POSTGASTRECTOMY SYNDROMES

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Few operations have achieved greater success in the control of any disease than has gastrectomy for peptic ulcer. The resulting popularity and increasing use of the operation has been followed in recent times by a plethora of publicity for its less fortunate side effects. Let it first be emphasized, therefore, that very few patients would choose to return to their former ulcer symptoms rather than continue to tolerate their postgastrectomy ones. Indeed, when the writer asked 837 gastrectomized patients whether they considered their operations to have been worth while, only 1.6 per cent. replied that they did not consider them so and would not have undergone gastrectomy if they had known what the result in their case would be.

The frequency of incidence and troublesomeness of side effects from gastrectomy are to some degree dependent upon the functional and mental make-up of the patient and to some degree upon the extent and complexity of the surgical interference. Whereas a moderate resection for gastric ulcer followed by gastro-duodenal anastomosis does not often leave the patient feeling other than normal, a very radical Polya type of operation is as like as not to result in postprandial symptoms of greater or lesser degree, particularly if the patient had already a tendency towards psychoneurosis.

The symptoms most frequently encountered after gastrectomy are those of 'dumping,' bilious regurgitation, abdominal colic, asthenia and inability to eat a large enough quantity of food to maintain body weight. Other nutritional disturbances may occasionally result from deficient absorption of specific minerals and vitamins, notably iron and vitamin B, and, rarely, a patient may develop macrocytic anaemia owing to insufficiency of intrinsic haemopoietic factor.

Dumping

A gastrectomy of any kind reduces gastric capacity and seriously interferes with the mechanism of emptying by ablation of the pylorus as

well as by inevitably destroying much of the nerve supply to at least the stomach, duodenum and pancreas. The result is rapid and sometimes precipitate gastric evacuation; in fact, in some cases a whole meal may be dumped into the small bowel in a few minutes. A proportion of patients whose stomachs behave in this way experience symptoms, after meals, which are partly abdominal and partly cardiovascular. The patient may have abdominal colic, but more often he is aware of vigorous but painless churning intestinal activity. Simultaneously, the pulse rate and blood pressure rise a few points, the patient becomes pale, feels hot and may sweat. In a bad attack he is then so overwhelmed with fatigue that he feels compelled to lie down, or may even lose consciousness.

The symptoms may come on immediately after eating or be delayed for 30, 60 or even 90 minutes. They may last an hour or clear up in 10 minutes. The frequency of the attacks is very variable from case to case. A few patients have an attack after every meal, but most have only one or two in a week and many experience no more than two or three in years.

Incidents usually begin when a return is made to full diet, but occasionally the first attack is experienced months, or rarely even years, after the operation. The general tendency is for the symptoms to become less severe and the attacks less frequent, finally to cease altogether. In some of the worst cases, however, little improvement is reported with the passage of time.

The proportion of patients who suffer from dumping has been reported at figures varying from 3 to 75 per cent., depending to some extent upon the technique of their operations, but to a much greater degree upon the severity of symptoms accepted by the observer as qualifying patients for classification as dumpers. Dumping symptoms can occur in patients with intact stomachs, when they are of the rapidly emptying kind found in subjects with the 'duodenal diathesis.' The symptoms could be said to grade over into those experienced

by anyone after over-eating and it is difficult or impossible to devise objective methods of assessing them. In an endeavour to eliminate the vagaries of the observer, the writer has put to 892 patients, 12 months or more after various kinds of gastrectomy, this question: 'Have you at any time since your operation experienced sudden dizziness, palpitation and sweating after a meal. Reply "Yes," "No" or "Occasionally."' The answers received are recorded in the table. The symptoms are plainly commoner after more radical resections.

Mechanism of the Dumping Syndrome

After gastrectomy, particularly of the Polya type, emptying of the stump of the stomach tends to be much accelerated. Though not all patients who have precipitate gastric evacuation experience dumping symptoms, there is evidence that the syndrome only occurs in those that do. It is generally believed that this excessively rapid emptying is the initial cause of the trouble.

The dumping of a mixed meal into the jejunum results in rapid absorption, particularly of sugar, and hyperglycaemia occurs. This was once thought to be the origin of the symptoms, but similar levels of blood sugar produced by intravenous injection of glucose do not bring them on. They can, however, be elicited by feeding other hypertonic solutions which do not cause hyperglycaemia. Moreover, they have been produced in a normal person by injecting hypertonic solutions direct into the intubated jejunum.

Meals which contain a high proportion of soluble materials of high osmotic value, such as sugar or protein hydrolysate, are particularly liable to bring on attacks. It is thought that the intact stomach dilutes such materials adequately before releasing them into the small bowel, but after gastrectomy they are discharged into the jejunum while still very hypertonic. The jejunum pours out quantities of fluid in an endeavour to render its contents isotonic and so contributes to its own distension.

Machella (1949) reported that the symptoms of dumping could be reproduced by inflating a balloon into the jejunum, but only if it was distended sufficiently also to cause pain. X-rays have not always demonstrated the jejunal distension which Machella postulated as the cause of the syndrome, but Welbourn and Glazebrook (1952) have drawn attention to the vigorous jejunal activity which can be observed and which is probably responsible for the visceral sensations.

Butler and Capper (1951) have reproduced dumping symptoms by putting a mercury-filled bag into the gastric remnant and have demonstrated a greater propensity for the filled stomach to sag and stretch in dumpers than in non-dumpers. They therefore believe the symptoms to

be due to nerve stimulation resulting from this stretching and they have prevented the syndrome by hitching the gastrojejunal stoma to the stump of the lesser omentum. The nervous pathway involved can be interrupted by procaine splanchnic block (Butler and Capper, 1951) or by thoracolumbar sympathectomy (Ray and Neill, 1947).

Hamilton Smith (*et al.*, 1953) has concluded that there must be release of a vasoconstrictor substance akin to adrenalin to account for some of the cardiovascular component of the syndrome and he has shown that the fatigue and muscular weakness are probably due to the fall in blood potassium which he has demonstrated.

Whatever the mechanisms involved, two important factors in the production of the dumping syndrome seem to be a drastic reduction of gastric capacity and a gastrojejunal anastomosis.

The Treatment of Dumping

Prophylaxis

When gastrectomy has to be performed it should be no more radical than is necessary to control the patient's disease. It might even be better to accept the occasional recurrence of ulceration rather than in making sure of its avoidance, greatly to increase the numbers of those with small stomach syndromes. Indeed, either circumstance may be the indication for a second operation.

Most surgeons have found that dumping is less frequent and less severe after Billroth I gastrectomies, but in the hands of Golligher (1952) this operation was no more successful in preventing the syndrome than were ones of the Polya type. An X-ray picture of one of Golligher's patients after Billroth I resection shows a straightened-out duodenum pulled across to the left and this has not often been seen among patients investigated by others after this type of operation.

When gastrectomy is performed for benign gastric ulcer, there is no need for the operation to be very radical (Johnson and Orr, 1953) and gastroduodenal anastomosis is nearly always possible. It is desirable that the greater curve of the stomach should be mobilized to a high level so that the stomach may be swung across with ease and mobilization of the duodenum can be avoided. When the operation is for duodenal ulcer it is held by some that the addition of vagotomy justifies the use of less radical gastric resection than would otherwise be indicated (Johnson and Orr, 1953). Gastroduodenal anastomosis is occasionally practicable, but is only safe in the hands of surgeons of exceptional experience, and most do not recommend it when the duodenum is the site of the disease.

Whether dumping is less frequent after gastro-

FIG. 1.—Pressure at P due to gravity is proportional to height 'a' and is unaffected by height 'b.' In the intact stomach P is relatively fixed and only 'b' is much increased by gastric filling. Pressure at P due to gravity is therefore little altered. After gastrectomy height 'a' represents the whole meal and pressure at P varies with the weight of the entire gastric contents.

jejunal anastomosis with the loop from the left to right or right to left, with a Hoffmeister valve or without, and with the stoma at the greater or lesser curve end, are still subjects of debate. O'Neil (1950) recommends a central stoma like the original Hoffmeister. Schofield (1953) prefers a Roux-en-Y anastomosis and Butler and Capper (1951) report marked success after hitching the stoma up to the stump of the lesser omentum.

Henley (1953) and Moroney (1953) replace the gastric reservoir with pedicled segments of jejunum and colon respectively, joining their grafts on to the duodenum, but neither of these operations should be used unless accompanied by a very radical gastric resection in order that the dangers of anastomotic ulcer shall be reduced to an acceptable minimum.

The writer holds that the essential features of an operation designed to prevent dumping are that it shall provide an adequate gastric reservoir and that the stoma shall be high in position and fixed, and he bases this view upon the following theory.

In the intact stomach the pylorus is fixed and the filled stomach bags out below it, thus greater gastric filling does not increase the effect of gravity upon emptying (Fig. 1). Moreover, the stomach accommodates itself to increased volume of contents without a corresponding rise in intragastric

pressure. Unless a very radical resection has been performed, or the duodenum unduly mobilized, this is still true after Billroth I gastrectomy. After Polya operations, however, the gastric outlet moves up and down with the stomach, with the result that the vis-a-tergo at the stoma varies with, and is proportional to, the weight of the gastric contents. On the other hand, if the stoma is hitched up to the stump of the lesser omentum, as advised by Capper, the filled stomach is compelled to rotate and balloon out below its outlet, with the result that its mode and rate of emptying are more like those of the intact organ. Though this is not the theory upon which Capper based his operation, it is the writer's belief that this is the reason why it is so successful (Fig. 2).

This explanation conforms with the observation that recumbency stops dumping, for this also relieves pressure at the stoma due to the weight of the meal.

The Surgical Cure of Dumping

Perman (1947) has converted Polya anastomoses to gastroduodenal ones after the duodenal stump has had time to become healthy. Several surgeons have tried inserting a Hoffmeister baffle when this has been omitted at the first operation. Capper, Moroney and Henley have each achieved many

FIG. 2.—Effect of hitching the gastro-jejunal anastomosis up to the stump of the lesser omentum. Descent of the stoma on gastric filling, and therefore increase in the component of the head of pressure at P due to gravity, are greatly reduced.

INCIDENCE OF SIDE-EFFECTS AFTER VARIOUS TYPES OF GASTRECTOMY (Johnson and Orr)

								Postprandial weakness, etc. (dumping or hypoglycaemic attacks)		Vomiting or regurgitation of bile		Colic		Attacks of diarrhoea
								Yes	Oc.	Yes	Oc.	Yes	Oc.	Yes
222	4/5—7/8	Polya	gastrectomies	..	..	..	37	10	20	4	30	12	4.5	
232	2/3	Polya	gastrectomies	..	..	..	13	3	10	6	11	4	1.5	
266	2/3	Polyas	+ vagotomy	..	..	..	11	13	12	4	18	4	2.1	
92	2/3	Billroth I	gastrectomies	..	..	..	10	5	10	2	14	3	—	
25	2/3	Billroths	+ vagotomy	..	..	..	(4)	(0)	(8)	(4)	(8)	(0)	—	

Brackets round figures indicate percentages in a very small group.

Percentages of patients answering 'Yes' or 'Occasionally' to the questions, 'Have you since your operation ever suffered from:

- '(1) Sudden attacks of weakness, sweating and palpitations after meals?
- '(2) Colic or wind pain?
- '(3) Vomiting or the regurgitation of bile?
- '(4) Attacks of diarrhoea?'

successes after modifying previous operations in accordance with their own principles. The writer has tried all these operations with success, but does not use Henley's or Moroney's operations when the original operation has been for duodenal ulcer. The one patient in whom he inserted a Hoffmeister valve was cured for only three months and is now as bad as ever again.

Vagotomy has been used in the treatment of dumping (Stapler, 1949) with occasional success, out since it has been reported that 2/3 Polya gas- crectomy plus vagotomy has been followed by a slightly higher incidence of dumping than has 2/3

Polya alone (table) it cannot be recommended with confidence.

The Management of Dumping

A bad attack of dumping may be relieved by lying down and patients should be advised to avoid exercise after food. Meals should be small, frequent and of even size. They should be eaten slowly and taken dry and should contain a mini- mum of soluble material of high osmotic value, such as sugar and protein hydrolysate. Many patients find that milk, particularly if sweetened, will bring on an attack.

The diet should contain a high proportion of fat, and proteins of the solid, less quickly digested varieties.

The ganglion-blocking hexamethonium drugs are effective experimentally, but cannot be used as regular medicaments. Atropine and banthine are helpful, but only when taken in quantities sufficient to cause uncomfortable dryness of the mouth. Ephedrine before meals has been said to reduce the symptoms, and preprandial alcohol has been found beneficial.

Potassium chloride with meals relieves the element of muscular weakness and fatigue.

Hypoglycaemia

A syndrome very similar subjectively to that caused by dumping, but coming on two hours or more after food and tending to be much milder and of shorter duration, has been shown to be due to hypoglycaemia. This syndrome is more frequent after vagotomy alone than after gastrectomy alone (Johnson, 1948). It has been thought to be due to the reactive hypoglycaemic swing which follows the postprandial hyperglycaemia found in most gastrectomized subjects. Hamilton Smith (1953) found that two patients subject to hypoglycaemic attacks had exceptional persistence of these hypoglycaemic phases and he attributed this to greater functional hyperinsulinism, possibly due to 'nervous' over-reaction.

It has been suggested (Johnson, 1950) that, since vagotomy and gastrectomy both result in loss of the parasympathetic nerve supply to the pancreas, control of insulin secretion may be less delicate after these operations. It is more generally held, however, that the control of insulin secretion is entirely chemical. The milder late postprandial or hypoglycaemic symptoms are quickly abated by a lump of sugar or a tablet of ephedrine.

Bilious Regurgitation

The vomiting of bile is a remarkable post-gastrectomy phenomenon, for as much as a cupful of bile unmixed with food may be returned within 10 minutes of a meal. This implies that the stomach must already have become empty of food. The bilious vomit is preceded by nausea and sometimes by colic, both of which it relieves. Wells and McPhee (1952) have named this the 'afferent loop syndrome' and believe it to be due to distension with bile of an afferent loop which has become kinked where it meets the stomach, the vomit occurring when pressure finally overcomes the obstruction and the afferent loop empties into the gastric remnant.

The symptoms are unresponsive to medical measures, but may be cured by a jejunoplasty, as described by Steinberg (1949) and Wells and Wel-

bourn (1951). After several successes with this operation the writer set out recently to perform it on a patient with severe postprandial colic relieved by vomiting bile, but laparotomy revealed a large anastomotic ulcer.

The regurgitation of bile mixed with food is said to be the result of afferent loop filling and stasis and to be more common after left to right or Moynihian anastomoses.

Colic

Abdominal colic is a relatively frequent post-gastrectomy complaint. It may occur by itself or it may accompany dumping or precede bilious vomiting or diarrhoea. It may arise anywhere in the bowel and is often hard to localize. The addition of vagotomy to gastrectomy seems slightly to increase the incidence of colic, but the performance of a moderate resection reduces it. Glazebrook (1952) has demonstrated marked alterations in the behaviour of the small bowel after gastrectomy and these may follow vagotomy without gastrectomy, too.

Weight Loss

In the immediate post-operative period patients who have had gastrectomies pass into a phase of negative nitrogen balance during which they lose 7 to 14 lb. in body weight. Many recover their pre-operation weight in the course of months or years, but few ever return to the weight they were before they were attacked by ulcer. This is quite different from the case of patients who were lucky enough to be among those cured by vagotomy alone. Moreover, weight loss appears to be roughly proportional to the amount of stomach removed (Johnson, 1948). Dumping symptoms, when present, cause patients still further to limit their intakes and such patients tend ultimately to become restabilized at weights several stones below their previous levels.

Measures which control dumping also improve body weight and frequent feeds with high fat content are indicated. Operations which restore gastric capacity, such as jejunal (Henley, 1953) or colonic (Moroney, 1953) replacement, may have to be resorted to.

Diarrhoea

Looseness of the bowels was an unexpected sequel to vagotomy, which received much publicity, and the use of vagotomy as an adjunct to gastrectomy has been opposed on the score that diarrhoea would follow. Diarrhoea is also a complication of gastrectomy without deliberate vagotomy and in the table are given the figures for the incidence of this complication after various operations. Diarrhoea is sometimes associated with

precipitate gastric emptying and then occurs soon after meals. A degree of steatorrhoea is common after gastrectomy.

Asthenia

The least understood of all the sequelae of gastrectomy is asthenia and often this is a patient's only complaint. Herein lies an important and almost virgin field for research. Testosterone will relieve this symptom to some extent in males.

In Conclusion

It must be borne in mind that not all post-prandial symptoms complained of by patients who have had gastrectomies are sequelae to their operations or recurrences of their peptic ulcers. Pain shortly after food should always suggest a lesion of the large bowel, or gall bladder disease may have supervened. Anorexia, weight loss and vomiting can mean a carcinoma in the gastric remnant or the patient may have chronic retention and be passing into uraemia.

The pain due to stomal ulcer after Polya gastrectomy can be very like that which sometimes accompanies dumping, for both tend to come on sooner after food than did the pain of the former duodenal ulcer, both may be eased by sodium bicarbonate and either may be unrelieved by food. If sweetened milk causes pain, dumping is probably the cause, and if alcohol brings on the distress recurrent ulcer is more likely.

A few patients are never relieved of their ulcer-like symptoms by their gastrectomies. Very rarely indeed this is due to the immediate development of a stomal ulcer. The writer was asked by a colleague to see a patient who had had a severe haemorrhage 10 days after gastrectomy, in whom such an early recurrence was found to be the cause.

Some of the remaining patients have developed dumping symptoms which they have been unable to distinguish from their former ulcer ones. The rest mostly had other lesions, as well as their ulcers, all along, lesions which were not detected and remained untreated. Far the commonest of these is reflux peptic oesophagitis, for this quite often co-exists with duodenal or with gastric ulcers. The writer has operated upon three such patients, found to have hiatal herniae, who had been referred to him because their ulcer-like symptoms had persisted after gastric resection. Both hiatus hernia and oesophageal reflux can escape detection even at the most careful X-ray examination and only by oesophagoscopy can oesophagitis be diagnosed or excluded with assurance.

Frequent and persistent bilious regurgitation, such as may occur after total or near total gastrectomy, can produce a troublesome oesophagitis as one of its complications, an oesophagitis which is presumably triptic in origin.

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PULMONARY TUBERCULOSIS FOLLOWING PARTIAL GASTRECTOMY

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It is still uncertain whether partial gastrectomy predisposes to the development of pulmonary tuberculosis. Reference to this possibility is made in papers by Pulvertaft, Drablos, Swynnerton and Tanner and Warthin. Isorni observed 21 gastrectomized cases among 742 patients in a French sanatorium and thought that the association was too frequent to be coincidental. In this paper 11

cases of active pulmonary tuberculosis following partial gastrectomy are recorded. Four were seen in the course of a five-year follow-up of 93 partial gastrectomies. Five were inmates of a ward for chronic pulmonary tuberculosis and two others were encountered in the course of routine hospital work.

Two additional cases were also seen in the