medicine and to report on the aims of treatment; secondly, to follow up a series of out-patients so treated.

Out of a total of 3,226 consecutive referrals during the five-year period 1948-52 235 patients received a course of psychotherapy.

The types of psychotherapy used were: (1) superficial for 45% of the cases, and (2) distributive analysis for 49%; the remaining 6% were treated mainly by abreactive methods. The average number of sessions given to each patient was seven.

We followed up these patients early in 1954. No patient was followed up who had not been discharged for at least 15 months, and in about 35% the follow-up period was at least two and a half years. 59% were interviewed by the original therapist, 15% by a social worker, and only 10% were untraced. The method of follow-up is described in detail.

It was found that of our 235 patients 40% were "much improved," 32% were "improved," and 15% were "not improved"; the remainder were either untraced or had died.

It is our opinion that results of this order can be expected from short courses of psychotherapy in a provincial out-patient department provided that a careful selection of cases is first made.

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VAGAL RESECTION IN TREATMENT OF DUODENAL ULCER

BY

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Vagal resection for the treatment of duodenal ulcer has not been generally accepted in this country. It is not the purpose of this paper to discuss the theoretical grounds for its use, nor to review the voluminous literature on the subject, but to present the results obtained since late 1947 in one surgical unit. Pollock (1952) collected a large series, including 1,314 cases of duodenal ulcer, from various centres.

Present Investigation

As no large series from one source has been reported on in Britain, it seems worth while analysing the results of a series of 473 consecutive cases (401 male, 72 female) up to the end of 1955. These were entirely unselected. Every duodenal ulcer case referred to us for surgical treatment was treated as detailed below. The only exceptions were (1) those who refused surgical treatment; (2) those seen first with severe haemorrhage which it was impossible to control by any means other than a direct attack on the site of haemorrhage in the ulcer; and (3) those first seen with acute perforation requiring immediate operation—simple closure of the perforation was done. If persistence of ulceration or recurrence of ulceration or symptoms occurred the cases were dealt with in the routine manner and then included in the series. These exceptions comprised less than 2% of the total.

Table I shows the age incidence and the duration of symptoms. Perforation had occurred in 17% and notable haemorrhage in 17%. Medical treatment before

TABLE I.—Age Incidence and Duration of Symptoms in 473 Cases

Age:	10-19	20-29	30-39	40-49	50-59	60-69	70-79
	1%	16.5%	30%	30%	17%	5%	0.5%

Pre-operative Duration of Symptoms in Years								
0-	1-	2-	3-	4-	5-9	10-14	15-19	20+
9%	10%	10%	9%	7%	27%	15%	5%	8%

operation had been given at home in 76% and in hospital in 19%. Over 50% had had symptoms for more than five years, and over a third had had either a perforation or noteworthy haemorrhage before operation.

The normal routine before operation was: history; physical examination; barium-meal x-ray examination; gruel fractional test meal; and a Hollander (1946) insulin test meal. After operation the gruel fractional test meal and the insulin test meal were repeated. Routine post-operative x-ray examination was not possible in all cases; it was made in many, including every case with any post-operative symptoms. Pre- and post-operative weights were recorded.

For various reasons the full investigation outlined was impossible to carry out in every case, but in over 92% of cases the data were adequate for assessing the completeness or otherwise of the nerve section.

Operation

The patient is brought to the theatre with a naso-gastric Ryle tube in position. The surgical approach is through an upper left paramedian incision, the rectus muscle being retracted laterally. After inspection, including confirmation of the presence of the duodenal ulcer, a Balfour self-retaining retractor is inserted. The left lobe of the liver is then detached from the diaphragm by cutting the suspensory ligament, close to the liver, care being taken not to damage the left inferior phrenic vein. The left lobe of the liver can then be folded and held gently to the right with a Deaver retractor. The stomach is packed down as far as possible with two packs, the upper one being placed between stomach and spleen and retracted downwards and to the left with a Deaver retractor. This exposes adequately the lower inch (2.5 cm.) of the oesophagus. The peritoneum over the oesophagus is cut transversely, the left forefinger inserted, and the opening in the peritoneum enlarged up and down. With the left fore- and mid-fingers behind and the thumb in front it is easy to identify the oesophagus with its Ryle tube.

By "burrowing" behind and around the oesophagus from right to left the two fingers emerge at the left of the oesophagus, where they pick up a gauze tractor, one end of which is pulled back around the oesophagus. During the "burrowing" process if slight traction is kept on the oesophagus it is easy to feel the right vagus behind and include it in the tissues picked up. The two ends of the gauze tractor are caught together in an artery forceps on which an assistant makes firm traction. The vagus nerves are readily palpated as taut cords. Each in turn is isolated from the oesophagus; two fingers are inserted between the nerve and the oesophagus and spread widely to free at least 2 in. (5 cm.) of nerve from the oesophagus. The nerve trunk is then caught with long Kocher artery forceps and the nerve stripped cranially as far as possible. A section of the nerve is then resected, at least 2 in. (5 cm.) being removed.

When each nerve has been thus dealt with it is found that the lower 2-3 in. (5-7.5 cm.) of the oesophagus is more mobile and can be pulled up with the gauze tractor to allow careful inspection. Any structures resembling nerve twigs are seized with diathermy forceps and sectioned after coagulation; usually these "nerve fibres" are small blood vessels emptied by the traction, and coagulation before section expedites operation. By pulling first on one side, then on the

other, of the gauze tractor the oesophagus can be rotated easily and sufficiently to allow complete inspection of the entire circumference of its lower reaches. It is essential to be painstakingly careful in the search for any branches of the nerves and to be certain that two nerves have been found and dealt with, the right nerve in particular being occasionally missed in picking up the tissues in the original "burrowing" procedure. When the nerve section has been completed, bleeding points are coagulated by diathermy and the left lobe of the liver is unfolded and replaced *in situ*, where it will adhere to its original support. The use of lighted retractors has not been found an advantage. Adequate field lighting can be obtained by tilting the normal theatre operating lamp.

The gastro-enterostomy has always been of the retrocolic no-loop isoperistaltic type and performed with clamps in the standard manner. The opening is always made at the lowest part of the stomach, and the size of the opening made is small, the aim being to achieve an anastomotic opening equal in calibre to the normal pylorus. A large gastro-enterostomy stoma is likely to lead to dumping syndrome sequelae.

If pyloroplasty is carried out the essentials are to remove a diamond-shaped area at the pylorus, including compulsorily a segment of pyloric sphincter, and where possible the ulcer itself. The resultant gap is sutured transversely in two layers. While the production of an adequate channel is necessary, the resection of part of the pyloric sphincter is regarded as the essential step in this operation.

Difficulties during operation have been rare. In two cases the oesophagus was holed during isolation. The gap was repaired without untoward sequelae. In two cases the pleura was opened without any serious complication. Before the necessity to take great care not to inflict venous damage was appreciated one patient died of severe uncontrollable haemorrhage from tearing of the left inferior phrenic vein from the inferior vena cava in freeing the liver. We now prefer to omit this step if any difficulty appears probable in freeing the liver safely.

Immediate Post-operative Results

The total mortality from operation was 2.1%. The 10 fatalities were: one anaesthetic death; one immediate death from haemorrhage as described; one death three days after operation from acute cardiac failure; one death five days after operation from perforation of the duodenal ulcer (at operation the ulcer was noted to be near perforation; it would have been wise to make a direct attack on the ulcer or at least to sew omentum over the danger area); two deaths six days after operation from paralytic ileus; three deaths from pulmonary embolus, on the fourth, seventh, and seventh days after operation; and one death six days after operation from "pseudomembranous enterocolitis." There has been no death in the last 200 consecutive cases up to the writing of this report.

Post-operative complications have been few. In the early part of the series post-operative chest complications—almost invariably a right lower segmental collapse—occurred, but pre- and post-operative breathing exercises supervised by physiotherapists have practically eliminated these. Surprisingly, ileus has been uncommon.

Dysphagia has occurred in less than 2% of cases and has been without exception of short duration.

Results at Follow-up

Cases have been followed up by return visits to out-patient clinics at intervals after operation of one month, three months, six months, and annually thereafter, unless symptoms necessitated more frequent visits. Early in the series patients were admitted for insulin test meals annually, but this practice was discontinued as a routine. A questionnaire was sent out to all cases in late 1955. If the form was not returned and the patient could not be traced information

was sought from the family doctor. By these means enough information has been obtained to allow of a final assessment of results.

From the results in the several groups certain general points emerge. (1) Complete vagal resection as shown by insulin test meals remains complete permanently. Insulin test meals negative immediately after operation have remained negative to our knowledge for as long as eight years after operation. (2) Complete vagal resection was achieved in only 86% of cases, complete section was doubtful in 7%, and failure to achieve complete section occurred in 7%. With increasing experience we think complete section is now made in over 90% of cases. We believe that incomplete section of the two vagi explains some—perhaps all—of the unsatisfactory results which have been published. To make a complete section requires experience and great care. (3) In 365 cases note was taken of whether the vagus nerves showed any branching. It was found that the left nerve alone was branched in 21% of cases, the right alone in 6%; both nerves were branched in 43%, and in only 30% of cases were both nerves single cords. This emphasizes the need for careful technique to achieve complete section.

At first vagal resection alone was practised. It became evident early in the series that this operation was not wholly satisfactory, and since 1950 the operation of choice has been vagal resection and posterior gastro-enterostomy. In a small number of cases pyloroplasty has been combined with vagal resection, sometimes by choice to compare a number of these cases with those having gastro-enterostomy, sometimes because some local condition precluded gastro-enterostomy. Table II shows the operations performed and the year of operation.

TABLE II.—Operations Performed in 473 Cases

Year	1947	'48	'49	'50	'51	'52	'53	'54	'55	Total
Vagal resection only ..		37	34	35	7	3	1	1		118
" " and gastro-enterostomy	2	12	40	26	41	63	55	46	47	332
Vagal resection and pyloroplasty ..				12	1			1	6	19
Vagal crush ..		1	2	1						4

Vagal Resection Alone

Vagal resection alone was the operation in 118 cases. There was one death from anaesthetic causes in the series. Of the 117 survivors one died of intercurrent disease six years after his original operation but had had no dyspepsia or other digestive troubles until his death from secondary renal carcinoma; one died of aneurysm four years after operation, having had no digestive complaints in the interim; and 10 cases were either insufficiently followed up or could not be traced. This leaves for consideration of results 105 of the original 118.

Of these, 23 required gastro-enterostomy for symptoms secondary to the vagal resection, such as gross gastric retention, with foul flatulence and diarrhoea. Six further cases await gastro-enterostomy. In all these cases the vagal section appeared complete. Thus in 28% of cases vagal resection alone has been a failure, and the necessity to relieve gastric retention by a second operation in so many cases condemns it.

In the 23 cases in which secondary gastro-enterostomy was required the duodenal ulcer was healed at the time of the second operation. All have remained well and symptom-free since their second operation. They are not included in the 332 cases whose primary operation was vagal resection and gastro-enterostomy.

In four of the remaining 76 patients who had vagal resection alone recurrence of the duodenal ulcer occurred; in all four the vagal section was not complete. One case developed a gastric ulcer within three years of operation. While some of the results have been unexceptionally good a considerable percentage of patients have troublesome flatulence and diarrhoea, and uncomfortable fullness after meals.

These indifferent results and the high rate of secondary gastro-enterostomy required forced us to the alternative of adding gastro-enterostomy to the original nerve resection.

Vagal Resection with Gastro-enterostomy

Vagal resection combined with retrocolic gastro-enterostomy was performed in 332 cases. In assessing results the classification suggested by Visick (1948) has been adopted: grade 1, cases having no gastric symptoms; grade 2, cases with preventable minor symptoms; grade 3, cases whose symptoms are not preventable but cause no interference with their activities; grade 4, symptoms preventing full enjoyment of life; and grade 5, failures.

In assessing the results grade 1 cases have been restricted entirely to those without any symptoms; in grade 2 are placed those with minor symptoms such as occasional flatulence, fullness after large meals, slight occasional indigestion after dietary indiscretion, and, on rare occasions, a loose bowel movement not amounting to diarrhoea. In grade 3 are included those with some occasional bilious vomiting, or occasional diarrhoea or intermittent discomfort relieved by alkalis. In grade 4 are those with dumping or hypoglycaemic syndromes, those with troublesome diarrhoea, and those with troublesome bilious vomiting. In grade 5 are stomal ulcers, recurrent duodenal ulcers, and those who fail to derive any benefit from operation.

The results of a total of 332 cases show that nine died from operation, an operative mortality of 2.7%. Of 324 survivors, seven died of intercurrent disease unrelated to the operation or ulcer and were free of dyspepsia, etc., to the date of death. Of the remainder, 10 have not been included in the assessment of final results as they have been followed up for less than a year; all were symptom-free at the time of writing. Nine cases could not be traced. This leaves 298 cases followed up adequately for assessment. Of these, 238 are grade 1, 31 grade 2, 8 grade 3, 13 grade 4, and 8 grade 5.

All the 31 in grade 2 have very minor symptoms, are satisfied with the result, and consider the operation has been of decided benefit and well worth while. The eight in grade 3 are also pleased with their present position as compared with their pre-operative state. Their symptoms are not of serious consequence and do not incommode them to any noticeable degree. Therefore one can say that the results in 93% of cases are satisfactory.

Of the 13 in grade 4, five have considerable trouble from dumping; three have a marked hypoglycaemic syndrome (one persisting seven years after operation); two suffer from bilious vomiting to a troublesome degree, probably due to fault in the gastro-enterostomy; two have persisting diarrhoea; and one has had partial gastrectomy elsewhere. This last patient was very neurotic and when first seen was referred to the psychiatric department, whose report was unfavourable. His duodenal ulcer persisted and operation was eventually undertaken. For a time after operation he remained well. He then again complained of symptoms similar to those before operation. Repeated investigation revealed no organic basis for his complaints. He then went elsewhere, where again after a period, and after an unfavourable psychiatric report, laparotomy was undertaken. His duodenal ulcer was healed and his gastro-enterostomy stoma healthy. Partial gastrectomy was done. He is not yet symptom-free. It was an error to operate on his duodenal ulcer in the first instance.

Among the eight in grade 5 the duodenal ulcer has recurred in five, of whom four obviously failed to have complete nerve sections, as shown by positive insulin responses after operation; the one case with a negative insulin response had one post-operative test meal only, and section may be incomplete. One case has had no relief of symptoms: ulceration has persisted, and a positive insulin response indicates failed section. Two cases have developed stomal ulcers. In both, vagal section was incomplete. In one the left nerve was known to have been missed during operation, but anaesthetic

difficulties prevented prolongation of search for the nerve. When his stomal ulcer developed, the vagal section was completed at a second operation two years after his primary surgery. Prompt healing of the stomal ulcer occurred, and the patient has been in excellent health and symptom-free for the past five years. In the second case a large stomal ulcer was found at the second operation four months after the first; vagal resection was repeated, but the post-operative insulin meal was still positive after the second operation. Apparent healing of the stomal ulcer occurred, with disappearance of symptoms, disappearance of the ulcer on x-ray examination, a negative faecal occult blood test, and a gain in weight. In just over a year the symptoms recurred and partial gastrectomy was undertaken elsewhere.

There has been a gain in weight in 70% of cases, the average being 8.3 lb. (3,765 g.); 5% have shown no change in weight; 25% have lost an average of 6.4 lb. (2,900 g.).

We have not found any case in which pulmonary tuberculosis developed after operation: no such case is known to the local tuberculosis service. Also no case has shown evidence of anaemia.

The 277 patients in the first three grades are well satisfied. They are no longer on diet and do not require to restrict themselves in any way so far as food is concerned. From this they derive much psychological benefit. The great majority have returned to their pre-operative occupations; those who have taken lighter jobs have been more than balanced by those who have found themselves capable of heavier work after operation. There has been almost no loss of working-time from digestive causes since their return to work after operation, a feature which is noted with gratitude by numbers in replying to the questionnaire.

Other Operations

Vagal crush was done in four cases. In all four a negative post-operative insulin test meal became positive within 12 months, with a return of pain and dyspepsia. The operation appears to have no useful place.

Vagal resection was combined with pyloroplasty in 19 cases. In all of them the results have been excellent. 80% have gained an average of 10.5 lb. (4,760 g.), 10% have lost 4 lb. (1,815 g.), and 10% have not changed their weight.

Conclusions

In the treatment of duodenal ulceration, operations on the vagal nerves alone, either by resection or by crushing, do not give good results. When vagal resection is combined with posterior gastro-enterostomy excellent results are obtained in over 90% of cases, with a mortality rate around 2%. It seems likely that equally good results may be obtained by vagal resection combined with pyloroplasty. The results are at least as good as those after partial gastrectomy, and the operative mortality is probably appreciably lower. These good results, added to the fact that partial gastrectomy is not excluded as a further possible operative treatment for failure in resistant cases, indicate that the combined operation should be the method of first choice in the treatment of duodenal ulceration.

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A fourth, expanded edition of the catalogue of isotopes on sale from the isotope division of the Atomic Energy Authority has now been published. Copies of the catalogue may be obtained from the isotope division, A.E.R.E., Harwell, Didcot, Berkshire. A separate catalogue covering naturally radioactive materials, long-lived fission products, labelled compounds, and other materials requiring processing or synthesis is obtainable from the Radiochemical Centre, Amersham, Buckinghamshire.