, was absent altogether in about a third of my cases. When it does occur, the presence of very minute particles of blood clot may occasionally be detected on minute inspection of the vomitus.

It is too widely believed that absence of the liver dullness is an early symptom of perforation. This is not so, for in every one of the above cases which was sent for operation before the rigidity of the abdominal muscles had begun to pass off liver dullness was found. In some it was diminished, while in others it was unaltered. So long as this protective muscular rigidity lasts, in some cases for many hours, the extravasation of air is more or less held in check, and the liver dullness is not obliterated. Later, with the spreading peritonitis, muscular relaxation, and commencing distension, the dullness vanishes, a sign that Nature is losing its power of resistance, and the patient is passing into the final stage of the disease.

Another point that perforative peritonitis teaches, and that is that a certain amount of fluid in the abdominal cavity is compatible with resonant flanks. Completely dull flanks, like the absence of liver dullness, is a sign of advanced peritonitis. In the earlier stages the fluid in the peritoneal cavity, moderate in amount and limited as it often is by adhesive peritonitis, fails to reach the flanks, or does so only to a small extent, and consequently the colon resonance is not interfered with or only slightly diminished.

The only disease with which perforation of the stomach was confounded in my cases was appendicitis. In 4 the appendix was explored in the first instance. In 2 of these, from the fact that the pain and tenderness were most acute over that region, a diagnosis of appendicitis was made, while in the other 2 it was found impossible prior to operation to differentiate between a rupture of the stomach and a perforated appendix. In arriving at a conclusion, too much stress cannot be laid upon the previous history. A chronic history of ill-defined dyspeptic symptoms preceding an acute abdominal crisis should always lead one to suspect the rupture of an ulcer. Then, again, I believe the pain of a perforation is more agonizing than that of a ruptured appendix. When pain is referred by the patient equally to the epigastrium and right iliac region, a good guide to the site of the lesion is, which of the two regions is the more tender. When the diagnosis is uncertain and the abdomen is opened over the appendix the odour of the purulent fluid is, I believe, of great diagnostic value. The appendix may share the general peritonitis and show patches of septic exudate and it may occasionally be difficult to decide from its appearance whether it is diseased or not, but if the pus is inodorous the stomach ought at once to be explored. The offensive odour of the pus in a case of ruptured appendix is rarely

absent, while in rupture of the stomach there is little or no odour.

As in all other acute abdominal cases, the earlier operation is undertaken the better the prognosis. This is well borne out in the table given, the mortality among those got within the first twelve hours being much less than among those got at a later period. But while the duration of the perforation is of chief importance, there are other considerations which have a bearing on the prognosis, namely, the amount and character of the food in the stomach at the time of rupture, the size of the perforation, the extent of the extravasation, and last, but by no means to be neglected, the resistance of the patient. As showing how the amount of extravasation may be limited, the following case may be quoted:

Perforation of Gastric Ulcer: Operation Eight Hours Afterwards: Recovery.

J. M., aged 24, a domestic servant, had for several years suffered from anaemia and frequent attacks of pain and vomiting about an hour after meals. She had never had haematemesis. For twenty-four hours prior to perforation she had more epigastric pain than usual, but it varied in severity until 1 p.m. on March 26th, 1906, when it became suddenly very intense and she had to go to bed. The pain now radiated through to the lower dorsal region and up to the left shoulder, and was accompanied by vomiting of a light brown material. Her physician ordered her to hospital, where her condition was found as follows: General appearance good, temperature 101 F., pulse fair in quality, 106, respirations 30. She complained of pain in the left epigastric and lower dorsal regions and over her left shoulder; abdominal respiration absent. Tenderness in the left epigastrium was most pronounced, and there was cutaneous hyperaesthesia in Head's triangle. The abdominal muscles were very rigid, especially the recti at their upper part. Percussion note all over the abdomen, including the flanks, was clear, and the liver dullness was not diminished.

Operation.

At 9.20 p.m. on March 26th, 1906, eight hours after perforation, the abdomen was opened in the epigastrium through the left rectus muscle; a small quantity of turbid fluid escaped, and on exploring the stomach a perforation was revealed on the anterior wall, 1 in. from the lesser curvature and 2 in. from the pylorus. This perforation was almost occluded by a small finger-like process from the gastro-hepatic omentum and by a partial recent adhesion of the ulcerated area to the diaphragm and edge of the liver, so that an opening only the size of a pin-head was left uncovered. On separating the light adhesions and lifting off the finger of omentum the full extent of the perforation became evident. It measured $\frac{3}{4}$ in. in length by $\frac{1}{2}$ in. broad, and its edges were clean cut. Round this opening was a small quantity of turbid fluid. After the surrounding area had been wiped clean, the ulcer, which was about the size of a shilling, with indurated edges, was invaginated by two rows of Lembert suture. The anterior surface of the stomach and upper surface of the transverse colon were wiped with normal saline solution, and, as the rest of the abdominal cavity was apparently uncontaminated, the abdominal wound was closed without drainage. The patient made a completely smooth recovery, and was discharged well on April 23rd, 1906.

But for the purposeful-like action of the finger of omentum and the limiting adhesions of the ulcerated surface, this patient's condition would have been much worse. Later complications also may vitiate results which are immediately successful. Of the 10 cases which were operated upon twelve hours or less after operation, 3 died. These 3 recovered from the immediate effects of the operation, dying later of complications; Case No. 5, which is given in detail above, succumbed fourteen days afterwards to pneumonia, Case No. 9 twenty-seven days later to acute mental symptoms, Case No. 10 nine weeks later to pyaemia.

The treatment of perforation of the stomach resolves itself into the treatment of the peritonitis after removing its cause. The closure of the rupture can be effected either by two rows of Lembert suture or a purse-string overlapped by a Lembert suture. It is safer, I believe, to employ two layers of sutures, especially in late cases, where the affected area is oedematous and friable, and sutures are exceedingly apt to tear through. As a rule, it is not a difficult matter to find a perforation, but occasionally, as the following case shows, it is an impossibility, and then other methods of treatment must be resorted to.

Perforation of Gastric Ulcer: Operation Twenty-nine Hours Afterwards: Gastro-cutaneous Fistula: Recovery.

G. C., aged 19, a domestic servant, had a history of pain or discomfort after meals for an indefinite period. In May, 1905, she had an attack of rather severe abdominal pain, which incapacitated her for work, and one milder attack a little later. On November 23rd, 1905, at 4 p.m., she felt sick and vomited, and immediately afterwards was seized with very intense

abdominal pain in her right iliac region, left shoulder and arm. This pain diminished after a couple of hours but later again increased in severity. Pain remained agonizing during the night and extended from the right iliac fossa all over the abdomen. No vomiting occurred after the onset of severe pain. She was admitted to hospital at 8 p.m. on November 24th, 1905, when her condition was as follows: Temperature 98.3°, pulse 120, respirations 38. Her appearance was good; she complained of general abdominal pain but most severe about the umbilicus. Abdominal respiration was fair over the upper half which was also somewhat retracted, less marked over the lower half which was rather distended. Abdominal tenderness was general, but most pronounced just above the umbilicus. The liver dullness was normal.

Operation.

In view of the pain having been first felt in the right iliac fossa, the abdomen was opened, twenty-nine hours after the commencement of the acute illness, over the appendix. This appeared normal. Immediate epigastric incision was then made and the anterior wall of the stomach was found drawn up and adherent to the under surface of the liver by patches of recent yellow exudate through the interstices of which was escaping turbid fluid containing numerous food particles. These adhesions were broken down and a search instituted for the perforation, but it completely defied detection. The turbid fluid came welling up from the pyloric end of the stomach, and this, combined with the patches of lymph on the stomach wall, so effectually obscured the field that the search, which could not be prolonged on account of the fact that the patient's pulse and general condition were rapidly running downhill, had to be abandoned. The whole area of the stomach affected was therefore packed over with sterile gauze, the end of which was brought out at the upper angle of the abdominal wound. This was then closed after the peritoneal cavity, the soiling of which was partial, had been wiped clean.

For the first three days the dressings had to be frequently changed, on account of a greenish soakage. At the end of this time, under an anaesthetic, the gauze tampon over the stomach was removed with difficulty. No sooner had the last of it left the wound than 6 to 8 oz. of bile-stained fluid, containing small masses of curdled milk and glairy mucus, escaped. No subsequent plugging was used, and for an hour and a half after removal of the tampon she complained of pain in the left shoulder. At first the soakage from the wound was considerable, but the abdomen remained perfectly quiet, and she soon expressed herself as comfortable. For six days she was fed per rectum, but after this minute quantities of milk and water were administered by the mouth and gradually increased. Some of the curdled milk appeared at intervals in the discharge from the epigastric fistula, but gradually the quantity diminished, and discharge ceased on December 15th, three weeks after operation. She was dismissed, able to take ordinary diet, on February 2nd, 1906.

In dealing with the resulting peritonitis my earlier practice in perforation cases was to flush the abdomen regularly; but latterly this procedure has been abandoned, wiping alone being employed, except in widespread soiling. In extensive extravasation where fluid and food particles have got well below the transverse colon, then flushing with sterile salt solution is still employed in the following manner: A stab wound is made above the pubes and a Keith's drain lodged in Douglas's pouch. The sterilized end of the rubber tube from the irrigator, the glass nozzle having been previously detached, is then, guided by the hand, introduced through the epigastric incision into the abdominal cavity, which is then flushed from above downwards, the fluid emerging through the Keith's drain. This is carried out, the flexible tube being moved about to special pockets, until the fluid from the drain comes away clear, after which the epigastric incision is closed, with or without drainage according to circumstances. It is of paramount importance that the irrigating fluid should be of a proper temperature, otherwise shock will certainly be induced. The Fowler position and proctoclysis have so revolutionized the outlook in the acute abdomen, and have met with such wide acceptance, that no further comment need be made on this excellent method of after-treatment.

The routine performance of gastro-jejunostomy, at the same time as the perforation is dealt with, has been recently advocated with plausible but by no means convincing arguments. The aim of operation on a perforation is to avert death, and I feel convinced that the additional time necessary to make the short circuit will turn the scale against many cases requiring every particle of strength to stand even a short operation. The more rapidly the perforation and peritonitis can be dealt with compatible with efficiency the better the chance of recovery; and to lay it down that the performance of gastro-jejunostomy is an essential part of the treatment of a perforation seems to me fraught with the greatest danger. True, in certain early cases, gastro-jejunostomy may be

added to the operative treatment with safety and advantage, but it should be employed with the greatest discretion. An operation which is theoretically ideal and academic may be far from a life-saving one. Moreover, it seems now clear that gastro-jejunostomy should not be performed as a matter of routine even as a secondary operation, but should be reserved for those cases in which the perforation is so situated that its closure leads to pyloric obstruction or marked interference with the motor function of the stomach. That invagination and suture may lead to the disappearance of an ulcer is corroborated by Case No. 10, which died nine weeks after operation of pyaemia. At the *post-mortem* examination the pathologist could discover no trace whatever of the ulcer. So far two cases have come back with gastric symptoms after operation for perforation. In both the perforation was pyloric, and both have been relieved by gastro-jejunostomy.

In some of the cases recorded the patient was almost moribund when put on the table; but there ought never to be any question as to the propriety of operation—no matter how remote the chances of a successful result are, the patient ought to have the chance, for without operation the outcome is certain.

INTUSSUSCEPTION CONTAINING A SARCOMA OF THE INTESTINAL WALL: ENTER- ECTOMY: RECOVERY.

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The following case presents some features so rare and interesting that we venture to consider the notes worth publishing:

History.

E. S., a boy aged 4½ years, was first seen at 9 p.m. on November 14th, 1908, when suffering from acute abdominal pain of a spasmodic character; between the spasms there seemed to be absolute freedom from pain—there was no vomiting, and nothing was to be felt in the abdomen; the attack lasted until 8 a.m. on November 15th. He was thin, pale and delicate-looking, and there was a previous history of abdominal pain and vomiting for two months, but otherwise he was quite well up to the time of this sudden attack.

On November 16th he was running about quite well.

On November 18th he had a similar attack, pain at intervals all day, vomiting frequently. Temperature, 100° F., pulse, 120. Nothing was felt in the abdomen. On November 19th the attacks of pain and vomiting continued; the temperature was normal, the bowels constipated. No blood, but a little mucus was passed with hard faeces without straining. Retraction of both testicles was marked throughout the attack.

From November 20th to November 23rd the patient was much better, having pain only at times; vomiting had ceased.

On November 23rd a lump was felt for the first time to the right of the umbilicus; the following day he was better and no lump could be felt.

On November 28th, at 5 a.m., he had another severe attack of pain with vomiting which was more or less continuous; for the first time he showed signs of being seriously ill; he was pale with anxious expression, tongue and lips dry, pulse rapid and feeble; examination of the abdomen was difficult, and the right rectus abdominis muscle was very resistant; the pulse was 132, and the temperature 98.4°; a small constipated motion was passed during the day. The pain was very acute and of a spasmodic character, the boy being literally doubled up with it. As the result of a surgical consultation an exploratory operation was performed.

Under A.C.E. a well-marked sausage-shaped mass was felt to the right of the umbilicus, freely movable, well defined, of doughy consistence, and just above and to the median side was another smaller mass.

Operation.

On opening the abdomen through the right rectus abdominis muscle a congested enteric intussusception was found, about 4 in. or 5 in. in length, with a tightly constricted neck, close to which a mass of enlarged mesenteric lymphatic glands was present. As reduction was impossible, and the patient's condition extremely grave, the whole of the intussuscepted gut was resected as rapidly as possible, one of the mesenteric glands removed, and a speedy end-to-end anastomosis of the divided ends of the gut by suture was performed. The abdomen was then filled with hot saline lotion and closed by through-and-through silkworm gut sutures.