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President's Address

Disabilities which may Follow the Peptic Ulcer Operation

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One of the major changes which has occurred in the last thirty years has been an acceptance of the fact that a knowledge of physiology is of no less importance to the modern surgeon than is a knowledge of anatomy.

In some aspects of our art, for example in treating shock or cardiac arrest and in operations under hypothermia, this knowledge is used in order to maintain normal physiological processes. In the surgery of peptic ulcer the reverse is often the case: we glibly refer to the 'physiological operations' of antral resection and of vagotomy but what we really mean is that we have used knowledge of the normal gastric digestive processes in order to reduce or destroy them. Peptic ulceration depends on gastric digestive activity; the more effective and modern operations are designed to damage this process. The remarkable thing about these modern operations is that so many patients retain such excellent powers of digestion and we must certainly not be surprised that many have 'disabilities' of greater or lesser degree.

In the earlier years of this century conservative operations were used, local excision, wedge and sleeve resection, pyloroplasty and gastrojejunostomy; most surgeons were reasonably satisfied with them and mainly concerned about the operative mortality. Two things led to the general abandonment of these procedures. The first was the discovery that spontaneous remissions were the most typical feature of ulcer disease and the long remissions these operations produced were initiated by the bed rest and convalescence, with the strong reassurance of an operation; this explains why even appendicectomy was considered a good method of treating duodenal ulcer, but a salpingectomy would have given comparable results. The second reason for the abandonment of these relatively minor procedures was that on a longer follow up, five to ten years, the recurrent ulceration rate was high. The recurrent ulcer rate was high in part because the

operation did not much alter the normal gastric secretory and motor activity and, for the same reason, side-effects were minimal. The substitution of these operations either by partial gastrectomy with its elimination of the antral hormone, reduction in the digestive cell population and rapid entry into the small intestine or by vagotomy with its widespread effects reduced the recurrent ulcer incidence but also led to numerous undesirable symptoms.

Recurrent Peptic Ulceration

Recurrent peptic ulceration may occur after any form of ulcer operation except total gastrectomy. After partial gastrectomy combined with vagotomy the chance of recurrence is negligible, in fact if there is such a recurrence we can be reasonably certain that either the vagotomy was incomplete or there is an ulcerogenic pancreatic tumour present.

The treatment of jejunal or recurrent duodenal ulceration is now almost stereotyped. If the original operation was a gastrojejunostomy it should be converted into either a high gastrectomy or a low gastrectomy with vagotomy. If the original operation was a gastrectomy, then a vagotomy should be added, sometimes with local excision of the ulcer. If the original operation was a vagotomy, then antral resection or a low gastrectomy must be added and an incomplete vagotomy must be made complete. In all these cases a search for a pancreatic tumour or a retained gastric antrum must be made.

Occasionally the recurrent ulcer is gastric. Because a gastric ulcer is very rarely seen in association with a Polya type of gastrectomy, the almost certain cure is to carry out a gastrectomy completed by a gastrojejunal anastomosis.

Side-effects of Ulcer Operations

Much more frequent, however, and perhaps less amenable to surgery are the non-ulcer symptoms which it has become evident over the years may follow the more effective ulcer operations, most often after gastrectomy or vagotomy and less frequently after gastrojejunostomy.

It is a popular misconception that gastrectomy has many side-effects but that vagotomy has only one, namely episodic urgent diarrhoea. Table I may therefore be helpful; it was compiled by our

Table 1

Residual symptoms five years after vagotomy and drainage (1948-60)

	Pyloroplasty					Anterior juxtapyloric gastrojejunostomy				
	Total cases		Mild	Moderate	Severe	Total cases		Mild	Moderate	Severe
No.	%	No.				%				
Diarrhoea	49	24	28	13	8	34	29	16	11	7
Hypoglycaemia	61	30	39	18	4	32	27	21	10	1
Pain:										
Ulcer-like	6	3	3	2	1	3	2.5	1	1	1
Non-ulcer (cramps, &c.)	34	17	20	10	4	17	15	11	4	2
'Fullness' p.c.	101	50	67	28	6	57	49	43	11	3
Belching	43		27	13	3	16		12	2	2
Anorexia	5		3	2	—	3		3	—	—
Nausea	14		10	2	2	5		5	—	—
Vomiting	8	4	5	1	2	2	2	1	1	—
Regurgitation:										
Bile	6	3	6	—	—	13	11	10	3	—
Other	6	3	6	—	—	4	3	2	1	1
Heartburn	5		2	2	1	3		2	—	1
Dysphagia	4		4	—	—	4		4	—	—
Dumping	4		4	—	—	2		—	2	—
Depression	3		2	—	1	—		—	—	—
Food intolerance	10	5	5	4	1	6	4.5	4	1	1

then two research Fellows, Dr Brian Swynnerton and Mr John Smith, neither of whom carried out the operation or was associated with it (Table 1).

In discussing the side-effects I propose to compare the two types of operation, gastrectomy and vagotomy.

Digestive deficiencies: After partial gastrectomy a minority of patients find that they can no longer take milk or eggs with comfort and sometimes fried foods or vegetables are less well tolerated; this they contrast with the excellent digestive powers they had had before the operation for — after all — they had digested a part of their own duodenum! This food intolerance is most marked after Polya-type operations, less frequent with the Billroth I and rare after gastrojejunostomy. It is similar to the digestive difficulties occasionally seen in some patients with atrophic gastritis. It occurs after vagotomy with pyloroplasty or gastrojejunostomy in 5% of the cases.

Deficient absorption of iron and calcium may occur after gastrectomy. These metals, prepared for digestion by going through an ionic stage in the stomach, are mainly absorbed in the duodenum and upper and small intestine; rapid transit through the stomach and perhaps bypassing the duodenum explains their malabsorption. Iron deficiency is most marked in those with a low intake and in women below the menopause, calcium deficiency in patients who are unable to tolerate or who dislike milk. Vitamin B₁₂

deficiency, inevitable after total gastrectomy, is occasionally reported many years after partial gastrectomy: the vitamin, which is absorbed in the ileum, is separated from the foodstuffs in the stomach where it binds with the intrinsic factor, a mucoprotein, producing a nondiffusible complex which is thus protected from digestion as it traverses the jejunum. It would be premature to say how frequent these deficiencies will be after vagotomy for they take a long time to become evident: it is probable that the incidence will depend on the type of drainage used and will naturally be highest with antrectomy.

Early post-cibal symptoms: These may occur after any form of gastrectomy or vagotomy. The commonest symptom, a feeling of 'fullness' after eating, occurs in 50% of patients after vagotomy and to a similar extent after gastrectomy. Symptoms of palpitations, flushing and drowsiness are troublesome five years after the operation in about 7% of gastrectomy cases but in only 2% after vagotomy; these symptoms are commoner shortly after the operation and diminish with time; they are probably the combined result of jejunal, not gastric, distension and a reduced blood volume.

Regurgitation and vomiting of gastric or bilious material occurs in about 6–10% of cases after vagotomy and pyloroplasty and 15% after vagotomy and gastrojejunostomy: it is due in part to the presence of duodenal juices in the stomach and partly to the damage to the phreno-

oesophageal ligaments by the vagotomy. After partial gastrectomy *bilious* vomiting may occur but in a much smaller percentage of cases, about 2%, more often with gastrojejunal than gastroduodenal anastomosis. These cases are *not* due to afferent loop distension, for at reoperation the afferent loop is normal or smaller than normal; furthermore those patients I have seen with a distended afferent loop do not often vomit bile. The typical feature is that after a meal the patient gets a burning epigastric pain which is relieved by vomiting bile, unmixed with food. After months or years, although the vomiting tends to diminish, the burning epigastric discomfort after meals persists. Any operation which effectively removes bile and pancreatic juices from the stomach remnant completely cures both the bilious vomiting and the epigastric burning pain. Therefore, although the bile must come from the normal afferent loop, I have no doubt that the burning pain and vomiting which may follow partial gastrectomy are due to a post-operative gastritis produced or aggravated by the presence of biliary and pancreatic juices: such gastritic changes may be seen on gastroscopy and found on microscopy.

Hypoglycæmia-like attacks: It is well known that attacks resembling hypoglycæmia, coming on one to three hours after meals, with sweating, faintness and sometimes unconsciousness, may occur after partial gastrectomy, but it is not so well known that they occur in 30% of cases after vagotomy with pyloroplasty or gastrojejunostomy or even, strangely enough, without a drainage operation. In some of these cases a low blood sugar value has been demonstrated during the attack. A fluid and carbohydrate meal increases the liability to such attacks as illustrated by one of my gastrectomy patients, a sexagenarian who had a very good overall result following a gastrectomy with gastrojejunal anastomosis for chronic duodenal ulcer; he lived in the country but had a flat in town; on two occasions, each time when he was visiting town, he had collapsed about two hours after breakfast, needing transfer to hospital. On questioning him we found out that his normal breakfast in the country was of bacon and eggs but, when he stayed in his flat, he took a breakfast of only cereal, sugar, milk and coffee; this would lead to a very unstable blood-sugar curve, compared with his normal high fat and protein breakfast, and was the cause of his functional hypoglycæmic attack in London.

Disturbance of bowel action may occur following the ulcer operation. This amounts to diarrhoea in just over a quarter of the cases following vagotomy. In some cases this leads merely to a more

regular action and the patient is often pleased on this account; in others it may lead to two or three bowel actions a day, most commonly a normal motion before breakfast and a slightly looser one after breakfast. In about 4% of patients it leads to periodic attacks of urgent watery diarrhoea, usually lasting one day, occasionally more, greatly disturbing the patient. The cause of this complication is not known. The lowered acidity plus the gastric stasis would favour alimentary infection as a cause and certainly many are improved by courses of intestinal antiseptics such as phtalylsulphathiazole. Infection is unlikely to be the whole answer, however, and some disorder of peristalsis may play a part.

Following partial gastrectomy rush peristalsis may occur, possibly a result of jejunal over-distension, resulting in borborygmi and post-cibal bowel actions. Frank steatorrhœa following gastrectomy is rare. Occasionally more severe diarrhoea may follow gastrectomy and in some of these cases I suspect that it is due to a coincident, inadvertent division of the cœliac branch of the posterior vagus nerve. Indeed, if the main branch of the left gastric artery is ligatured and divided, it is difficult to avoid division of this nerve.

Vagotomy cramps: A symptom peculiar to vagotomy is a mid-abdominal cramp-like pain, occurring in 15% of patients, probably associated with disordered small bowel peristalsis following division of the cœliac nerve.

After partial gastrectomy the incidence of carcinoma appears to be much the same as that for unoperated cases. One of my patients has developed pyloric carcinoma five years after vagotomy and pyloroplasty but this is no more than the expected incidence.

Cardiospasm: Transitory cardiospasm may occur after vagotomy, probably due to denervation of the parasympathetic supply to the lower œsophagus: two have appeared some years later, with food bolus impaction in the lower œsophagus despite the absence of any organic narrowing of the gullet.

The Treatment of Post-operative Disabilities

The patient's reaction to these disabilities will vary according to the severity of his previous ulcer disease. Minor dumping will not much disturb a man who has been suffering repeated attacks of severe pain. The onset of dumping palpitations does worry many patients for they fear that it indicates the onset of some cardiac disability. Therefore it is helpful, immediately

after recovery from the operation, to explain that early post-cibal symptoms may occur, that they usually disappear with time, that they do not denote any cardiovascular disease and to give simple instructions on how to deal with them.

Although the severity of postgastrectomy symptoms may be less well borne by patients of lesser moral fibre, it is to be remembered that they *are* organic and not nervous in origin and that psychotherapy is rarely of much assistance.

Furthermore, prolonged and severe post-cibal symptoms, particularly bilious vomiting, lead to severe depression and malnutrition, so that the patient may attempt suicide or develop pulmonary tuberculosis. Fortunately, many of the disabilities, particularly those following partial gastrectomy, can be ameliorated by medical or surgical means.

Medical Management

Some *metal deficiencies* may be prevented. Young female patients who have a gastrectomy should be advised to take an iron preparation, e.g. ferrous gluconate, 350 mg, 3 times every Sabbath; other patients should have a yearly hæmoglobin estimation. Patients who find they cannot tolerate milk or dislike it should be reassured, for it is, after all, primarily a drink for infants, but nevertheless they should be advised to take daily the BPC tablet of calcium (500 mg) and vitamin D (500 units).

Low vitamin B₁₂ levels are found in 45% of gastrectomy patients five years after operation (Williams, 1964). Therefore a B₁₂ estimation should be made five years postoperatively or, if this is difficult, prophylactic administration can do no harm and may improve the patient's weight and sense of well-being.

Early post-cibal and hypoglycæmic symptoms may be ameliorated by restoration of a normal blood volume, and by taking meals with minimal fluid and commencing with enough fat and protein to ensure a low intrajejunal osmotic pressure and a stable blood sugar curve.

Diarrhœa after vagotomy may be helped by an occasional five-day course of intestinal antiseptic such as phthalylsulphathiazole, on the assumption that the diarrhœa is in part infective. Otherwise treatment is symptomatic, the most valuable help being given by an occasional $\frac{1}{2}$ grain tablet of codeine phosphate to be taken before an important social or business engagement. Anticholinergics may reduce the frequency of bowel action but lead to a feeling of distension.

The possibility of an accidental gastroileostomy as the drainage operation must also be eliminated.

Prophylaxis

It is interesting that partial gastrectomies may be carried out in the same way for the same disease on two patients and yet one patient may have severe side-effects, the other may be perfectly comfortable. A slight alteration of the 'lie' of a gastrectomy may also affect it, for on one occasion I removed the diseased gall-bladder from a patient who had had a comfortable Polya gastrectomy for over twenty years and after this he developed attacks of vomiting resulting from an adhesion which altered the 'lie' of the stoma, drawing it to the right; fortunately, it was easily corrected.

Too high a gastric resection for benign ulceration should be avoided. For high gastric ulcer there is a place for the occasional gastrectomy below the ulcer. For duodenal ulcer we can afford to take some risk of recurrent ulceration now that we have such an effective method, vagotomy, to deal with the ulcer recurrence.

I do not think the antecolic or retrocolic position plays any part in reducing side-effects, nor does the length of the afferent loop provided it is under 8 in. (20 cm) long. Over the last fifteen years we have made comparison (Table 1) between different forms of drainage with vagotomy to discover which would lead to the least side-effects: we now have a follow up of a minimum of five years on 331 cases of pyloroplasty and juxtapyloric gastrojejunostomy. There are certain differences, but the overall results are so similar that we now feel we can employ one or the other according to the technical situation encountered. We have not used partial gastrectomy or antrectomy in association with vagotomy except on rare occasions. I am aware that one surgeon in the United States reports large series of cases of combined total vagotomy and low gastrectomy, finding less post-operative diarrhœa than I see after appendicectomy and less dumping than I see in the normal population: nevertheless this combination if *universally* adopted would, I think, eliminate the feature of vagotomy that our patients appreciate most, namely its lower mortality.

Now that we have good knowledge of the effects of total vagotomy, one must pursue the operation of pure gastric vagotomy or selective vagotomy. Six years ago I carried out 12 vagotomies preserving either the cœliac or the hepatic nerve and the results in this inadequate series

Table 2**Bowel habit following selective vagotomy
(48 operations; 1 recurrent ulcer)**

	<i>No. of cases</i>
Total	47
Constipated	0
No change	23
Irregular (previously regular)	1
Motion more frequent	20
Diarrhoea:	
Transient (first six months post-operatively)	1
Episodic, mild	2
Episodic, moderate	0
Episodic, severe	0
Other changes:	
Urgency (without diarrhoea)	2
Motion soft	12
Motion pale	11

Length of follow up: Less than one year in 13 cases, one to two years in 31 cases, two to three years in 3 cases (1 case untraced)

suggested that division of the cœliac nerve was an important factor, for the only 2 cases of minor episodic diarrhoea occurred in the 7 cases where the cœliac nerve was cut and the hepatic spared. Diarrhoea has also been reported after simple division of the cœliac nerve for pancreatic pain. Over the last three years we have preserved both cœliac and hepatic nerves in some 60 cases, 48 followed up over six months (Table 2) and the results so far suggest that the untoward bowel symptoms are reduced by this procedure.

Surgical Management

Over the years I have used many methods of treatment and now would like to generalize on my experiences in dealing with post-gastrectomy disabilities. First and foremost, the addition of vagotomy to a gastrectomy in the absence of definite recurrent ulceration never relieves side-effects and usually worsens them. It is usually wise to look for an associated hiatus hernia; its repair may relieve regurgitation or heartburn but will not cure the epigastric burning discomfort seen in the patient with bilious vomiting. Short-circuiting the afferent and efferent loops of a gastrectomy may relieve bilious vomiting but is not a certain cure. Nearly all the effective operations used for dumping, particularly the jejunal or colonic interposition operations, will increase the risk of stomal ulceration (Fig 1) so any later complaints that these patients may make of post-prandial pain must be listened to sympathetically and most carefully investigated.

The operations of which I have most experience for post-gastrectomy disabilities are conversion from gastrojejunal to gastroduodenal anastomosis (Tanner, 1954) and a special form of conversion to a Roux type of anastomosis (Tanner 1951)

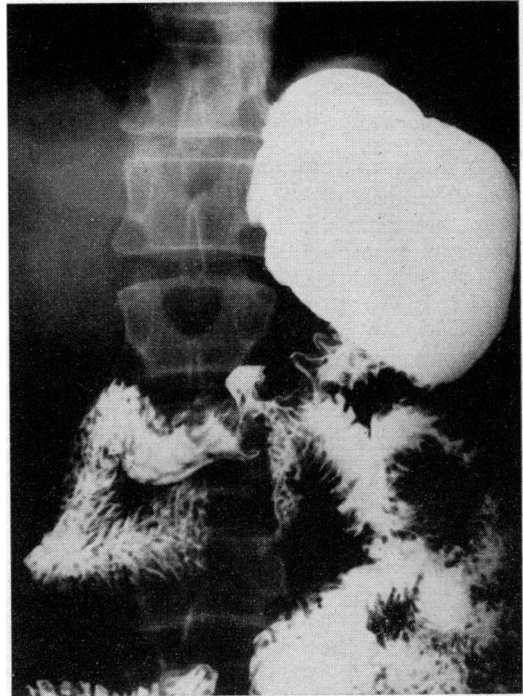


Fig 1 *Colonic interposition carried out successfully for post-gastrectomy symptoms. The peptic colonic ulcer which has developed can be clearly seen*

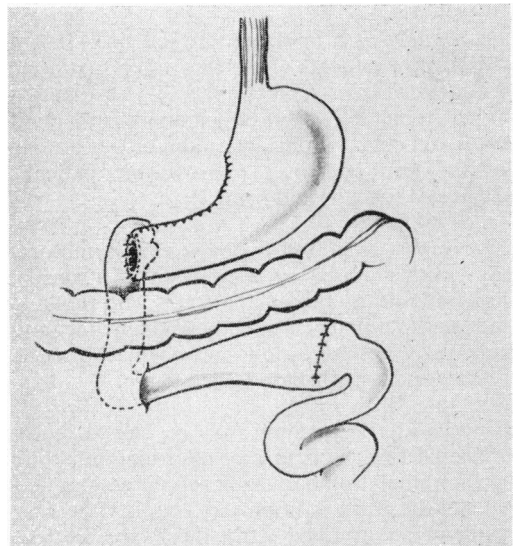


Fig 2 *Conversion from gastrojejunal (Polya, Billroth II &c.) to gastroduodenal (Roux, Péan, &c.) anastomosis. After dismantling the stoma and repairing the jejunum, the narrowed end of the stomach may be united to the end or side of the duodenal stump*

Table 3

Results of conversion operations:
To Billroth I (Gastroduodenal anastomosis)

Symptom	No. of cases	Cured	Improved	Unchanged	Worse
Total	55	14	37	3	1
Bilious vomiting	34	11	12	10	1
Fullness, pain or nausea p.c.	29	13	12	4	0
Vasomotor	14	4	6	4	0
Diarrhoea	10	0	7	1	2

Table 4

Results of conversion operations:
Billroth I: Tolerance of milk and egg

	No. intolerant pre-conversion	Now able	Still unable
Milk	33	11	22
Egg	32	18	14

which I began in 1948 and 1950 respectively and so have a good idea of their late results.

Conversion to Billroth I (Fig 2): This was primarily used for early post-cibal symptoms, 'hypoglycaemia-like' attacks, rush peristalsis and bilious vomiting. The results of this operation (Table 3) have been carefully followed by my colleague Dr B F Swynnerton.

It was interesting to see that some patients who had been intolerant of milk and egg began to take them again; this may have played some part in their weight gain (Table 4).

Conversion to Roux anastomosis: In 1951 I described a simple method of converting an intact loop œsophagojejunal or gastrojejunal anastomosis to a Roux form, without having to dissect out the original anastomosis (Fig 3). This leaves both efferent and afferent loops draining the stomach, which I prefer to the more conventional method of Roux conversion, not only because of its greater ease and simplicity but also because, in some patients, bilious vomiting is caused by an inadequate efferent stoma; if the afferent side of the stoma is then closed off, they lose their bilious vomiting but instead get 'small stomach' symptoms with food vomiting, œsophageal distension and great discomfort. In the method we employ all that is necessary is to make a restricted abdominal incision, find and transect the jejunum just beyond the duodenojejunal junction and reimplant the two divided ends into the adjacent efferent loop with 18 in. (46 cm) between them. Mr John Smith (St James's Hospital) has followed up the cases carried out over five years previously (Table 5). I call it the

Table 5

Results of conversion operations: 'Roux 19'

Symptom	No. of cases	Cured	Improved	Unchanged	Worse
Total	41	23	10	4	4
Bilious vomiting	29	23	4	2	-
Fullness, pain or nausea p.c.	18	9	6	2	1
Vasomotor	5	1	1	3	-
Diarrhoea	3	-	2	1	-

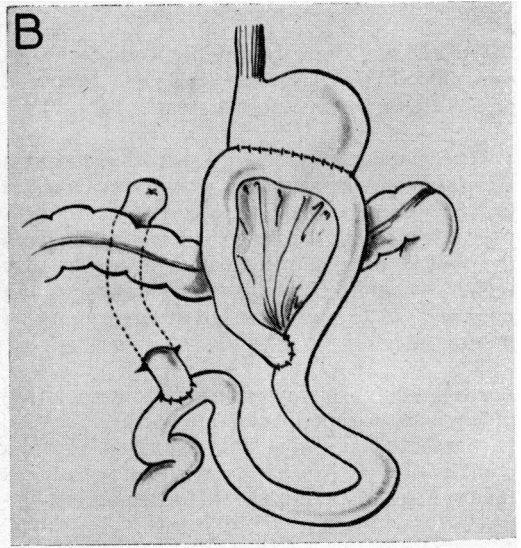
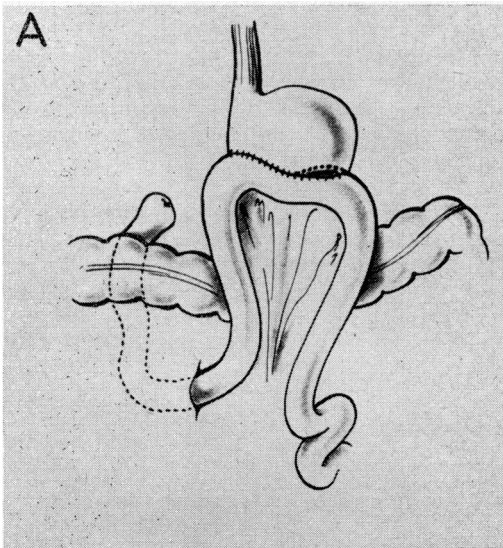


Fig 3A, B Conversion from œsophagojejunal or gastrojejunal anastomosis to the 'Roux 19' operation, effected simply by exposing the duodenojejunal junction, transecting the afferent loop and uniting the cut ends to the adjacent efferent loop with an 18 in. (45 cm) interval between them

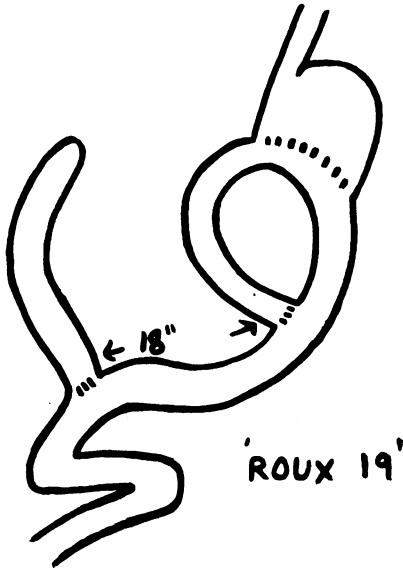


Fig 4 This rough diagram demonstrates why we refer to the operation as a 'Roux 19' conversion

'Roux 19' operation (Fig 4), because it was so named by my then registrar Mr J E H Pendower. Table 5 shows that there is a greater overall cure rate and bilious vomiting is, as would be expected, nearly always relieved. The relief of the bili-pancreatic gastritis improves the tolerance to milk and eggs even more than the Billroth I conversion (Table 6).

Weight gain is greater with the Roux than with the Billroth I conversion and the beneficial results are earlier and more dramatic (Table 7).

Three patients who had a 'Roux 19' conversion may have developed stomal ulceration: One was proved at operation. The second was thought probable on clinical grounds; the patient suffered the typical pain, but settled on a conservative regime. The third patient had a hæmatemesis, but no stomal ulcer was identified at laparotomy six months later.

Post-vagotomy symptoms: Surgery does not afford much help, except in certain severe cases. We have relieved vomiting and regurgitation by a combination of 'Roux 19' conversion with hiatal repair. For early dumping and for hypoglycæmia-

Table 6

Results of conversion operations:
'Roux 19': Tolerance of milk and egg

	No. intolerant		
	pre-conversion	Now able	Still unable
Milk	9	6	3
Egg	10	7	3

Table 7

Weight change following conversion

Weight change	Percentage of patients undergoing	
	Billroth I	'Roux 19'
Gain	48	58
No change	33	31
Loss	19	11

like attacks or for diarrhoea, we have seen some benefit by dismantling a gastrojejunostomy and making a pyloroplasty instead, though the relief of diarrhoea is not dramatic. Conversion to gastrectomy is only helpful with severe retention symptoms.

Conclusion

We shall never get a complete cure of post-gastrectomy or post-vagotomy symptoms for we cannot replace the stomach or reconnect up the vagus nerve. No doubt, too, some of our poor results follow poor selection for operation. In addition some who appear to be cured may relapse after two or three years: one patient had a blow on his abdomen at work and his symptoms came back; another man's wife deserted him and he relapsed. If we carefully re-examine our pre-operative notes we will find that some of the so-called 'side-effects' do not result from the operations but are a continuation of pre-operative functional symptoms.

Generally speaking, however, my impression is that the two procedures of Billroth I and 'Roux 19' conversion are among the most satisfactory methods of dealing with these very difficult problems.

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