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BILATERAL VAGOTOMY AND GASTROJEJUNOSTOMY

FOR CHRONIC DUODENAL ULCER

A thesis submitted for the degree of
Master of Surgery, University of Glasgow

by

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"Knowledge advances by steps, and not by leaps."

Baron Macaulay 1800-1859.

"What is all knowledge too but recorded experience,
and a product of history."

Thomas Carlyle 1795-1881.

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ACKNOWLEDGMENTS

This thesis reports the results of a follow-up study in a series of 248 patients treated for chronic duodenal ulcer by Mr. G. Y. Feggetter and is entirely the work of the author except where indicated. The compilation of the series, the search of hospital records, X-rays, operation notes, etc., the tracing of patients who had not been seen for many years, and finally the interviews were conducted by the author. The preliminary steps in determining blood group and secretor status were undertaken by the author, but for the sake of accuracy, the titrations were performed by Mr. J. R. Kirkley, senior technician of the Blood Bank, Royal Victoria Infirmary, Newcastle upon Tyne, to whom the author extends grateful thanks. His thanks are also due to Mrs. D. Weightman for her help in the statistical analysis of the results.

The author expresses his gratitude to Professor A. G. R. Lowdon and Professor A. W. Kay for their helpful advice and criticism.

Finally, the author is indebted to Mr. G. Y. Feggetter for his foresight in introducing what was largely an untried operation in the late forties, and for his determination and zeal in persisting with the same operation for many years, thus enabling a true and valuable assessment to be made of the long-term results. His help, encouragement, example and humour have at all times sustained the author during the two years in which this work has been in progress.

The provisional results of this series have been published in Surgery, Gynecology and Obstetrics (1963), 116, 175, under the title, "The long-term results of bilateral vagotomy and gastro-jejunosotomy for chronic duodenal ulcer".

Some of the results in the blood group and secretor status section have been submitted to the British Journal of Surgery and accepted for publication under the title, "The significance of ABO groups and secretor status in duodenal ulcer".

INTRODUCTION

INTRODUCTION

This thesis is concerned with the evaluation of bilateral vagotomy and gastrojejunostomy for chronic duodenal ulcer. I have been interested in the problem of the definitive surgical treatment of duodenal ulcer for some years. As many surgeons have found when dealing with this disease, vagotomy and gastrojejunostomy seemed a satisfactory alternative to offer a patient rather than gastrectomy with in many cases, the unfortunate sequelae of vasomotor disturbances and malabsorption syndromes. Many factors prevented the widespread adoption of vagotomy and a gastric drainage procedure instead of gastrectomy. The initial result seemed satisfactory but what would be the incidence of recurrent ulceration after many years? What were the side effects of the operation and would they occur with the same frequency as after gastrectomy? Would it be more prudent to perform gastrectomy for the more severe forms of the disease and reserve gastrojejunostomy and vagotomy for the milder cases of duodenal ulceration? Would the operation be safe in patients with a history of perforation or haemorrhage? Reference to the medical literature on this subject did little to answer these and other questions. Detailed assessments of the long term results and side effects in large numbers of cases were not available, especially in this country.

Trimble and Lynn (1950) in their excellent review of the subject state, "Decided differences of opinion exist at present concerning the position that vagus resection, erroneously known as vagotomy, occupies in the surgical management of peptic ulcer. On the one hand, such eminent surgeons as Allen, Lahey, St. John, Walters and Wangensteen (to mention but a few) believe that this operation has little to offer and may even be fraught with serious consequences when supplemented by a gastric drainage procedure. They either vigorously condemn vagus resection in its entirety or, at most, justify its employment in restricted instances only.

In contrast, a number of distinguished surgeons, most notably Dragstedt, insist that division of the vagus nerves, most often combined with simple gastrojejunostomy, is not only physiologically sound but more satisfactory than partial gastrectomy. Some, therefore, recommend it as the procedure of choice in virtually all cases of chronic peptic ulcer except those in which the ulcer is in the stomach and lends itself readily to removal.

In the main, however, impressions are less well formed, and whereas the enthusiasm for vagus resection seems to have waned somewhat of late, there still prevails a general state of confusion and indecisiveness."

Illingworth (1953) when considering vagotomy states, "Yet this, surprisingly enough, is the time for the thoughtful

practitioner to review the evidence to decide where the truth really lies. Surgical opinion on vagotomy as on so many other current topics is apt to be carried away by initial enthusiasm and, expecting too much, to be excessively disappointed in the result. Between the turncoat reverses of popular favour the operation may still have a restricted field."

It seems reasonable to assume that since these statements were made, enough time has passed for a more clear understanding of the place of vagotomy and a gastric drainage procedure in the treatment of chronic duodenal ulcer.

That this is not so, however, is shown by Postlethwait (1963) who states, "Because of the newness of vagotomy with a drainage procedure, it may be some years before a correct evaluation can be made." Again in the same review we find, "Records are being accumulated at a gratifying rate, but the unfortunate fact remains that valid follow-up information cannot be obtained until sufficient time has passed".

It was my good fortune, therefore, in 1960 to begin an association with Mr. G. Y. Feggetter of the Royal Victoria Infirmary, Newcastle upon Tyne, who was among the first surgeons in the United Kingdom to practise bilateral vagotomy and gastrojejunostomy for chronic duodenal ulcer. He adopted the operation because of dissatisfaction with the after effects of gastrectomy. It is greatly to his credit that having made the decision to adopt this

operation no patient with a chronic duodenal ulcer for which surgery was indicated, had a gastrectomy unless as an emergency for massive haemorrhage or for a concomitant gastric ulcer.

This then presented an ideal opportunity to assess the real value of this operation. Many of the variables which detract from an accurate assessment of gastric operations had been eliminated. All patients had been operated on by the same surgeon. All patients had the same operation irrespective of the degree of severity of the ulcerative process. As the first operation had been performed late in 1947, it meant that a study of the long-term effects was feasible.

In addition to assessing the long-term results of this operation, it was decided to evaluate the role of various factors on the result: viz. age at operation, length of dyspeptic history, and indications for operation.

Moreover, in recent years, increasing attention has been directed to the part played by the ABO blood groups and secretor status in the aetiology of chronic duodenal ulcer. In this thesis the influence of these blood group factors on the severity of duodenal ulceration and on the outcome of surgical treatment has been estimated.

With Mr. Feggetter's encouragement, I began this study in December 1960 and by reviewing all patients operated on before December 1950, it has been possible to choose a minimum follow-up period of ten years as the basis for this investigation.

MATERIAL AND METHODS

MATERIAL AND METHODS

The first operation was performed in December 1947 and all patients treated up to and including December 1950 are incorporated in the series. Between these dates 248 patients with chronic duodenal ulcer were treated by bilateral vagotomy and gastro-jejunosomy. Because of the long interval since 1950, some patients have moved from the region and could not be traced and a few were unwilling to co-operate in the review:-

Total number of patients	248
Untraced	20
Unwilling to co-operate	19
	<hr style="width: 10%; margin: 0 auto;"/>
	209
	<hr style="width: 10%; margin: 0 auto;"/>

It was possible, therefore, to undertake a full analysis of 209 patients.

All patients who were traced were interviewed and examined except for 11 who had moved from the region and who were asked to complete a pro forma. Each interview took approximately 20-30 minutes and particular care was taken to allow each patient to state his symptoms without prompting. If it became obvious that the patient was unaware of the side effects of the operation, then leading questions were asked. On this basis symptoms were called

'mild' when obtained only by careful questioning and 'severe' if volunteered by the patient. This simple classification was adopted as it was thought that any attempt to define intermediate grades would make assessment more difficult or even impossible.

The questionnaire sent to the 11 patients who were unable to attend for interview was as follows:-

SCORE OUT THE ANSWERS WHICH DO NOT APPLY TO YOU

- | | | |
|----|---------------------------------------|--|
| 1. | Are you in good health? | Yes
No |
| 2. | Are you able to do your work? | Yes
No
No because of
unrelated cause.
Retired. |
| 3. | Do you consider yourself | Cured?
Improved?
Not improved?
Worse? |
| 4. | Is your appetite | Good?
Poor?
Poor in the mornings
only? |
| 5. | Do you suffer from flatulence (wind)? | No
No inconvenience.
Inconveniencing. |
| 6. | Do you suffer from diarrhoea? | No
No inconvenience
Inconveniencing. |
| 7. | Do you suffer from abdominal pain? | Similar to before
More severe
Less severe
Different type
No. |

8. What is your weight?
9. What has your occupation been since the operation?

Each patient was encouraged in an accompanying letter to state more fully the symptoms described in the proforma. Where doubt existed about the replies to a questionnaire, further correspondence took place.

ABO groups and secretor status studies were performed on blood and saliva taken from patients who attended for interview. The specimens of saliva for determination of secretor status were immediately boiled for ten minutes and stored at -20°C . until testing - usually on the following day. The determination was carried out using the method of Boyd and Shapleigh (1954) in which a saline extract of *Ulex Europaeus* is titrated against the patient's saliva with suitable group O cells as an indicator. The cells were freshly drawn from the same donor on each occasion. Only those patients whose saliva showed no evidence of inhibition when compared with a normal saline control were classed as non-secretors.

The ABO groups were determined by standard tube methods.

DETAILS OF SERIES

DETAILS OF SERIESAGE OF PATIENT AT TIME OF OPERATION AND DURATION OF
DYSPEPTIC HISTORY

Two hundred and five patients in the series are males and only four are females. The preponderance of males is due to the inclusion, in the early post-war period, of a large number of Servicemen invalided from the Forces on account of duodenal ulcer and referred by the Ministry of Pensions for treatment. This is another of the factors which made evaluation of the series worthwhile. Peptic ulcer is generally a much more severe disease in men and as a result this series is probably a greater test of the efficacy of the operation than one which includes a large proportion of women.

The age distribution of the patients at the time of operation was as follows:-

10 - 19 years	1
20 - 29 "	22
30 - 39 "	63
40 - 49 "	80
50 - 59 "	39
60 +	4
	<hr/>
	209
	<hr/>

When taken in conjunction with the duration of dyspeptic history the above age distribution figures confirm that duodenal ulcer commonly begins in the second decade of life.

Thus:-

Length of dyspeptic history	Age at Operation					
	15 - 19 yrs.	20 - 30 yrs.	30 - 40 yrs.	40 - 50 yrs.	50 - 60 yrs.	60 + yrs.
5 yrs.	-	9	6	10	5	-
5 - 10 yrs.	1	12	42	37	15	1
11-20 yrs.	-	1	12	24	10	2
20 + yrs.	-	-	3	9	9	1
	1	22	63	80	39	4

Closer analysis reveals, however, that 10 patients between the ages of 40 and 50 years had a dyspeptic history of less than 5 years and 5 patients who were between 50 and 60 years at the time of operation had had symptoms of duodenal ulcer for less than 5 years.

The great majority of patients had a long history of duodenal type dyspepsia and the duration of their symptoms was as under:-

1 - 2	years	6
2 - 3	"	6
3 - 4	"	10
4 - 5	"	8
5 - 10	"	108
10 - 20	"	49
Over 20	"	22
		<hr/>
		209
		<hr/>

The fact that only 30 patients had a history of less than 5 years serves to show that chronicity of an ulcer had to be well established before operation was advised.

DYSPEPTIC SYMPTOMS

Epigastric pain typical in its site and its relationship to meals was present in 163 patients. Forty five patients had pain in other abdominal areas or pain which did not have a definite relationship to meals. Pain was relieved by food and alkalis in 174 patients but in the remainder no relief was obtained by these measures. Ninety one patients complained of pain in the back.

It is generally accepted in cases of chronic duodenal ulcer that vomiting is not a feature of the disease unless pyloric stenosis, penetration of adjacent organs or some other complication develops. Nevertheless 102 patients stated that vomiting was a frequent event. Occasional vomiting occurred in 56 patients. Only 51 patients were not affected by vomiting.

Pain which wakens the patient at night is also a typical feature of duodenal ulcer dyspepsia and in this series was experienced by 131 patients.

RADIOLOGICAL INVESTIGATIONS

The efficacy of a barium examination in the diagnosis of duodenal ulceration was well established in this group of patients.

All except 35 patients had a barium meal. A completely negative report was obtained in only six patients all of whom had a demonstrable ulcer at operation. A negative report therefore is exceptional and should lead to a search for causes other than duodenal ulcer in a patient with dyspepsia.

Equivocal results were obtained in ten patients. Actual visualization of an ulcer crater was possible in 104 patients; in the remainder duodenal deformity or pyloric stenosis was seen.

Illingworth (1953) confirmed the reliability of X-ray examination in peptic ulcer. Postlethwait (1963) reported positive X-ray findings in 78.9 per cent. of 380 cases of duodenal ulcer.

INDICATIONS FOR OPERATION

As is the usual practice, the complications of peptic ulcer were regarded as indications for operation. Many patients had a history of either haematemesis, melaena, perforation, or stenosis but in 19.6 per cent. multiple indications were present: 7 patients had a history of haemorrhage, perforation and pyloric stenosis.

Failure of Medical Treatment

This was the most frequent reason for seeking operation. Of the 209 patients under consideration, 115 had one or more admissions to hospital during their illness for intensive conservative management, with relapse in every case. In 8 patients, the failure of medical management was due to a lack of self discipline and in only 5 patients was the failure the result of economic pressure.

The remainder relapsed because of the inability of medical management to cure a chronic duodenal ulcer.

Haemorrhage

Sixty nine patients had a history of haemorrhage prior to operation; in 45 this was manifest as haematemesis and in 24 instances as melaena. Nineteen patients had a haematemesis on more than one occasion and in 11 haematemesis was severe enough to require transfusion.

Perforation

Perforation had occurred in the past in 45 patients and 3 of these had perforated on two occasions. In 17 instances, perforation was the only complication of the duodenal ulcer but in the remainder haemorrhage or stenosis or in 7 cases all three had occurred during the course of the disease.

Pyloric Stenosis

Stenosis was one of the indications for operation in 78 patients. In 41 patients no other indications were present but the remainder had in addition a history of haemorrhage or perforation or both.

SIZE OF ULCER AT OPERATION

No ulcer was found at operation in 4 patients. Oedema was a marked feature in 78. The ulcer at operation was described

as small in 23 and in 146 patients some degree of stenosis was found.

NATURE OF OPERATION

The usual approach was made through an upper left trans-rectus incision or in the case of patients with previous laparotomies for perforation, through the old incision. The standard operation of per hiatal bilateral vagotomy with a posterior no loop isoperistaltic gastrojejunostomy was performed in 203 cases. In one case a vagotomy with pyloroplasty was performed; in 4 subhepatic vagotomy with a posterior gastrojejunostomy because of adhesions between liver and diaphragm, and in one vagotomy with anterior gastrojejunostomy and enteroanastomosis because of a very short transverse mesocolon. In every case as well as dividing the main vagal trunks a search was made for small fibres especially of the anterior vagus and these when found were divided. The anastomosis in every case was placed at the most dependent part of the stomach and was performed with clamps using two layers of continuous catgut on an atraumatic needle.

Post-Operative Complications

One death occurred. This patient died on the third post-operative day from uraemia secondary to a chronic pyelonephritis which had been unsuspected before operation. Apart from this there were 45 complications in 38 patients. As can be seen from the

table, respiratory complications were the most common and accounted for seventeen of the total. The next most frequent complication was diarrhoea during the post-operative period in hospital.

Post-operative Complications

<u>Chest</u>	Basal collapse	6
	Infection	10
	Pulmonary embolus	1
<u>Wound</u>	Infection	5
	Dehiscence	1
<u>Haemorrhage</u>	Wound	1
	Intraperitoneal	1
<u>Cyclical vomiting</u>		1
<u>Diarrhoea</u>		12
<u>Established ileus</u>		4
<u>Dysphagia</u>		3
		45
		45

All these patients were symptom free on discharge from hospital.

Pre-operative Test Meal

During the period 1947-1950 when these cases were treated the standard gastric test meal in use was the Rehfuss test meal. This consists of one pint of gruel made by boiling down two

tablespoonfuls of oatmeal in one quart of water, straining the mixture and flavouring with salt. A Ryle's tube is passed in the fasting patient and gastric contents withdrawn. One pint of gruel is then taken and the gastric contents are aspirated every fifteen minutes for two and a half hours. The samples are then titrated with N/10 NaOH and the number of c.cs. used to neutralise the HCl is entered on a graph made of the results. The maximum content of HCl occurs usually in the specimen withdrawn at one and a half hours and seldom exceeds 40 c.c. of NaOH.

For this series:-

0 - 20 c.c. of NaOH	was regarded as	'low'
20 - 40 c.c.	" " " "	'normal'
40 + c.c.	" " " "	'high'

One hundred and six patients had pre-operative test meals with the following results:-

High	84
Normal	16
Low	6
	<hr/>
	106
	<hr/>

PRE-OPERATIVE HAEMOGLOBIN

It was found possible to trace the pre-operative haemoglobin value in 146 patients. See accompanying table.

Less than 70%	6
70 - 80%	2
80 - 89%	7
90 - 99%	17
100% +	114
	<hr/>
	146
	<hr/>

LENGTH OF FOLLOW-UP

As stated previously, the minimum follow-up period of this series is 10 years. Seventy seven patients, however, were followed up for more than 11 years, 78 for more than 12 years and 21 for more than 13 years.

RESULTS AFTER TEN YEARS

RESULTS AFTER TEN YEARSASSESSMENT OF RESULTS

The clinical assessment of the results of gastric operations is notoriously difficult and the classification used is that described by Hamilton et al (1955) based on the work of Dragstedt et al (1951). This method is preferred because of the relative ease with which any individual result can be fitted into one of the groups. These categories are as follows:-

- Excellent: Free of all ulcer type symptoms or objective evidence of ulcer while on unrestricted diet and without medications. Side effects absent or very mild. Usual occupation.
- Good: Free of ulcer symptoms or objective evidence of ulcer, but moderate persistent side effects of some type which are not seriously disturbing. Works practically full time.
- Improved: Still partly incapacitated (side effects, weakness, nervousness etc.) but no persistent ulcer pain and no objective evidence of recurrent ulcer. Patient himself feels he is definitely improved.

Poor or Failure: Definite persistent ulcer type pain
or proven recurrent ulcer. Incapacitating
side effects. Re-operation.

As mentioned in the previous chapter, one post-operative
death occurred. Twelve patients have died since the operation:-

Deaths since Operation

<u>Cause and Date</u>	<u>Time after Operation (Years)</u>
1. Coronary occlusion (1951)	1
2. Carcinoma of bronchus (1951)	1
3. Heart failure (1951)	3
4. Suicide (1952)	3
5. Pneumonia (1952)	3
6. Carcinoma of stomach (1953)	4
7. Specific aortitis (1955)	6
8. Appendicitis (1955)	6
9. Enterocolitis (1956)	7
10. Subarachnoid haemorrhage (1958)	8
11. Cerebral haemorrhage (1958)	10
12. Cirrhosis of liver (1960)	10

Total: 12 deaths.

Although 9 of these patients were symptom free at the time
of death and there is no reason to assume that they would not

remain so, they are not included in the satisfactory results as they did not survive the minimum ten-year follow-up period.

Three (Nos. 6, 11 and 12) were known to be failures at the time of death, and are therefore included in the results.

Four patients known to be symptom free emigrated before the ten-year follow-up and are excluded from the analysis.

Thus:-

Available for analysis	209 cases
Operative death	1
Deaths since operation	12
Emigrated before 10 year survey	4
	<hr/>
	192
Failures at time of death	3
	<hr/>
Therefore number of patients in whom results could be assessed after 10 year period	195
	<hr/>

As reported above, it was possible to assess results in 195 patients who had a follow up of at least ten years with the following results:-

Excellent	129	(66.1%)
Good	32	(16.4%)
Improved	16	(8.2%)
Failed	18	(9.3%)
	<hr/>	
	195	
	<hr/>	

It is apparent from these results that over 82 per cent. of patients with a follow-up of more than ten years are completely free from ulcer symptoms and are working full time. They fall into the "excellent" and "good" results categories.

The patients with excellent results have no dyspepsia, are able to eat and drink anything without discomfort, and have no side effects and no loss of work. Those with results in the "good" category have slight symptoms which prevent their inclusion in the "excellent" group. These symptoms might be slight flatulence after meals, occasional diarrhoea or occasional bilious regurgitation. They have no ulcer pain and the ulcers are regarded as healed. The patients regard themselves as cured and these symptoms are elicited only on careful questioning.

The patients in the "improved" group have either slight persistent ulcer type symptoms or mild side effects from the operation.

The patients in the "failed" group are as follows:-

<u>Case No.</u>	<u>Reason for failure</u>	<u>Time of failure</u>
14	Stomal ulcer*	2 years
42	Stomal ulcer*	2 years
243	Stomal ulcer*	3 years
119	Stomal ulcer*	4 years
23	Stomal ulcer*	6 years
85	Stomal ulcer	6 years
174	Stomal ulcer	10 years
31	Recurrent symptoms	4 years
4	Recurrent symptoms	7 years
61	Recurrent symptoms	8 years
19	Persistent symptoms*	Since operation
105	Persistent symptoms	Since operation

<u>Case No.</u>	<u>Reason for failure</u>	<u>Time of failure</u>
124	Bilious vomiting*	Since operation
187	Gastric ulcer*	2 years
126	'Gastritis'*	4 years
123	Carcinoma of stomach*	4 years
247	Obstructed loop*	6 years
95	Gastric adenoma*	7 years

Total 18 patients

* Denotes subsequent gastrectomy.

Some of these failures indicate the severity of the criteria applied to the results. Several of the cases are not true failures of the operation as a treatment of chronic duodenal ulcer but are included because they are in some way, however remote, considered to be due to the surgical procedure (Nos. 95, 125, 126, 187, 247).

Stomal ulceration occurred in seven patients giving an overall incidence of 3.6 per cent. Three of the seven stomal ulcers occurred in the first 50 cases and are therefore due possibly to an incomplete vagotomy. When stomal ulceration occurred, it did so in three cases within three years but in one case ten years passed before anastomotic ulceration declared itself.

Recurrent symptoms were present in three patients after four, seven, and eight years respectively. In none of these cases was it possible to demonstrate an ulcer, but they are presumed to have recurrent duodenal ulceration.

Each failure is described more fully below with the reasons for assessment as such:-

Case No. 4.

Joseph Vaughan, aged 45 at operation on 2/7/48.

This patient was advised surgery because of failed medical treatment. He complained of frequent bilious vomiting at the time of review and of recurrent symptoms since 1955.

A fractional test meal showed a high acid curve. A failure due to recurrent symptoms.

Case No. 14.

Peter Lynn, aged 25 at operation on 19/11/48.

This patient was advised surgery on account of failed medical treatment. A post-operative test meal showed a low acid output and he remained well until 1951 when he had a haematemesis and melaena. He had another haemorrhage in 1954 and a stomal ulcer was shown on barium meal. A gastrectomy was performed on 28/9/54 and the presence of a stomal ulcer was confirmed. A failure because of stomal ulceration.

Case No. 19.

Edward Bertie, aged 45 at operation on 11/12/48.

Surgery was advised in this patient because of a history of perforation, haematemesis on two occasions, and the development of pyloric stenosis. A post-operative test meal showed a low

acid curve. He had persistent symptoms after operation. A Billroth I gastrectomy was performed on 6/9/56 and the presence of a duodenal ulcer was confirmed. A failure due to persistent symptoms.

Case No. 23.

Charles McCarthy, aged 40 at operation on 11/2/49.

This patient was recommended surgery because of failure of medical treatment. A post-operative test meal showed a low acid curve. He developed epigastric pain after meals in 1955 and was advised gastrectomy but refused. However he had a massive haemorrhage for which an emergency gastrectomy was performed on 8/3/61. Examination of the resected specimen showed a stomal ulcer from which the haemorrhage had occurred. A failure due to stomal ulceration.

Case No. 31.

Richard Kelly, aged 50 at operation on 22/3/49.

This man was advised surgery because of a past history of haematemesis and perforation. A post-operative fractional test meal showed a low acid curve. He was admitted to hospital in 1953 with a diagnosis of acute exacerbation of a duodenal ulcer. This settled on treatment but was followed by symptoms of biliary colic and after investigation he had a cholecystectomy in 1954 for gallstones. He had intermittent

bouts of dyspepsia following this operation and was re-admitted to hospital in 1960 with a further acute exacerbation of his duodenal type symptoms. Barium investigation was negative. A failure due to recurrent symptoms.

Case No. 42.

J.W. Wood, aged 35 at operation on 31/5/49.

This patient had operation advised because of the development of pyloric stenosis. A post-operative test meal showed a normal acid curve and he developed symptoms of a stomal ulcer in 1951. The symptoms persisted for several years and finally on 1/11/56 a gastrectomy was performed and this demonstrated a jejunal ulcer 1 x 1½" in size. In this patient there is evidence from the post-operative test meal that the vagotomy was incomplete. A failure due to stomal ulceration.

Case No. 61.

J.M. McDonald, aged 45 at operation on 4/10/49.

This man was recommended for operation as a result of failed medical treatment. A post-operative test meal showed a low acid curve. He was well until 1957 when he developed recurrent symptoms and these symptoms have persisted since and were present at the time of the review in 1961. This patient has not been investigated. A failure due to recurrent symptoms.

Case No. 85.

P. France, aged 40 at operation on 14/3/50.

This patient was advised operation because of a previous history of haematemesis on two occasions and failure of medical treatment. A post-operative fractional test meal showed a high acid curve but he had no symptoms until 1955 when a barium meal performed for recurrent symptoms showed no evidence of stomal ulceration. He was admitted to hospital on 20/9/56 with a perforated stomal ulcer and this was treated by simple suture. He was well thereafter as far as his stomach was concerned but he developed cirrhosis of the liver with bleeding oesophageal varices from which he died. Post-mortem confirmed the cirrhosis and varices but there was no evidence of a stomal ulcer. In this case the post-operative fractional test meal suggested an incomplete vagotomy. A failure due to stomal ulceration.

Case No. 95.

Charles Cheek, aged 42 at operation on 20/6/50.

This man was recommended surgery because of haematemesis from a known duodenal ulcer. A post-operative test meal showed a low acid curve. He began to have gastric symptoms five years after operation and was advised gastrectomy. At operation there was no evidence of an anastomotic ulcer or duodenal ulcer

but the resected stomach contained a large gastric adenoma.

A failure due to gastric adenoma.

Case No. 105.

Windsor L. Hall, aged 41 at operation on 10/10/50.

This patient was advised operation because of a history of haematemesis and melaena. A post-operative test meal showed a normal acid curve. His symptoms recurred intermittently following operation. He has not been investigated. A failure due to persistent symptoms.

Case No. 119.

Donald Morrison, aged 45 at operation on 19/9/50.

Operation was advised in this case on account of failure of medical treatment. Following operation he was well until 1954 when he had an emergency gastrectomy for massive haematemesis. A stomal ulcer was found at operation. A failure due to stomal ulceration.

Case No. 124.

Melville Watts, aged 33 at operation on 6/6/50.

This patient was advised operation because of failure of medical treatment. A low acid curve was found post-operatively. He had persistent and severe bilious vomiting from the time of operation and on 10/6/52 a Polya gastrectomy was performed. A failure due to repeated bilious vomiting.

Case No. 125.

R. Gibson, aged 43 at operation on 5/4/49.

This patient was advised operation because of the development of pyloric stenosis. Three years post-operatively he began to lose weight and complained of epigastric pain and a barium meal showed a carcinoma of the stomach. A gastrectomy was performed on 16/2/53 and this revealed an adenocarcinoma of the stomach with invasion of the lymph nodes. The patient died on 16/7/53. A failure due to carcinoma of the stomach.

Case No. 126.

Frederick Sharp, aged 35 at operation on 20/12/49.

This patient developed pyloric stenosis and was advised operation because of this. He was well until 1953 when he complained of increasing breathlessness associated with gastric symptoms. He was seen by a surgeon who considered that his symptoms were due to stomal ulceration and on 5/5/53 a gastrectomy was performed. He developed a severe post-operative pulmonary infection which an X-ray revealed was due to bilateral active pulmonary tuberculosis. Histology of the stomach showed multiple tuberculous ulcers in the gastric mucosa. A failure due to "gastritis".

Case No. 174.

David Bell, aged 45 at operation on 21/4/48.

This patient had a duodenal ulcer and surgery was recommended for a developing pyloric stenosis. No record is available of his progress after this but in June 1958, he was admitted to hospital with a cerebral haemorrhage which proved fatal. At post-mortem examination he was found to have an anastomotic ulcer. A failure due to stomal ulceration.

Case No. 187.

Ivy Marshall, aged 40 at operation on 8/2/50.

This woman was advised operation on account of pyloric stenosis. A post-operative fractional test meal showed a normal acid curve. She was well until 1952 when her gastric symptoms returned. Investigation showed that she had a gastric ulcer and on 2/9/53 a gastrectomy was performed. A failure due to gastric ulceration.

Case No. 243.

Edwin Soulsby, aged 42 at operation on 15/11/50.

Operation was advised in this case because of a history of haematemesis and melaena. The symptoms recurred in 1952 and investigation revealed the presence of a stomal ulcer. A Polya gastrectomy was performed for this on 20/4/52. This patient developed symptoms again in 1960 and re-investigation showed another stomal ulcer. A failure due to stomal ulceration.

Case No. 247.

Norman Armstrong, aged 45 at operation on 24/3/48.

This patient was advised operation because of failure of medical treatment and a history of perforation. He had no symptoms until 15/2/54 when he was admitted as an emergency with severe epigastric pain and vomiting. At operation he was found to have a kinked and obstructed efferent loop near the stoma and this was treated by gastrectomy. There was no evidence of an anastomotic ulcer. A failure due to an "obstructed loop".

POST-OPERATIVE TEST MEAL

The first 64 patients in the series had a gruel test meal similar to the one before operation. The examination was performed two to seven months after operation.

The following results were obtained:-

High free acid (40 m.eq.+)	6
Normal " " (20-40 m.eq.)	12
Low " " (0-20 m.eq.)	46
	64

The results of operation in these patients are:-

	Excellent	Good	Improved	Failure	
High Acid	4	-	1	1	6
Normal Acid	5	2	2	3	12
Low Acid	21	12	6	7	46
	30	14	9	11	64

Although these numbers are small, it is nevertheless interesting to note that good results have been obtained in some patients who still have a high acid. When the test meals, in the 4 patients with excellent results after 10 years, are compared with their pre-operative meals, in every case the total acid is substantially reduced. This reduction in acid has presumably been enough to enable healing of the ulcers, and this has been maintained.

SUBSEQUENT GASTRECTOMY

Gastrectomy was performed on 12 of the failures without a death. It seems, therefore, that a surgeon need not fear an increased mortality if gastrectomy is necessary should bilateral vagotomy and gastrojejunostomy fail.

COMPARISON WITH THE RESULTS IN OTHER SERIES

Overall Results

In considering other results, attention must be given to several factors.

Many of the reported series do not have a follow-up quite as long as the one which is the subject of this thesis, and because of this their results are probably on the optimistic side. It has been shown in this chapter that failures can occur, after many years, in patients who have been regarded as "cured".

On the other hand, some authors report very poor results but Crile (1952) pointed out that many unsatisfactory results can be accounted for by the fact that some series are highly selected. Vagotomy and gastroenterostomy was reserved by many workers for the patient in whom a small ulcer was found at operation, the patient whose symptoms were out of proportion to the demonstrable pathology, or the patient who had not experienced any of the severe complications of peptic ulceration. These are the very patients in whom it is possible that any gastric operation may be unsuccessful due to the discrepancy between pathology and symptoms.

In the early reported series in the late forties and early fifties, at a time when the diagnostic and pathological distinction between gastric ulcer and duodenal ulcer was sometimes not as widely appreciated as at present, many gastric and prepyloric ulcer patients had a bilateral vagotomy and gastrojejunostomy and were included in the published series. In general terms, the results in these patients were unsatisfactory.

Hamilton et al. (1955) reported the results 4 $\frac{1}{2}$ to 10 $\frac{1}{4}$ years after bilateral vagotomy and gastrojejunostomy in 42 patients with chronic duodenal ulcer. Thirty-six per cent. of patients had "excellent" results, 33 per cent. were "good", 21 per cent. were "fair", and 10 per cent. had a "poor" result.

Hoerr (1955) using the same classification of results described

the outcome of vagotomy and gastrojejunostomy in 145 patients with duodenal ulcer. "Excellent" results were obtained in 92 (63.4%), "good" in 26 (17.9%), "improved" in 6 (4.1%), and "failed" in 21 (14.6%). These patients were followed up for 5 years.

Oberhelman and Dragstedt (1955) in 487 cases found "good" results in 82 per cent., "fair" in 8 per cent. and "poor" in 10 per cent.

McEvedy and Kirkland (1955) published the results in 151 patients. "Good" results were seen in 86.1 per cent. 7.9 per cent. of patients were "improved" and 6 per cent. were failures. The follow-up in this series was only 3 to 5 years.

Weinstein et al. (1955) reported the results of a 1 to 8 year follow-up in 58 cases with unsatisfactory results in 10 per cent.

Lloyd-Davies (1956) described 198 cases of duodenal ulcer who had bilateral vagotomy and gastroenterostomy with a follow-up of from 5 to 7 years. Satisfactory results were seen in 92.4 per cent and 7.6 per cent. were regarded as failures.

Trueman and Kippen (1956) in a series in which a few were seen 10 years after vagotomy and gastroenterostomy, but some only 3 years after, reported 93 cases. "Good" results were seen in 82.8 per cent., "fair" results in 6.4 per cent. and 10.4 per cent. were assessed as "failures".

Hindmarsh (1957) assessed the results 1 to 8 years after

operation in 197 patients. 98 per cent. were satisfactory and only 2 per cent. were failures.

Everson et al. (1957) published the results in a 1 to 8 year follow-up of 178 patients. 74.4 per cent. of patients were traced. 84 per cent. of patients expressed themselves as satisfied with the operation. Failure occurred in 12.9 per cent.

Mackelvie (1957) reported a large series of patients (332) with a follow-up of from 2 to 10 years but with only a few over 7 years. Two hundred and ninety-eight patients were traced and the results were graded 1 to 5 with group 5 regarded as failures. Two hundred and thirty-eight patients were placed in grade 1, 31 in grade 2, 8 in grade 3, 13 in grade 4 and only 8 in grade 5.

Walters et al. (1957) found excellent or good results in 76 per cent. of 123 patients.

McCullough (1959) in an excellent review of the results in 93 patients recorded 70 per cent. with a "good" result, 17 per cent. with a "fair" result and 13 per cent. with a "poor" result. The length of follow-up is not detailed in this series.

Edwards et al. (1960) described their results at follow-up in 127 patients. 60 per cent. of patients were observed for more than 6 years and some for as long as 14 years. Failure was recorded in 14.9 per cent.

Burge and Clark (1960) reviewed the ten-year results in 262

patients. Failure occurred in 13 (4.9%).

D'Alonzo (1961) reported on the ten-year results in 400 patients. Only 13 per cent. of these patients had vagotomy combined with gastrojejunostomy. In these cases, "excellent" results were obtained in 58 per cent., "good" in 28 per cent., "fair" in 10 per cent. and "poor" results in 4 per cent.

Holt and Lythgoe (1961) reviewed the results at 10 years in 84 cases. They found 90.5 per cent. satisfactory and 9.5 per cent. unsatisfactory results.

Austen and Edwards (1961) in appraising 100 cases found a 5 per cent. incidence of failure.

Postlethwait (1963) in a 5-year follow-up of 165 cases found satisfactory results in 128 patients (76.6%).

The overall results are satisfactory in the above series, but they should be viewed, in some cases, with a certain amount of reservation, because of the factors discussed at the beginning of this section.

Stomal and Recurrent Ulceration

The incidence of stomal and recurrent ulceration in the present series is 5.1 per cent (3.6% stomal ulceration and 1.5% recurrent duodenal ulcer). This compares favourably with the incidence reported by some workers and is considerably better than others.

Hoerr (1955) reports an incidence of 8.2 per cent., McEvedy and Kirkland (1955) 6 per cent., Weinstein et al. (1955) 10 per cent., Lloyd-Davies (1956) 5.6 per cent. and Trueman and Kippen (1956) 1 certain and 1 possible stomal ulcer in their series of 93 cases.

Hindmarsh (1957) reported a 2 per cent. incidence of stomal ulceration. Oberhelman and Dragstedt (1955) had 28 proved and 7 suspected recurrent ulcers in their series of 487 cases - an incidence of 7.2 per cent. McCullough (1959) had 8 patients with stomal ulceration (8.6%).

Burge and Clark (1960) found recurrent ulceration in 3.8 per cent, D'Alonzo (1961) 4.0 per cent., Holt and Lythgoe (1961) 1.2 per cent. and Austen and Edwards (1961) 5 per cent.

The following authors have reported a higher incidence of stomal ulceration:- Henson and Rob (1955) 12.4 per cent., Everson et al. (1957) 12.9 per cent., Walters and Mobley (1957) 13 per cent., Edwards et al. (1960) 14.9 per cent. and Postlethwait (1963) 22.4 per cent.

Gastric Ulceration

In the present series, only one patient developed a gastric ulcer following operation - an incidence of 0.5 per cent. McCullough (1959) had one gastric ulcer in 93 patients (1.0%) and Burge and Clark (1960) report an incidence of gastric ulceration following

vagotomy and gastrojejunostomy of 0.8 per cent.

Gastric Carcinoma

There is no reference to the development of gastric cancer in the above reports, although one case was found in the present series.

Gastric Adenoma

Although one patient in the present series developed a gastric adenoma and had a gastrectomy because of this, the above series do not report any other case of this complication.

Recurrent Haemorrhage

Hoerr (1955) reports recurrent haematemesis in 4.1 per cent. of his series. Trueman and Kippen (1956) describe 3.2 per cent., Walters et al. (1957) 17 per cent. and Pallette and Harrington (1958) 17 per cent.

In the present series, there were no instances of bleeding following operation other than in those patients with stomal ulceration. However, in the past few years, the author has seen several patients with recurrent small bleeds, the ultimate cause of which was found to be jejuno-gastric intussusception. It may be that some of the cases in the above series are chronic retrograde intussusception.

Stomal Obstruction

It is surprising that so few patients develop stomal dysfunction. In this series only one patient developed an efferent loop obstruction and required a gastrectomy.

In the series reviewed above, McCullough (1959) had one patient with a badly placed stoma which required revision and Burge (1960) had one patient who developed a stomal stenosis which necessitated re-operation.

SIDE EFFECTS

SIDE EFFECTS

Bilateral vagotomy and gastrojejunostomy is followed in some patients by symptoms, which are related to the physiological disturbances produced by section of the vagi, the gastroenterostomy, or, as is more likely, the combination of the two procedures. In general terms, these symptoms are not severe, but as the purpose of this thesis is to evaluate the operation, all side effects are included no matter how slightly the patient is inconvenienced by them. One hundred and twenty nine patients (66.2%) have no symptoms of any kind; the remaining 66 have symptoms of one sort or another, but as already stated above, apart from a few, these are mild, but are still present at least ten years after the operation.

APPETITE

Forty six patients have a poor appetite which they state dates from the operation. A further 19 patients have a poor appetite in the morning, but this improves throughout the day, and by the early evening, they are able to eat heartily. The symptoms, in this latter group, suggest a mild degree of gastric stasis. One hundred and nineteen patients claim that their appetite is excellent.

FLATULENCE

This is one of the common sequelae of operation. One hundred

and two patients (52.3%) have some degree of fullness or flatulence after meals. Seventy eight patients do not regard the flatulence as being of any moment, but 24 (12.3%) regard the symptom as troublesome.

VOMITING

Bilious vomiting may be a complication of most types of gastric operation, but the incidence in this series, after bilateral vagotomy and gastroenterostomy, is high (22.4%). Thirty five patients have occasional bilious vomiting. This usually consists of a single episode of vomiting on rising in the morning, after which the patient feels well. In these mild cases, the vomiting occurs at weekly or fortnightly intervals. In the more severe cases (12 patients), vomiting occurs more than once a week in 11, and in one case vomiting is a daily occurrence.

Since the analysis of this series became available, I, in common with other surgeons, have changed to pyloroplasty as the gastric drainage procedure and my impression is that the incidence of bilious vomiting is very much reduced.

DIARRHOEA

In the present series, a total of 52 patients (26.6%) have diarrhoea. In general, it does not seem to be a burdensome complication. Only 16 patients regard the diarrhoea as an inconvenience. In fact, some patients are pleased to have more

frequent bowel action instead of their previous constipation. In 22 patients the diarrhoea occurs daily, but the remaining 30 have intermittent attacks, with periods of remission with normal bowel habit.

Patients with diarrhoea can be divided into three groups:-

1. Those with daily diarrhoea; one to three loose motions per day.
2. Those who feel vaguely unwell for twenty four hours, followed by a period of diarrhoea for twenty four hours, before resuming normal bowel habit for a variable period of from 6-12 weeks.
3. Those who without warning have a single explosive attack of diarrhoea, following which they are completely normal again for several weeks or months.

The aetiology of the diarrhoea following bilateral vagotomy and gastrojejunostomy is obscure. Patients who complained of severe diarrhoea were investigated by fat balance studies and stool cultures but no evidence of malabsorption or infection was forthcoming. Further long-term studies of a large number of patients with diarrhoea will be necessary before an explanation can be given of the causes of the different types of diarrhoea.

VASOMOTOR SYMPTOMS

Vasomotor symptoms after meals, which are so common following gastrectomy, do not occur with much frequency after vagotomy and gastroenterostomy. In this series, 26 patients 'dump' in some degree after meals; 23 patients regard the symptoms as mild but 3 regard it as an inconvenience.

PAIN

Five patients describe attacks of epigastric pain similar to that experienced before the operation. Nine patients have the same type of pain but it is much less severe, and 5 patients complain of abdominal pain of a different type. The remaining patients have no pain of any kind after meals.

WEIGHT

The fact that only 36 patients (17.2%) have lost weight after this operation is one of the most encouraging features of this series. Thirty two patients (15.7%) gained weight, and of these, 5 gained more than two stones.

PULMONARY TUBERCULOSIS

Pulmonary tuberculosis is regarded as a hazard in patients who have a gastrectomy, and has been thought to be a sound reason for advising vagotomy and gastroenterostomy when a patient is at risk. This is a false premise however, as 7 patients (3.6%)

in this series developed pulmonary tuberculosis following operation. All of these cases occurred in the group with weight loss and a poor appetite.

POST-OPERATIVE ANAEMIA

Ten years plus after operation, several patients have an anaemia. Investigation has shown the anaemia to be of the iron deficiency type and there is no example of a macrocytic anaemia in this series.

HAEMOGLOBIN VALUE

Below 70%	7
70-79%	7
80-89%	14

The remainder have a haemoglobin of 90% or over.

WORK LOSS

Over 80 per cent. of patients have lost no work or, at the most, only a few days on account of gastric symptoms since operation. This is especially gratifying as 114 patients are engaged in manual labour, and of these, 53 are employed as coal miners. Only 5 patients have changed their occupation because of continuing symptoms.

COMPARISON WITH SIDE EFFECTS IN OTHER SERIES

Appetite

None of the published series, referred to in the previous

chapter, considers post-operative appetite in any detail.

Flatulence

As mentioned above, the incidence of flatulence is 52.3 per cent. (40.0% mild and 12.3% troublesome). These figures are very similar to the incidence described by Holt and Lythgoe (1961), 48 - 20 per cent. slight, and 28 per cent. troublesome.

Conversely, Lloyd-Davies (1956) records an incidence of 15 per cent. and Austen and Edwards (1961) one of 15 per cent.

This variation may be a question of the amount of gastric stasis which in turn probably depends on the size of the stoma.

Bilious Vomiting

The incidence of this complication in the author's series is 22.4 per cent.

Lloyd-Davies (1956) reports 14 per cent., Walters et al. (1957) 15 per cent., and Burge and Pick (1958) 13 per cent.

Holt and Lythgoe (1961) describe their incidence of bilious vomiting as 23 per cent. (18% mild and 5% severe).

Cox and Kerr (1957) mention the highest figures, however - 33 per cent. (25% mild and 8% severe).

Diarrhoea

This is the side-effect which excites most comment in the published reports of this operation. Walters et al (1957) have the highest incidence - 35 per cent. At the other extreme,

Austen and Edwards (1961) claim 15 per cent. (13 per cent. mild and 2 per cent. moderate). Other reported figures are Lloyd-Davies (1956) 19 per cent., Holt and Lythgoe (1961) 20 per cent. (10 per cent. mild and 10 per cent. severe), Hoerr (1955) 20.7 per cent. (15.1 per cent. mild and 5.5 per cent. severe), Clark (1961) 22 per cent., and Burge and Clark (1960) 30 per cent. The present series has an incidence of 26.6 per cent.

Vasomotor Symptoms

There is a remarkable variation in the incidence of this side effect as reported in the literature (3 per cent. - 52 per cent.).

In order of increasing incidence these are Walters et al. (1957) 3 per cent., Hoerr (1955) 4.8 per cent., Austen and Edwards (1961) 6 per cent., Holt and Lythgoe (1961) 6 per cent., Lloyd-Davies (1956) 11 per cent., Cox and Kerr (1957) 12 per cent., Burge and Pick (1958) 16 per cent., and Everson et al. (1957) 52 per cent.

Loss of Weight

In the various series, with one notable exception, weight loss occurs in from 11 per cent. to 26 per cent.

Burge and Pick (1958) found loss of weight in 11 per cent., Austen and Edwards (1961) 13 per cent., Walters et al. (1957) 14 per cent., Holt and Lythgoe (1961) 17.8 per cent., Mackelvie (1957) 25 per cent., Postlethwait (1963) 26 per cent., and Everson et al. (1957) 71.2 per cent.

Pulmonary Tuberculosis

No reference is made to pulmonary tuberculosis, as a complication of bilateral vagotomy and gastrojejunostomy, by other workers.

Post-operative Anaemia

No mention is made of anaemia in other published series reviewed by the author.

It is apparent in this and the previous chapter that there is a considerable variation in the results and incidence of side effects in the series reviewed. Since the same operation was performed, in general terms, in each case, it seemed to the author that the explanation might lie in differences between patients rather than in slight variations in technique of the operation.

In the following chapters some of the factors which may be implicated are considered in detail.

INFLUENCE OF INDICATIONS FOR OPERATION

INFLUENCE OF INDICATIONS FOR OPERATION ON RESULTS
AND INCIDENCE OF SIDE EFFECTS

Influence on Results

In the introduction, the opinion of several surgeons was given to the effect that if bilateral vagotomy and gastrojejunostomy is to be used at all in the treatment of chronic duodenal ulcer, then its employment is justified in restricted instances only. The results in this series, however, are very satisfactory and they include all grades of severity of chronic duodenal ulcer. In this chapter, it is proposed to analyse the results in patients in whom the indication for operation was failed medical treatment alone and compare them with the results in patients with more severe and demanding indications for operation, in order to determine whether the severity of the duodenal ulcer is reflected in the results of bilateral vagotomy and gastrojejunostomy. These groups, in the interests of brevity, are called 'Uncomplicated' and 'Complicated' respectively.

Uncomplicated Group

Excellent	55	(73.4%)
Good	7	(9.3%)
Improved	7	(9.3%)
Failed	6	(8.0%)
	—	
	75	
	—	

There is no doubt from these figures that the results in this group are extremely satisfactory. Over 82 per cent. of patients fall into the 'excellent' or 'good' categories.

Complicated Ulcer Group

Under this heading, all cases of chronic duodenal ulcer with indications for operation other than failed medical treatment are included, e.g. haemorrhage, perforation, pyloric stenosis, either singly or in combination. Altogether 120 patients fall into this group, and as such, it is a demanding test of the value of bilateral vagotomy and gastrojejunostomy for the severe ulcer. Thus:-

	<u>Complicated Group</u>
Excellent	74 (61.7%)
Good	25 (20.8%)
Improved	9 (7.5%)
Failure	12 (10.0%)
	<hr style="width: 50px; margin: 0 auto;"/> 120 <hr style="width: 50px; margin: 0 auto;"/>

Over 61 per cent. of patients are completely symptom free after at least ten years, with a further 20 per cent. with minor symptoms or side effects. This compares very favourably with the failed medical treatment category. Although fewer patients fall into the 'excellent' group, the total in the 'excellent' and 'good'

groups remain the same.

Statistical analysis of these two categories of ulcer severity, the 'Uncomplicated' and the 'Complicated', shows $X^2 = 5.058$. p is greater than 0.10. This result is not significant and, as such, is of great importance in that it confirms that the severity of a duodenal ulcer is no bar to treatment of bilateral vagotomy and gastrojejunostomy. Satisfactory results can be confidently anticipated in patients with well-established chronic duodenal ulcer, who have had one or more of the serious complications of ulcer, such as haemorrhage or perforation.

By a further breakdown of the 'Complicated' group, it is possible to find out where the poorer results tend to occur, although the numbers in some groups are small.

Haemorrhage Alone

Excellent	9 (42.8%)
Good	7 (33.3%)
Improved	1 (4.8%)
Failed	4 (19.1%)
	—
	21
	—

This is a group in which the results are most disappointing as only 43 per cent. of patients are completely symptom free after ten years. Notwithstanding, the combined 'excellent' and 'good' results total 76.1 per cent.

Perforation Alone

Excellent	10	(58.8%)
Good	3	(17.6%)
Improved	3	(17.6%)
Failed	1	(6.0%)
	<hr/>	
	17	
	<hr/>	

These results tend not to be as satisfactory as in the failed medical treatment group as far as the 'excellent' category is concerned.

Pyloric Stenosis Alone

Excellent	28	(68.3%)
Good	6	(14.6%)
Improved	2	(4.9%)
Failed	5	(12.1%)
	<hr/>	
	41	
	<hr/>	

These results illustrate the very satisfactory results which can be obtained without resort to gastrectomy in patients who are usually in poor shape when they come to operation.

Haemorrhage and Perforation

Excellent	7
Good	2
Improved	1
Failed	1
	<hr/>
	11
	<hr/>

Haemorrhage and Stenosis

Excellent	9
Good	5
Improved	2
Failed	0
	<u>16</u>
	—

Perforation and Stenosis

Excellent	6
Good	1
Improved	0
Failed	0
	—
	7
	—

Haemorrhage, Perforation and Stenosis

Excellent	5
Good	1
Improved	0
Failed	1
	—
	7
	—

As the numbers are so small in each of the last four groups, and as they represent the most severe type of duodenal ulcer in the series, it is more satisfactory to bring them together under the heading 'Multiple Indications', with the following results:-

Excellent	27	(65.8%)
Good	9	(21.9%)
Improved	3	(7.3%)
Failed	2	(5.0%)
	—	
	41	
	—	

It seems from the above results, therefore, that the fact that a patient has had multiple severe complications of duodenal ulceration is no bar to treatment by bilateral vagotomy and gastro-jejunosomy and that excellent long term results can be confidently expected. In one small group, i.e. 'Haemorrhage alone', the number of patients with 'excellent' results is not as high as in the other groups, although the total numbers are small in this particular category.

Only one other author (McCullough, 1959) relates his results to the indications for operation in any detail. He found the following results in 99 patients:-

Result	Failed Medical Treatment	History of Haemorrhages	History of Perforations
Good	68%	64%	77%
Fair	16%	18%	18%
Poor	16%	18%	5%

These results support the findings of the present series.

Influence on Post-operative Side Effects

In order to determine whether the severity of duodenal ulcer has any bearing on the incidence of post-operative side effects, the patients are divided into the same two groups: the 'Uncomplicated' ulcer category (75 cases) and the 'Complicated' ulcer category (120 cases).

Appetite

	Poor	Poor in a.m.	
Uncomplicated ulcer (75)	16	8	24
Complicated ulcer (120)	30	11	41
	46	19	65

There is no difference in the two groups as far as a generally poor appetite is concerned (21.3% and 25.0%).

This applies also to those with a poor appetite in the morning only (10.6% and 9.1%).

Flatulence

	Inconveniencing	Not Inconveniencing	
Uncomplicated ulcer (75)	7	33	40
Complicated ulcer (120)	17	45	62
	24	78	102

Once again there is virtually no difference between the two groups in the incidence of flatulence post-operatively (53.3% and 51.6%).

Bilious Vomiting

	Occasional	Frequent	
Uncomplicated ulcer (75)	11	3	14
Complicated ulcer (120)	24	9	33
	35	12	47

The impression from the above table is that post-operative bilious vomiting is commoner in the 'Uncomplicated' group.

Statistical survey shows, however, that $X^2 = 1.515$. p is greater than 0.2. This is not significant.

Diarrhoea

	Not Inconveniencing	Inconveniencing	
Uncomplicated ulcer (75)	17	2	19
Complicated ulcer (120)	19	14	33
	36	16	52

Diarrhoea occurs following bilateral vagotomy and gastro-jejunosotomy in 25.3 per cent. of those operated on because of uncomplicated ulcer and in 27.5 per cent. of those patients whose indication for operation was a complicated ulcer. There is no difference in the incidence of post-operative diarrhoea.

Vasomotor Symptoms

	Mild	Severe	
Uncomplicated ulcer (75)	6	1	7
Complicated ulcer (120)	17	2	19
	23	3	26

It appears from the above table that 'dumping' is much less common in the 'Uncomplicated' ulcer group after operation but this is not confirmed statistically. $\chi^2 = 1.172$. p is greater than 0.2. This does not approach the level of significance.

Weight Loss

	Loss of Weight
Uncomplicated ulcer (75)	17
Complicated ulcer (120)	19
	—
	36
	—

The assumption from the above table is that weight loss is not as common after operation for a 'complicated' ulcer. The difference is not significant statistically. $\chi^2 = 1.014$. $p = 0.3$.

Post-operative Anaemia

	Anaemia
Uncomplicated ulcer (75)	11
Complicated ulcer (120)	17
	—
	28
	—

The incidence in each of these categories is 14.6 per cent. and 14.1 per cent. respectively. The incidence of post-operative anaemia bears no relationship to the severity of the duodenal ulcer.

The above findings demonstrate that the severity of duodenal ulceration bears no relationship to the incidence of side effects following bilateral vagotomy and gastrojejunostomy.

INFLUENCE OF BLOOD GROUP AND

SECRETOR STATUS

THE INFLUENCE OF BLOOD GROUP AND SECRETOR STATUS ON THE RESULTS
OF OPERATION AND THE INCIDENCE OF POST-OPERATIVE SIDE EFFECTS

Lehrs (1930) demonstrated the blood group substances A and B in the saliva of some patients. Others are not able to secrete these substances in their saliva. The latter group are known as non-secretors.

Schiff and Sasaki (1932) showed that the ability to secrete the group A, B or O substance in the saliva was inherited as a Mendelian dominant.

These blood group substances are not only secreted in the saliva but are present in the other body fluids as well. They are found in gastric juice, pancreatic juice, bronchial secretion, seminal fluid, and in all glandular secretions. The group O substance is known as H and is secreted by group A, B and AB individuals as well as those who belong to group O. This H substance is also found in the serum of eels and in seeds of *Ulex Europeaus*.

A group A individual secretes substances A and H, a group B individual B and H, group AB, A, B and H, and group O, H only. These blood group substances are complex mucopolysaccharides, and one of their important constituents is the monosaccharide L-fucose.

Grubb (1948) found an association between the secretor/non-secretor system and the blood group system of Lewis. Le(a+) individuals are non-secretors of A, B and H substances. This has been confirmed by Race and Sanger (1954).

Approximately 76 per cent. of the population are secretors and 24 per cent. non-secretors of the blood group substances in the body fluids.

Aird et al. (1954) were the first to point out the association between blood group O and peptic ulceration. Clarke et al. (1955) took this observation a stage further by showing that the real significance lay in the incidence of blood group O in patients with duodenal ulceration. These findings have been confirmed by Wallace et al. (1958) and by Newman et al. (1961).

Clarke et al. (1956) showed in addition a significantly higher proportion of non-secretors in patients with duodenal ulceration than in a control series. These observations were also confirmed by Wallace et al. (1958) and Newman et al. (1961).

Several workers tried to relate the severity of the disease to the incidence of the non-secretor state. Brown et al. (1956) found no great difference in incidence between non-complicated ulcers and those with perforation and haemorrhage. Buckwalter et al. (1956) found they could not distinguish between medically and surgically

treated cases. Roberts (1957) re-examined the data of Aird et al. (1954) and confirmed the suggestion of Brown et al. (1956) that a particularly high incidence of the non-secretor state is found in patients with stomal ulceration. Doll et al. (1961) endorsed this observation.

It was decided in this series to examine the above factors in relation to duodenal ulcers, of a severity sufficient to justify surgical treatment, and to determine the influence, if any, of the blood group and secretor status on the outcome of surgical treatment and the incidence of side effects.

It was possible to determine blood groups and secretor status in 175 patients in whom the ten-year plus results had been assessed.

Three hundred and one patients attending a clinic in the hospital, and whose blood group and secretor distribution were known to conform to the distribution in the region, were used as controls.

The blood group and secretor status of 175 cases in the series is given below. Controls in brackets.

Blood Group	Total	Secretor	Non-secretor
A	62	41	21
B	9	3	6
AB	4	2	2
O	100(156)	70	30
Totals	175(301)	116(230)	59(71)

These figures show that there is a significant increase in the incidence of non-secretors in this series when compared with the control group ($X^2 = 7.90$. $p = 0.005$). In contrast to the findings of other workers, a significant increase in the number of group O subjects with duodenal ulcer is not established ($X^2 = 1.05$. $p = 0.3$). This latter finding is very interesting in that a significant increase in group O subjects is found if the national incidence of group O patients is used as the control group. The incidence of group O is very high in the North of England, and this fact stresses the importance of selecting a control series from the local incidence, rather than accept the national figures.

Severity of Ulcer

It is established above that the inability to secrete the A, B and H substances is associated with an increased liability to duodenal ulceration. Is the non-secretor state also associated with an increased severity of the ulcerative process? By separating the cases into those with no history of haemorrhage or perforation and those with a history of these serious complications, it is possible to evaluate this effect. Thus:

	No.	Group				Secretor	Non-secretor
		A	B	AB	O		
Cases with haem./perf.	75	25	6	3	41	44	31
Cases without haem./perf.	100	37	3	1	59	72	28
	175	62	9	4	100	116	59

Statistical analysis of these figures reveals $\chi^2 = 2.84$.

$p = 0.1$. This is an insignificant result and there is no evidence to suggest that the non-secretor state influences the severity of the ulcer.

Influence on the Results of Surgery

The outcome of operation in the patients in whom blood group and secretor status are available is as follows:

Result	No.	Group				Secretor	Non-secretor
		A	B	AB	O		
Excellent	119	44	6	3	66	76	43
Improved	30	11	-	-	19	22	8
Improved	16	5	3	1	7	11	5
Failed	10	2	-	-	8	7	3
	175	62	9	4	100	116	59

Taking the results in the secretor and non-secretor groups, $X^2 = 1.085$. This value is insignificant. The outcome of surgical treatment is independent of the secretor status.

Taking the results as far as group O secretor and non-secretor individuals are concerned, p is greater than 0.3. This is insignificant.

It seems, therefore, that the inability to secrete A, B and H substances in the gastrointestinal fluids need not be taken into account when considering bilateral vagotomy and gastrojejunostomy in patients with duodenal ulcer. The increased incidence of the non-secretor state in stomal ulceration as reported by Brown et al. (1956), Roberts (1957) and Doll et al. (1961) has not been confirmed in this series.

Influence on Incidence of Side Effects of Operation

The blood group and secretor status of patients with side effects is tabulated below under each side effect.

Appetite

	Group				Secretor	Non-secretor	
	A	B	AB	O			
Poor	9	3	1	29	28	14	42
Poor in a.m.	8	-	-	7	10	5	15
	17	3	1	36	38	19	57
%	27.4	33.3	25.0	36.0	32.7	32.2	

There is no significant difference between these groups.

Flatulence

	Group				Secretor	Non-secretor	
	A	B	AB	O			
Mild	26	4	3	38	46	25	71
Severe	8	-	1	13	16	6	22
	34	4	4	51	62	31	93
%	54.8	44.4	100	51.0	53.4	52.5	

There is no difference in the incidence of flatulence in these groups. The numbers in group AB are too small to permit analysis.

Bilious Vomiting

	Group				Secretor	Non-secretor	
	A	B	AB	O			
Mild	8	2	-	20	19	11	30
Severe	1	2	-	8	5	6	11
	9	4	-	28	24	17	41
%	14.5	44.4	-	28	20.6	28.8	

The results are similar in each group. In blood group B the numbers are too small to allow analysis.

Diarrhoea

	Group				Secretor	Non-Secretor	
	A	B	AB	O			
Mild	16	1	-	15	27	5	32
Severe	3	1	1	9	11	3	14
	19	2	1	24	38	8	46
%	30.6	22.2	25.0	24.0	32.7	13.5	

Although there is little difference in the incidence of diarrhoea in the various blood groups there is a striking difference between the incidence in secretors and that in non-secretors. ($\chi^2 = 6.482$. p is less than 0.02.)

This is an important finding as it shows for the first time that there is a group of individuals who are especially liable to develop diarrhoea following vagotomy and gastrojejunostomy.

The mechanism is obscure. One would have expected that the secretor state, if it had any effect, would be protective to the intestinal mucosa. In fact, it seems that the non-secretor state exerts the protective influence against diarrhoea. It may be that following vagotomy the intestinal mucosa is sensitized in some way to the presence of A, B and H substances in intestinal mucus.

Vasomotor Symptoms

	Group				Secretor	Non-secretor	
	A	B	AB	O			
Mild	6	3	-	13	15	7	22
Severe	1	-	-	2	2	1	3
	7	3	-	15	17	8	25
%	11.2	33.3	-	15.0	14.6	13.5	

There is no significant difference in these results.

Weight Loss

	Group				Secretor	Non-secretor	
	A	B	AB	O			
No. of patients	10	-	-	25	26	9	35
%	16.1	-	-	25.0	22.4	15.2	

Although there is an apparent difference in incidence in the secretor group when compared with the non-secretor group, $\chi^2 = 0.845$ and this value is of no significance statistically.

Post-operative Anaemia

	Group				Secretor	Non-secretor	
	A	B	AB	O			
No. of patients	16	-	-	10	18	8	26
%	25.8	-	-	10.0	15.5	13.5	

These differences are not significant.

With the exception of diarrhoea, the blood group and secretor status of patients have no effect on the incidence of post-operative side-effects.

OTHER FACTORS

OTHER FACTORSINFLUENCE OF AGE AT OPERATION ON RESULTS

The table below lists the age at operation and the post-operative result at 10+ years.

	15-19 yrs.	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Excellent	1	10	40	49	25	4	129
Good	-	6	12	9	5	-	32
Improved	-	4	3	8	1	-	16
Failed	-	1	3	13	1	-	18
	1	21	58	79	32	4	195

These results seem to indicate that the older the patient at operation the more likely the chance of "failure". Statistical evaluation, however, shows that age at operation and result are not related. $X^2 = 6.933$. p is greater than 0.1.

Postlethwait (1963) expresses the opinion that in his series, the older the patient the better the result.

McEvedy and Kirkland (1955) found statistical evidence, as in this series, that age does not affect the result.

INFLUENCE OF AGE AT OPERATION ON INCIDENCE OF SIDE EFFECTS

The number of patients with side effects in each age group at operation is tabulated below. Rather than subject each side effect to statistical analysis, the total number of side effects

in each age group is considered and analysed at the end of the chapter.

Appetite

	15-19 yrs.	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Poor	-	1	15	16	13	1	46
Poor in a.m.	-	6	6	6	1	-	19
	-	7	21	22	14	1	65
%	-	33.3	36.2	27.8	43.7	25.0	33.3

Flatulence

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Mild	12	25	32	9	-	78
Severe	2	7	8	6	1	24
	14	32	40	15	1	102
%	66.6	55.1	50.6	46.8	25.0	52.3

Bilious Vomiting

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Mild	1	14	15	4	1	35
Severe	1	4	5	2	-	12
	2	18	20	6	1	47
%	9.5	31.0	25.3	18.7	25.0	24.1

Diarrhoea

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Mild	9	6	14	7	-	36
Severe	2	3	9	2	-	16
	11	9	23	9	-	52
%	52.3	15.5	29.1	28.1	-	26.6

Vasomotor Symptoms

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
Mild	2	6	9	6	-	23
Severe	-	-	3	-	-	3
	2	6	12	6	-	26
%	9.5	10.3	15.1	18.7	-	13.3

Weight Loss

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
No. of patients	1	12	16	7	-	36
%	4.7	20.6	20.2	21.8	-	18.4

Anaemia

	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
No. of patients	4	4	14	5	1	28
%	19.0	6.9	17.7	15.6	25.0	14.3

The total number of patients with side effects in each age group at operation is as follows:-

	15-20 yrs.	20-30 yrs.	30-40 yrs.	40-50 yrs.	50-60 yrs.	60+ yrs.	
No. with side effects	-	11	18	30	7	-	66
Total in each group	1	21	58	79	32	4	195

It would appear from the above table that the younger the patient at operation the more likely is the development of side effects after operation $\chi^2 = 6.706$ p is greater than 0.05. This result is just on the borderline of significance.

INFLUENCE OF LENGTH OF HISTORY ON RESULTS

It is a widely held belief that a patient with a chronic duodenal ulcer should earn his operation. The hypothesis is that the longer he has symptoms the better will be the surgical result. This idea is considered in the following tables:

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Excellent	22	52	39	16	129
Good	11	14	5	2	32
Improved	6	7	2	1	16
Failed	5	9	2	2	18
	44	82	48	21	195

Statistically this result is significant. $\chi^2 = 8.823$.

p is less than 0.05. McEvedy and Kirkland (1955), on the other hand, found that the duration of the disease, in their series, did not affect the result.

The fact that there is statistical confirmation for the clinical impression that better results are found in those with a long history is very interesting. It may be that the patient who has had a peptic ulcer for many years has had time for the symptoms to become firmly implanted in his memory and, therefore, is more satisfied with the relief that operation brings. Alternatively,

the patient who has had an ulcer for a few years only, or who has had minimal symptoms, but operation was necessitated by the development of pyloric stenosis or haemorrhage, is perhaps more aware of the symptoms from the disturbed physiology following operation, and is less vividly conscious of his pre-operative existence.

Whatever the explanation, there is no doubt that in this instance clinical impressions are valid.

INFLUENCE OF LENGTH OF HISTORY ON SIDE EFFECTS

As in the previous chapter, the effect on each side effect is listed in the following tables. At the end of the chapter, an analysis is made of the effect of length of history on the incidence of side effects.

Appetite

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Poor	5	26	6	9	46
Poor in a.m.	6	10	2	1	19
	11	36	8	10	65
%	25.0	43.9	16.7	47.6	33.3

Flatulence

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Mild	27	28	16	7	78
Severe	3	17	2	2	24
	30	45	18	9	102
%	68.2	54.8	37.5	42.8	52.3

Bilious Vomiting

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Mild	8	19	5	3	35
Severe	5	2	4	1	12
	13	21	9	4	47
%	29.5	25.6	18.7	19.0	24.1

Diarrhoea

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Mild	12	13	8	3	36
Severe	4	8	2	2	16
	16	21	10	5	52
%	36.3	25.6	20.8	23.8	26.6

Vasomotor Symptoms

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
Mild	5	10	6	2	23
Severe	-	3	-	-	3
	5	13	6	2	26
%	11.3	25.8	12.5	9.5	13.3

Weight Loss

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
No. of patients	8	19	4	5	36
%	18.1	23.1	8.3	23.8	18.4

Anaemia

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
No. of patients	5	16	5	2	28
%	11.3	19.5	10.4	9.5	14.3

The total number of patients with side effects is tabulated below with the length of dyspeptic history:-

	0 - 5 yrs.	6 - 10 yrs.	11 - 20 yrs.	20+ yrs.	
No. with side effects	22	30	9	5	66
Total in each group	44	82	48	21	195

From the above table it would appear that the shorter the peptic ulcer history the more likely is the patient to experience post-operative side effects. Statistical analysis establishes $X^2 = 8.932$. p is less than 0.02. This result is significant.

It may be that the same explanations for the association of a short history of dyspepsia with a lower incidence of satisfactory results apply also to the higher incidence of side effects. The only other interpretation is that the presence of a duodenal ulcer for many years, in some way, lessens the disturbance to gastric physiology which results from vagotomy and gastro-jejunosomy. There is no evidence to support this hypothesis.

THE PLACE OF BILATERAL VAGOTOMY AND
GASTROJEJUNOSTOMY IN THE TREATMENT OF
CHRONIC DUODENAL ULCER

THE PLACE OF BILATERAL VAGOTOMY AND GASTROJEJUNOSTOMY
IN THE TREATMENT OF CHRONIC DUODENAL ULCER

The surgical treatment of chronic duodenal ulceration has passed through many phases. As each new operation was developed a wave of surgical enthusiasm followed with the widespread adoption of the new procedure. After a variable period of years the sequelae of operation became apparent and the zeal with which the procedure was received waned. Such was the fate of gastroenterostomy (Clark, 1951). In many ways it is unfortunate that the incidence of stomal ulceration was so high after this operation, as the good results were very satisfactory indeed and the surgical mortality almost nil. Every surgeon is familiar with the patient with an epigastric scar who claims that many years previously he had a by-pass operation "for his stomach" and has had no symptoms of any kind since.

Recognition of the late development of stomal ulceration following gastroenterostomy led to the increasing use of gastrectomy in the treatment of duodenal ulceration. This operation was almost universally accepted and, until the early nineteen forties, was the operation of choice.

Once again the same pattern emerged. Recurrent and stomal ulceration were uncommon after gastrectomy but after a few years it became generally accepted that the mortality of operation was higher than that of gastrojejunostomy and that undesirable side effects

followed operation. Some of these sequelae were obvious viz. loss of weight, anaemia, and vasomotor symptoms, but others such as the malabsorption syndromes only became discernible after the development of the radio-isotope techniques for studying gastrointestinal absorption and only after very many years had passed for the clinical picture to declare itself. There is an ever increasing bibliography of the vasomotor and metabolic disturbances following gastrectomy but the reports of Goligher and Riley (1952), Zollinger and Ellison (1954), and more recently Clark and Logie (1962) are of special merit.

Dissatisfaction with the results of gastrectomy, as far as the consequences were concerned, was one of the factors which led to vagotomy making its appearance as a weapon in the surgical attack on the problem of curing duodenal ulceration. At the same time, it was hoped to avoid the undesirable after effects of gastrectomy because no resection of gastric tissue was involved. Another factor was the increasing knowledge of the role of the vagus in gastric secretion. It was thought that section of the vagi would stop the nervous phase of gastric secretion. The surgical world owes a great deal to Dragstedt for pioneering vagotomy in the early nineteen forties. Initially vagotomy lived up to expectations. The nervous phase of gastric secretion was abolished and the duodenal ulcer healed. Once more an unexpected

after effect was observed. Gastric stasis developed in a large percentage of cases (Illingworth and Kay, 1947) and re-operation was necessary. After a few years gastric drainage operations became routine in the treatment of duodenal ulcer by vagotomy.

Because of the many previous disappointments in gastric surgery, surgeons all over the world were reluctant to adopt vagotomy and gastrojejunostomy. The lesson of conservatism in trying new surgical procedures for the treatment of duodenal ulceration had been well learnt. The early workers in this field in the United States began performing bilateral vagotomy and gastrojejunostomy in late 1944 and in this country in 1947. The operation was not widely practised here or in America until the middle nineteen fifties. Because of this very few long-term results, in substantial numbers of patients, were available. In addition the conservative approach to new operations as explained above led many surgeons to use the operation in selected cases only until the long-term results were known. As stated in the introduction, it was this widespread doubt and lack of information on the late results which supplied the stimulus to the author to analyse Mr. G. Y. Feggetter's results and to attempt to answer some of the questions posed in Chapter I of this thesis.

THE RESULTS OF THE OPERATION

Bilateral vagotomy and gastrojejunostomy is a safe operation. In all the series reviewed by the author in this thesis the mortality

for the operation is much lower than that for gastrectomy. For example, Mr. G.Y. Feggetter whose patients make up the present series, has performed bilateral vagotomy and gastrojejunostomy in 1,600 cases with 6 deaths, a mortality of 0.37 per cent. It is unlikely that an operation with a lower mortality than this will be found for chronic duodenal ulcer. The risk to life approaches that of laparotomy per se. In the author's opinion, this low mortality is a potent argument in favour of vagotomy and gastrojejunostomy. Assuming that the mortality for elective gastrectomy is as low as 2 per cent. for the country as a whole, and this is probably a conservative estimate, then for every 1,000 patients one would expect 4 deaths from bilateral vagotomy and gastrojejunostomy but 20 deaths from gastrectomy. Considering the many thousands of patients per annum who have elective surgery for duodenal ulceration many lives would be saved if the standard operation were vagotomy and gastrojejunostomy. There was a case at one time for advising a radical operation such as gastrectomy for the cure of a duodenal ulcer on the grounds that anything less was liable to result in stomal ulceration with the highly fatal complication of gastro-jejuno-colic fistula. This view is no longer valid since a better understanding of fluid and electrolyte disturbances, antibiotic therapy, and improved anaesthetic techniques has made operation for this dreaded complication relatively safe. In this series 12 patients had a gastrectomy for failed vagotomy and

gastrojejunostomy without a death.

The problem of delayed gastric emptying post-operatively is worth special mention. Usually after vagotomy and gastrojejunostomy oral feeding can begin after 48 hours. In a few cases delayed gastric emptying occurs and unless the medical staff exercise great care and examine these patients daily enormous gastric dilatation occurs with its associated electrolyte disturbance. The condition seems to be more common in patients operated on for pyloric stenosis. The author is of the opinion that, in a case of pyloric stenosis coming to vagotomy and gastrojejunostomy, it is better to use a fine polythene gastrostomy tube for gastric aspiration, and so save the patient 7 to 10 days' misery with a nasogastric tube in position, until gastric emptying begins.

The results of the operation are very satisfactory. There was a deliberate attempt on the author's part throughout the assessment of this series to be, if anything, hypercritical in order to assess the true value of the operation. It is stressed that if symptoms, however slight, were elicited, then these were given their due place in the compilation of results. In any case symptoms are relative. Many patients at interview considered themselves 'excellent' results although classified by the author as 'good'. In recalling their life before operation they seemed willing to accept the price of a few residual symptoms.

One of the most satisfactory features of the series is the work record of patients following operation. Some patients regarded this as being of prime importance in that it led to a restoration of their self respect because they could work gainfully, regularly, and increase their financial security. Surprisingly many patients stated that for them one of the most pleasing results of the operation was an increased self-confidence. Prior to operation they had regarded themselves as neurotic and unstable and the realization that the disease had a curable organic basis came as a considerable relief.

Side Effects

There is a price to pay for the surgical cure of chronic duodenal ulcer by bilateral vagotomy and gastrojejunostomy. Side effects such as loss of appetite, flatulence and vasomotor symptoms are frequent but in general terms mild and insignificant. There is a high incidence of diarrhoea and bilious vomiting following operation - see appropriate chapter.

This series shows that severe diarrhoea is not as great a problem as claimed by other workers in this field but nevertheless it remains a problem. Burge (1958) deserves credit for his approach to this particular side effect but in reviewing the cases of diarrhoea in this series, the author's impression is that diarrhoea is independent of the extent of vagotomy. The patients with severe diarrhoea, almost without exception, experience an 'aura' of feeling

vaguely unwell for anything up to 24 hours before the diarrhoea begins. This, in addition to the fact that periods of remission occur, suggests that the diarrhoea is possibly infective in origin, but there is no proof of this.

Although the incidence of bilious vomiting is high in this series severe biliary regurgitation is fortunately uncommon. It may be that pyloroplasty combined with vagotomy may lead to a lowering of the incidence of this complication. The author has adopted this operation since the incidence of bilious vomiting in this series became apparent, but it will be many years before it can be established that the overall results of vagotomy and pyloroplasty are as good as those of vagotomy and gastrojejunostomy.

One of the reasons for advising gastrojejunostomy and vagotomy rather than gastrectomy is that gastrectomy carries a risk of relighting old pulmonary tuberculosis. This series shows that pulmonary tuberculosis occurs with much the same frequency after vagotomy and gastrojejunostomy.

THE SEVERITY OF DUODENAL ULCERATION

One of the major questions posed in the Introductory Chapter was whether vagotomy and gastrojejunostomy could be used in the patient with a severe duodenal ulcer which had given rise to such serious complications as haemorrhage and perforation. Many surgeons are concerned about this issue. Crile (1952) states

"The safety of vagotomy with gastroenterostomy, the absence of side effects when the gastroenterostomy is constructed properly, and the fact that failures are still correctible by gastric resection commends vagotomy with gastroenterostomy as the standard treatment for complicated duodenal ulcer." Alternatively Edwards et al (1960) hold the view that vagotomy and gastroenterostomy "should be used in lieu of resection in certain instances which include the geriatric patient, the poorly nourished chronically underweight patient, especially women; and the patient who presents technical problems which are too dangerous for resection." This thesis has shown that there is absolutely no reason to assume that the results of operation are worse in patients who have severe forms of duodenal ulceration. Statistically the results in patients who are operated on because of "Failed Medical Treatment" and in patients with a history of haemorrhage, perforation and pyloric stenosis are indistinguishable. In fact the patients with multiple indications for operation have results as good as any other group. McCullough (1959) in a much smaller group of patients also found that the severity of the ulcer did not affect the result.

Bruce et al (1959) advocate selective surgery in the treatment of chronic duodenal ulceration. They suggest that the operation should be "tailored" to the size of the patient's parietal cell mass. The procedures they recommend are:

1. The resection of the entire or greater part of the parietal

cell mass - extensive or total gastrectomy.

2. A combination of vagotomy and standard two-thirds gastrectomy.

3. A combination of vagotomy and "conservative" surgery.

There is no doubt that the ultimate aim in duodenal ulcer surgery is to find a reliable method of selecting the correct operation for each individual patient and the above work by Bruce and others is a step in the right direction. Nevertheless the author feels that this thesis shows the above measures are too radical and are unnecessary in view of the low incidence of recurrent and stomal ulceration after gastrojejunostomy and vagotomy. Bruce et al in their article state however that "a combination of vagotomy with a drainage procedure, pyloroplasty or gastroenterostomy may yet be shown to provide long-term follow-up results comparable with those obtained by standard gastrectomy in those selected duodenal ulcer patients who do not have a very high acid output." It seems, therefore, that the availability of long-term results such as the present series may cause a modification of the views expressed above.

Another approach to the problem of the severe type of duodenal ulcer being a bar to treatment by vagotomy and gastrojejunostomy is the adoption, especially in the United States, of vagotomy and antrectomy. There is no doubt that excellent results are possible with this operation and the operation is based on the increasing

awareness of the part that the antrum plays in acid secretion. The author's view is that the operation has one major drawback in that it carries with it the disadvantages both of vagotomy and of gastrectomy. The patient is liable to the side effects of vagotomy and at the same time the operative mortality approaches that of gastrectomy.

This thesis has also shown that the severity of the ulcer bears no relation to the incidence of side effects after operation.

THE BLOOD GROUPS AND SECRETOR STATUS

The blood groups and secretor status seem important in the aetiology of duodenal ulceration. The exact mechanism of action is unknown. The strong association between blood group O and duodenal ulceration is not confirmed in the present series and the significance of this is discussed in the appropriate chapter. There is strong statistical evidence to support the association of duodenal ulceration with the non-secretor state in this series.

The ability to secrete the complex blood group mucopolysaccharides in the body fluids apparently confers some degree of protection to the duodenal mucosa from ulceration. It is possible that the duodenal mucus containing these blood group substances is much more resistant to the effects of gastric juice than the mucus secreted by the non-secretor of the blood group polysaccharides.

Alternatively the gastric juice in the secretor because it contains the blood group mucopolysaccharides may have subtle differences in action, as yet undetected, from gastric juice secreted by the non-secretor.

Whatever the explanation, it is tempting to assume that since the non-secretor state predisposes to duodenal ulceration then the duodenal ulcer which develops is of the severe variety. This thesis has shown that this is not so. Moreover, there is no difference in the result of operation between the secretor and the non-secretor. The blood group and secretor state have no effect therefore on the outcome of bilateral vagotomy and gastrojejunostomy.

The incidence of side effects is not under the influence of group or secretor state with the exception of diarrhoea. This makes the finding that there is a significant increase in the incidence of diarrhoea in secretors all the more interesting. The reason for this is obscure but the discovery is of importance in that, for the first time, something has emerged in the investigation of post-vagotomy diarrhoea which points to a group of individuals as being those particularly affected.

THE AGE AT OPERATION

The long-term results of this operation show that there is no statistical evidence in support of the view that the older the

patient the better the result of the operation. The younger the patient at operation, the more likely he is to experience side effects post-operatively. No explanation can be offered for this observation other than to suggest that the young patient is more sensitive to physiological disturbances than the older individual.

LENGTH OF DYSPEPTIC HISTORY

There is statistical evidence in this series which supports the observation that better results are obtained in patients with a long history of duodenal ulcer dyspepsia. The explanation is possibly that the patient who has had an ulcer for many years is vividly aware of the duodenal ulcer "life" and is more readily satisfied with the relief that operation brings.

There is also statistical confirmation of the impression that the shorter the history the more likely is the patient to suffer side effects post-operatively. It may be that the same reasons as put forward for the association of short history with fewer "excellent" results holds good for side effects as well. On the other hand the presence of a chronic duodenal ulcer for many years may, because of the associated chronic gastritis, render the stomach less susceptible to the physiological disturbances following gastrojejunostomy and vagotomy.

Having taken into account all the factors mentioned and discussed in this and previous chapters, the author's contention is that a strong

case has been established for the adoption of bilateral vagotomy and gastrojejunostomy as the operation of choice for all grades of severity of duodenal ulceration, in the first instance. The long-term results, the side effects and their incidence are known and seem satisfactory, with the possible exceptions of bilious vomiting and diarrhoea. Stomal or recurrent ulceration will occur in approximately 5 per cent. of cases. For these failures, gastrectomy is the operation of choice but where the vagotomy is known to be satisfactory, there may be a place for antrectomy. By adopting this sequence of treatment many patients will be saved the consequences of gastrectomy. The overall mortality for the surgical treatment of duodenal ulceration will fall, if the more conservative operation is used routinely, and over the years a not inconsiderable number of patients will owe their lives to this fact alone.

Perhaps the advent of pyloroplasty rather than gastrojejunostomy will lower the incidence of bilious vomiting but several years have yet to pass before the long-term results of this operation are known.

The other disadvantage of vagotomy and gastrojejunostomy is diarrhoea but in this thesis the author has shown that a group exists (secretors) which is particularly susceptible. Further research is needed in this direction in order to determine whether the diarrhoea can be prevented or no.

SUMMARY

SUMMARY

The results in a consecutive series of 248 patients with bilateral vagotomy and gastrojejunostomy for chronic duodenal ulcer after a minimum follow-up period of ten years are presented.

1. Results are assessed as 'excellent' in 66.1 per cent., 'good' in 16.4 per cent., 'improved' in 8.2 per cent., and 'failed' in 9.3 per cent.
2. Stomal ulceration is found in 3.6 per cent. and recurrent ulceration in a further 1.5 per cent.
3. The side effects of the operation are: poor appetite, flatulence, bilious vomiting, diarrhoea, vasomotor symptoms, weight loss, anaemia and pulmonary tuberculosis. With the exception of bilious vomiting and diarrhoea, the incidence of these side effects is low. Although the incidence of bilious vomiting and diarrhoea is high, most cases are mild and are not troublesome to the patient.
4. The severity of the duodenal ulcer does not affect the result of the operation or the incidence of side effects.
5. The non-secreter state predisposes to duodenal ulceration. The association of blood group O with duodenal ulceration, noted by other workers, is not confirmed in this series.

6. The blood group and secretor status do not affect the severity of the ulcer or the outcome of treatment.
7. The blood group and secretor status do not influence the incidence of side effects with the exception of diarrhoea. Diarrhoea occurs with greater frequency in secretors when compared with non-secretors.
8. The age at operation does not affect the result of the operation.
9. The younger the patient, the more likely he is to develop side effects.
10. The longer the history of duodenal ulceration, the better the result of operation.
11. The shorter the history, the more likely is the patient to develop post-operative side effects.

The author concludes that bilateral vagotomy and gastrojejunostomy is the operation of choice in patients with chronic duodenal ulcer and should be adopted as the routine surgical procedure in the first instance.

COMPLETED TABLES

Results according to Indication for Operation

Indication for Operation	Total in Group	Result				Appetite		Flatulence		Bilious Vomiting		Diarrhoea				Vaso-motor Symptoms		Weight		Anaemia			
		Excellent	Good	Improved	Failed	Poor	Poor in a.m.	Mild	Severe	Mild	Severe	Mild	Severe	Intermittent	Continuous	Severe	Mild	Severe	Loss	Gain	70% Hb.	70%+ Hb.	80%+ Hb.
Failed Medical Treatment	75	55	7	7	6	16	8	33	7	11	3	17	2	6	13	6	1	17	15	3	2	3	6
Haemorrhage	21	9	7	1	4	2	4	7	5	6	1	3	4	2	5	2	-	2	3	-	2	3	3
Perforation	17	10	3	3	1	5	3	6	3	3	2	4	3	3	4	1	-	4	-	-	1	1	1
Pyloric Stenosis	41	28	6	2	5	8	1	14	4	9	3	6	1	5	2	5	-	8	7	3	1	2	2
Haemorrhage & Perforation	11	7	2	1	1	6	3	4	3	3	1	1	3	2	2	-	2	1	2	-	1	1	1
Haemorrhage & Stenosis	16	9	5	2	-	6	-	10	1	2	2	3	2	3	2	6	-	4	1	1	-	1	1
Perforation & Stenosis	7	6	1	-	-	1	-	2	1	1	-	-	1	-	1	-	-	-	3	-	-	-	-
Haemorrhage, Perforation & Stenosis	7	5	1	-	1	2	-	2	-	-	-	2	-	1	1	3	-	-	1	-	-	-	-
Totals	195	129	32	16	18	46	19	78	24	35	12	36	16	22	30	23	3	36	32	7	7	14	14

Results According to Blood Group and Secretor Distribution

		A Secretor	A Non-Secretor	B Secretor	B Non-Secretor	AB Secretor	AB Non-Secretor	O Secretor	O Non-Secretor	Total Secretor	Total Non-Secretor	
Age of patient at operation	15-19 yrs.	-	-	-	-	-	-	1	-	1	-	1
	20-30 yrs.	6	-	1	-	1	-	8	2	16	2	18
	30-40 yrs.	9	10	-	3	-	1	21	10	30	24	54
	40-50 yrs.	17	8	2	2	1	-	27	11	47	21	68
	50-60 yrs.	8	3	-	1	-	1	12	6	20	11	31
	60+ yrs.	1	-	-	-	-	-	1	1	2	1	3
		41	21	3	6	2	2	70	30	100	59	175
Length of symptoms	0-5 yrs.	11	6	1	1	1	1	13	7	26	15	41
	5-10 yrs.	17	5	1	3	-	-	33	15	51	23	74
	10-20 yrs.	7	9	1	2	1	1	17	4	26	16	42
	20+ yrs.	6	1	-	-	-	-	7	4	13	5	18
		41	21	3	6	2	2	70	30	100	59	175
Results of operation	Excellent	29	15	2	4	1	2	44	22	76	43	119
	Good	7	4	-	-	-	-	15	4	22	8	30
	Improved	4	1	1	2	1	-	5	2	11	5	16
	Failed	1	1	-	-	-	-	6	2	7	3	10
		41	21	3	6	2	2	70	30	100	59	175
Appetite	Poor	7	2	-	3	1	-	20	9	28	14	42
	Poor in a.m.	5	3	-	-	-	-	5	2	10	5	15
		12	5	-	3	1	-	25	11	38	19	57
Flatulence	Mild	14	12	3	1	2	1	27	11	46	25	71
	Severe	7	1	-	-	-	1	9	4	16	6	22
		21	13	3	1	2	2	36	15	62	31	93

(Continued)

Results According to Blood Group and Secreter Distribution (Continued)

		A Secreter	A Non-Secreter	B Secreter	B Non-Secreter	AB Secreter	AB Non-Secreter	O Secreter	O Non-Secreter	Total Secreter	Total Non-Secreter	
Bilious Vomiting	Mild	5	3	-	2	-	-	14	6	19	11	30
	Severe	1	-	-	2	-	-	4	4	5	6	11
		6	3	-	4	-	-	18	10	24	17	41
Diarrhoea	Mild	12	4	1	-	-	-	14	1	27	5	32
	Severe	3	-	-	1	1	-	7	2	11	3	14
	Continuous	5	3	-	-	-	-	9	-	14	3	17
	Intermittent	10	1	1	-	1	-	12	3	24	5	29
		15	4	1	1	1	-	21	3	38	8	46
Vasomotor symptoms	Mild	3	3	1	2	-	-	11	2	15	7	22
	Severe	-	1	-	-	-	-	2	-	2	1	3
		3	4	1	2	-	-	13	2	17	8	25
Weight	Loss	7	3	-	-	-	-	19	6	26	9	35
	Gain	6	3	1	2	-	-	10	1	17	6	23
Anaemia	70% Hb.	3	2	-	-	-	-	1	1	4	3	7
	70%+ Hb.	2	-	-	-	-	-	2	2	4	2	6
	80+% Hb.	8	1	-	-	-	-	2	2	10	3	13
		13	3	-	-	-	-	5	5	18	8	26
Total in Each Group		41	21	3	6	2	2	70	30	100	59	175

Results According to Age at Operation

		15-19 years	20-30 years	30-40 years	40-50 years	50-60 years	60+ years	Totals
Result of Operation	Excellent	1	10	40	49	25	4	129
	Good	-	6	12	9	5	-	32
	Improved	-	4	3	8	1	-	16
	Failure	-	1	3	13	1	-	18
		1	21	58	79	32	4	195
Appetite	Poor	-	1	15	16	13	1	46
	Poor in a.m.	-	6	6	6	1	-	19
		-	7	21	22	14	1	65
Flatulence	Mild	-	12	25	32	9	-	78
	Severe	-	2	7	8	6	1	24
		-	14	32	40	15	1	102
Bilious Vomiting	Mild	-	1	14	15	4	1	35
	Severe	-	1	4	5	2	-	12
		-	2	18	20	6	1	47
Diarrhoea	Mild	-	9	6	14	7	-	36
	Severe	-	2	3	9	2	-	16
	Continuous	-	4	4	9	5	-	22
	Intermittent	-	7	5	14	4	-	30
		-	11	9	23	9	-	52
Vasomotor Symptoms	Mild	-	2	6	9	6	-	23
	Severe	-	-	-	3	-	-	3
		-	2	6	12	6	-	26
Weight	Loss	-	1	12	16	7	-	36
	Gain	-	7	8	14	2	1	32

(Continued)

Results According to Age at Operation (Continued)

	15-19 years	20-30 years	30-40 years	40-50 years	50-60 years	60+ years	Totals
Anaemia 70% Hb	-	1	-	3	3	-	7
70%+ Hb	-	2	1	3	1	-	7
80%+ Hb	-	1	3	8	1	1	14
	-	4	4	14	5	1	28
Total No. with After Effects	-	11	18	30	7	-	66
Total No. in Each Group	1	21	58	79	32	4	195

Results According to Length of Dyspeptic History

		0-5 years	5-10 years	10-20 years	20+ years	Totals
Result of Operation	Excellent	22	52	39	16	129
	Good	11	14	5	2	32
	Improved	6	7	2	1	16
	Failed	5	9	2	2	18
		44	82	48	21	195
Appetite	Poor	5	26	6	9	46
	Poor in a.m.	6	10	2	1	19
		11	36	8	10	65
Flatulence	Mild	27	28	16	7	78
	Severe	3	17	2	2	24
		30	45	18	9	102
Bilious Vomiting	Mild	8	19	5	3	35
	Severe	5	2	4	1	12
		13	21	9	4	47
Diarrhoea	Mild	12	13	8	3	36
	Severe	4	8	2	2	16
	Continuous	10	5	7	-	22
	Intermittent	6	16	3	5	30
		16	21	10	5	52
Vasomotor Symptoms	Mild	5	10	6	2	23
	Severe	-	3	-	-	3
		5	13	6	2	26
Weight	Loss	8	19	4	5	36
	Gain	10	10	11	1	22

(Continued)

Results According to Length of Dyspeptic History (Continued)

	0-5 years	5-10 years	10-20 years	20+ years	Totals
Anaemia					
70% Hb	2	3	1	1	7
70%+ Hb	2	3	2	-	7
80%+ Hb	1	10	2	1	14
	5	16	5	2	28
Total No. with After Effects	22	30	9	5	66
Total No. in each Age Group	44	82	48	21	195

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