

A clinical appraisal of the treatment of chronic duodenal ulcer by vagotomy and gastric drainage operation

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SYNOPSIS The authors have followed up 100 patients upon whom a vagotomy plus a drainage operation was performed for chronic duodenal ulceration by one of them (H.C.E.) at King's College Hospital during the 11-year period 1948-1958.

DATA

All the patients entered the hospital because of chronic duodenal ulceration. Eighty-one were men and 19 were women. Their average age at the time of operation was 39.8 years, with a range of 14 to 74 years, and the length of symptoms before surgery averaged 10.2 years, with a range of one to 30 years. Previous ulcer complications had occurred in 37 of the patients as follows:—Bleeding (16), obstruction (13), and perforation (8). Vagotomy was followed by gastroenterostomy in 90 patients and by pyloroplasty in 10 (Table I).

All patients underwent gastric acid studies before operation, including resting free and total acid determinations and insulin response (Hollander, 1946, 1948). These tests were then repeated post-operatively, usually within two weeks of operation, or occasionally a number of months later, at a time of a re-admission. The acid studies of a few of the cases are not reported, either because the tests were deemed to be unsatisfactory, or because the records are lost.

OPERATIVE TECHNIQUE

A right paramedian incision is made from the left xiphisternocostal angle to the umbilicus, and the diagnosis of duodenal ulceration confirmed. The left lobe of the liver is retracted upwards and to the right (there is rarely need to divide the coronary ligament) and the vagus nerves exposed by incising the peritoneum and fascia propria over the lower end of the oesophagus, beginning the incision to the left of the oesophagus. Further exposure is obtained by gentle traction on a length of Paul's tubing passed

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TABLE I

SUMMARY OF RESULTS

Cases	100
Male	81
Females	19
Mean age (yr.)	39.8 (14-74)
Mean length of symptoms (yr.)	10.2 (1-30)
Total ulcer complications before surgery	37%
Bleeding	16%
Obstruction	13%
Perforation	8%
Pre-operative acid studies	
Resting free acid (mEq./l.) in 89 cases	46 (0-110)
Insulin response in 88 cases	87 positive
Type of operation performed with vagotomy	
Pyloroplasty and gastroenterostomy	90
Pyloroplasty	10
Complications and mortality (%)	
Severe	1
Mild	15
Mortality	1
Post-operative acid studies	
Resting free acid (mEq./l.) in 82 cases	10 (0-60)
Insulin response in 82 cases	13 positive
Mean length of follow-up (yr.)	4.9 (2-11)
Success of surgery in patients' opinion	96% yes
Full day's work	96% yes
Recurrent ulcer	5%
Weight change (%)	
Gain	23
Loss	13
Gastrointestinal symptoms (%)	
Dumping	6
Diarrhoea	15
Other	15

around the oesophagus. The left (anterior) vagus is usually visible, but on occasion needs to be located with the finger. The right (posterior) branch is located manually and brought into view by hook retraction. One to one and a half inches of each

nerve is resected, and both proximal and distal ends ligated with fine thread. Any residual smaller branches are recognized by finger palpation, and divided without ligature. Considerable time and care is taken to ensure that all vagal nerve tissue is divided, although, as will be seen, this was not always achieved.

The gastroenterostomy is made just posterior to the greater curvature of the stomach, and placed as near to the pylorus as is technically suitable, and the stoma made large enough to admit three fingers. It is isoperistaltic, with no loop. If a pyloroplasty is employed as the drainage procedure, an adequate stoma is ensured by making the incision through the antro-duodenal wall two inches in length, and centred at the pylorus. The patients do not normally receive intravenous therapy or blood replacement during or after operation.

After discharge from hospital all the patients have been seen at three-monthly intervals in the out-patient surgical clinic during the first year, and at least once during the second year. From then on follow-up has continued in a somewhat haphazard way, sometimes by mail and sometimes by clinic visits. At the time of this evaluation all patients were sent a questionnaire. In addition, 39 of the patients were interviewed.

COMPLICATIONS AND MORTALITY OF SURGERY

Complications after operation were uncommon (Table II). There was one case of pulmonary embolus,

Complication	Percentage
Severe	
Pulmonary embolus	1%
Mild	
Stomal obstruction	4%
Wound sepsis	1%
Pneumonia or atelectasis	8%
Thrombophlebitis	1%
Total	15%
Mortality of surgery in 100 cases from pulmonary embolus	1%

which resulted in the only death in the series. Other complications were mild, and included four cases of transitory stomal obstruction, one case of superficial wound sepsis, eight cases of pneumonia or atelectases (all successfully treated by physiotherapy, coughing, and/or antibiotics), and one case of femoral thrombophlebitis.

ACID STUDIES AND RECURRENCE OF ULCERATION

The average resting free acid in 89 pre-operative patients was 46 mEq./l. with a range of 0 to 110

mEq./l. (Table III). This can be compared with an average resting free acid in 82 post-operative patients of 10 mEq./l. with a range of 0 to 60 mEq./l.

TABLE III
ACID STUDIES

Cases	Pre-operative 89	Post-operative 82
Resting free acid (mEq./l.)	46 (0-110)	10(0-60)
Insulin response (%)	99	16

Of 82 patients, 99% had a positive pre-operative insulin response, while only 16% had a positive post-operative insulin response.

The relation between the post-operative insulin response and ulcer recurrence is interesting and significant (Table IV). In none of the 69 patients

TABLE IV
INSULIN RESPONSE AS MEASURE OF
EFFECTIVENESS OF SURGERY

Post-operative	Cases	No.	%
Insulin Response		Recurrent Ulcers	Recurrence
Negative	69	0	0
Positive	13	5	38

with a negative post-operative insulin response has there thus far been evidence of recurrent ulceration. Of the 13 cases with a positive post-operative insulin response, five cases (38%) have shown evidence of recurrent ulceration.² Their post-operative histories are briefly as follows:—

CASE 1 This 34-year-old man entered King's College Hospital with a four-year history of intractable duodenal ulceration. Acid studies revealed a pre-operative resting free acid level of 60 mEq./l. Post-operative resting free acid was recorded at 40 mEq./l. and the insulin response was strongly positive. Ulcer symptoms recurred six months post-operatively. Subtotal gastrectomy was performed and the patient has now been well for five years.

CASE 2 This 28-year-old man entered King's College Hospital with a five-year history of intractable duodenal ulceration. Acid studies revealed a pre-operative resting free acid level of 50 mEq./l. Post-operative resting free acid was recorded at 20 mEq./l. and the insulin response was strongly positive. Three years post-operatively the patient noted recurrent ulcer symptoms. He was treated with antacids and diet and is doing well one and a half years after recurrence of symptoms.

CASE 3 This 29-year-old man entered King's College Hospital with a six-year history of intractable duodenal

²In one of them the drainage operation was a pyloroplasty.

ulceration. Acid studies revealed a pre-operative resting free acid level of 70 mEq./l. Post-operative resting free acid was recorded at 30 mEq./l. and the insulin response was strongly positive. Two years post-operatively he noted recurrence of ulcer symptoms and gastro-duodenal bleeding; he was treated with antacids and diet and is doing well five years after recurrent trouble.

CASE 4 This 26-year-old man entered King's College Hospital with a history of intractable duodenal ulceration. Acid studies revealed a pre-operative resting free acid level of 60 mEq./l. Post-operative resting free acid was recorded at 60 mEq./l. and the insulin response was strongly positive. One and a half to two and a half years post-operatively, the patient noted recurrent ulcer symptoms and gastroduodenal bleeding; he was treated with diet and antacids, and is now doing fairly well five years after his last recurrent symptoms.

CASE 5 This 31-year-old man entered King's College Hospital with a five-year history of intractable duodenal ulceration. Acid studies revealed a pre-operative resting free acid level of 50 mEq./l. Post-operative resting free acid was recorded at 20 mEq./l. and the insulin response was moderately positive. One year after surgery he noted recurrence of ulcer symptoms. He was treated with diet and antacids and is doing fairly well two and a half years after recurrence.

RESPONSES TO ENQUIRIES

WAS THE OPERATION A SUCCESS? All patients were asked whether they considered their operation a success, and 96 of the 99 living patients said yes. The three patients who said no all had recurrent ulcers. (The two additional patients with recurrent ulcer disease thought their operation was a success, because they felt much better and more able to control their symptoms with diet and medication.)

FULL DAY'S WORK Of the 99 living patients, 96 are now doing a full day's work—as much or more work than they were doing pre-operatively at a time when they felt well. There are three patients who are unable to do a full day's work, two because of recurrent ulcer symptoms and one because of 'general ill health', as was present before his operation.

SYMPTOMS As regards post-operative symptoms (Table V), 6% of the patients reported discomforts suggestive of the dumping syndrome (5% very mild, 1% moderate). In the 'mild' cases the symptoms were vasomotor in type, and in the one 'moderate' case bilious vomiting was the predominant feature. In none were the symptoms severe enough to keep the patient from doing a full day's work (five gastroenterostomy, one pyloroplasty).

TABLE V
POST-OPERATIVE SYMPTOMS RELATED TO SURGERY

	Mild (%)	Moderate (%)	Severe (%)
Dumping	5	1	0
Diarrhoea	13	2	0
Flatulence or OCC indigestion	15	0	0

Fifteen had diarrhoea (13 mild, 2 moderate). In no case was the diarrhoea severe enough for the patient to consider this a serious problem, or to keep the patient from doing a full day's work. (Two of the mild cases had a pyloroplasty.)

Fifteen of the patients had various complaints of flatulence and indigestion, all of a mild degree (one pyloroplasty, 14 gastroenterostomy).

WEIGHT Twenty-three per cent. of the patients gained weight. The average gain was 14 lb., with a range of 2 to 56 lb. Thirteen of the patients lost weight. The average loss was 9 lb., with a range of 2 to 24 lb. (Table VI).

TABLE VI

CHANGE IN WEIGHT SINCE SURGERY

Gain in weight	23%
Average gain	14 lb.
Range	2 to 56 lb.
Loss in weight	13%
Average loss	9 lb.
Range	2 to 24 lb.

ANAEMIA Only one patient has been noted to be anaemic. This patient has required iron to maintain her haemoglobin at 80%.

DISCUSSION

A recurrence rate of 5% with a 4.9 year average follow-up compares favourably with the recurrence rate after subtotal gastrectomy or after vagotomy alone. Statistics compiled by the Committee on Peptic Ulcer of the American Gastroenterological Association (Sandweiss *et al.*, 1952) revealed a recurrence of ulcer symptoms in 4.3% of patients after subtotal gastrectomy. This is similar to the recurrence rate of 4.2% after subtotal gastrectomy recently reported by Armstrong and Penick (1960). Brooks and Moore (1953) found a recurrence rate of 13% after vagotomy alone and Sandweiss *et al.* (1952) have reported even higher recurrence rates following this procedure. The results of vagotomy and a gastric drainage procedure, however, do not match the extraordinarily low incidence of recurrent ulceration associated with hemigastrectomy and

vagotomy. Farmer and Smithwick (personal communication) and Edwards, Herrington, Stephenson, Carlson, Phillips, Cate, and Scott (1957) found a recurrence rate after this procedure of 0.9% and 0% respectively.

The relationship of recurrent ulcer disease with the completeness of vagotomy as indicated by the insulin response test is significant. No case in this series with a negative insulin response post-operatively has thus far developed a recurrent ulcer, while 38% of the cases with a positive post-operative insulin response have suffered from recurrent disease.

Undesirable side-effects following vagotomy and a gastric drainage procedure are neither frequent nor severe. Only 6% of our patients developed symptoms consistent with the dumping syndrome and in only one case was this of even moderate severity. These results compare favourably with a reported 11% to 33% incidence of the dumping syndrome after subtotal gastrectomy (Hayes, 1955; Jordan, 1958; Armstrong and Penick, 1960) and of 23.1% after hemigastrectomy and vagotomy (Edwards *et al.*, 1957).

The absence of side-effects after vagotomy and a drainage procedure is also reflected by weight statistics, which show that more of our patients gained than lost weight after operation. Even more significant is the fact that of the 13 patients who lost weight only two lost more than one stone, and in none was weight loss a serious problem. In contrast, reported results following subtotal gastrectomy indicate an approximate 40% incidence of weight loss (Muir, 1949; Ivy, Grossman, and Bachrach, 1950); in about 18% to 22% (Muir, 1949; Armstrong and Penick, 1960), the weight loss exceeded one stone. Excessive weight loss may also be a problem after hemigastrectomy and vagotomy. Farmer and Smithwick (personal communication) recently found that a moderate or severe weight loss occurred in 3.2% of their patients after this operation.

Vagotomy and a gastric drainage procedure is associated with a high incidence of post-operative diarrhoea. It occurred in 15 of our patients, but in only two cases was it more than mild in degree, and in none was it so severe as to incapacitate. Reported results following subtotal gastrectomy reveal a lesser incidence of diarrhoea, which is usually mild in degree (Sandweiss *et al.*, 1952). (The incidence of post-operative symptoms was on a similar scale after pyloroplasty as after gastroenterostomy, but the number of patients submitted to the former are too small to assess the relative merits of the two procedures from the clinical standpoint.)

Finally, the operation of vagotomy and gastric drainage is usually technically easy and quick to

perform and thus avoids the complications, immediate and remote, which are inherent in the operation of partial gastrectomy. The absence of severe operative complications, the low operative mortality coupled with an incidence of side effects and recurrent ulceration, which compares favourably with alternative forms of surgical treatment, strengthen our belief that this procedure amply justifies itself as a method of treatment for chronic duodenal ulceration.

SUMMARY AND CONCLUSIONS

1 One hundred patients with chronic duodenal disease treated by vagotomy and a gastric drainage operation are reviewed.

2 Vagotomy and a gastric drainage operation is usually an easier and safer procedure than partial gastrectomy, and is associated with a lower operative mortality and morbidity.

3 Recurrent symptoms occurred only in those patients in whom the post-operative insulin response indicated that vagotomy had been incomplete. It is therefore essential that vagotomy should be complete.

4 The long-term post-operative side effects of this procedure are less frequent and less debilitating than those associated with operations for chronic duodenal ulceration which entail removal of part of the stomach.

A P P E N D I X

RESTING FREE AND TOTAL ACID STUDIES AND INSULIN RESPONSE

These tests are carried out after the patient has been starved from 6 p.m. to 9 p.m. A Ryle's tube is passed into the stomach through the nose, and 5 to 10 ml. of gastric contents withdrawn at hourly intervals for 12 hours. Fifteen to 20 units of regular insulin are then given intravenously. After 15 minutes, further quarter hourly specimens of gastric contents are withdrawn for one hour. The Ryle's tube is then removed and the patient given 50 grams of glucose.

Free and total acid levels are determined on all samples by titration using thymol blue as indicator.

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