SURGERY OF PEPTIC ULCERATION AND ITS COMPLICATIONS

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Part I

LECTURE ONE

Gastric and Duodenal Ulceration. Operative Methods. Results of Operation

I am greatly honoured by your invitation to me to deliver the lectures in memory of John Coakley Lettsom.

It is only nine years since my distinguished predecessor, Sir Gordon Gordon-Taylor, delivered the Lettsomian Lecture on the subject of haemorrhage from peptic ulcer (Gordon-Taylor, 1945). I shall have little of value to add to his words on this aspect except to record diminished mortality figures, largely as a result of the policies he then advocated to us. I shall discuss the subject widely and can therefore only touch lightly on certain aspects, though I shall prod more heavily in certain places where it may do good.

Selection for Surgery

Twenty to thirty years ago there was more disagreement among clinicians on the selection of cases for surgical treatment. In those days the physician tended to find it one of his functions to save the patient from the surgeon. The patient who arrived at the surgical outpatients' clinic with an ulcer sometimes found that his only course of medical treatment was a packet of alkaline powder to take while awaiting admission for operation! Nowadays the position has changed. The physician is almost more ready than the surgeon to advocate surgical interference. There are even a few hybrids like Dr. F. Avery Jones and myself who have both medically and surgically treated patients under their care and do, I believe, have equal pleasure in recording successful results by either method. The causes of this new outlook are many. The gastroscope has proved a common bond of interest between physicians and surgeons. It has shown to the surgeon how readily the acute

gastric ulcer can heal and how even the chronic ulcer begins to heal when the patient is rested in bed. It has shown to the physician the very organic and destructive nature of the ulcerative lesion and demonstrated the persistence of many chronic ulcers long after the symptoms have disappeared.

The increasing use of surgical methods is founded on solid grounds. The first is that of enforcing a state of invalidism on the patient there is no medical means of preventing relapse of ulceration. The second is the increasing efficiency of operations for peptic ulcer in relieving pain, preventing ulcer recurrence and in avoiding side effects of the operations. The diminishing operative mortalities and morbidities are also a major encouragement for surgery. The last but very effective cause of the increasing use of surgery is a rising demand for surgery from the laity who have come to discover its possibilities.

Principles of Selection for Surgery

In the selection of cases for operation certain general principles can be established. The first is that the subjective success of an operation varies directly with the amount of pain which the patient has previously suffered, though there are occasional exceptions to this. It will be found that there is less satisfaction with the operation among those who have had an emergency operation, e.g. to arrest gastro-duodenal bleeding, than among those operated on for chronic pain, though it cannot be disputed that nevertheless both operations have succeeded in their object, the one to avoid death from bleeding, the other to cure chronic ulcer pain.

The next principle is that the patient who gets good relief from bed rest and medical treatment is the one who is most certain to get relief from surgical treatment. One should be somewhat

wary of the case who gets no relief from medical treatment unless the ulcer is a penetrating one. Periodical remission of symptoms and relief of pain from bed rest are typical features of peptic ulceration, and if they are missing the possibility of an incorrect diagnosis or of an excessive functional overlay should be considered.

Young patients, being intolerant of ill health, are often anxious for surgery prematurely and tend to regard the operation as the removal of an unpleasant aching foreign body and do not realize that it entails an alteration in their gastric physiology. Nevertheless, well-selected young subjects do extremely well after gastrectomy.

P.J.T., aged 25, was admitted under my care in 1941. He gave a history of duodenal type of dyspepsia since childhood and of an unsuccessful operation for duodenal ulcer, I believe a pyloroplasty, at the age of 13. I carried out a partial gastrectomy for a chronic penetrating duodenal ulcer. His subsequent progress was excellent, he gained weight and is now a muscular and well-nourished man. At any rate his progress satisfied his family, for in 1943 his 34 year old brother (T.T.) came for a gastrectomy for a stomal ulcer following a gastro-jejunosomy performed when he was aged 21, and in 1951 his remaining two brothers, M.T., aged 36, and P.T., aged 38, both requested and had partial gastrectomies for severe duodenal ulceration. All the four young men had histories of ulceration dating from childhood or teens and made careful observation of their brother's progress before submitting themselves for surgery!

Middle-aged men with heavy family and social responsibilities are sometimes debarred from surgery because it is believed that their nervous temperament may invite failure. It is my impression that many such patients become emotionally more stable when a major cause of their anxiety, namely the ulcer, is removed.

Elderly patients not infrequently decide to retire from work on account of their persistent ulcer symptoms, believing that freed from responsibility and daily toil the ulcer will heal. If the diagnosis of chronic ulceration is correct, most such patients are disappointed in their hopes and find that they are unable to enjoy their retirement without the help of surgery.

The Diagnosis of Peptic Ulceration

Three years ago Dr. Cochrane Shanks told us something of the radiological diagnosis of peptic ulceration (Shanks, 1952). X-ray examination of the passage of an opaque meal remains the second most important means of diagnosis. I would give the first place to the clinical history. The symptoms of peptic ulceration tend to follow certain

well-marked patterns with occasional difficult variants such as the penetrating ulcer in which the food-pain relationship is lost, the ulcer at the cardiac end of the stomach which may produce an angina-like pain or the posterior duodenal ulcer which may cause only an intractable backache until a melaena discloses the intestinal origin of the pain. However, the fact that certain other forms of dyspepsia, for example that due to simple or malignant tumours or to gastritis, and some functional forms may mimic ulcer dyspepsia, make it unsafe to operate merely on a clinical diagnosis.

A difficulty arises when a patient with typical ulcer symptoms is reported to have normal appearances on X-ray examination. Repetition of the X-ray after a short period of bed rest may enable the radiologist to demonstrate scarring more clearly. In this type of case a gastric analysis is helpful. If the patient has duodenal ulcer-like symptoms, the X-ray is negative and the fractional test meal reveals a high acidity, then I think it wise to treat the patient as a duodenal ulcer. If an ulcer-like dyspepsia is found with a negative X-ray and an achlorhydria on test meal examination, then it is well to add a gastroscopic examination, when an atrophic gastritis or even an ulcer or carcinoma may, at times be found. The 'false positive' of radiology is also disconcerting and on several occasions I have found the test meal of help. For example, a deformity believed to be due to duodenal ulceration may be associated with hypoacidity or an acidity. Such conflicting findings indicate the need for gastroscopy, particularly if there is blood in the gastric content. On gastroscopy in such cases I have found a carcinoma, often fundic or diffusely infiltrative, on several occasions. An atrophic gastritis may be present and if so, one can be sure that the duodenal deformity is either a false finding or it is the healed scar of an ulcer from which the patient suffered earlier in life. This latter combination is important because gastric resection may not relieve the symptoms of atrophic gastritis. I have seen three patients who had a gastrectomy because of the laparotomy findings of a duodenal scar—but who in fact had long since ceased to suffer from the duodenal ulcer, because with the passage of the years they had developed gastric atrophy and hypoacidity, and all three were disappointed by the post-operative persistence of their symptoms. One must ever be guarded as to the symptomatic prognosis of active gastric ulceration when it is associated with achlorhydria and atrophic gastritis. The majority will have symptomatic relief but in some, presumably those whose symptoms were due to the gastritis rather than to the ulcer, dyspeptic symptoms of varying severity may continue.

In a clinic such as ours in S.W. London where

there are about three gastric ulcers to every five duodenal ulcers treated and where more than a half of the cases of haematemesis have a gastric lesion, we find gastroscopy of great value in diagnosis. A successful gastroscopy is usually more reliable than an exploratory laparotomy in the detection of the smaller gastric ulcers. On gastroscopy I have occasionally discovered gastric polyps or gastric diverticula, and many times found gastric ulcers in patients who had previously had negative gastric findings at laparotomy. It is the most reliable means of differentiation between simple ulcer and carcinoma, apart perhaps from laparotomy. It is frequently quoted in the North American literature that some 10 per cent. of ulcers resected in the belief that they are innocent, are in fact malignant. With the aid of pre-operative gastroscopy we find well under 1 per cent. of such resected ulcers to be malignant on histological or follow-up investigation. It is reported that a carcinoma may appear to heal for a time on X-ray examination. In a series of between 1,000 and 2,000 gastroscopic examinations of gastric ulcers I have never found a gastric ulcer apparently heal and later turn out to be malignant. Therefore I place considerable value on pre-operative visualization of a gastric ulcer. In cases of doubt at laparotomy I have usually found it safe to trust my pre-operative gastroscopic diagnosis. The disadvantage of gastroscopy is the need for very extensive training and an experience of many hundreds of examinations before one is able to interpret the findings.

Peptic Ulceration and the Gastric Mucosa

Perhaps it is opportune at this stage to make some remarks on the relation between the gastroscopic appearances of the gastric mucosa and peptic ulceration. Duodenal ulceration is usually associated with a raised gastric acidity, an increased volume of basal day and night secretion, and a vigorous secretory response to stimulation by appetite or by food. On gastroscopy, as Harold Rodgers has pointed out, it is usual to find the normal mucosal pattern, the *areae gastricae*, to be well marked and the folds well developed. One never finds widespread atrophic changes in the presence of an active duodenal ulcer. In cases of gastric ulceration the mucosa is occasionally well developed, but much more often it is thinner than normal. Not infrequently the *areae gastricae* are flattened and unrecognisable, with stippled congestion of the mucosa, or even atrophic changes, making it possible to see intramucosal and submucosal blood vessels. In these cases the gastric acidity is depressed below normal, or there may be achlorhydria. Thus it appears that gastric ulcer frequently arises in a diseased or degenerate

FIG. 1.—With the high secretion of gastric juice, a duodenal ulcer may appear. When the mucosa degenerates, the duodenal ulcer tends to heal and a gastric ulcer may appear. (Note—This illustration has also appeared in the *Edin. med. J.*, 1951, 58, 288.)

mucosa, and the acid-peptic factor is much less important.

My impression (Fig. 1) is that the duodenal ulcer appears in subjects with a healthy gastric mucosa which possibly under some nervous influence is capable of excessive secretion, causing ulceration of the duodenal mucosa. With the onset of gastritis or degenerative atrophic changes, and there is on the average a tendency for the gastric acidity to fall with advancing years, the powers of excessive secretion diminish and a duodenal ulcer will tend to heal. This gastritic tendency leads to a decrease in the resistance of the gastric mucosa, so that despite the lowered erosive power of the gastric juice, it may break down to produce a gastric ulcer much as the skin ulcerates in a case of varicose eczema, with the minimum of trauma.

That this is the sequence of events is supported by the fact that gastric ulceration tends to appear on the average some ten years later in life than duodenal ulcer.

It is also supported by a finding that has frequently interested me at operation in cases where there is evidence of coincident gastric and duodenal ulceration. In 90 per cent. of such cases, it is found that the gastric ulcer is active, but the duodenal is inactive or is a healed scar. In the cases when the duodenal ulcer is active it is often found that the gastric ulcer is an early or subacute

one, suggesting that when the two are combined, the gastric ulcer is waxing, the duodenal waning.

About one quarter of my gastric ulcer cases are found to have a duodenal scar or ulcer. The age of onset of symptoms in the combined group is similar to that of the age of onset of duodenal ulceration. The age at operation is more similar to the age at operation of gastric ulcer cases.

		D.U. and G.U.	G.U.
Age of onset of symptoms	..	32.2	40.8
Age at operation	..	42.6	47.6

This small point also suggests that duodenal ulceration was the first event and gastric ulceration a later event in cases of combined ulceration.

Further evidence of the difference in the erosive powers of the gastric juice is given by the vast experience we have from the performance of gastro-jejunal anastomoses. If a hundred gastro-jejunosomies are done for duodenal ulcer, about a half will get jejunal ulceration. If a hundred are done for gastric ulceration, the gastric ulcer may persist but the jejunum will rarely ulcerate. Similarly, the jejunal ulceration rate after gastrectomy for duodenal ulcer is usually 2-3 per cent., but only a small fraction of 1 per cent. after the same type of gastrectomy done for gastric ulcer.

I think that if the erosive powers of the gastric juice are diminished in gastric ulcer cases, then it is reasonable to assume that the gastric mucosa in such patients has a diminished resistance to ulceration.

These points are I think important and help to guide us in our selection of operations for the various forms of peptic ulcer.

Operative Methods in Dealing with Peptic Ulcer

A great many ingenious operations have been described, carried out and finally discarded, in the treatment of peptic ulceration. Some ten years ago, in my armchair, I discovered—or if I study the literature hard enough, I shall probably find that I re-discovered a form of gastro-jejunosomy that seemed less likely to lead to stomal ulceration. I decided that a likely cause of stomal ulceration was that as the gastro-jejunal stoma was placed in the most dependent part of the body of the stomach, not only was the adjacent jejunum constantly bathed in the resting gastric juice, but the susceptible jejunal mucosa was sutured to acid secreting gastric mucosa. It occurred to me that a stoma immediately proximal to the pylorus would be in less contact with the resting intercibal juice and as the secretion of the pyloric mucosa is

weakly alkaline, the jejunal mucosa would be adjacent to alkali secreting gastric mucosa. I carried out some twelve of these operations in 1943, which I called juxta-pyloric gastro-jejunosomy. At a follow-up some three years later, I found the operation extremely satisfactory, though two or three were requiring alkaline powders from time to time. Fortunately I decided to wait longer before generally advocating the operation. What is the position today—some ten years later?

GASTRO-JEJUNOSTOMY FOR DUODENAL ULCER

Operations 1943-44. Follow-up 1954

	Juxta Pyloric Operation	Orthodox Operation
No. of operations	12	19
Followed-up, ten years	9	15
Recurrent } Proved	2	7
Stomal } Clinical diag-	2	8
Ulceration } nosis	3	1
Well	4	4
Died (not of ulcer)	0	3

I need hardly emphasize the grave risks in accepting new operations based only on theoretical considerations, without the test of time.

I believe it is safe to say that the orthodox operation for gastric or duodenal ulcer is a partial gastrectomy, with vagotomy still under trial. The short circulating operations, the local excisions and plastic operations have been discarded, apart from their occasional use as a temporary expedient, as palliation in feeble or aged persons, or as an accessory to vagal resection. A wide pyloroplasty is sometimes of help in a senile starved person with a stenosed duodenal ulcer. A gastro-jejunosomy is also justifiable for aged or decrepit persons with intractable ulcer pain. It will usually cure the duodenal ulcer, though age and decrepitude may not protect the patient against stomal ulceration, and one can only hope that the stomal ulcer will be less troublesome than was the duodenal ulcer.

Partial gastrectomy for gastric and duodenal ulceration is a well-tried operation and has maintained its prestige despite much criticism. My late senior registrar, Mr. Colin Craig, now consultant surgeon at Lowestoft, and a physician colleague, Dr. Chippendale, recently made an extremely critical follow-up of 611 consecutive, elective and emergency partial gastrectomies for ulcer, carried out at St. James's Hospital (271 for gastric ulcer, 246 for duodenal ulcer, 89 for gastric and duodenal ulcer, 5 unclassified). Follow-up by personal interview between three and six years after operation disclosed that 89 per cent. of the patients were completely satisfied by the operation and had had to make no change in their normal

habits of life. None of the gastric ulcer cases had developed further ulcer trouble, though five of the 244 patients with duodenal ulcer (2 per cent.) had developed stomal ulceration. It has been suggested that stomal ulceration can be almost eliminated if only 5-6 cm. of stomach is preserved. I would agree that such is probable, but it would be an entirely ridiculous price to pay. We know that the three-quarter or so gastrectomy generally carried out makes no very profound change in the patients' general health or longevity. Such extreme resections however are likely, like total gastrectomy, to produce an appreciable number of cases of macrocytic anaemia as well as many microcytic ones. Now that we have another very promising weapon, namely vagotomy, in the treatment of stomal ulcer, there is even less need to perform these drastic resections for the sake of the 2-3 per cent who are going to develop a stomal ulcer.

Of late years, with the great increase in the numbers of the gastrectomized population, considerable interest and some alarm has been aroused by the incidence of certain symptoms appearing after meals, notably epigastric discomfort with sweating, flushing, palpitations, sometimes fatigue and at times accompanied by biliary regurgitation, or diarrhoea. These have been grouped together as the early post cibal symptoms or 'dumping symptoms'—a term which Dr. Cochrane Shanks in his Lettsomian Lecture suggested 'should be dumped.'

In view of our very great ignorance of the mechanism, prevention and treatment of these symptoms, I considered that it would be helpful to try and discover which form of gastrectomy was least prone to develop these symptoms. Mimirriss and Burt (1948) have reported a similar investigation. Therefore the period 1946-49 was divided into two. During the first part, all gastrectomies for duodenal or duodenal plus gastric ulcer were performed by an antecolic gastro-jejunal anastomosis, the jejunum running from lesser to greater curve, with a valve on the lesser curve half of the stomach, and an afferent loop 9 to 15 in. in length. During the second period, similar anastomoses were made with a much shorter loop, but the stomach was drawn through the transverse mesocolon—a retrocolic anastomosis. During the whole period, many of the gastric ulcers were treated by the Billroth I (Péan) form of gastrectomy (reconstruction by gastro-duodenal anastomosis).

Craig and Chippendale classified the results under the following categories.

Category I. Free of all gastric symptoms.

„ II. Fullness after meals.

„ III. The early post-cibal syndrome—with mild symptoms, a satisfied patient

and no interference with normal habits.

„ IV. The early post-cibal syndrome—with several symptoms necessitating rest after meals and causing interference with normal work.

„ V. The late post-cibal syndrome.

„ VI. Recurrent ulceration.

„ VII. Deficiency syndromes; including loss of weight, anaemia, vitamin deficiencies.

„ VIII. Miscellaneous.

The following Table gives the results so far as early post cibal symptoms are concerned:—

Cases		Billroth I	Antecolic Polya	Retrocolic Polya
Total assessed	..	95	245	168
Category I	..	51	146	77
		(53.7%)	(59.6%)	(45.8%)
„ II	..	22	50	37
		(23.2%)	(20.4%)	(22%)
„ III	..	11	29	33
		(11.6%)	(11.8%)	(19.6%)
„ IV	..	4	8	13
		(5.4%)	(3.3%)	(7.7%)

I was surprised to find that the retrocolic gastro-jejunal type came out somewhat the worse as regards both the mild and severe types of post cibal symptoms. It should be added that Craig and Chippendale found that our Billroth I patients while having a similar incidence of dumping to the antecolic valved gastro-jejunal operation, had generally milder symptoms.

The antecolic Polya and the Billroth I operations thus proving the more satisfactory, we have since used them more frequently.

We found, however, a grave drawback to these long looped antecolic operations. Cases of acute afferent loop obstruction occurred in a few of our own patients and other surgeons told me of acute obstruction of the long afferent jejunal loop as early as five days, and as late as seven years after the operation. It is true that any form of gastrectomy may be followed by obstruction or internal herniation, but such mishaps are rare. One loop obstruction occurred in the series of 168 retrocolic gastrectomies, (Fig. 2) two years after operation. The efferent loop of jejunum has passed through an opening bounded by the short afferent jejunal loop and meso-colon, and was successfully reduced by my then Registrar, Mr. E. Murray. The afferent loop obstruction typical of the long looped antecolic operation was very fully investigated by my late Senior Registrar, Mr. Derek Teasdale, and it has also been described by Quinn W. F. and Gifford J. H. (1950). It may be illustrated by the following history.

A.E., a female, aged 47 in 1947 had a haemate-

EFFERENT LOOP OBSTRUCTION. RETROCOLIC ANASTOMOSIS.

FIG. 2.—Obstruction of efferent jejunal loop following retrocolic partial gastrectomy.

LONG AFFERENT LOOP OBSTRUCTION.

FIG. 3.—Obstruction of long afferent loop behind its own mesentery following antecolic partial gastrectomy.

SAFE ANTECOLIC LOOPS.

FIG. 4.—Moynihan type of gastrectomy (above) and short loop antecolic 'efferent to greater curve' gastrectomy (below). These appear to be free from the risk of afferent loop obstruction.

mesis and three weeks later was subjected to gastrectomy at a London Hospital. She was well for nearly four years, when she developed severe peri-umbilical pain radiating to the back, temporary collapse and slight vomiting. She was admitted to St. James' Hospital four days later. On examination she was apyrexial, pale and thin. There was a midline epigastric operation scar and a sausage-shaped mass under the left costal margin. The haemoglobin was 46 per cent. and urinary diastatic index raised to 800 units (Normal 33). After transfusion she was operated on by Mr. Teasdale. A little free fluid escaped on opening the abdomen. There was an antecolic gastrectomy with afferent jejunum joined to the lesser curve. The duodenum and gall-bladder were tensely distended and the afferent jejunal loop similarly distended lay behind and to the left of the efferent loop (Fig. 3). Attempts to reduce this loop were unsuccessful and so after aspiration of much biliary

fluid from it, the efferent and afferent loops were short circuited. This afferent loop was found to be 18 in. long. The post-operative course was smooth and on discharge her urinary diastase was 20 units.

Altogether four such cases were seen at St. James', in one of which the afferent loop was so distended that it ruptured and led to death. One or two cases were suspected of slight obstruction after operation, but subsided after turning the

patient on the right side and elevating the foot of the bed. These cases were enough to make us abandon the antecolic long loop efferent to greater curve (E.G.) operation, despite its greater freedom from 'dumping' symptoms. Gastro-duodenal anastomosis was a satisfactory alternative in gastric ulcer cases but we were averse to using the very unhealthy duodenum in duodenal ulcer cases. It seemed to us that the gastro-jejunal possibilities were either (Fig. 4): (1) Moynihan (efferent-

FIGS. 5 and 6.—The author's technique for performing gastrectomy with a valve in non crushing (Lane's) clamps.

jejunum to lesser curve) (E.L.) operation, or, (2) Short loop antecolic efferent loop to greater curve (E.G.) anastomosis.

We decided on the latter and since 1951 nearly half the gastrectomies have been of this type. I have personally performed just under two hundred and about three hundred of this type have been carried out by my 'team' without any further afferent loop or other mechanical troubles. The afferent loop is made only 4 in to 5 in. long and may seem tense to the observer at the time of anastomosis, but when it lies in the abdomen it is free of tension.

A description of my present mode of performance of the antecolic operation may be of interest. After duodenal division and closure, and mobilization of the stomach, the stomach and jejunum are placed in Lane clamps, with a four to five inch afferent jejunal loop. After uniting the two with a Lembert (Figs. 5 and 6) stitch a Payr clamp is placed half to two-thirds of the way across the lesser curve side of the stomach, this being the part which is to be closed. I think it unreal to measure the future stoma in inches in such an elastic organ as the stomach, and so I leave a stoma between a third and a half of the stomach diameter. After removal of the stomach the lesser curve half is closed with a sewing machine stitch. I used fine silk for this during the war but had to abandon this practice, for my colleague, Mr. Desmond, and I had some six cases of mild haematemesis up to a year after operation due to extrusion into the stomach of one of the

knots, with retention of the second knot in the stomach wall (Fig. 7). The diagnosis was evident on gastroscopic examination when the knot could be seen hanging from what was a stitch abscess cavity and which bled, presumably when it underwent peptic digestion. In two cases we had to remove the silk at a second operation and the suspected state of affairs was confirmed. In a third case I was able to introduce a flexible forceps into the stomach through a rubber channel made in the side of a Hermon Taylor gastroscope, and grasp and pull out the stitch, whereupon there was no more trouble (Fig 8). The lesson is, of course, to use continuous catgut or *interrupted* non-absorbable stitches when suturing gastric tissues. We use the former.

To continue with the gastrectomy. After uniting the open end of the stomach to an opening in the jejunum, the gastrectomy is completed by simply continuing the Lembert stitch round the anterior surface of stomach and jejunum, taking deep bites over the closed part of the stomach to produce a valvular effect. This is, I believe, simpler than the orthodox Hofmeister valve and is more likely to have a valvular action. I have made the valve in this fashion since 1941 and there has been no leak or other anxiety connected with it, so it is certainly safe.

The main difficulty in the operation for duodenal ulcer concerns safe duodenal closure. It so happens that I have never had a leak and certainly no mortality, or so far as I know, morbidity from duodenal leakage, and so it may be helpful to make a few remarks on our methods of closure. The first point is that we never hurry and are prepared to spend as much time over duodenal closure as over the rest of the operation. The second point is that although we usually find it advisable to dissect just past the ulcer in order to get a conical stump to invaginate, we never mind where the duodenum is closed so long as it is closed safely. We never dissect well past the ulcer simply in order to give the pathologist a good specimen. The appearance of the ulcer at operation is the best evidence of the duodenal pathology. Good *specimens* of duodenal ulcer are best obtained from the post-mortem room.

The third point is that in dissecting distal to the ulcer, where sharp dissection is always necessary, we keep close to the duodenal wall. When clamping vessels, bands or omenta, we clamp so close to the duodenum that one cannot put on a second forceps and so it is necessary to cut between the duodenum and forceps. When there is a large completely penetrating ulcer, I find it helpful to put one finger in the duodenum and shave the duodenum off the pancreas, keeping the scalpel close to the finger.

FIG. 7.—Gastroscopic view of silk knot partially extruded into stomach after gastrectomy. (Note.—This illustration was also shown in the *Edin. med. J.* article.)

FIG. 8.—Type of flexible forceps used to extract the silk knot from the stomach.

The fourth point is to operate with the ulcer quiescent whenever possible. To allow this object we insist on giving the patient a few days in hospital prior to operation. The consequent lack of acute inflammation will enable one to transect the duodenum close to, and in difficult cases even through the ulcer, and the fibrotic duodenum at the ulcer edge will be found to hold sutures well.

Point number five is that we never cut, cauterize, or insert needles into healthy pancreatic tissue for fear that leakage of pancreatic juice may occur. When it is difficult to invaginate the duodenal stump, I do not hesitate to put interrupted non-absorbable sutures between the healthy lateral duodenal wall and the fibrotic ulcer crater edge in the pancreas.

The sixth very important point is that there must be no obstruction of the afferent loop of the gastro-jejunal anastomosis—for this could lead to stump rupture. So far as my own technique is concerned this reinforces our decision to abandon

the long antecolic afferent loop in favour of a 4 to 5 in. one.

Finally, if there is anything short of perfection in the closure of the stump, a small drainage tube should be placed down to it. I have only once noticed any intestinal discharge from this tube, about 1 ml. of mucus per day, three weeks after a difficult post-pyloric, pre-ulcer closure; nevertheless it is a wise precaution.

What of the patient in whom duodenal closure appears to be too hazardous to attempt? In such cases there are three alternatives.

1. Gastro-jejunostomy, preferably combined with vagotomy.

2. Two-stage gastrectomy. Stage one is prepyloric closure of the duodenum across the antrum, removal of the lower two-thirds of the body of the stomach followed by gastro-jejunal anastomosis. The second stage, carried out six weeks later when all ulcer activity will have died down, is to excise the antrum.

GASTRIC ULCER PLUS DUODENAL ULCER
STENOSING COMMON DUCT.
PARTIAL GASTRECTOMY.

FIG. 9.—Final disposition after dealing with a case of gastric ulcer associated with a duodenal ulcer which had stenosed the common bile duct.

3. Pre-pyloric closure of the duodenum, removing the antral mucous membrane and then making a high partial gastrectomy. Follow-up studies have shown no difference in the late progress of this form of gastrectomy from those with duodenal closure distal to the ulcer. A criticism of this method is the difficulty in controlling bleeding while separating the mucosa from the muscular coat of the antrum. It is necessary to leave branches of the right gastric and right gastro-epiploic arteries to the pyloric antrum intact, for the only other good blood supply coming to the antrum from the duodenal side lies in the submucosa, and this is destroyed in removing the mucosa. The application of arterial clamps on the right gastric and right gastro-epiploic vessels makes little difference to the bleeding and putting a non-crushing clamp across the duodenum in cases of penetrating duodenal ulcer is very hazardous, thus there is no alternative to slow and careful ligation of the submucosal vessels during the stripping of the seromuscularis from the mucous membrane.

A rare difficulty arises in the case where a duodenal ulcer has stenosed the common bile duct. Perhaps recital of our management of a complicated case of this type will be of interest: L. J., female, aged 64, first came to St. James' Hospital in 1938, when she had a cholecyst-gastrostomy for jaundice due to involvement of the common bile duct by a duodenal ulcer. She had a thirty

year history of duodenal dyspepsia, but in 1949 a gastric ulcer arose and gave increasingly severe pain and vomiting. Gastroscoy confirmed the presence of a high chronic gastric ulcer. In 1953, I operated on her and found a high gastric ulcer, a narrowed duodenum, stenosed common duct and a healthy cholecyst-gastric anastomosis. We dismantled the anastomosis of stomach and gall-bladder, transected the duodenum just beyond the pylorus but proximal to the stenosed area. The duodenum was closed by uniting the fundus of the gall-bladder to it, and after partial gastrectomy a gastro-jejunal anastomosis was made. (Fig. 9.)

As the gastro-duodenal (Billroth I) form of reconstruction proved very satisfactory in our follow-up, we use it for most of our gastric ulcer cases, where the duodenum is healthy, or duodenal ulceration is inactive. There has been a suggestion that stomal ulceration is commoner after the Billroth I operation, but as stomal ulceration is extremely rare after gastric ulcer resection, this is no objection.

I would like to make a few remarks concerning gastrectomy for gastric ulcer. In order to avoid a narrow stoma, it is wise to use at least half the gastric diameter for it, no matter how narrow the duodenum may be. The duodenal circumference can always be increased by an anterior incision, extending distally from its cut end.

A great deal of ingenuity can be used in constructing the new stomach when the gastric ulcer is found in awkward situations.

When the ulcer is high and on the posterior wall; in our experience the commonest situation in women (25 per cent.) and the situation in 10 per cent of the male cases, then I use what we call the rotation gastrectomy (Tanner, 1952). The curvatures and the ulcer region are dissected free, and then the ulcer is grasped with the left fingers. (Fig. 10.) A Payr or Stevenson clamp is placed over half the gastric diameter on the opposite side to the ulcer, that is the anterior wall, lower down on the stomach, and this is to be the new stoma. (Fig. 11.) After cutting across the stomach below this clamp a second curved crushing clamp is made to arch over the ulcer, and then the stomach with a tongue-shaped extension of the posterior wall containing the ulcer, is removed. The cut edges contained in the crushing clamp are united with two layers of suture and the part in the Payr or Stevenson clamp is anastomosed end to end to the duodenum. The rotation of the stomach if anything makes the stoma lie more normally, despite the fact that the gastric side of the stoma is made almost entirely of anterior gastric wall. (Fig. 12.)

We see many very high gastric ulcers within a centimetre or two of the cardiac orifice. We have

FIG. 10.—'Rotation gastrectomy.' The clamp is placed across the stomach below ulcer level, after the stomach has been rotated.

FIG. 11.—Diagrammatic representation of the 'rotation gastrectomy' for high posterior gastric ulcer. (Note.—This illustration was also shown in *Ann. Roy. Coll. Surg.*, 1952, 10, 45.)

never practised gastrectomy below the ulcer although we have resected below a high healed gastric scar on two occasions. No matter how high a gastric ulcer may be, we never find it necessary to use a transthoracic approach. Removal of the xiphoid process and sternotomy may help the abdominal approach at times. We have never found it necessary to perform total gastrectomy for a gastric ulcer. We avoid total resection by fashioning a stomach out of the greater curve side of the fundus and then removing a long upward extension of the lesser curve to just excise the ulcer edges—an extended Pauchet operation (Fig. 13.) Several arguments may be used against cutting close to the ulcer, but I do so for the following reasons:

1. By preliminary gastroscopic observation of the ulcer and the further information gained at laparotomy, it is extremely rare to mistake carcinoma for an innocent ulcer, not more than one in a hundred gastric ulcer resections.
2. For many years I have cut close to high

FIG. 12.—Final appearance after 'rotation' Billroth I gastrectomy.

ulcers—through thick fibrous submucous coats—and these cases heal well, appear healthy gastroscopically and eventually do as well as any other.

Some difficulty may arise when the resection goes up to or into the oesophagus. Normally we close the incision which surrounded the ulcer area in two layers and finish the case with a gastroduodenal anastomosis. If, however, the upper end reaches the oesophagus, the incision is closed in one layer (if very thick, two layers) without inversion. The cut end of the stomach is then anastomosed to a jejunal loop and the afferent loop of jejunum is brought up over the lesser curvature suture line as high as the oesophagus, in order to reinforce the single line of sutures. (Fig. 14.) This, if done carefully, makes it absolutely safe. Some temporary dysphagia may follow, but so long as at least half of the oesophageal circumference was intact, the dysphagia disappears in time.

FIG. 13.—Form of gastrectomy for high lesser curve gastric ulcer. (Also illustrated in *Edin. med. J.* article.)

FIG. 14.—Form of reconstruction for ulcer which abuts on or invades the oesophagus. (Note.—Illustration also in *Edin. med. J.*)

Very high resections for gastric ulcer may be necessary on three types of occasion.

1. When the blood supply to the stomach is damaged.

G.T., aged 51, gave a history of gastric ulceration and repeated haematemesis. An attempt at gastrectomy failed in October 1952, apparently because the ulcer was high and penetrating. Haematemesis was repeated twice and so in January 1953, the stomach was approached by a thoraco-abdominal incision. Again the operation was abandoned after the spleen had been removed and the fundus mobilized. Haematemesis recurred, and so in May 1953 she was transferred to St. James' Hospital, when at gastroscopy a deep penetrating innocent ulcer was found just below oesophagus level. We reopened the abdominal incision. The pyloric end of the stomach was first mobilized, which naturally entailed division of the right gastric and right gastro-epiploic arteries. The spleen had been removed by the previous operator so that the vasa brevia and left gastro-epiploic had been divided. The last artery to the stomach, the left gastric artery, had been completely destroyed by the ulcer. In such a case a high resection was

necessary because practically the only blood supply was that which came through the oesophagus. However a useful remnant of greater curve was preserved and united to the duodenal stump making a Billroth I form of gastrectomy (Fig. 15). The patient made good progress.

2. The high hour glass stomach.

If stenosis of the stomach due to gastric ulceration occurs very high up, then transection above the scarred area is usually the most satisfactory procedure. I have used sleeve resection to avoid too extreme a resection, but this procedure is of doubtful prognosis. Some will ulcerate on the scar and stenose again, and the functional result sometimes leaves much to be desired, perhaps as a result of the division of so many vagus fibres to the lower stomach.

3. The high ulcer on the greater curvature. Similar considerations apply to the rare cases of greater curve simple ulcer in the upper stomach.

Operative Mortality

Let us consider next the operative mortality. Operative mortalities have fallen a good deal in almost all classes of operation of late years, and it is our duty to keep a careful watch on this figure, particularly when dealing with non-malignant conditions. New methods become fashionable from time to time, such as the various forms of gastric replacement operation. Used indiscriminately these methods will raise the ulcer-gastrectomy mortality, and therefore I believe that they should be reserved for the occasional case where an orthodox gastrectomy has proved unsatisfactory. There are two conditions, however, when a tender regard for the gastrectomy mortality must be abandoned.

1. In considering the mortality of resection for cancer. Here the main object is to extirpate the tumour radically, and too careful attention to the immediate mortality figures may lead the surgeon to carry out an inadequate operation.

2. In cases of massive haematemesis and melaena. In some cases, death is almost certain unless a hazardous gastrectomy is performed on a near moribund patient. At such times the surgeon's aim must be at the goal of a *low mortality for haematemesis*, and it is not the time to think in terms of a low mortality for any particular operation.

Therefore in considering the mortality of gastrectomy, it clarifies the position if we consider it under various headings according to the lesion treated, and consider emergency resections separately. Taking my personal operative mortality since 1941, when the sulphonamide drugs which were potent against pneumonia first came into wider use, the figures are as follows:

FIG. 15.—Post-operative X-ray of a Billroth I anastomosis in a patient who had had all the gastric arteries divided except those coming through the oesophagus.

Mortalities for gastrectomy for peptic ulcer (excluding operations primarily for acute bleeding, perforation or for gastro-colic fistula) (1941-53).

	Cases	Deaths	Mortality
Duodenal ulcer ..	531	7	1.3
Gastric ulcer ..	637	9	1.4
Stomal ulcer following gastro-jejunostomy..	107	1	1.0

I have not available our general hospital mortality figures, including operations by colleagues and registrars, but I know that they would be much the same.

(The second and third lectures of this series will be published in the next two numbers of this journal.)