THE SURGICAL TREATMENT OF DUODENAL ULCER

Declaration

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DECLARATION

I hereby declare that the contents of this thesis have been composed by myself. I was given assistance by those mentioned under acknowledgements.

I.M.C. Macintyre

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I am grateful to Rob Elton for running the life table analyses on patients who had closure of perforated peptic ulcer and highly selective vagotomy and to Jag Varma for running the Chi square tests.

Plate 1 is reproduced by courtesy of the Curator of the Museum of The Royal College of Surgeons of Edinburgh.

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UNIVERSITY OF EDINBURGH

ABSTRACT OF THESIS (Regulation 3.5.10)

This thesis has outlined the development of operations for duodenal ulcer from gastro-enterostomy which sought initially to merely bypass the ulcer, to an increasing physiological approach which progressively sought to reduce gastric secretion whilst minimising operative sequelae. The published results for gastro-enterostomy alone, Polya gastrectomy, truncal vagotomy with gastro-enterostomy and with pyloroplasty and finally for highly selective vagotomy have been critically reviewed. Dissatisfaction with operative mortality and recurrent ulcer as the sole criteria of success led to the development of methods to assess quality of life. The application of computer technology has permitted analysis of quality of life over some 20 years after five principal operations for duodenal ulcer at the Western General Hospital, Edinburgh. Paradoxically partial gastrectomy was associated with a superior quality of life than the more commonly used procedures involving truncal vagotomy. Highly selective vagotomy has been shown to be a safe and effective operation for duodenal ulcer which modifies the diathesis so that recurrent ulcer is more amenable to medical therapy. The incidence of duodenal ulcer has been shown to be in continuing decline. The treatment of perforated duodenal ulcer by simple closure and H2 receptor antagonists has been shown to have superseded immediate definitive operation for perforated ulcer. Surgical treatment of duodenal ulcer has been shown to be associated with an increased long term mortality predominantly through increased respiratory and circulatory deaths in the first post-operative year. A long term increase in death from malignant disease particularly of bronchus has also been demonstrated.

INTRODUCTION

THE DEVELOPMENT OF SURGICAL TREATMENT FOR DUODENAL ULCER

Although there are records in Greek, Roman and Medieval manuscripts of symptoms which can be interpreted with hindsight as descriptions of duodenal ulcer, the first clear record of the symptoms and pathology was by Sir Benjamin Travers in 1817 (Travers 1817). In 1830 Dr. John Abercrombie, an Edinburgh physician described in great detail 7 cases of duodenal ulcer (Abercrombie 1830). The cases include the first accounts of the clinical features of duodenal ulcer, including the relationship to meals and localisation of pain in the epigastrium. Abercrombie also described post mortem findings after fatal haemorrhage, but noted that the "quantity of blood brought up is often immense - and yet the disease is often not fatal". He also recognised perforation describing a specimen in the museum of The Royal College of Surgeons of Edinburgh in which a perforated duodenal ulcer was clearly demonstrated. That specimen remains on display in the College museum today and is shown in Plate 1.

Plate 1

Specimen of perforated duodenal ulcer in Museum of RCSEd. described by Abercrombie (1830). (Photograph courtesy of the conservator of the museum RCSEd.)

Abercrombie's was the first clear description of the symptoms of duodenal ulcer disease and is worth quoting. He wrote "The leading peculiarity of disease of the duodenum seems to be that the food is taken with relish and the first stage of digestion is not impaired; but the pain begins about the time when the food is passing out of the stomach or about two to four hours after a meal". This was the first occasion in which the possibility of making the diagnosis in life had been suggested. Abercrombie's contribution was followed by similar reports from Treir in Copenhagen, and Krause in Berlin.

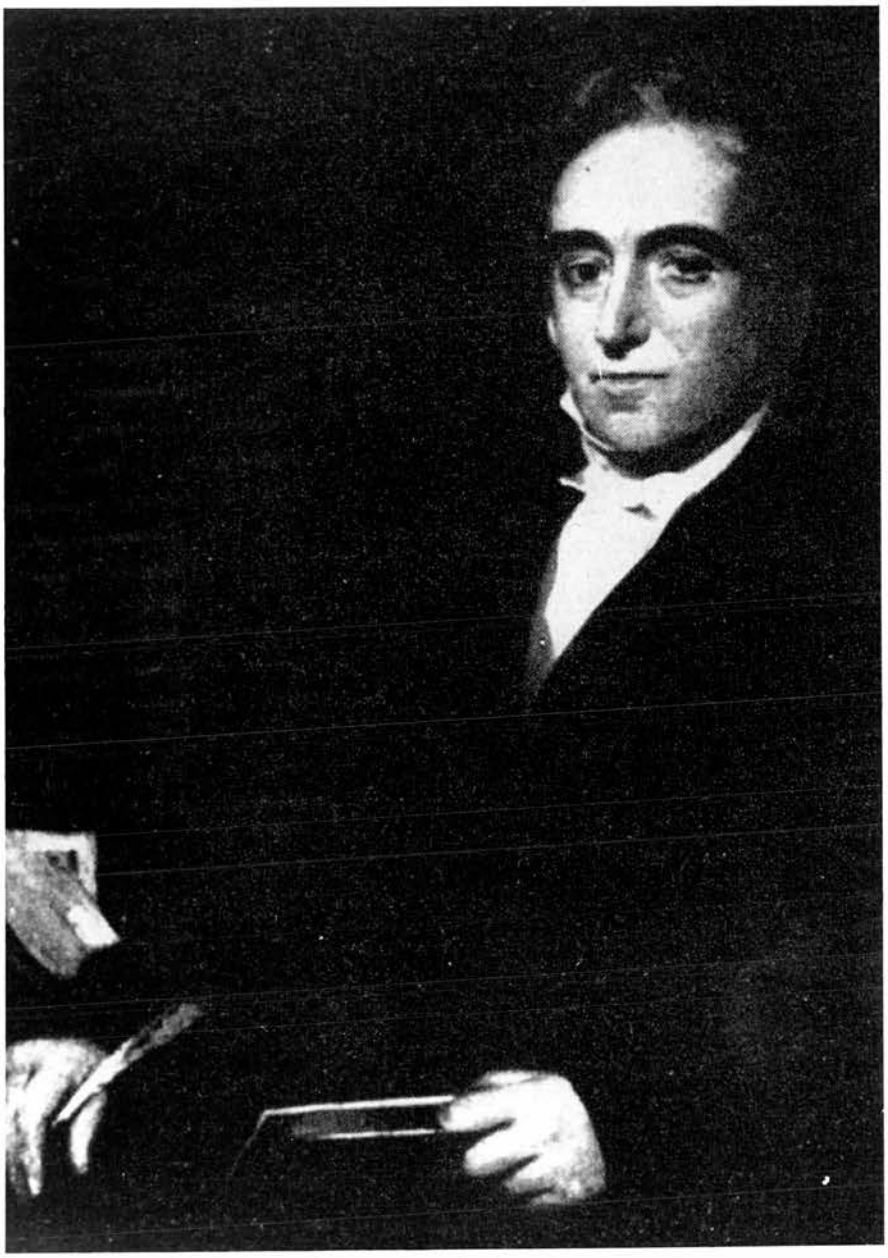


Plate 2

Dr. John Abercrombie

In 1867 Clark at the London Hospital described the clinical features of perforated duodenal ulcer thus introducing the condition as a possible cause of peritonitis (Clark 1867). Mackenzie in 1888 wrote that "duodenal ulcer, although much rarer than gastric ulcer is not so very uncommon as the textbooks would imply" (Mackenzie 1888). The turn of the century saw a dramatic rise in duodenal ulcer and fall in gastric ulcer.

The earliest recommendations about treatment were those of Abercrombie (1828) who recommended milk, a view endorsed by Cruveilhier (1842). Brinton (1856) and Fox (1875) recommended the use of regular meals and antacids. Sippy (1915) advocated regular bland meals and milk in an effort to ensure thorough and continuous neutralisation of acid.

The growing body of knowledge about the clinical features increasingly allowed surgeons to diagnose duodenal ulcer with sufficient confidence to operate. The contributions of Mayo-Robson (1900) and of Moynihan (1900) in describing the clinical features, and operative treatment were immense.

The history and development and published results of the surgical treatment of duodenal ulcer are described in the initial chapters of this thesis. The results obtained at the Western General Hospital, Edinburgh, in terms of curing the symptoms of duodenal ulcer disease, and immediate and long term side effects and complications created by the treatment are considered in later chapters.

FOREWORD

DUODENAL ULCER - A DISEASE OF THE 20TH CENTURY ?

The surgery of duodenal ulcer disease may well be seen by future medical historians as a phenomenon of the 20th century. Although a clear description of the clinical features had been given as early as 1830, the condition was rarely diagnosed in life before the end of the century.

The early gastric operations - gastric resection and gastro-enterostomy - devised for the treatment of gastric cancer, were first performed successfully in 1881, by Billroth and his assistant Wolfler. During the following decade these operations were applied to duodenal ulcer. Before the turn of the century the operation was usually performed for vomiting when a preoperative diagnosis of gastric cancer had been made. It was natural that the inflammatory mass discovered on such occasions should be treated by bypass in the form of gastro-enterostomy.

As the new century began gastro-enterostomy became the accepted procedure as duodenal ulcer was diagnosed clinically with increasing confidence. In the first decade of the 20th century the advocacy of gastro-enterostomy by Moynihan and Mayo helped ensure the predominance of this procedure in the treatment of duodenal ulcer until the time of the First World War.

The problem of stomal ulceration had been described soon after the introduction of the procedure, yet it was not until the 1920's that this was shown to be a common problem. In the post-war decade an increasing number of surgeons notably Polya in Hungary, von Heberer in Germany and Lewisohn in the United States began to recommend gastric resection for the treatment of chronic duodenal ulcer. In the 1930's in continental Europe and the U.S.A. and in the 1940's in Britain, gastrectomy gradually superseded gastro-enterostomy as the preferred operation.

The incidence and prevalence of duodenal ulcer had continued to rise until

the mid 1950's in both the U.S.A. and the U.K. By the middle of the 20th century, it had reached virtual epidemic proportions affecting some 10% of the population of the U.K. at some time in their lives. Research into its aetiology and treatment came to dominate surgical departments throughout the Western World in the 1940's and 1950's.

As understanding of the physiological control of gastric secretion increased so operations based on decreasing vagally and antrally mediated acid output were introduced. Dragstedt reported truncal vagotomy in man for the first time in 1943, and, combined with antrectomy in the U.S.A. and with a drainage procedure in the U.K., this gained in popularity throughout the 1950's and 1960's.

Thereafter the incidence and prevalence began to decline and that decline continues. Paradoxically the onset of this decline coincided with the widespread introduction of more physiological surgical operations with fewer side effects. The emergence of the long term sequelae of gastric resection had added impetus to the search for safer procedures. Truncal vagotomy and drainage became the favoured surgical procedure for duodenal ulcer in the 1960's in the U.K. and most of Europe. The problems of gastric incontinence, resulting from the drainage procedure, and of parasympathetic denervation of the entire gastro-intestinal tract from truncal vagotomy, pushed research in the direction of less radical more physiological techniques to reduce gastric acid output. The development of selective vagotomy by Griffith and Harkins in the late 1950's led in turn to the description of highly selective vagotomy by Johnston and Amdrup in the late 1960's. This was widely practised, particularly in European centres, throughout the 1970's and 1980's.

It was ironic that as surgical treatment became safer and more effective so the incidence of the disease began to decline from about the middle of the 20th century. There followed a decline in ulcer operations which was precipitated when effective medical treatment became available for the first time at the start of the last quarter of the century.

As we enter the last decade of the century the flood of ulcer operations of fifty years ago has slowed to a trickle. Indeed elective surgical operations have all but disappeared throughout the developed world. Non-operative techniques are increasingly displacing emergency operations for bleeding and to a limited extent for perforation.

At the time of writing surgery for duodenal ulcer is almost exactly 100 years old. It seems a particularly appropriate time therefore to assess the contribution of surgery to the management of duodenal ulcer.

This thesis aims to trace the development of the various operations which have been used to treat this disease and to assess their strengths and weaknesses.

The work on which the thesis is based was done in the Western General Hospital, Edinburgh. The Gastro-Intestinal Unit was established at the start of the National Health Service aimed to investigate and treat patients with gastro-intestinal disease using a combined medical and surgical approach (Card and Bruce 1958).

Duodenal ulcer was the problem which dominated gastro-intestinal practice at that time. Card in 1952 had been the first to demonstrate the phenomenon of maximal acid output from the parietal cell mass in response to histamine (Card 1952), work acknowledged by Kay in his seminal paper the following year (Kay 1953). Subsequently Card and Marks demonstrated a linear relationship between the maximal acid output from the stomach and

the number of parietal cells in duodenal ulcer patients. The demonstration that patients with duodenal ulcer had a spectrum of maximal acid output led to the hypothesis that logically operation for the ulcer should be determined by the level of acid output - the more radical procedures being indicated for high acid secretors, ranging through vagotomy for medium secretors to gastro-enterostomy alone for low secretors.

Until that time the choice of operation had been largely an arbitrary one. In order to assess the results of this treatment policy and to assess the long term outcome after operations for duodenal ulcer, the Gastric Follow-Up Clinic was established by W. P. Small in 1959. Details of these patients, their operations and the outcome of those operations were meticulously recorded over some 30 years so that by 1985 over 4500 patients had been documented.

The aim of the thesis is to establish the part played by surgery in the treatment of duodenal ulcer by analysing the results of the various operations used in its treatment. The results of the principal operations in terms of relief of symptoms, side effects, quality of life and cause of death are critically assessed.

PART I

HISTORICAL REVIEW OF THE OPERATIONS USED TO TREAT DUODENAL ULCER

CHAPTER 1

BILLROTH I GASTRECTOMY

In many respects it is surprising that gastric resection represented the first surgical attempt to treat duodenal ulcer, preceding the less demanding procedures of gastro-enterostomy or vagotomy. Gastrectomy was introduced for the treatment of obstructing antral or pyloric tumours and it was a logical step for this then to be applied to obstructing duodenal ulcer disease.

The first published account of gastric resection was that of Christian Michaelis, Professor of Surgery at Marburg University 1786-1814. Aware of the problem of gastric outlet obstruction he attempted unsuccessfully to resect the pylorus in experimental animals. However, in 1810 his pupil Daniel Merrem was able to perform the successful resection of the distal stomach with restorative anastomosis to the duodenum in three animals (Merrem 1810).

Temkin's translation of the original work indicates that the resection was a very limited one with only 0.6 cm. of tissue being excised from either side of the pyloric sphincter (Temkin 1957). It was nonetheless an important advance which Billroth referred to and drew inspiration from 70 years later. The first gastric resection in man was performed by Jules Pean, a Parisien surgeon who had carried out the first successful splenectomy in 1867. In April 1879 Pean performed what amounted to a pylorectomy for a carcinoma at the pylorus but the patient survived for only 5 days (Pean 1879).

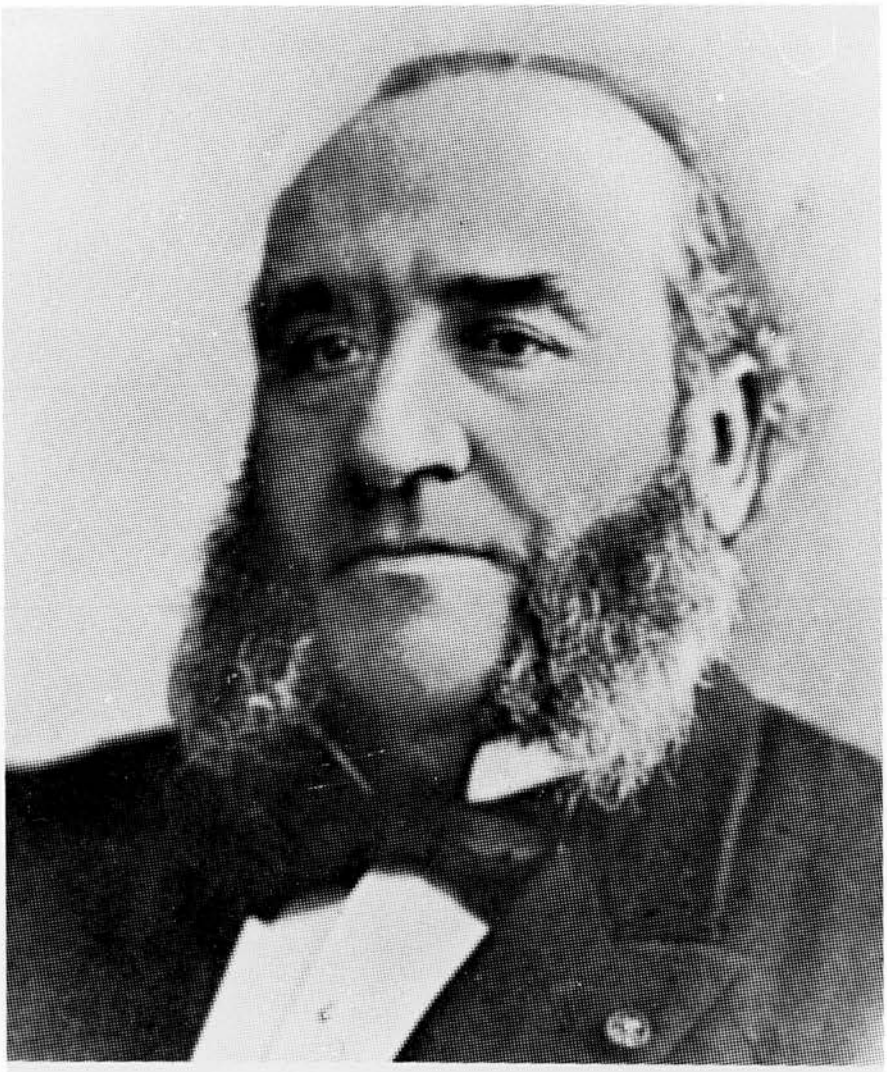


Plate 3

Jules Pean

Credit for the first planned gastric resection in man is given to Ludwig Rydygier. Born in Poland in 1850 he studied medicine in Berlin where he received his M.D. thesis in 1874 for investigations into the effects of carbolic acid. This was an important contribution to antisepsis as it described not only the benefits but also the side effects of carbolic acid used

as a surgical antiseptic (Rudowski 1986). He was thus familiar with the advances in antisepsis and anaesthesia which paved the way for modern gastro-intestinal surgery. Rydygier also was well versed in experimental method. A series of gastric resections in dogs preceded his operations in man. On November 16th, 1880 he performed a limited gastric resection with a two layer gastro-duodenal anastomosis on a patient with an antral cancer. As with Pean's original effort Rydygier's operation was not successful, the patient dying 12 hours after the procedure (Rydygier 1881).

Plate 4

Ludwig Rydygier

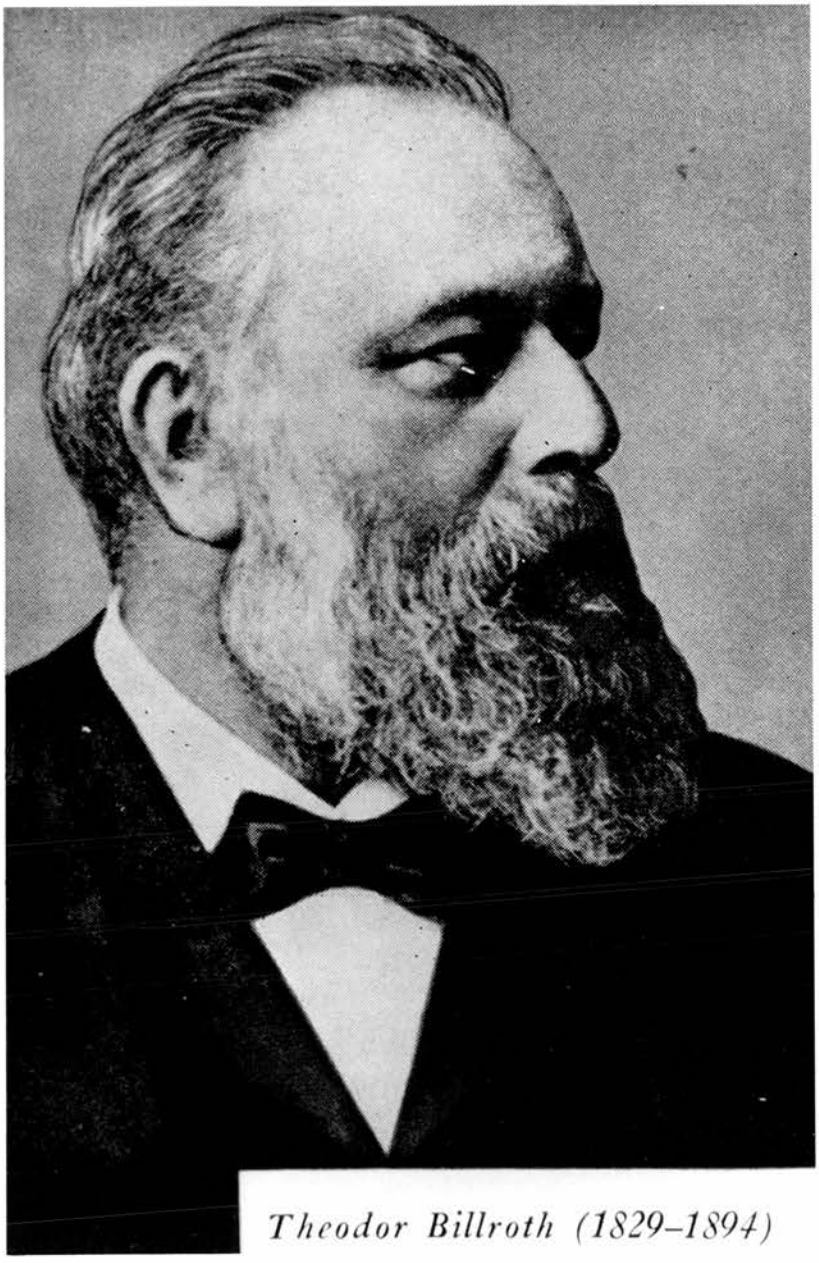
It is the name of Theodor Billroth that will for ever be eponymously associated with gastric resection. Although not the first, his was the first successful gastric resection, the patient surviving for four months. It was Billroth and the school which he established which laid the foundations upon which gastric surgery was built.

Billroth was born in 1829 at Bergen on the island of Rugen just off the North German Coast. From his early years Billroth had shown a love of music and was a gifted pianist. Although he wished to pursue a career as a musician his mother had decided that he should instead become a doctor but throughout his life he never relinquished his enjoyment of music. He became a close friend and confidant of Johannes Brahms and many of the young surgeons he chose as assistants were also talented musicians (Mendelbaum 1957).

The family moved to Griefswald where Billroth began his medical studies in 1848. After studying for three years at Gottingen, Billroth qualified in medicine from Berlin in 1852. The influence of Langenbeck, at that time the leading German surgeon of his day, and von Graefe attracted him to a surgical career (Sigerist 1971). In 1860 he became the Professor of Surgery in Zurich and here, by meticulous collection of his results and their presentation before his contemporaries, he laid the foundations for surgical audit. He was the first clinician to systematically record patient temperature and to record the results of operations not only in terms of in-patient but also 5 year outcome.

In 1867 Billroth accepted the Chair of Surgery in Vienna. This appointment of a Prussian, coming as it did just one year after the defeat of the Austrian armies at the hands of the Prussians at Sadowa, was not an easy decision either for Billroth or for the faculty in Vienna where

anti-Prussian feeling was high. Gersterer, an American surgeon who studied at Billroth's clinic, speculated that his move to Vienna was to join Brahms who had moved there one year earlier (Gersterer 1917). Whatever the reason behind it, with this move to Vienna began one of the most productive and important periods, perhaps the single most important, in the history of gastric surgery.



Theodor Billroth (1829–1894)

Plate 5

Theodor Billroth

The foundations for the many surgical innovations which Billroth's school was to produce were laid on firm scientific principles. In 1878 his first assistant Wolfler was sent to Lister's Edinburgh clinic and when he returned the principles of antisepsis were adopted in Vienna.

The concept of gastrectomy was first tested in the animal laboratory by two assistants, Gussenbauer and von Winiwater in 1874. They performed what has come to be known as a Billroth I gastrectomy and obtained long term survival in two of seven dogs. Having demonstrated that the technical problems could be overcome they moved on to assess the feasibility of resecting gastric tumours in man. In an autopsy study they found that 223 (41%) of 542 pyloric tumours had no metastases and that 43% were mobile (Gussenbauer and von Winiwater 1876).

These preliminary studies paved the way for the first planned and successful gastric resection. In 1877, following success with the first gastrorrhaphy Billroth felt sufficiently confident to predict that "No insurmountable obstacles to partial excision of the stomach exist, either on anatomical, physiological grounds. It must succeed." That first successful gastrectomy was performed by Billroth on January 20th, 1881 (Billroth 1881). Ziegler in a review of the operation records, described the lengthy pre-operative gastric lavage lasting one and a half hours. The procedure was performed under Chloroform anaesthesia and all drapes and sutures soaked in carbolic although Lister's carbolic spray was not used. A transverse abdominal incision was made. The duodenum was divided 1.5 cm. distal to the tumour and anastomosed to the stomach with carbolised silk. The patient recovered well only to die of tumour recurrence some 4 months later (Ziegler 1949). Billroth in his Offenes Schreiben emphasised the preparation which had led up to this first successful gastrectomy when he wrote "Gastric resection like any other

operation has been fully prepared anatomically, physiologically and technically by my pupils and myself" (Billroth 1881). By 1890 some 41 gastrectomies had been performed at Billroth's clinic with 19 operative successes.

Gastric resection had become established in surgical practice not by serendipity but as the result of a methodical progression through animal research, planned surgical procedures, careful follow-up, autopsy studies and statistical analysis.

The first gastric resection for peptic ulcer was first performed by Ludwig Rydygier. Like Billroth, whom he had visited in Vienna, his surgical innovations were based on preliminary laboratory research. After initial studies on experimental dogs, and the initial failure described above, he performed a successful resection in November 1881 for a prepyloric peptic ulcer (Rydygier 1882). His account in Zentalblatt fur Chirurgie of this first gastrectomy for ulcer was accompanied by an editorial footnote "Hoffenentlich auch letzte" (Hopefully also the last).

Far from being the last it was the start of a new era of surgical treatment for the new epidemic of peptic ulcer disease.

It was Billroth himself who in 1885 performed the first major modification of gastrectomy - duodenal stump closure and gastro-jejunal anastomosis - the Billroth II procedure or Polya procedure.

Inevitably it was in Billroth's clinic that first refinements to the technique of gastrectomy with gastro-jejunal anastomosis were made and these will be described shortly.

As experience with the procedure increased so the mortality from

Billroth I gastrectomy continued to fall. By 1890 the operative mortality in Billroth's clinic was around 50%. The next decade saw improvements in surgical technique and postoperative care which progressively reduced this operative mortality.

Mayo-Robson and Moynihan in 1901 reviewed the mortality rates from several major clinics and the results are shown in Table 1.1.

	Date	Cases	Deaths	% Mortality
Kocher	1898	57	5	8.7%
Konlein	1898	24	5	20.8%
Czerny	1899	29	11	37.9%
Rutherford-Morrison	1900	16	7	43.7%

Table 1.1

Mortality following gastrectomy (from Mayo-Robson and Moynihan 1901)

Although the procedure was widely practised in continental Europe by the turn of the century, in Britain and America gastrectomy was slower in gaining acceptance because of the advocacy of gastro-enterostomy as a safer, more effective operation. A summary of the history and development of the operation is shown in Table 1.2.

1879	Pean	:	unplanned, unsuccessful
1880	Rydygier	:	planned, unsuccessful
1881	Billroth	:	planned, successful
1882	Rydygier	:	for peptic ulcer
1902	Kocher	:	side to end
1911	Shoemaker	:	lesser curve resection
1922	von Haberer	:	end to side
1947	Perman	:	as conversion for dumping
1953	Harkins	:	as antrectomy with vagotomy

Table 1.2

Summary of History of Billroth I Gastrectomy

The popularity of the procedure for duodenal ulcer was in decline by the 1950's. A few enthusiasts like Bohmasson (1953) and Nissen (1953) continued to report good results, Nissen claiming only 1 death in his

latter 277 cases (an operative mortality of 0.4%) without any recurrent ulcer.

In the years after the Second World War the increasing understanding of the physiology of gastric secretion and of ulcer disease enabled several investigators to test the scientific basis of the various operations for ulcer. Salmon (1959) measured gastric and duodenal pH in dogs after Billroth I or Billroth II gastrectomy. Whilst gastric pH was similar after each procedure, duodenal pH was significantly more acidic after Billroth I.

In the 1950's and 60's series were published with more complete follow-up extended over many years and with ever improving techniques of radiological and endoscopic diagnosis. The recurrence rates were high. Ordahl (1955) 28.6%; Goligher (1956) 17.5%; Walters (1956) 21.9%; Fisher (1958) 13.1%; Borg (1969) 17.6% and Goligher (1970) 13.7% were typical. By this time the long term nutritional and metabolic effects of gastrectomy were well established and vagotomy, which promised less morbidity, was increasing in popularity. Studies comparing Billroth I and Billroth II had clearly shown a much higher recurrence rate for the former (Table 1.3).

	BILLROTH I		BILLROTH II	
	Operations	Recurrent Ulcer (%)	Operations	Recurrent Ulcer (%)
Wallensten (1954)	111	14 (12.6%)	190	2 (1%)
Ordahal (1955)	35	10 (28.6%)	64	4 (6.2%)
Goligher (1956)	80	14 (17.5%)	-	-
Hickinbothan (1956)	100	10 (10%)	-	-
Walters (1957)	27	4 (14.8%)	449	22 (4.9%)
Fisher (1958)	84	11 (13.1%)	136	5 (3.7%)
Localio (1959)	75	8 (10.6%)	-	-

Table 1.3

Recurrent ulcer after Billroth I and Billroth II gastrectomy for duodenal ulcer in published series

These studies might well be regarded as the epitaph of the Billroth I procedure in the treatment of duodenal ulcer.

The reasons for the failure of the procedure in duodenal ulcer are probably two-fold. Firstly only a limited amount of stomach can be resected whilst ensuring that the gastro-duodenal anastomosis is under no tension. It seems likely therefore that in many instances the operation failed because antral resection was inadequate. Secondly, the gastro-duodenal anastomosis allows ingested food to pass through the duodenum stimulating gastrin release, a phenomenon which does not occur after the Billroth II procedure.

The Billroth I procedure was the first surgical treatment of duodenal ulcer and its ability to cure the ulcer diathesis was similar to that of some of the more physiological procedures which were to follow. The mortality and long term morbidity, however, combined with such a high rate of recurrence rendered this, the first operation for peptic ulcer, obsolete.

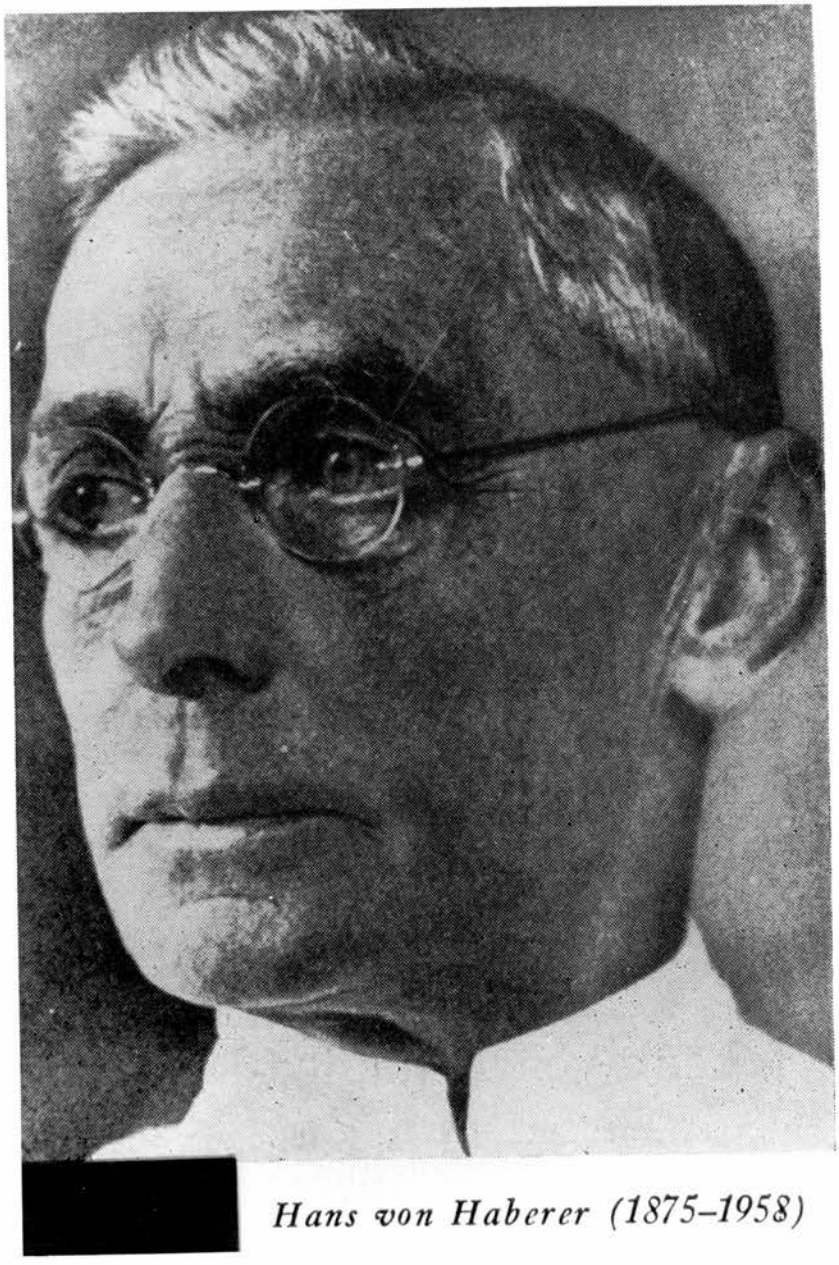
Gastro-enterostomy, whose origins and development are considered in detail later, had first been described in Billroth's clinic (Wolfler 1881). Two influential surgeons, Moynihan (1908) and Mayo (1904) published results which claimed gastro-enterostomy as an effective treatment of ulcer with a lower mortality than gastrectomy. As a result it remained the procedure of choice in the U.S.A. until the 1930's, and Britain till the 1940's.

Reports of a high incidence of stomal ulceration following gastro-enterostomy (Lewisohn 1925) and the influence of Heanage Ogilvie converted British and American surgeons to gastrectomy over the next two decades. In continental Europe, however, gastric resection, initially largely Billroth I, became the most popular treatment for the increasing tide of

duodenal ulcer disease. Shoemaker (1911), von Haberer (1915) and Friedman (1922) were prominent advocates.

By the decade 1920-1930 gastrectomy, (by this time largely Billroth II gastrectomy) had become the accepted procedure for duodenal ulcer on the continent of Europe, in America 10 years later, and in Britain after the Second World War.

Several authors continued to advocate Billroth I gastrectomy for duodenal ulcer, most notably von Haberer, who published the results of his initial experience in 1919 (von Haberer 1919). In a series of papers published over the next three decades he continued to promote this operation claiming it to be more physiological. By 1947 he was able to report a vast personal series of 3602 gastrectomies for duodenal ulcer, of which 2152 were Billroth I (von Haberer 1947). The quality of his follow-up information is not and could not have been acceptable by today's standards. He claimed that in 1644 consecutive Billroth I gastrectomies recurrence was observed in only 12, a rate of 0.7%. The recurrence rate following Billroth II gastrectomy was allegedly 0.5% (6/1111).



Hans von Haberer (1875–1958)

Plate 6

Hans von Haberer

von Haberer continued to publish his experience with the procedure until 1952 some 37 years after his first contribution (von Haberer 1952).

CHAPTER 2

BILLROTH II (POLYA) GASTRECTOMY

The original Billroth II gastrectomy performed by Billroth for antral cancer in 1885 has been referred to in Chapter 1.

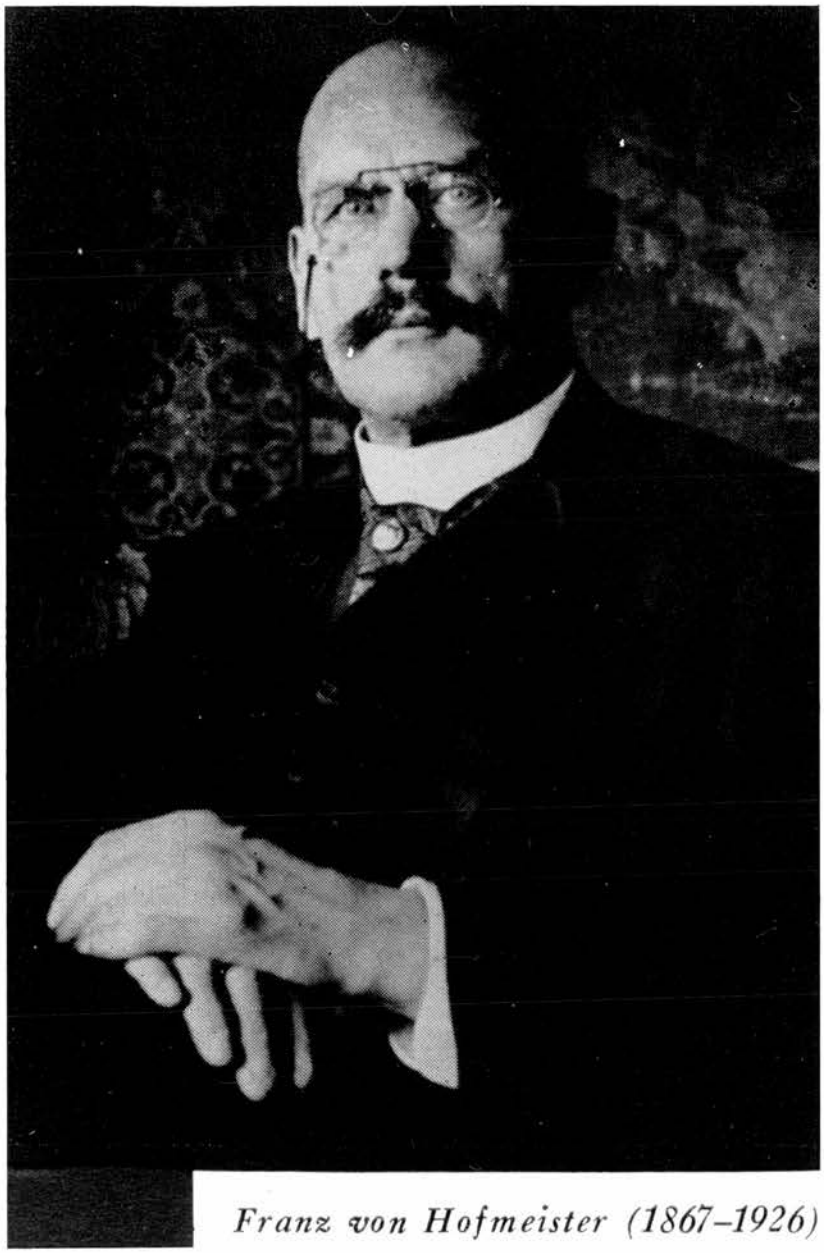
Billroth's original procedures involved closing the divided antrum with a row of sutures and performing an anterior gastro-enterostomy. Many variations have been described and the following account is limited to those which are considered, in retrospect, to have improved the technique or to have been widely practised.

As more extended resections for cancer were performed, Krolein (1888) advocated the anastomosis of the jejunum to the entire length of the divided stomach.

Hofmeister (1888) partially closed the divided antrum leaving the distal 5 cm. as a stoma to which the jejunum was then anastomosed.

Braun (1892) and Jaboulay (1892) independently modified this by describing an entero-anastomosis between afferent and efferent loops. This represented an attempt to overcome the problems of vomiting, a post-operative complication which had been recognised since the early days of both gastrectomy and gastro-enterostomy.

von Eiselsberg, a pupil of Billroth, described in 1889 the closure of the divided proximal stomach and linear gastrotomy to allow for a smaller gastro-jejunal stoma (von Eiselsberg 1889). The credit for this variation has been ascribed to Polya whose report in 1911 was given widespread exposure by Mayo resulting in subsequent eponymous fame. During the period up to the end of the First World War a number of modifications to the Billroth II gastrectomy had been described - almost all of them by continental surgeons. Hofmeister (1908), Polya (1911), von Haberer (1915) and Finsterer (1918) making the most important contributions.



Franz von Hofmeister (1867–1926)

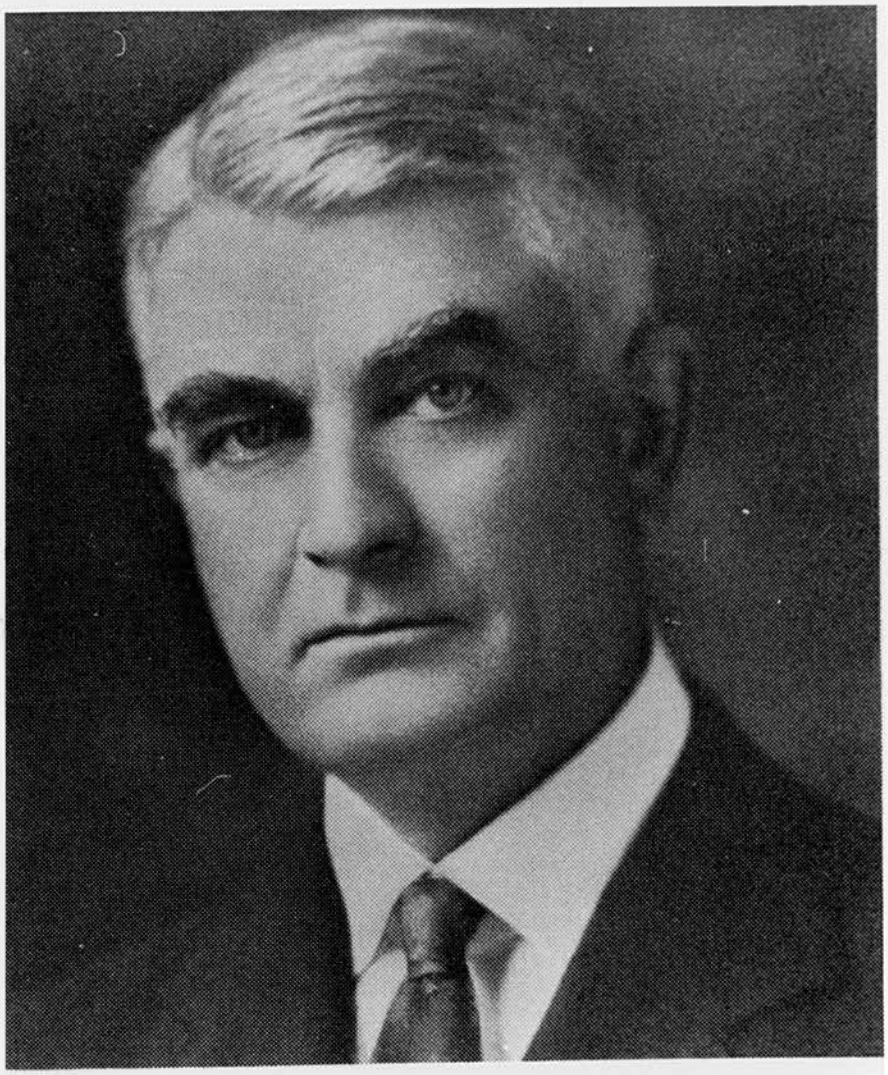
Plate 7

Franz von Hofmeister

Polya of Budapest described a retrocolic anastomosis, with the advantage of the short afferent loop, and a gastro-jejunal anastomosis along the length of the divided stomach with no valvular arrangement (Polya 1911).

Although Polya performed over 2000 of these resections for duodenal ulcer during his working lifetime, the operation took some time to become established in the treatment of duodenal ulcer.

It is relevant to speculate on the reasons for this. Undoubtedly the popularity of gastro-enterostomy resulted from its enthusiastic advocacy by Moynihan in the U.K. (Moynihan 1904, 1908, 1932) and Mayo in the U.S.A. (Mayo 1904, 1924).



WILLIAM J. MAYO
(1861–1939)

Plate 8

William J. Mayo

Moynihan's record of "only one death in the last thousand cases" (Moynihan 1932) must have been a powerful argument against gastrectomy whose mortality in the best hands in that period was of the order of 20% (Table 2.1) and for the average surgeon presumably even higher.

Secondly, although Edkins had in 1906 described a substance isolated from the pyloric mucosa which increased acid output and which he called gastrin (Edkins 1906), surgical thinking was slow to follow the logic that removal of the antrum would reduce acid output. For example Cook writing from Chicago some 40 years later referred to the "yet unproven Edkins theory". This despite the maxim of "no acid no ulcer" which had been described as early as 1910 by Schwarz (Schwarz 1910). By the 1930's research into antral function was following two separate lines. Groups like those of Grossman and Gregory looked for a substance secreted by the antrum while others like Dragstedt concentrated more on the function of the antrum by excluding, isolating and denervating.

The Billroth II resection was slow to find favour in the U.S.A. and even slower in Britain. Lewisohn's favourable results from the Billroth I procedure published in 1925 compared to his 30% recurrence rate after gastro-enterostomy began to sway surgical opinion in the U.S.A. toward gastrectomy (Lewisohn 1925). Strauss and his colleagues reported a series in 1930 with a 5.4% mortality rate (Strauss 1930). Yet by 1935 at the Mayo clinic less than 10 per cent of operations for duodenal ulcer were gastric resections more than 70 per cent being gastro-enterostomies. (Fig. 2.1)

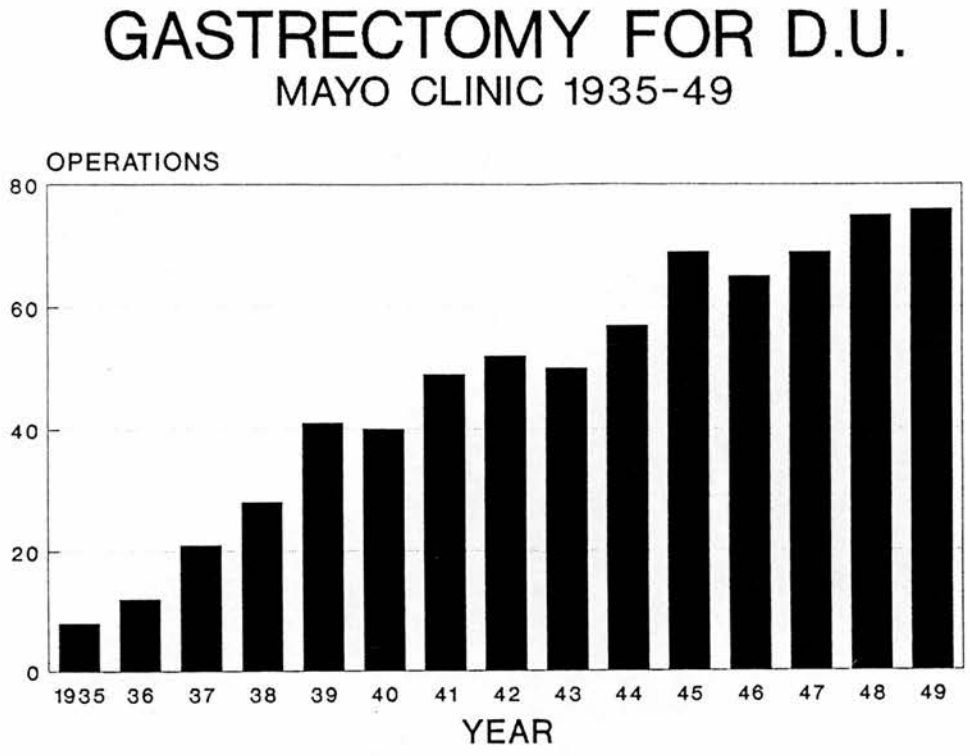


Fig. 2.1

Gastrectomy for D.U. Mayo Clinic 1935-49

With increasing disenchantment about the rate of stomal ulceration following gastro-jejunostomy the Billroth II resection became widely adopted throughout Europe and America as the operation of choice in the years after World War II. In Britain as a result of wartime service more surgeons came under the influence of Heanage Ogilvie, a committed gastrectomist for duodenal ulcer since the mid 1930's.

The experimental work on the gastric phase of acid secretion continued meantime to provide a surer scientific rationale for the surgical resection of the gastric antrum in the treatment of duodenal ulcer. Komarov (1938) isolated gastrin from dry pyloric mucosa and showed it to be a protein. Unvas (1945) isolated gastrin for the first time from human pyloric mucosa.

Wells records that from 1945 Billroth II resection rapidly supplanted gastro-enterostomy as the commonest operation for duodenal ulcer in Britain (Wells 1960).

Throughout the 1940's and 1950's Billroth II continued to be the most popular operative treatment for duodenal ulcer. The published results of the time suggested that the operation carried what was regarded as a low mortality (about 2%) and the results were good in 75-90% of patients.

Series published in the 1940's are shown in Table 2.1.

	Number of Cases	Good	Improved	Fair to Poor	Recurr.	Mort.
Allen (1947)	196	85	-	15	-	2%
Bartels (1943)	100	86	6.7	-	6.7	4%
Gaviser (1948)	364	86	10	4	1	4.5%
Gray (1949)	223	83	13	4	3.0	2.6%
Helferty (1950)	178	91.5	-	7.2	1.2	4.5%
Hosford (1949)	200	72	25	3.0	-	0.5%
McClure (1940)	74	78.6	13.8	-	4	5.3%
Miller T.G. (1946)	113	92.6	-	-	-	
Miller G. (1942)	230	90	10	-	0	3.0%
Mimpriss (1948)	248	73	22	5.0	0	2.0%
Rienhoff (1945)	260	78	12	8.0	-	2.0%
Sanders (1945)	101	90	-	10.0	-	2.7%
St. John (1948)	344	85	-	15.0	1.5-1.4	2.5%
Visick (1948)	505	78.7	16.4	4.9	0.9	4.9%
Walters (1940)	212	83.5	-	14	2.5	1.9%
Stephenson (1948)	72	87	-	-	4.0	6.9%
Watson (1947)	132	83	11.4	3	2.3	9.0%

Table 2.1

Series of Polya gastrectomy for duodenal ulcer published in the 1940's.
(Results in per cent of cases followed-up)

The debate in the immediate post war decade was less about which operation and more about the extent of the gastric resection. By the early 1950's the American Gastroenterological Association Committee on Peptic Ulcer had documented the mortality and recurrence rates for 2441 patients having gastrectomy for duodenal ulcer and followed up for a mean of 2.5 years. The operative mortality averaged around 2% and recurrence rate about the same (Jordan 1951).

Despite these impressive results, doubts grew about the operation. Gordon-Taylor (1929) and Inglefinger (1944) had alerted the surgical

community to the possibility of anaemia and weight loss in the long term but both remained enthusiastic gastrectomists.

The post war years also saw the rise of the formal Follow-Up Clinic which for the first time was able to achieve a comprehensive review of patients for many years after the operation with little loss to follow-up.

These clearly showed that the subtotal resection as advocated for example by Visick, could reduce recurrence to negligible levels but only at the expense of frequent dumping, small stomach syndrome and more severe nutritional and metabolic sequelae.

Anaemia after gastric resection was first described by Moynihan who suggested that the cause was lack of acid (Moynihan 1911). Faber (1913) was the first to suggest that there was in addition a macrocytic component. Morawitz (1930) suggested that the anaemia was usually hypochromic and that pernicious anaemia was uncommon. Lyngar (1959) showed a disturbance of absorption of iron and poor utilisation of the iron that was absorbed. In a review of 33 published reports dealing with some 7500 patients Deller and Witts (1962) found anaemia in 28% of patients after gastrectomy. In 0.33% of these the anaemia was megaloblastic. Both Mahmud (1973) and Buxton (1977) suggested that Vitamin B12 deficiency was rather more common and that the incidence increased with time. Fischer (1984) found that 7% of 766 patients were anaemic 22-30 years after resection but in none of these was the anaemia megaloblastic. Even with the prolonged follow-up possible in those studies published in the 1980's there is discrepancy in the incidence of post gastrectomy anaemia. Dinbar (1980) found 5% whilst Tovey and Clark (1980) described a 40% incidence.

Vitamin B12 deficiency varied from 10-50% in the published literature

(Deller 1962, Schafer 1973, Mahmud 1974). Some series, however, have shown no Vitamin B12 deficiency on long term follow-up (McEwan 1972, Buxton 1977, Dinbar 1980).

Metabolic bone disease following gastrectomy was documented by Everson in 1952. Because of the need, until recently, to establish the diagnosis by bone biopsy studies have almost certainly included senile osteoporosis as many of the post gastrectomy patients studied had reached the age group in which this is common. The incidence has consequently varied in the reported literature from 0.4% to 43% (Jones 1963, Morgan 1965, Eddy 1971, Silen 1973).

Weight loss after Polya gastrectomy was documented by Muir (1949) and by Wells and Welbourne (1951) who stressed the importance of its relationship to pre-operative weight. Wallensteen (1954) reviewed 17 published studies and found the incidence of significant weight loss after gastrectomy to vary between 10 and 75%. Ivy (1950) and Raunch (1952) found that post operative weight loss was related to the extent of the gastric resection. McLean (1954) and Johnston (1958) suggested that the main cause of post gastrectomy weight loss was largely due to reduced intake as a result of reduced gastric capacity.

The series published in the 1950's, 60's and 70's showed Billroth II resection in a much less favourable light than hitherto in terms both of operative mortality and recurrent ulcer (Table 2.2).

	n	Recurrence (%)
Ordahl (1955)	74	6
Hart (1956)	248	8.2
Everson (1957)	348	3.9
Wallenstein (1957)	190	4.2
Walters (1957)	449	4.9
Nyhus (1962)	106	7.5

Table 2.2

Recurrent ulcer rates in series of Billroth II gastrectomy

These showed furthermore that the subtotal rescction as advocated for example by Visick, could reduce recurrence to negligible levels but only at the expense of frequent dumping, small stomach syndrome and more severe nutritional and metabolic sequelae (Stammers and Williams 1963).

As more and more reports were published showing the long term nutritional and metabolic sequelae which could follow gastric resection so vagotomy and drainage increasingly found favour. Stammers and Alexander-Williams in an authoritative monograph (Stammers and Williams 1963) recorded the results in their series of 75% gastrectomy with a Billroth II anastomosis. Despite a low operative mortality of 1.4% and a recurrent ulcer rate of only 2%, they concluded that the operation should be abandoned because of the long term metabolic sequelae.

In what was to be the last major controlled randomised trial comparing subtotal gastrectomy with vagotomy + gastro-enterostomy and vagotomy + antrectomy, the Leeds/York trial showed an advantage for gastrectomy in terms of Visick grading, recurrent ulceration and no difference in operative mortality or "post-gastrectomy syndromes" (Goligher 1968). Yet despite this conclusion the authors were unable to recommend gastrectomy because of the reported long term sequelae (Cox and Pulvertaft

1968) and because the results of gastrectomy deteriorated with time (Pulvertaft 1964).

Thereafter subtotal gastrectomy declined in popularity as the operation of first choice in the U.K. although, as antrectomy combined with vagotomy, it remained popular in North America.

CHAPTER 3

GASTRIC BYPASS
GASTRO-ENTEROSTOMY

Gastro-enterostomy was first performed in September 1881 by Wölfler, Billroth's first assistant, during the latter's temporary absence from Vienna (Wolfler 1881).

Anton Wölfler (1850–1917)

Plate 9

Anton Wölfler

The intention had been to resect an antral tumour which proved at laparotomy to be immobile and thus unresectable. According to Moynihan's later account (Moynihan 1910) Wolfler was about to close the abdomen when his assistant Nicolandoni suggested that a bypass be attempted. An ante-colic gastro-jejunal anastomosis was fashioned with a long anterior loop. The patient lived for 4 months. When Billroth himself later attempted the procedure the patient died after a few days from what sounds like a stomal obstruction. The result of this early disaster was that the procedure fell into disrepute in Billroth's clinic and was developed elsewhere. The first development was introduced by Courvoisier, Professor of Surgery at Basle. As a result of a series of cadaver studies he concluded that taking the jejunum through the transverse colon would be less likely to produce obstruction. In 1883 Courvoisier's pride in the success of this the first retrocolic gastro-enterostomy clouded his clinical judgement. He took the patient by carriage to a meeting of the Swiss Medical Association on the fifth postoperative day. Although she apparently survived this ordeal she died 5 days later (Waugh 1953).

Successful results following posterior gastro-enterostomy were reported by von Hacker in 1885 (von Hacker 1885). Gastro-enterostomy for peptic ulcer was probably first performed by Doyen in 1894 (Olch 1962).

From its earliest days the procedure was complicated by the problem which Billroth had encountered at his first attempt at the operation - afferent loop obstruction. A variety of modifications were tried in attempts to overcome this. In the earliest days the mistaken concept that partially obstructing the efferent loop would produce equal resistance to gastric outflow via the stoma resulted in several unsuccessful variations. Chaput packed iodoform gauze around the efferent loop, while von Hacker (1885)

plicated it with a row of sutures. Rydygier (1884), hitched the afferent loop to the stomach to widen the angle between them. This was elaborated by Hadra (1891) who sutured both afferent and efferent loops to the stomach to widen the angle which the two loops made to the stomach.

A physiological rather than mechanistic approach was adopted by Rockwitz (1887) who described the first isoperistaltic anastomosis.

In a further attempt to overcome these problems of stomal obstruction, Jaboulay (1892) described an entero-anastomosis between duodenum and efferent loop. In the same year Braun performed an entero-anastomosis between afferent and efferent loops (von Braun 1892). Further refinements came from Peterson who introduced the no-loop concept in Czerny's clinic recommending an isoperistaltic anastomosis (Peterson 1900). This operation was adopted by Mikulicz who demonstrated it to Mayo in 1902. Mayo (1904) confirmed the benefits of the short loop but considered that there was no advantage in the isoperistaltic technique. The rationale for the operation when performed for duodenal ulcer was that the gastro-enterostomy would divert food from the duodenum and thereby "rest" the duodenum. The demonstration in dogs that ingested thiomin blue stained the duodenum as much as the jejunal loops led to several attempts to close the duodenum. Kelling (1900) used 3 sutures in the pre-pyloric region, and Wilms (1912) a strip of fascia. These inevitably failed to exclude the duodenum. Eiselsberg's suggestion (1910) of complete duodenal exclusion by division and resuture of the pylorus did not find favour.

The retrocolic "no-loop" operation rapidly gained in popularity. With increasing experience mortality rates fell as shown by the experience of the Mikulicz clinic as exemplified by Chlumski (Mayo-Robson and Moynihan 1901).

	Cases	Deaths	% Mortality
1881-1885	35	12	65.7%
1886-1890	114	53	47%
1891-1896	401	136	33.9%

Table 3.1

The decreasing mortality rates from gastro-enterostomy between 1881 and 1896 at Mikulicz clinic

The operation was championed by Mayo-Robson and Moynihan who in 1901 reported 40 posterior gastro-enterostomies for peptic ulcer with only 2 deaths (Mayo-Robson and Moynihan 1902). Moynihan's advocacy of this as a safe, effective operation was responsible for its widespread adoption in Britain as the procedure of choice in the treatment of duodenal ulcer - a position which did not alter until the 1930's.

Plate 10

Lord Moynihan of Leeds

Instead, in 1932 Moynihan was able to write that "in my last 1000 cases of operation for duodenal ulcer I have had 1 death" (Moynihan 1932). The influence of W. J. Mayo, who had learned the technique at Mikulicz clinic, ensured the predominance of gastro-enterostomy as the mainstay of duodenal ulcer treatment in the U.S.A. until the 1930's.

The complication, which was to bring about the demise of gastro-enterostomy, stomal ulceration, had been noted independently by Braun and Hahn as early as 1899 (Braun 1899 and Hahn 1899). By 1908 Paterson was able to report 61 cases (Paterson 1908).

The problem had been reported in the English language literature by authoritative figures like Mayo (1902) and Wilkie (1910). It was generally accepted that the advantage of much lower mortality more than compensated for this complication.

The lag period between gastro-enterostomy and stomal ulceration was first recognised by Van Roojen in 1910. His results showing the delay between operation and jejunal ulcer are reproduced in Table 3.2.

Within 10 days	3
10 days - 3 months	5
3 months - 6 months	9
6 months - 12 months	10
12 months - 18 months	9
18 months - 2 years	6
2 - 3 years	5
3 - 4 years	8
4 - 5 years	4
5 - 10 years	6
More than 10 years	1

Table 3.2

Time to appearance of jejunal ulcer after gastro-enterostomy (Van Roojen 1910)

Wilkie (1910) reporting 6 jejunal ulcers following gastro-enterostomy, concluded after histological studies that non-absorbable suture material was responsible, at least in some, for ulceration and recommended that absorbable sutures be used.

The problem of jejunal ulceration was recognised increasingly throughout the 1920's, and largely, although not solely, prompted Pribram

in 1923 to write that "Gastro-enterostomy is a disease and not an operation".

It was Lewisohn who in 1925 published the series which was to move American surgeons away from gastro-enterostomy as the standard treatment for duodenal ulcer (Lewisohn 1925). Lewisohn had worked for 2 years as assistant to Czerney where he had learned not only surgical techniques but the value of careful audit. His report of a stomal ulceration rate of 25% proved a major influence on American surgeons. By the 1930's gastro-enterostomy had been supplanted in the U.S.A. by gastrectomy as the favoured operation. Wangensteen (1942) recorded its "obituary as the standard operation for duodenal ulcer". The demise of the procedure in the Mayo clinic between 1935-1949 is graphically demonstrated in Fig. 3.1.

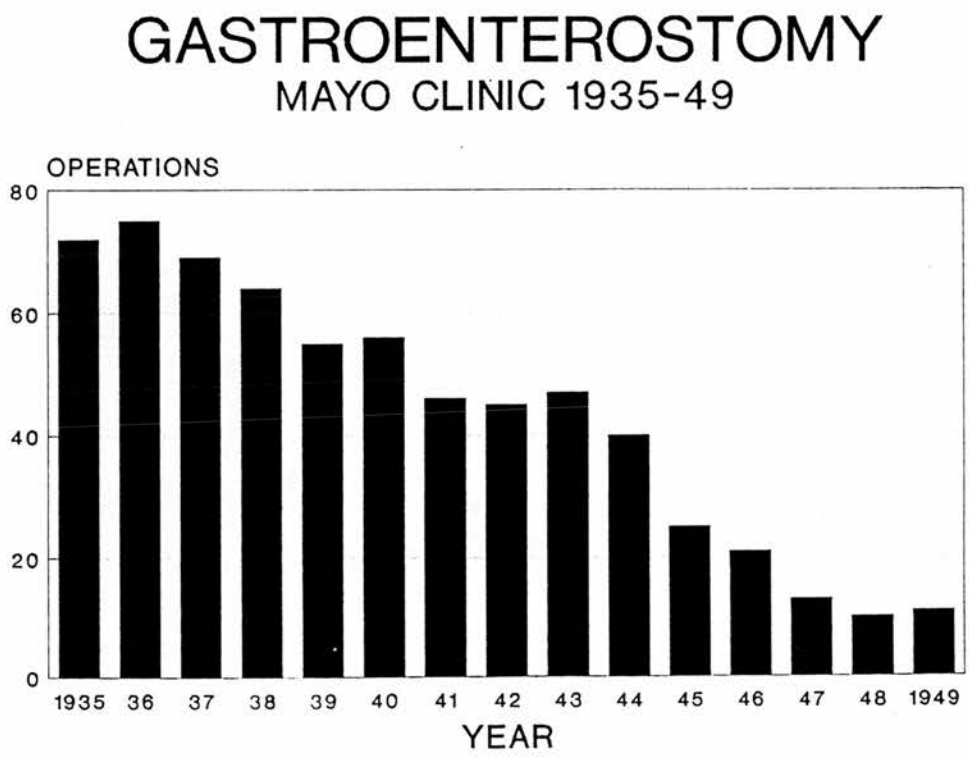


Fig. 3.1

The decline in gastro-enterostomy at the Mayo Clinic 1935-1949

In Britain gastro-enterostomy as sole treatment for duodenal ulcer was being performed less often. In 1929 Luff had reported the results on 2609 cases on behalf of the British Medical Association whose members had contributed cases to the review. His conclusion that the rate of recurrent ulcer following simple gastro-enterostomy was 2.8% was heralded by a leading article in the British Medical Journal as the definitive study endorsing the procedure (Luff 1929). This 'definitive' study was soon condemned by Hurst who pointed out that no follow-up was obtained in 23% of patients, that 2-9 years follow-up in the remainder was inadequate to comment on recurrent ulcer incidence, and that patients who bled or had pain during follow-up, must be assumed to have recurrent ulcer. He concluded that the incidence of recurrent ulcer was at least 10% and probably considerably higher (Hurst 1929).

A similar mass survey was carried out in 1935 by Wright on behalf of the Association of Surgeons of Great Britain and Ireland. He reported a recurrence rate of 8.6% in 2051 cases (Wright 1935). In his view follow-up was unnecessary because most patients return to the same surgeon when symptoms recur.

Moynihan continued to advocate gastro-enterostomy into the 1930's and Sherren in 1925 went so far as to say that gastro-enterostomy had done "more than any other operation for the good of the human race" (Sherren 1925).

Heanage Ogilvie took a different view and his opinion was influential. He calculated that the true incidence of recurrent ulcer after gastro-enterostomy was 20% (Ogilvie 1935). On the basis of this and the low mortality in the published results of the time, he advocated gastrectomy which had become the favoured procedure in continental Europe. Ogilvie's

views were enhanced by the esteem in which he was held in the U.K. and by his position of seniority in the British Army during the Second World War, when he rose to the rank of major-general. In 1956 he scathingly condemned gastro-enterostomy by writing that "For the unskilled surgeon on the unfit patient it has much to recommend it".

Other reports confirmed a high incidence of stomal ulceration. Clark (1951) reported 18% and Illingworth (1953) 20%.

Wells (1960) records that after 1945 gastro-enterostomy was rapidly supplanted in the U.K. by partial gastrectomy because the long term results were unsatisfactory in 25%. The era of more complete and long term gastric follow-up had dawned. Clark (1951), from Illingworth's unit, was able to report a follow-up rate of 77% at 20 years. At 10 years 43% of patients had recurrent symptoms described as severe in 23%. Tanner (1959) reported a 50% recurrence rate on long term review. Truncal vagotomy with antrectomy had replaced it in all but a handful of centres by the late 1950's.

Its continuing use was recorded in two units (both in Edinburgh) into the 1960's and in one of these into the 1970's. Farquharson (1956) expressed misgivings about the widespread use of gastrectomy with its attendant sequelae. In support of gastro-enterostomy he recorded 5170 cases followed up for 4-10 years with a recurrent ulcer rate of 3.5% (Farquharson 1956).

In the Western General Hospital, the selective policy (described in the foreword to this thesis) in which gastro-enterostomy was reserved for patients with an MAO below 50 mEq. was proposed by Bruce and colleagues in 1959 (Bruce, Card, Marks, Sircus 1959). This followed their observation

that jejunal ulcer was more frequent in high acid secretors. In one of the last published accounts of the results of gastro-enterostomy for duodenal ulcer, Small and Smith (1977) recorded 139 patients with pre-operative MAO of less than 30 mEq/hr. who were followed up for 4-18 years. The recurrent ulcer rate was 2.2%. Results like this, however, were too late to save gastro-enterostomy as an accepted operation for duodenal ulcer.

Gastro-enterostomy alone is no longer advocated or practised in the treatment of uncomplicated duodenal ulcer. In retrospect it was a procedure whose use in duodenal ulcer evolved from its logical use to bypass the stenosing duodenal ulcer. The rationale for its use in man must be regarded as defective. It was applied to the problem of ulcer because it was available rather than planned on an understanding of the underlying patho-physiology. While truncal vagotomy will reduce the acid response to circulating pentagastrin or histamine by 65-70% gastro-enterostomy will reduce it by only 15-20% (Gillespie 1960). As understanding of the physiology of gastric secretion increased it became apparent that this level of acid buffering was insufficient in many patients to control the disease and to prevent jejunal ulceration (Christiansen 1981). Furthermore Harkins (1961) showed the cyclical increase in acid output resulting from antral and duodenal stimulation with subsequent increase in gastrin and somatostatin output which more than negated any buffering effect of duodenal contents being returned to the antrum. A review of those larger studies with long follow-up periods suggested that the operation has failed in its objective in about 30% (Small 1964).

Furthermore, in the days before H2 receptor antagonists, the development of jejunal ulcer demanded re-operation. Since the arrival of H2 receptor antagonists some jejunal ulcers can be successfully treated

with these drugs but this must nonetheless be regarded as failure of the operation.

Gastro-enterostomy also has nutritional and metabolic sequelae in the long term. In the series from the Western General Hospital, Edinburgh, 24% of patients lost weight.

Gastro-jejunostomy alone as a treatment for duodenal ulcer was introduced because of expediency, was not based on physiological principles and its short lived popularity owed more to its safety rather than its efficacy in treatment of duodenal ulcer.

CHAPTER 4

TRUNCAL VAGOTOMY

The earliest known written work on the vagus was that of Marinus, who, in the first century A.D. described the anatomy of the vagi. None of his original work survives today but is cited by Galen in his book "On the usefulness of the Parts of the Body" (May 1968).

The earliest scientific observations on the role of the vagus in gastric secretion were made by Sir Benjamin Brodie (1814). In a series of experiments published in 1814, he demonstrated that copious volumes of watery fluid were present in the stomachs of dogs after sacrifice by an intravenous injection of arsenic. In dogs whose vagal nerves were sectioned before sacrifice secretions were absent and in some instances the lining of the stomach was seen to be completely dry.

Beaumont (1833) among his observations of the gastric fistula of Alexis St. Martin, noted alterations in the volume of gastric secretion in times of emotion. Heidenheim (1879) developed an isolated denervated antral pouch in the dog which was to prove the experimental model for many of the subsequent studies of the controls of gastric secretion. The contributions of Pavlov and his school to our understanding of secretory controls were immense. Jurgens (1892) in Pavlov's laboratory, was able to demonstrate that subdiaphragmatic vagal section in dogs, could abolish hydrochloric acid from the fasting gastric juice. Pavlov produced experimental evidence to demonstrate a cephalic or psychic phase of gastric secretion mediated through the vagi. Section of the vagi inhibited this response.

Of particular interest to future developments in the surgery of duodenal ulcer was his observation that in dogs this inhibition remained present for several months. The side effects of vagal section were also described about this time. Cannon (1906) showed that vagotomy in cats delayed gastric

emptying, while Ungar (1911) found gastric dilatation and stasis in vagotomised dogs.

Thus by the turn of the century the physiological basis for vagal section as a means of reducing gastric acid secretion was well established. The relationship between acid secretion and duodenal ulcer was also becoming clearer. The interest which Pavlov's school had created in the investigation of gastric acid secretion was such that the measurement of gastric acid secretion had become common in clinical practice. In the absence of investigative tools to diagnose those ulcers which did not bleed or perforate, a syndrome called "hypersecretion" was described.

It was Moynihan (1908) who gave a clear and authoritative description of the characteristic symptoms which enabled a much more confident diagnosis of duodenal ulcer to be made. In an uncompromising dismissal of prevailing concepts he wrote "Hypersecretion is not a disease in itself. Hypersecretion is duodenal ulcer".

The early attempts at vagotomy were not designed to lower gastric secretion. Jaboulay in 1899 was probably the first to perform vagotomy in man according to McCrea (1926). This procedure was done in an attempt to treat the abdominal pains of tabes dorsalis. Exner (1912) performed a subdiaphragmatic truncal vagotomy to try to control the vomiting in tabetic patients with "gastric crisis". Exner and Schwarzmann (1914) reported 20 cases of gastric crisis treated by vagotomy, with success in 10. Exner also gave this first description in man of gastric stasis following the procedure, and advocated a gastrostomy to overcome this complication. Bircher (1920) reported the results of vagotomy on 20 patients whose symptoms suggested a diagnosis of gastric ulcer. The symptoms were reportedly abolished but at operation the diagnosis of ulcer was confirmed in

only one instance.

Latarjet's writings in 1922 had to wait some 40 years before being afforded the credit they deserved.

After initial cadaver dissection Latarjet described in detail his technique of vagotomy in which the anterior trunk was divided below its hepatic branch and the posterior trunk below its coeliac branch. He presented results of this procedure in 24 patients, 6 of whom had tabetic crisis. Three of these had vagotomy alone and 3 a vagotomy with gastro-enterostomy. The latter was not performed as a drainage procedure to accompany the vagotomy but was the commonly performed procedure at that time for the abdominal pain and vomiting of the tabetic crisis to which Latarjet added vagotomy hoping for a cummulative effect. Eight of his patients with gastric ulcer were cured by vagotomy alone and seven by vagotomy and gastro-enterostomy (Latarjet 1922).

Hartzell (1929) showed that vagal section in the dog resulted in a marked reduction in free and total acid secretion.

McCrea (1926) of Manchester was the first surgeon to suggest that the vagi contributed to chronicity and complications of ulcer and recommended vagotomy for these problems. Pieri (1927) endorsed this view and reported successful results in eight patients with peptic ulcer.

In 1926 Klein in New York performed anterior truncal vagotomy as an adjuvant to gastrectomy for duodenal ulcer with the express objective of further lowering acid output (Klein 1929). In 1938 the same group was able to report 26 cases all of whom became achlorhydric after the procedure (Winkelstein and Berg 1938). Thus the rationale for vagotomy in treating duodenal ulcer and the technical expertise to perform it safely were known

from the 1920's. Why then did it fail to become accepted into mainstream surgical practice for another 30 years ?

Several reasons contributed to this. The first was failure of surgeons in clinical practice to consistently perform a complete vagotomy. This inevitably led to a high failure rate.

Review of the sketches of vagal anatomy made in the 19th and first two decades of the 20th century shows that although dissection had apparently been meticulous and the drawings detailed, important deficiences are apparent (Ruckley 1970). These workers had failed to appreciate for example the high origin of a branch to the fundus (later described by Grassi as the "criminal nerve") (Grassi 1977), and the presence of branches to the lesser curve, which pursue an independent pathway to the parietal cell mass. So early attempts at vagotomy confined only to the main trunks are certain to have been incomplete. Clinical results are poorly documented but it is likely that incomplete vagotomy led to early failure to relieve symptoms.

Although Birchner in Germany and Pieri in Italy performed vagotomy in patients with peptic ulcer, it was the methodical experimental and clinical work of Dragstedt and his colleagues which firmly established the place of truncal vagotomy in clinical practice from the early 1950's. In 1943 he reported two patients in whom transthoracic truncal vagotomy had been performed for chronic duodenal ulcer (Dragstedt and Owens 1943). The gastric acid secretion was lowered postoperatively and the ulcers healed. Further reports followed rapidly over the next few years. Dragstedt changed to an infradiaphragmatic vagotomy and reported the same lowering of acid secretion and ulcer healing. Yet in addition to recording the benefits of vagotomy, Dragstedt and his colleagues also noted some problems (Dragstedt 1950).

Firstly, whilst acid secretion was reduced it was not abolished, the pH of gastric secretion remaining in the range 1.9 to 3.7. Following vagotomy there was still free hydrochloric acid in the fasting gastric juice in many patients. Furthermore intravenous histamine still produced an acid secretory response in the face of vagal section. These observations and the resultant failure to control the disease in some patients, were the stimuli for those who regarded vagotomy as inadequate treatment. Their alternative, vagotomy and antrectomy is described in Chapter 6.

Thus vagotomy alone was slow to find favour, particularly in the United States where vagotomy with antrectomy became the most popular procedure. This may have been because of the association in the surgical mind of gastro-enterostomy with jejunal ulcer or perhaps because Dragstedt's group in continuing animal research had shown the antrum (and thus antrectomy) to be the key to the abolition of ulcer disease in the dog. By 1951 he was able to report that when the entire canine stomach was isolated from the intestinal tract and its vagal supply interrupted, that ulcers never developed.

In 1948 the American Gastroenterological Association formed the National Committee for the study of Peptic Ulcer. Their report concluded that gastro-enterostomy alone was the treatment of choice for peptic ulcer disease (Jordan 1952).

The second problem which Dragstedt described was that of gastric stasis as a result of the section of the vagal motor fibres to the antrum. The need for a drainage procedure was recognised early. The development of gastro-enterostomy has been outlined in Chapter 3.

Pyloroplasty was first performed by Heineke (1886). A longitudinal

incision was made through all layers of the anterior wall of duodenum and antrum across the pylorus and was sutured transversely to avoid narrowing the gastric outlet. Mikulicz described an identical procedure 2 years later (Mikulicz 1888). Thus although the two did not collaborate their names are eponymously linked as the Heineke-Mikulicz pyloroplasty which was to become the most widely performed drainage procedure. It was not used initially as a drainage procedure but rather to excise anterior ulcers and then for infantile congenital hypertrophic stenosis. In the latter condition the results were almost always fatal until Ramstedt performed the first pyloromyotomy in 1910 (Ramstedt 1912).

The first pyloroplasty for duodenal ulcer was performed in 1896 at the Mayo clinic and excision of the ulcer with closure as a pyloroplasty was reported from there in 1902. Judd (1930) reported a series of such cases concluding that the procedure was successful in about 60%.

Pyloroplasty as a drainage procedure did not find favour in the U.S.A. The American Gastroenterological Association conducted a study of over 4000 surgical procedures for peptic ulcer performed in the United States (Jordan 1952). Vagotomy without drainage was followed by gastric retention in 10-12%. Largely as a result of this side effect the total numbers of vagotomy without drainage in the U.S.A. fell from 292 in 1946 to 130 in 1948 and by 1950 the numbers were "too small to consider analysis".

Weinberg and colleagues from California (Weinberg 1956) described a single layer pyloroplasty which they claimed was superior to the double layered Heineke-Mikulicz. In their report of 500 cases they claimed only 5% of patients suffered untoward side-effects which they believed was due to the elimination of retrograde movement of food seen with gastro-jejunal anastomoses.

Vagotomy and gastro-jejunostomy as advocated by Dragstedt increased in popularity in the U.K. throughout the 1950's and 1960's. Weinberg (1956) reported favourable results with pyloroplasty as an alternative drainage procedure. Dragstedt adopted the Weinberg pyloroplasty (Dragstedt 1975) and vagotomy and pyloroplasty became the most popular operation for duodenal ulcer in the English speaking world in the 1960's and 1970's. Prospective randomised trials comparing these drainage procedures, however, showed no difference in results between them (Kennedy F. 1973 and Kennedy T. 1973).

Given the enthusiasm with which truncal vagotomy had been adopted it was surprising that several controlled studies found problems. In the Leeds-York trial reported by Goligher (1968) vagotomy and gastro-enterostomy was inferior to vagotomy and antrectomy and also to subtotal gastrectomy in terms of Visick grading, recurrent ulcer and the incidence of diarrhoea. Furthermore vagotomy and drainage was not associated with a lower incidence of operative mortality or of post gastrectomy symptoms. Other trials, Cox (1968), Price (1970), Howard (1973) and Postlethwait (1973) failed to show a clear benefit for vagotomy. While the mortality rate tended to be higher following gastrectomy, the recurrent ulcer rate tended to be lower. Truncal vagotomy and drainage probably remained the preferred operation because of its lower mortality rate and because of concern about the long term nutritional and metabolic sequelae of gastrectomy.

The failure to demonstrate a clear advantage for vagotomy and drainage over gastric resection was worsened by the demonstration of iron deficiency and megaloblastic anaemia (Cox 1964), steatorrhoea (Cox and Bond 1964) (Wastell 1966) and dumping (Kraft 1967) although none as severe as could occur after gastrectomy. The most severe of the post vagotomy sequelae

was diarrhoea (Table 4.1).

	Incidence of Diarrhoea	
	Total	Severe
	%	%
Pollock (1952)	16	7
Jordan (1952)	26	-
Kraft (1962)	38	-
Smith (1963)	28	-
Goligher (1964)	27	6.5
Cox & Bond (1964)	23	5
Burge (1964)	30	8
Barnes & Williams (1967)	30	3

Table 4.1

Post vagotomy diarrhoea
in published series

The problems of diarrhoea and dumping led to dissatisfaction with truncal vagotomy and fuelled the search for a better procedure.

The controlled trials of the late 1970's and early 1980's showed a clear advantage for H.S.V. over truncal vagotomy (Table 4.2) but doubts about the recurrence rate after H.S.V. combined with its technical challenge have ensured an occasional role in the 1990's for truncal vagotomy.

	HSV	TV	Dumping		Diarrhoea		Vomiting		Failed Op.	
			HSV	V&D	HSV	V&D	HSV	V&D	HSV	V&D
Stoddard (1978)	64	62	3	18	4	7	2	10	3	7
Koffman (1979)	77	76	3	7	2	5	-	-	14	11
Dunn (1980)	20	20	-	-	0	10	0	2	1	4
Christiansen (1981)	83	176	-	-	-	10	0	2	16	34

Table 4.2

T.V. and drainage compared with H.S.V.

A summary of results of vagotomy and drainage in published series is shown in Table 4.3.

	n	Duration (years)	Recurrence (%)	Mortality (%)	Visick I + II (%)
Nobles (1966)	151	10-	19.2	1	-
Eisenberg (1969)	455	1-10	3.6	1.0	-
Goligher (1969)	119	5-8	5.9	0	89
Stempien (1971)	161	10-18	25.4	-	68.3
Berger (1972)	79	9-	10	0	81
Kennedy (1973)*	46	-5	8	0	-
Postlethwait (1973)	337	5-	6.2	0.6	83
Kronborg (1975)	435	6-8	10	-	74
Thompson (1975)	200	3.4-7	13	0.5	-
Brooke-Cowden (1976)	389	-15	16	1.6	-
O'Leary (1976)	348	7-17	5.8	1-2	-
Pemberton (1980)	182	1-17	12.3	4.4	-
Selking (1989)*	50	-6	8	0	71
Smith (1981)*	290	5-10	1.5	-	75
Fiser (1982)	645	1-10	4.5	0.4	96.4
Mulholland (1982)	183	0-10	11.6	0	62
Cetti (1983)	239	1-5	5	0.8	88.9
Koofman (1983)*	67	2.5-5.5	7.5	0	82
Koo (1983)*	51	1-6	12	0	86
Hoffmann (1984)*	73	5	13.6	-	79.7

* Randomised controlled trials

Table 4.3

Results of truncal vagotomy and drainage in published series

CHAPTER 5

SELECTIVE AND HIGHLY SELECTIVE VAGOTOMY

Latarjet's was the earliest report on a technique of vagal section which sought to selectively divide vagal fibres to the stomach whilst preserving those to the rest of the G.I. tract (Latarjet 1922). Although drainage procedures had overcome the problems of gastric stasis which vagotomy produced, they had brought their own sequelae. Dumping could be attributed to gastric incontinence and bile vomiting to reflux into the stomach through the afferent loop or the incompetent pylorus. Diarrhoea was thought to result from parasympathetic denervation of the abdominal viscera, which in addition caused bloating, excessive borborygmi and abdominal discomfort.

Franksson of Stockholm (1947) devised a selective denervation without a drainage procedure but, in the light of his subsequent experience came to recommend one. Independently Jackson (1948) and Moore (1948) in the U.S.A. described partial gastric vagotomy which consisted of preservation of the coeliac division of the posterior vagus but division of the anterior vagal trunk. It was Griffith and Harkins (1957) who published the first account of selective vagotomy. They subsequently produced evidence, based on insulin tests of vagally mediated acid output, that the procedure resulted in satisfactory denervation of the parietal cell mass. Because the motor innervation of the antrum was divided a drainage procedure was still required.

Early results of selective vagotomy from Griffith (1960) and Burge (1960) independently were promising both in terms of recurrent ulcer and post-vagotomy sequelae. As has happened so often in the saga of operations for duodenal ulcer, controlled trials and more especially long term follow-up studies showed no advantage for the new procedure over truncal vagotomy and drainage (Sawyers 1968, Mason et al 1968, Kennedy and Connell 1969). Longer follow-up by these groups (Sawyers 1977, Kennedy 1975) confirmed that the problems of dumping, vomiting and diarrhoea were no

different following selective vagotomy and drainage. As it was more technically demanding and time consuming the operation is no longer performed.

A summary of the results from published series is shown in Table 5.1.

	n	Length F.U. (years)	Recurrence (%)	Mortality (%)	Visick I + II (%)
Amdrup (1973)	100	5-	6	NK	NK
Kennedy (1973)	49	-5	2	0	NK
de Miguel (1974)	131	5-9	9.2	0	83
Madsen (1980)	50	5.5-8	14	NK	NK
Griffith (1980)	87	12-17	5.5	NK	NK
Dejgaard (1980)	50	5.5-8	17.7	0	53
Siim (1981)	105	10-13	15	1	77
Hoffmann (1984)	81	5-	19.8	NK	44

Table 5.1

Results from published series of selective vagotomy

Highly Selective Vagotomy

The search for a technique that would denervate the parietal cells but avoid denervation of the intestine and its appendages had led Griffith in 1953, working in Harkins laboratory in Seattle, to perform in dogs a procedure which he termed parietal vagotomy. Antral motility was retained whilst complete denervation of the parietal cell mass was achieved as demonstrated by negative insulin tests. Griffith sought the opinion of Drs. Dragstedt and Hollander about the new technique, but neither the pioneer of truncal vagotomy nor the developer of the insulin test approved. They rejected the concept of selective or parietal vagotomy because they believed that any one vagal fibre to the stomach, if left intact, could re-inervate the entire stomach (The all-or-none law) (Griffith 1977).

Griffith describes 3 parietal vagotomies done in 1956 but because of the disapproval of his seniors was not allowed to repeat the procedure. He states

that the three patients did "quite well without either dumping or recurrence" (Griffith 1977).

Burge recognised the advantages of avoiding a drainage procedure and published an account of selective vagotomy without drainage (Burge 1969). He believed that bilateral selective vagotomy would preserve the innervation to the prepyloric stomach. His failure to appreciate the anatomy of the nerve of Latarjet resulted in its division with consequent gastric stasis.

Holle and Hart in Munich in 1967, apparently unaware of Griffith's work, had shown in the experimental model that the vagal innervation of the antrum actually inhibited gastric secretion. This led them on to develop a parietal cell vagotomy preserving the antral innervation in order to preserve this antral inhibition of acid secretion (Holle and Hart 1967).

Griffith meanwhile had continued with dog experiments designed to produce evidence to show that the "all or none" law did not apply. He aimed to further demonstrate that the vagal innervation of the stomach was segmental and that the hepato-biliary vagal fibres did not contribute to gastric innervation. These hypotheses were finally proved by 1969 (Griffith and Amdrup 1969). On the basis of this knowledge Amdrup began to perform parietal cell vagotomy in man. The antral innervation was preserved in order to maintain antral motility. The initial experience with this operation was reported by Johnston in 1970 (Johnston and Wilkinson 1970) and by Amdrup the same year (Amdrup and Jensen 1970).

In previous chapters the superiority of H.S.V. in terms of dumping and diarrhoea has already been discussed and results from published series are shown in Table 5.2.

	n	Dumping	Diarrhoea	Vomiting
Kennedy (1975)	50	0	0	12
Jordan (1976)	45	4.4	0	0
Wastell (1977)	52	5.7	1.9	0
Sawyers (1977)	86	1.1	1.1	-
Stoddart (1978)	64	4.7	6.2	3.1
Faxen (1978)	25	12	0	-
Dorricott (1978)	116	4.3	4.3	5.2
Koffman (1979)	77	3.9	2.6	-
Dunn (1980)	20	-	0	10
Christiansen (1981)	83	0	-	-
de Vries (1983)	82	2.4	5	7.3
Matheson (1983)	137	4	0	7
Donahue (1984)	40	4	0	-
Gorey (1984)	509	0	0	-
Teichman (1985)	68	2	2	-
Harling (1985)	41	4	2	-
Herrington (1986)	109	1.9	2.8	-
Hoffman (1987)	84	3.5	0	0
Soper (1989)	396	3	2	5

Table 5.2

Dumping, diarrhoea and vomiting in published series of H.S.V.
(- indicates not described)

The one area in which H.S.V. remains under suspicion is that of recurrent ulcer.

Recurrent ulcer has proved in the published literature to be the main problem associated with the operation. The tables below show the recurrence rate, operative mortality and Visick gradings in those published series with minimum follow-up of 5 years or maximal follow-up of 12 years or more.

	F.U. Period (Years)	Total	Recurrence (%)	Mortality (%)	Visick I + II (%)
Goligher (1978)	5-8	259	5 (1%)	0	NK
Nilsell (1979)	5-9	52	10 (19%)	NK	NK
Madsen (1980)	5-8	100	26 (26%)	NK	NK
Blackett (1981)	5-12	233	25 (11%)	NK	NK
Storey (1981)	5-9	93	15 (16%)	0	NK
Muhe (1982)	5-6	524	73 (14%)		
Liavag (1982)	5-10	282	35 (12%)		
de Miguel (1982)	5-9	143	14 (10%)	0.6	85
Lunde (1983)	5-11	428	51 (12%)	NK	NK
de Vries (1983)	5-7	71	7 (10%)	0	72
Gorey (1984)	5-12	350	28 (8%)	0	88
Graffner (1985)	5-10	405	57 (14%)	0.5	NK
Teichman (1985)	10-	68	18 (25%)		
Herrington (1986)	6-13	109	10 (9%)	0.7	83
Paimela (1987)	8-11	67	11 (16%)		
Holstein (1987)	10-13	100	18 (18%)	NK	NK
Muller (1987)	5-	493	69 (14%)	0.2	92
Schache (1989)	5-15	242	20 (11%)	0	85
Soper (1989)	5-13	396	55 (14%)	0	89
Hoffman (1987)	14-18	106	32 (30%)	0	57
Johnston G.W. (1989)	10-20	305	46 (15%)	0.2	92

Table 5.2

Summary of results following H.S.V. in published series with a minimum follow-up of 5 years

Series which have a maximum length of follow-up of more than 10 years have also been considered.

	F.U. Period (Years)	Total	Recurrence (%)	Mortality (%)	Visick I + II (%)
Donahue (1984)	4-12	40	8 (20%)	0	NK
Marceau (1986)	3-12	203	24 (12%)	0	88
Ensog (1986)	1-10	306	42 (13.8%)	0	67
Jordan (1986)	1-10	90	9 (10%)		
Byrne (1987)	1-14	223	25 (11.2%)	0.4	83.4
Martin (1989)	1-19	990	100 (10.1%)		
Raab (1989)	1-16	984	271 (29.7%)	0.3	79.1

Table 5.3

Summary of results following H.S.V. in published series with follow-up exceeding 10 years

For a given recurrence rate to be meaningful the length of follow-up of the series is crucial. It has been well established that recurrent ulcer after highly selective vagotomy continues to present throughout the length of

follow-up so that those series with long follow-up will have higher recurrence rates (Taylor 1988). Indeed in one of the series with the longest follow-up yet available (Hoffman 1988) only one-third of recurrences were manifest at 5 years. For all these reasons only those series with a minimum follow-up of 5 years or a maximal follow-up of 10 years or more have been included.

This review of published experience inevitably shows a considerable range of recurrent ulcer rates. Apart from variations in the all important length and completeness of follow-up, there must be variations in surgical technique in a procedure in which the detail of that surgical technique is crucial. Jordan (1987) has confirmed statistically significant differences between recurrence rates of different surgeons on long-term follow-up. Nor can criteria of selection for the operation be uniform - some of the series included pyloric or prepyloric ulcers for which the procedure is now known to be inappropriate (Muller 1987). Furthermore definitions of recurrent ulcer differ. For most surgeons there are ethical objections to endoscoping asymptomatic patients. The recurrent ulcer rates referred to are therefore symptomatic recurrences. Most workers have accepted the definition that any peptic ulcer be it in duodenum or stomach, large or small, acute or chronic, shall be designated recurrent ulcer. Because of these differences in definition more emphasis has been placed in this study on the behaviour of recurrent ulcer, its symptoms, its complications and its response to treatment.

Other variations on the theme were described by Taylor in Edinburgh (Taylor 1979). His lesser curve sero-myotomy reduced the time and the tedium of H.S.V. Hill (1978) developed a further variant combining anterior H.S.V. and latterly sero-myotomy with posterior truncal reducing the operating time still further.

With the continuing decline in the incidence of duodenal ulcer, the increasing efficacy of medical treatment, and the introduction of endoscopic therapy, it seems unlikely that further innovations in the surgical management of the disease will be forthcoming. As surgical interest has inevitably decreased and the time and resource devoted by surgeons to duodenal ulcer has lessened so it seems increasingly likely that the above procedures will represent the last surgical contribution to the management of duodenal ulcer.

CHAPTER 6

VAGOTOMY AND ANTRECTOMY

Vagotomy combined with antrectomy represents an approach to duodenal ulcer disease which more than any other is based on a clear understanding of the physiology of gastric acid secretion. Arguably the procedure abolishes both the cephalic and gastric phases of acid secretion without the need for extensive gastric resection with its untoward sequelae. It is undoubtedly the procedure which most successfully abolishes the ulcer diathesis.

Klein (1929) published the first report of the combination describing anterior truncal vagotomy combined with Billroth I gastrectomy in 8 patients with duodenal ulcer "with hyperacidity". The problem of hyperacidity in the aetiology of duodenal ulcer was appreciated by Winkelstein and Berg who in 1938 advocated vagotomy and partial gastrectomy and were able to demonstrate achlorhydria as a result of the procedure (Winkelstein and Berg 1938).

The experimental and clinical studies on vagotomy by Dragstedt have been described in Chapter 4. His group (Woodward 1954) showed that in dogs with a Pavlov pouch, gastric secretion was reduced after vagotomy but subsequent antrectomy completely abolished secretion in the isolated stomach pouch.

The experimental work of Storer (1950) in Dragstedt's laboratory demonstrated in the dog the superiority of vagotomy and antrectomy in preventing recurrent ulceration. In the Mann-Williamson preparation vagotomy alone protected against ulceration in 55% of animals, antrectomy alone in 66% and vagotomy plus antrectomy in 83%. Kay (1962) compared the acid response to histamine in man following those three procedures. Vagotomy reduced maximal acid output by 60%, antrectomy by 70% and a combination of the two procedures by 95%. The first clinical reports of

complete truncal vagotomy, as advocated by Dragstedt, combined with gastric resection, came from Farmer and Smithwick (Farmer 1951) who performed a 50% gastrectomy, arguing that by removing the antrum in addition to performing truncal vagotomy they could in one operation reduce the two major stimuli to parietal cell acid production. They made the important observation that this procedure reduced acid output as much as radical gastrectomy, alone or combined with vagotomy.

Edward and Herrington (1953) described a 40% gastrectomy a procedure which they christened "antrectomy". They performed their first such procedure in 1947 the same year in which Daintree Johnson in London described a similar operation (Orr and Johnson 1947).

Dragstedt's group showed in a series of animal experiments an 86% reduction in acid output in both Pavlov and Heidenhain pouches (Woodward 1950) and virtual complete protection against stomal ulcer in the Mann-Williamson preparation (Storer 1950).

The procedure was taken up with enthusiasm in the United States with numerous reports of series with recurrent ulcer rates of less than 1% (Table 6.1).

	n	'Satisfactory' Visick I + II	Recurrence rate	Mortality	Length F.U.
Thoroughman (1964)	504	91%	0.4%	1.6%	2-14
Goligher (1968)	116	78%	1.7%	0%	5-8
Cox (1970)	2405	97%	0.7%	1.5%	NK
Palumbo (1970)	510	90%	0.6%	2.7%	1-16
Wolf (1972)	547	90%	0.6%	1.1%	1-10
Postlethwait (1973)	331	89%	0.7%	0.9%	10
Smithwick (1974)	719	93%	1.5%	1.9%	1-26
Jordan (1974)	90	89%	1.1%	0%	1-8
Sawyers (1977)	50	94%	0%	0%	NK
Dorricot (1978)	106	68%	0.9%	0.9%	NK
Hubert (1980)	466	95%	0.7%	1.1%	13-25
Fiser (1982)	148	86%	1.4%	0.7%	1-10
Koo (1983)	51	96%	0%	2%	1-6
Donahue (1984)	46	80%	0%	0%	4-12
Herrington (1986)	3642	94%	0.5%	1.5%	1-30

Table 6.1

Results of published series of vagotomy with antrectomy

The vast experience reported by Herrington represents the combined experience of the three major hospitals in Nashville Tennessee, dating from 1947. The reconstruction was of the Billroth I type.

In many centres in North America this remains the operation of choice for duodenal ulcer (Nyhus 1986) and in these centres it seems unlikely to be displaced by any other surgical technique but rather by medical therapy.

CHAPTER 7

PERFORATED DUODENAL ULCER

Since the first successful operation for perforated duodenal ulcer by Dean in 1894 (Dean 1894), there has been controversy as to the best operative management. Each new definitive operation had its advocates in the immediate treatment of perforation.

The obvious first treatment was simple closure. Pyloric stenosis could follow simple closure of large ulcers, and gastro-enterostomy, which was being increasingly performed for non-perforated ulcer, was advocated as an addition to simple closure but failed to find favour.

Recurrent ulcer dyspepsia in 50-70% of survivors (Illingworth, Scott and Jamieson 1946) was the problem which stimulated the move toward an immediate definitive procedure. This led to the introduction of partial gastrectomy in some centres as immediate definitive treatment. This resulted in a debate about safety. Was definitive surgery possible without an increase in operative mortality ? Several small published series suggested that this was so but again the procedure failed to gain widespread acceptance. When truncal vagotomy became available this too was recommended as a safer immediate definitive operation. This procedure and its successor highly selective vagotomy was shown in several large series to carry no greater an operative mortality than simple closure.

There remained, however, considerable controversy about the natural history of perforated ulcer after simple closure and doubt persisted about whether or not immediate definitive surgery was indicated at all. The many published series of the natural history of ulcer disease following simple closure showed considerable disagreement. One school suggested that perforation was an isolated self-limiting complication of ulcer disease from which further symptoms were uncommon. The other suggested that perforation indicated an aggressive ulcer diathesis unlikely to resolve without

further treatment. A compromise position between these extremes resulted in the evolution of a policy of selection for immediate definitive operation. Only those patients considered at risk of subsequent symptoms were selected for immediate definitive operation, the remainder having simple closure.

The problem of how to select patients remained. The most widely used predictor was length of ulcer history; those with a short (less than 3 month) dyspeptic history before perforation were, it was argued, likely to have "acute" ulceration and thus unlikely to have future problems (Illingworth 1946). Neither this nor the surgeon's judgement about "acute" or "chronic" at the time of operation proved a successful predictor.

On the other hand a blanket policy of definitive surgery for all at the time of perforation resulted in unnecessary operations with their attendant side effects.

The controversy seems to have been resolved by the advent of the H2 receptor antagonists which have restored simple closure as procedure of first choice. The risks of recurrent ulcer dyspepsia can be reduced by prescribing an H2 receptor antagonist at the time of simple closure. As in the treatment of uncomplicated duodenal ulcer so in the treatment of perforation, the H2RA or proton pump antagonists seem destined to replace definitive ulcer procedures.

Historical Aspects

The first report of the clinical features and autopsy findings in patients with perforated peptic ulcer came from Sir Benjamin Travers in 1817 (Travers 1817). Dr. John Abercrombie, an Edinburgh physician, described in 1828 the clinical and autopsy findings and refers to a specimen in the Royal

College of Surgeons of Edinburgh (Abercrombie 1828). (This specimen has been located and is shown in Plate 1. This is thought to have originally belonged to the Wilson collection and came to Edinburgh in 1824 as part of the Bell collection) By 1843 Crisp was able to report 50 cases of gastric and duodenal perforations in the Lancet (Crisp 1843).

The first attempt to treat the condition by surgical closure was made unsuccessfully by Mikulicz in 1887 (Mikulicz 1888). Heussner in 1882 successfully closed a perforated gastric ulcer (Kriege 1892). Credit for the first successful operation is ascribed to Dean who in 1894 successfully treated a perforated duodenal ulcer by simple closure (Dean 1894). Gastro-enterostomy, which was being increasingly practised as the 19th century drew to a close, was advocated by Braun in 1897 as an adjunct to simple closure (Braun 1897). Initially this was to overcome the problem of duodenal narrowing resulting from the closure of large ulcers. By the first decade of the 20th century another advantage of the technique was claimed - ulcer recurrence was allegedly lower. Moynihan who was to remain until the 1930's an ardent advocate of gastro-enterostomy as the elective operation of choice for duodenal ulcer, did not support its use in perforated ulcer unless stenosis seemed likely as a result of closure. It gained acceptance in only a few centres. Roscoe Graham's powerful advocacy of simple closure based on his own series which carried a 2% operative mortality (Graham 1937) continued to influence surgical practice well into the 1950's. He was clear in advising surgeons that their responsibility to the patient with a perforated ulcer extended only to life saving measures but not to trying to cure the ulcer problem for good.

So simple closure remained the treatment of choice for about fifty years. Harkins (1961) commented that while in 1946 simple closure remained the

preferred treatment for perforated ulcer, by 1960 three methods - simple closure, immediate gastrectomy and continuous aspiration were popular to varying degrees in different clinics.

Immediate gastrectomy was reported by Keetly in 1902 (Keetly 1902) and this treatment was advocated by von Haberer in 1919 (von Haberer 1919).

In a review of published literature DeBakey in 1940 calculated that for the period 1930-1940 mortality rate following emergency gastrectomy was 25% in over sixteen thousand published cases (DeBakey 1940). Illingworth showed that the mortality in Glasgow over the period 1924-1943 was 12.5% (Illingworth, Scott, Jamieson 1946). Yudine in Moscow in 1939 reported 937 cases of perforated ulcer treated by immediate gastrectomy with a mortality rate of 8.9% (Yudine 1939). Although this appeared to be an improved on treatment by simple closure it was taken up by few British or American surgeons. Lowden in 1952 published a series of sixty-five perforations of whom 51 were treated by gastrectomy with no deaths when fit patients under 70 years were selected for this definitive treatment (Lowden 1952). Many authors continued to advocate the procedure including Bisgard (1956), Emmet and Williams (1957), Jordan and DeBakey (1961). Gastric resection failed to gain acceptance as an immediate definitive procedure and has now largely been abandoned.

Non-operative treatment, first advocated in the 1930's enjoyed a vogue in the 1940's and 1950's. Thereafter it fell into disuse except for very high risk patients. With the development of more intensive and more effective methods of support, the method has again evoked interest.

Lane (1931) was the first to record the use of non-operative treatment and Wangensteen (1935) recorded 3 cases treated in this way. Seely reported

a series in 1951 of 106 cases with 1 death (0.9% mortality). The incidence of intraperitoneal abscess was 15% not greatly different from the levels in operated series of the time.

Herman Taylor practised this technique from 1944 and published his 10 year experience in 1957. In this series of 208 perforations the mortality rate was 1.9%. He considered that when the technique was confined to young patients or "acute" ulcer perforations the mortality (1 to 7%) was as good as that following operative treatment.

By 1956 Seely was able to record 784 cases treated non-operatively with a mortality rate of 4.5%.

Heslop (1952) compared operative to conservative treatment in 2 unselected groups of patients but without randomisation. The mortality in the operated group was 9% and was 8% for patients treated conservatively.

By 1960 Harkins reported that three methods, simple closure, immediate vagotomy and drainage and partial gastrectomy were all widely practised at that time by American surgeons (Harkins 1960).

But it was simple closure that remained the treatment of choice in the U.K. Shepherd (1960) reviewing the three main treatment options then available concluded that simple closure remained the treatment of choice for most perforated duodenal ulcers. The controversies in treatment centered around whether a definitive procedure should be added in any, or all, or in selected patients only. There was also controversy amongst the advocates of selection about how to select.

Illingworth (1946) showed that patients with a dyspeptic history of less than 3 months before operation had a much lower incidence of subsequent

dyspepsia. He therefore suggested a policy of immediate definitive surgery for those patients with a dyspeptic history of longer than three months at the time of perforation. The concept of "acute" versus "chronic" ulcers led to the advocacy of a policy of simple closure for "acute" and definitive treatment for "chronic" ulcers.

There remained, however, considerable disagreement about the natural history of perforated ulcer after simple closure and the need for subsequent definitive surgery. Reports of the need for subsequent definitive surgery ranged from 27-71% (Table 7.1).

	n	Subsequent Definitive Surgery
Skovgaard (1977)	111	71%
Wagensteen (1972)	89	70%
Griffin (1976)	122	58%
Gillen (1986)	54	57%
Jarret (1972)	297	45%
Backgaard (1979)	80	43%
Nemanich (1970)	79	43%
Heuman (1983)	77	42%
Boey (1985)	393	39%
Sawyers (1975)	254	37%
King (1987)	86	27%

Table 7.1

Further surgery after simple closure of perforated duodenal ulcer

The popularity of simple closure as the treatment of choice had been enhanced by two series in the mid 1930's with very low mortality. Tilton (1936) reported 52 consecutive cases treated by simple suture with 1 death - a 1.9% mortality. Roscoe Graham (1937) described a similar series of 51 consecutive cases with a single death giving an identical mortality of 1.9%. On the basis of this series Graham became a powerful advocate against a definitive procedure writing in 1937 that: "We have no responsibility to such patients but to save their lives. Any procedure of a more extensive character which aims to do more than this under the conditions and circumstances attending the perforation of a duodenal ulcer can, quite

justifiably be considered meddlesome surgery. We have no responsibility during the emergency to carry out any procedure designed to cure the patient of his original duodenal ulcer."

The controversy about simple closure versus definitive treatment has its origins in the early years of the century. Only when long term follow-up studies within controlled randomised trials become available can the controversy be resolved. The lack of such trials (outwith the Far East where the disease may well be different) has left insufficient evidence to date to resolve the controversy.

The greatest advance in elective management of duodenal ulcer has undoubtedly been the introduction of H2 receptor antagonists. How have they affected the management of perforated duodenal ulcer ? There is controversy in the published studies. Simpson (1987) showed that Cimetidine prescribed immediately postoperatively reduced subsequent dyspepsia and ulcer complications in the short term. By contrast Gillen (1986) found that the introduction of H2 receptor antagonists did not reduce the need for subsequent definitive surgery which remained at 57.4% in their hands. This led these authors to conclude that duodenal ulcer should be treated by definitive surgery whenever possible. This view was supported by the controlled studies of Boey and Wong (1987) and Tanphiphat (1985) and by the retrospective studies reported by Jordan (1982), Bennet (1985) and Wara (1983).

In recent years the demographic profile of the population with perforated duodenal ulcer has changed with an increase in the incidence in older age groups in Britain (Watt 1986) and in Finland (Paimela 1991). At least one recent series has suggested that, even with the improved resuscitation and anaesthetic techniques now available, that immediate definitive procedures

carry a significantly higher mortality in the elderly (Irvin 1989).

A major aim of our study into treatment of perforated duodenal ulcer was to determine whether an immediate definitive procedure was associated with a higher operative mortality, and to determine the effect of the immediate prescription of H2 receptor antagonists on the need for subsequent definitive surgery and the symptomatic outcome in patients with perforated duodenal ulcer.

CHAPTER 8

THE DEVELOPMENT OF AUDIT IN DUODENAL ULCER SURGERY

Billroth's remarkable contributions to gastro-intestinal surgery extended far beyond the operating theatre. Before his time scant attention was paid to the outcome after surgery. The assessment used by Florence Nightingale in the Crimea War of "improved, disimproved, died" held sway in many hospitals until the turn of the century and even beyond. It was Billroth who imposed on himself and all his pupils the discipline of recording each operation performed and the result. This methodical documenting of operative detail and outcome was to become one of the hallmarks of the Billroth school. His pupils including Esmarch, Mikulitz and Kocher passed on this discipline to Holstead in the United States and Moynihan in the United Kingdom.

The earliest account of the longer term results of surgery for duodenal ulcer were published by Czerney in 1908 (Czerney 1908).

In the United Kingdom Moynihan documented in great detail all the cases of duodenal ulcer which he operated on from his first case in January 1900. By 1910 he was able to publish the results of a series of 186 patients with 4 post operative deaths. Follow-up information extending up to 9 years postoperatively was available in 171 of the 182 cases (Moynihan 1910).

As the number of operations for ulcer grew and the need to assess their efficacy was recognised, clinics were set up specifically to review the long term results of surgery after peptic ulcer disease. Amongst the earliest of these was that established by Sir James Walton in London in the 1920's (Walton 1935).

As the incidence of duodenal ulcer increased in the U.K. over the first three decades of the 20th century, so too did its relative importance to the

workload of the general surgeon. The concept of a clinic or department devoted to regular, comprehensive and accurate follow-up took root in several centres in the United Kingdom.

The best known of these clinics were those in York established by Hedley Visick in 1942, by Sir Charles Illingworth in Glasgow in 1951, by Norman Tanner in St. James' Hospital, Balham, by Professor John Goligher in Leeds and latterly by Terence Kennedy in Belfast. The clinic established by W. P. Small at the Western General Hospital in Edinburgh in 1953 was among the largest and most successful of these and it is the results from this clinic which form the basis for the analysis of the results of surgery for duodenal ulcer in this thesis.

Hedley Visick, a York surgeon, deserves much of the credit for establishing a clinic devoted exclusively to the follow-up of patients following surgery for peptic ulcer. Visick, in conjunction with a physician, Dr. David Cameron, and a radiologist, Dr. C. N. Pulvertaft, organised a follow-up department funded initially by Visick himself and latterly by the York Peptic Ulcer Research Trust. Among the contributions of this clinic was the development of the "Visick grading". This was the first attempt to quantify the results of peptic ulcer operations.

In 1948 Visick outlined the techniques of follow-up in use at that time: "We send a questionnaire to every patient a week before his regular six monthly visit to the follow-up clinic. If he cannot come he returns it and the board grade him according to his answers. Where a returned card indicates that a patient does not clearly understand the questions the almoner or the welfare officer calls to explain. If a returned card suggests that the patient has pain or vomiting or has lost work, an appointment is made

for a personal examination and interview" (Visick 1948).

He goes on "only one patient was lost sight of in 1947". Pulvertaft writing in 1952 comments that, in the first ten years of its existence, follow-up at the clinic was 97.5% complete (Pulvertaft 1952).

The establishment of these follow-up clinics allowed a comprehensive long term follow-up over many years after the duodenal ulcer operation. By following-up over 90% and in many instances over 95% of patients it became possible for the first time to assess the long term results and sequelae of ulcer operations.

CHAPTER 9

THE CHANGING EPIDEMIOLOGY OF DUODENAL ULCER

While duodenal ulcer has been recognised as a clinical and pathological entity since the early years of the 19th century, there have been, and remain considerable difficulties in assessing the incidence and prevalence of the disease. The changes which continue to take place in the temporal, geographic, and gender incidence of the disease have been the subject of considerable research. The reasons for these changes give rise to continuing speculation.

Information about incidence has come from several sources; from autopsy studies, from hospital admission rates, from mortality studies, and more recently from studies of defined populations. Each one of these has its own problems of interpretation. Because of these problems the incidence of perforation of duodenal ulcer has been used as a readily diagnosable index of the disease incidence. Yet this method too has problems in interpretation. Finally rates of elective operations for the condition have been studied.

Autopsy studies are performed on a selected population, biased toward subjects who have died in hospital. Autopsies furthermore often fail to distinguish between acute and chronic ulcers and may fail to diagnose the scarring of the healed ulcer.

Hospital admission rates are subject to enormous variations in the way duodenal ulcer is managed in different centres. Before the 1960's uncomplicated ulcer was managed by hospital admission in many centres, whereas since then admission to hospital has been reserved for complications of the disease making hospital admission rates an unreliable marker for disease incidence.

Mortality studies give information only about the small minority of

ulcer patients who die from the condition. This minority are in many respects unrepresentative of ulcer patients as a whole.

In many respects studies of the rate of consultation with a primary care doctor for episodes in which duodenal ulcer is the final diagnosis, allow more accurate estimation of the incidence of the condition. The problem with this approach is that the method of diagnosing duodenal ulcer must be a standard one, ideally by endoscopy. Furthermore symptom complexes must be investigated using a standard protocol.

Studies of the incidence of duodenal ulcer in defined populations have become possible in recent years because of full documentation of all medical consultations in some general practices in the U.K., of Health Maintenance Organisations in the U.S.A., and of accurate registration and documentation in stable urban populations in Scandanavia. The increasing use of fibreoptic endoscopy has arguably improved the accuracy of diagnosis of current and more especially previous episodes of duodenal ulceration. Yet even in these circumstances the real accuracy of incidence measurement may be distorted by self-medication and by the asymptomatic ulcer.

The incidence of perforated duodenal ulcer as a yardstick of incidence has several attractions. The diagnosis is usually unequivocal and independent of observer variation. Treatment has uniformly been by operation in the vast majority of cases providing reliable statistics. Several authors, notably Sanders (1967) have suggested that perforations represent some 11% of the ulcer population and that perforation incidence is the most appropriate measure of incidence within a population. This is unlikely to be the case, however, as perforation rates vary between different populations and may be influenced by the age profile of the population and by other variables such as consumption of NSAIDs.

Each of these types of study will be considered in turn.

a) **Autopsy Studies**

Amongst the earliest autopsy studies to address the problem included those of Rokitansky (1839) who described 6 duodenal ulcers in his series from Vienna. Grunfeld in 1882 in Denmark was probably the first to look specifically for peptic ulcer in an autopsy series. In his personal series of 1,000 autopsies he found only 4 duodenal ulcers (Grunfeld 1882).

The earliest autopsy report from the U.K. was that of Perry and Shaw (1893) who found 149 duodenal ulcers in 17,652 autopsies, an incidence of 0.84%. In 1900 Fenwick and Fenwick reported a series of 47,912 autopsies from several centres which had been performed by several pathologists. In 2,019 (4.2%) either an ulcer or a scar was present (Fenwick and Fenwick 1900).

The increase in the incidence of duodenal ulcer disease at autopsy continued throughout the first half of the 20th century. In Stewart's series (Stewart 1929) of 2,000 patients, 374 (9.5%) had acute or chronic duodenal ulcer or scarring. This series is likely to be amongst the most accurate because it was conducted by one pathologist with a declared interest in the problem of duodenal ulcer.

These autopsy studies carried out between 1930-1960 have shown the highest incidence of duodenal ulcer.

A subsequent study from Stewart's department in Leeds examined 12,640 autopsies between 1930-1949 and found that 11.6% of males and 4.8% of females had duodenal ulcer (Watkinson 1960). Portis and Jaffe studied 9,171 autopsies at Cook County Hospital, New York, between 1929 and 1936. 218 patients (2.5%) were found to have duodenal ulcer (Portis and Jaffe 1938).

Falconer (1943) reported from Stockholm a series of 9,300 autopsies performed between 1930-1941. A total of 14.5% had duodenal ulcer disease.

The study by Levij in Rotterdam between 1940-1959 found that 15.6% of 8,019 corpses examined had evidence of duodenal ulcer disease (Levij 1963).

Thus autopsy studies performed in the first 60 years of the century have shown a progressive rise. Since 1960 the incidence of duodenal ulcer reported at autopsy has declined.

Watkinson (1960) reporting the British National Survey of peptic ulcer at autopsy, described duodenal ulcer lesions in 6.3% of which 3.9% were active and 2.4% ulcer scars.

A necropsy study from Malmo in Sweden (Lindstrom 1977) showed that of 2,218 subjects over 20 years and comprising 88% of all Malmo residents who died during the study year of 1969, 122 (5.5%) had active or previous duodenal ulcer.

b) **Hospital Admission/Discharge Rates**

Wilkie (1927) reported an increase in duodenal ulcers diagnosed in Edinburgh Royal Infirmary from 24 in 1906 to 236 in 1926.

More accurate statistics about disease specific hospital admission rates first became available in the 1950's. Before then the only discharge statistics available were from the armed services. Tidy (1943) documents British Army statistics for medical discharges resulting from inflammation or ulceration of the stomach or duodenum. For the years 1914-1915 there were 709, whereas for 1939-1941 there were 23,574.

Ivy (1946) calculated that 10% of the male population of the Western world would develop duodenal ulcer disease in their lifetime. This has become a dictum frequently quoted since then and has become difficult to disprove or alter despite the mass of epidemiological data which has become available since then.

Langman and his colleagues (Brown 1976, Coggan 1981) studied Hospital In-Patient Enquiry figures which record a one-tenth sample of all discharges and deaths from acute hospitals in England and Wales. In their study discharges for non perforated duodenal ulcer between 1958 and 1972 decreased from 34,083 to 29,988 a fall of 12.01%. In the succeeding five year period 1973-1977 admissions fell to 21,500 a decline of 28% over 5 years and 40% over 20 years.

A similar study (SCRIPS Review 1978) of discharges from all Scottish hospitals, showed a decline in patients with a diagnosis of duodenal ulcer between 1968-1975. For males the decrease over this 6 year period was 31%. This decline was confined to the under 65 age group.

A similar study from Finland showed a 15% decline in all hospital discharges in Finland, between 1969-1984 (Tilvis 1987). This decline occurred despite no change in the number of patients with perforation.

In the United States Kurata and colleagues (1982) reported discharge rates for all non-federal hospitals. They found between 1970-1978 a fall in hospital admissions from 153/100,000 to 82/100,000 a decline of 46%. Elashoff and Grossman (1980) reported similar findings. Wylie reported similar findings with the rate for hospital admission with a primary diagnosis of peptic ulcer falling from 25.2/10,000 in 1965 to 16.5/10,000 in 1981 in 790 U.S. hospitals, a decline of 29.5% (Wylie 1981).

A study from the Trent region of England (Bardhan et al 1989) showed no change in admission rates for perforated duodenal ulcer between 1972-1976 (99 per 10/6) and 1977-1984 (103 per 10/6). The rates for elective operations for uncomplicated ulcer fell by 53% between these two periods.

c) **Consultations in Primary Care**

Declining hospital admission rates may merely indicate that uncomplicated duodenal ulcer no longer requires admission to hospital rather than reflecting a true decline in incidence of the condition.

Meade (1968) reported a 40% decline in the incidence of duodenal ulcer amongst British physicians between 1940-1965. For male physicians aged between 35 and 64 the incidence fell from 3.1/1,000 in 1947-1950 to 2.4/1,000 in 1957-1960 to 1.7/1,000 in 1961-1965. A study of physicians in Massachusetts (Monson and McMahon 1969) showed a similar fall. In this study the lifetime prevalence was 9% in a study group with a mean age of 45 years.

The two studies by the Royal College of General Practitioners (RCGP) and the Office of Population and Census Statistics (OPCS) showed a fall in the numbers of patients consulting with a final diagnosis of duodenal ulcer. In 1955-1956 the rate was 5.9 per 1,000 consultations, by 1970-1971 it had fallen to 3.5. The decline was confined to men (Table 9.1).

	1955-1956	1970-1971
Males	9.6	5.3
Females	2.6	3.1
Both	5.9	3.5

Table 9.1

Rates per 1,000 patients consulting their General Practitioner 1955-1956 and 1970-1971 (RCGP/OPCS 1958, 1974)

In the United States, Vogt and Johnson (1980) reported on out-patient attendances by members of a Health Maintenance Organisation with over 200,000 members. By studying a 5% sample they estimated that the number of "out-patient episodes" for duodenal ulcer had declined from 13.7 per 1,000 patient years in 1967 to 4.1 episodes per 1,000 patient years in 1973.

Sonnenberg (1987) analysed National Disease and Therapeutic index statistics, which record consultations with over 200,000 office based physicians throughout the U.S.A. of whom a different 200 are randomly sampled each month. The rates of consultation by patients whose final diagnosis was duodenal ulcer fell from 43.0 in 1960 to 9.3 in 1981-1984 for men. For women the fall for the same period was from 19.9 to 7.5 per 1,000 consultations.

d) **Population Studies**

The incidence and prevalence of duodenal ulcer in a defined population has been difficult to assess until recent years because of the lack of a reliable end point. A conclusive diagnosis of ulcer can now be made by dependable barium or endoscopic examination applied to each member of that population with possible symptoms of duodenal ulcer.

Two Scottish studies, one from the South-West, the other from the North-East attempted to define the incidence of peptic ulcer in the respective communities. Litton and Murdoch (1963) calculated that the

incidence of duodenal ulcer in South-West Scotland between 1957-1959 was 7.9 per 1,000 but this included perforations, diagnoses made at laparotomy, and was weakened by confirming the diagnosis radiologically only in "the majority of cases".

Weir and Backett (1968) reported on the incidence of dyspepsia in the North-East of Scotland between 1960-1963 but their study of the incidence of proven peptic ulcer was based on a sample of 1,328, did not discriminate between gastric and duodenal ulcer and was confined to a rural community.

Bonnevie (1975) published what has been arguably the most accurate study to date on the incidence of duodenal ulcer in a defined population. The 500,000 residents of Copenhagen County were included and all barium meal and operation reports on this population were studied. Between 1962-1968 the annual incidence of new duodenal ulcer cases averaged 1.3 per 1,000 inhabitants over the age of 15 years.

By extrapolating the data from the U.S. National Health Interview Survey, Kurata and Haile (1984) calculated the one year period prevalence in the U.S.A. between 1961-1981 was 1.7-1.9%. During this period the prevalence for men fell from 2.31% in 1961 to 1.77% in 1981, while for women it rose from 1.11% in 1961 to 1.72% in 1981. The net effect was little change in the overall rate. From this data they reckoned that about 10% of U.S. citizens would develop peptic ulcer at some time in their life.

Schoon et al (1989) studied the population of Gothenberg in 1985. All duodenal ulcers diagnosed by radiology, gastroscopy, or laparotomy were included - a task facilitated by the computerised diagnostic registers in each department involved. They found 563 duodenal ulcers in the study year 1985, a rate of 1.56 per 1,000 population per annum.

To date it has not proved possible to assess the incidence in a defined British population.

e) **Perforated Duodenal Ulcer Rates**

Because of problems with collection, interpretation and comparison of data about uncomplicated duodenal ulcer, perforated ulcer has been used as a convenient yardstick of disease incidence (Susser 1962, Sanders 1967, Pulvertaft 1968). Readily diagnosed and universally treated in hospital it has allowed comparisons of geographical and temporal differences in incidence.

The earliest case reports have been described in Chapter 7. Reviewing the world literature at the turn of the century Brunner (1903) was able to find only 361 cases of perforated peptic ulcer to that time. Moynihan's entire experience by 1910 was of only 11 cases (Moynihan 1910). Schoemaker (1915) described a further 244 cases reported in the published literature between 1903-1911.

Bager (1929) collected all cases of perforated peptic ulcer in fifty Swedish hospitals between 1911-1925. Over this period he reported a progressive annual increase in the number of male admissions from 60 per year in 1911 to 130 per year in 1925. The difference in epidemiology between the sexes which had been recognised before the turn of the century, was again demonstrated in this study with no change in admissions in females over the study period.

Jennings (1940) in a major review of the age incidence and sex distribution over the previous 150 years clearly demonstrated the changing epidemiology. He showed that, before 1900 some 50% of peptic ulcer perforations affected females under the age of 25 years. After 1920, 90%

of such perforations affected males under 25 years.

The epidemiology of perforated peptic ulcer is an area in which studies from Scotland have been pre-eminent.

The early studies of Caird (1913) in Edinburgh reporting the years 1898-1912 and Dunbar (1929) who reported experience between 1913-1924 in Glasgow are valuable in demonstrating the very low incidence of the problem in the early years of the century. The major study of perforated peptic ulcer in the West of Scotland by Illingworth and his colleagues provides a unique record of the changing epidemiology of perforated peptic ulcer from 1924 when it was a relatively uncommon condition to 1973 by which time the ulcer epidemic had begun to decline (Illingworth, Scott, Jamieson 1944, Jamieson 1955, MacKay 1966, MacKay 1976). In these four successive studies all perforated peptic ulcers in the West of Scotland diagnosed at laparotomy or autopsy were included. The changing incidence over this period is shown in Fig. 9.1.

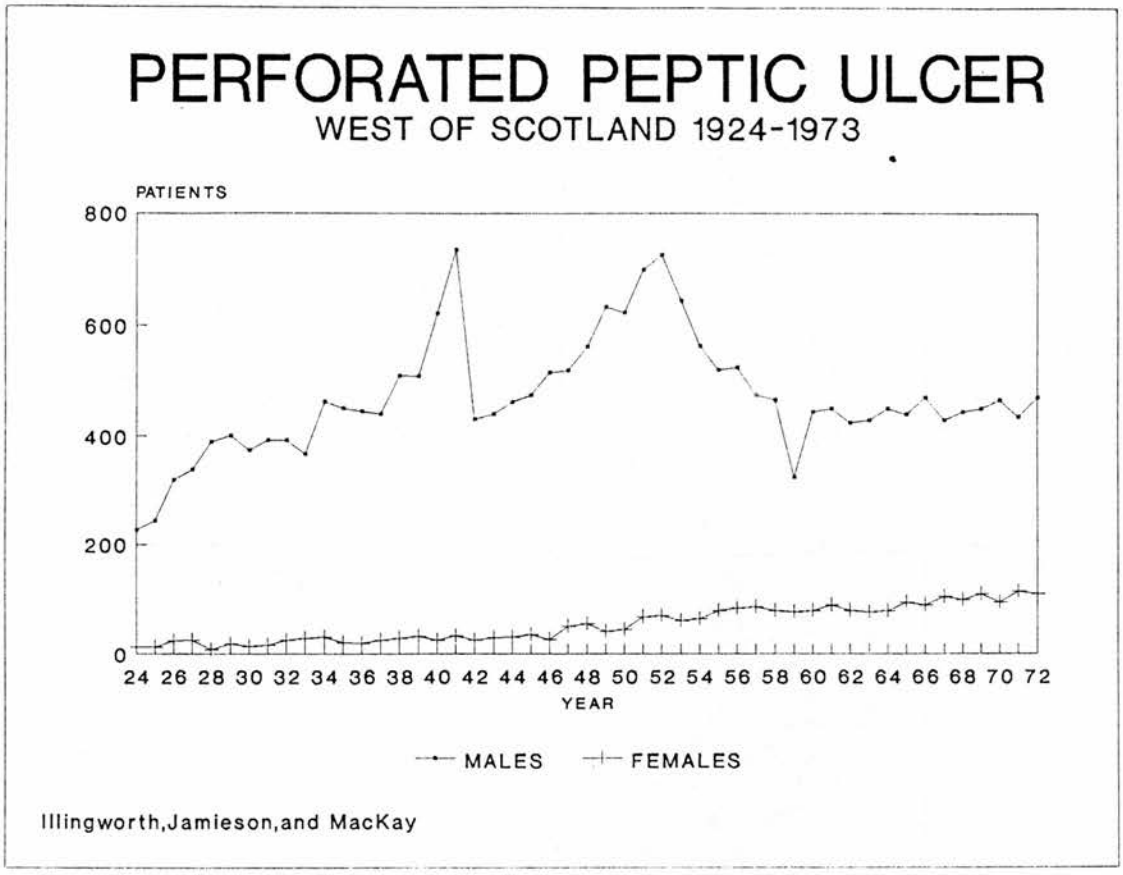


Fig. 9.1

Perforated peptic ulcer in the West of Scotland

From 1953 the decline in annual incidence is apparent, but has remained constant since 1963 with a relative increase in females.

The incidence of perforated peptic ulcer in South-West Scotland over the period 1946-1980 was reported by Neilson (1966) and Dark and MacArthur (1983). In the earlier part of the study period (1946-1965) the incidence of duodenal ulcer perforations increased to a peak of 19/100,000 population. In the later part (1966-1980) the incidence declined to 12/100,000 population. The incidence in females remained static over the period of the study. Over this time period the incidence of perforated gastric ulcer remained constant at $2.5/10^5$ population.

English national statistics were published by Brown, Langman and Lambert

(1976) using Hospital In-Patient Enquiry. The admission rates/10^5 for perforated duodenal ulcer fell by 25% for men but rose by 12% for women between 1958-1972 (Table 9.2).

	Men	Women
1958-1960	29.4	4.41
1961-1963	26.1	4.39
1964-1966	24.8	4.05
1967-1969	25.5	4.69
1970-1972	22.1	4.93

Table 9.2

Yearly admission rates per 10^5 population perforated duodenal ulcer in England and Wales (from Brown, Langman and Lambert 1976)

In an extension to that study, Coggan, Lambert and Langman (1981) reported a continuing decline in cases of perforated duodenal ulcer in the years 1973-1977. Analysis by age and sex, however, showed a persisting decline in males of all ages, while the incidence in females over 45 years rose. Thus between 1958-1962 and 1973-1977 the incidence of perforated duodenal ulcer in females aged 65-75 increased by 46% while that for females aged over 75 increased by 60%.

Yet several recent studies have suggested that since 1970 the annual number of duodenal perforations has remained constant.

Dreghorn and Moffat (1984) found no change in annual number of perforations when the period 1971-1982 was compared with 1970-1976 in Western Scotland. Similarly Gillen (1986) found no change in annual numbers over 1970-1982 in North-East England.

Gustavsson (1988) reported no change in the incidence of operations for perforated duodenal ulcer amongst the citizens of Rochester, Minnesota over the period 1956-1985.

Christensen (1988) found in a Copenhagen population no change in the incidence of ulcer perforation between 1974-1984.

Both Collier (1985) and Negre (1985) attributed the constant rate of perforation to a relative increase in perforation in the elderly and associated with the increasing use of non-steroidal anti-inflammatory drugs. Walt (1986) confirmed these suggestions in an analysis of national figures from England and Wales between 1958 and 1983.

Bardhan (1989) studied admission rates for perforated duodenal ulcer in the Trent region, finding no change between the periods 1972-1976 and 1977-1984.

f) **Elective Operation Rates**

The first report of a decline in elective operations for duodenal ulcer was from Seattle (Smith 1977). Between the periods 1966-1970 and 1971-1975 Smith reported a 35% decline in elective operations for duodenal ulcer. A study of operations for duodenal ulcer for the entire United States showed a 30% decline from 136,000 in 1966 to 97,000 in 1977 (Fineberg and Pearlman 1981). A similar decline was shown in a study from the Mayo clinic to have occurred in the residents of the town of Rochester. The rate of elective operations on previously unoperated patients fell from 49/100,000 per year in 1956-1960 to 6/100,000 in 1981-1985 (Gustavsson 1988).

A survey of the Hospital Discharge Survey of the U.S. National Center for Health Statistics in 1981 (Fineberg and Pearlman 1981), showed a progressive decline in the numbers of vagotomies and partial gastrectomies performed in the U.S. between 1966-1979 (Fig. 9.2).

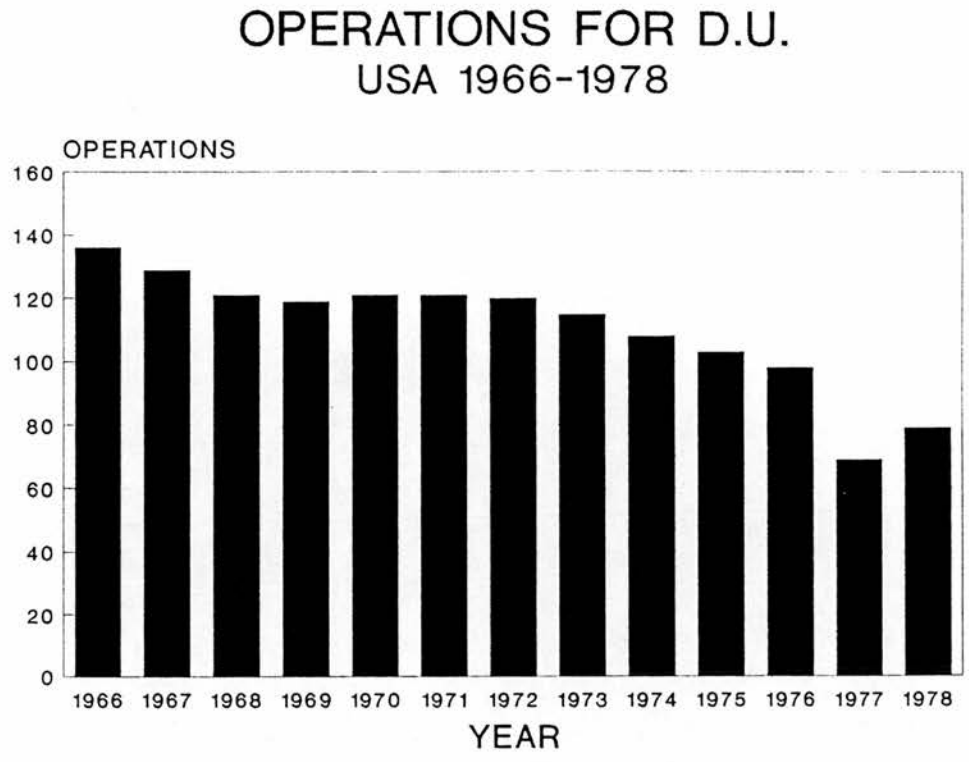


Fig. 9.2

Partial gastrectomy and vagotomy operations (000s) in the U.S.A. 1966-1978 (Fineberg and Pearlman 1981)

This decline from 136,000 procedures in 1966 to 79,000 in 1978 represented a 41% decline over 12 years.

A recent study assessed changes in elective duodenal ulcer operations in Helsinki between 1977-1987 (Paimela 1991). The rate per 10^5 inhabitants fell from 15.5 in 1977 to 12.3 in 1982 to 6.7 in 1987. Over the same period the rate of operations for perforated duodenal ulcer remained unchanged (1.2 per 10^5 in 1977, 1.3 per 10^5 in 1982 and 2.0 per 10^5 in 1987).

Similar changes have been reported from several U.K. centres the percentage decline varying from 28-70% depending on the years studied: 28% (Dreghorn and Moffat 1984); 30% (Quill 1983); 38% (Thomson 1981); 38% (Holmes 1987); 39% (Wylie 1981); 70% (Venables 1986).

The most recent report from the U.K. is that of Bardhan and colleagues (1989) who reported patterns of change in operations for duodenal ulcer in the Trent region of England between 1972-1984. Over this 13 year period elective operations for duodenal ulcer per 10^6 population fell from 162.4 to 76.2. As with all other studies which have concomitantly studied perforations, there was no fall in the rate of admissions for perforated duodenal ulcer over this period - the rate per 10^6 population being 98.5 in 1972-1976 and 102.6 in 1977-1984. Yet these figures concealed large rises in the rates for those patients aged over 65 from 264 in the former period to 352 in the latter, a 33% increase.

PRESENT STUDY

Scottish national operation statistics are obtained from SMR1 forms which are returned from hospitals to the Information and Statistics Division of the Common Services Agency of the Scottish Health Service at Trinity Park House. These are recorded on computer.

The number of operations for duodenal ulcer in Scotland for the years 1971-1987 have been calculated from the annual numbers of patients with a coded diagnosis of duodenal ulcer (ICD9 Code 532) who were also coded for the following operations: (OPCS 3 codes are in brackets) total (422) or partial gastrectomy (423); gastro-enterostomy (426); vagotomy with gastro-enterostomy (435); vagotomy with other gastric operations (436); vagotomy not elsewhere classified (434). The results are shown in Table 9.3 and Fig. 9.3.

Year	Male	Female	Total
1971	2410	677	3087
1972	2579	687	3266
1973	2186	675	2861
1974	2095	618	2713
1975	1924	554	2478
1976	1827	558	2385
1977	1291	399	1690
1978	1185	396	1581
1979	1103	418	1521
1980	1100	416	1516
1981	1264	501	1765
1982	901	358	1259
1983	997	437	1434
1984	918	386	1304
1985	746	309	1055
1986	681	278	959
1987	523	226	749
1988	504	204	708
1989	482	186	668

Table 9.3

Operations for duodenal ulcer in Scotland 1971-1987

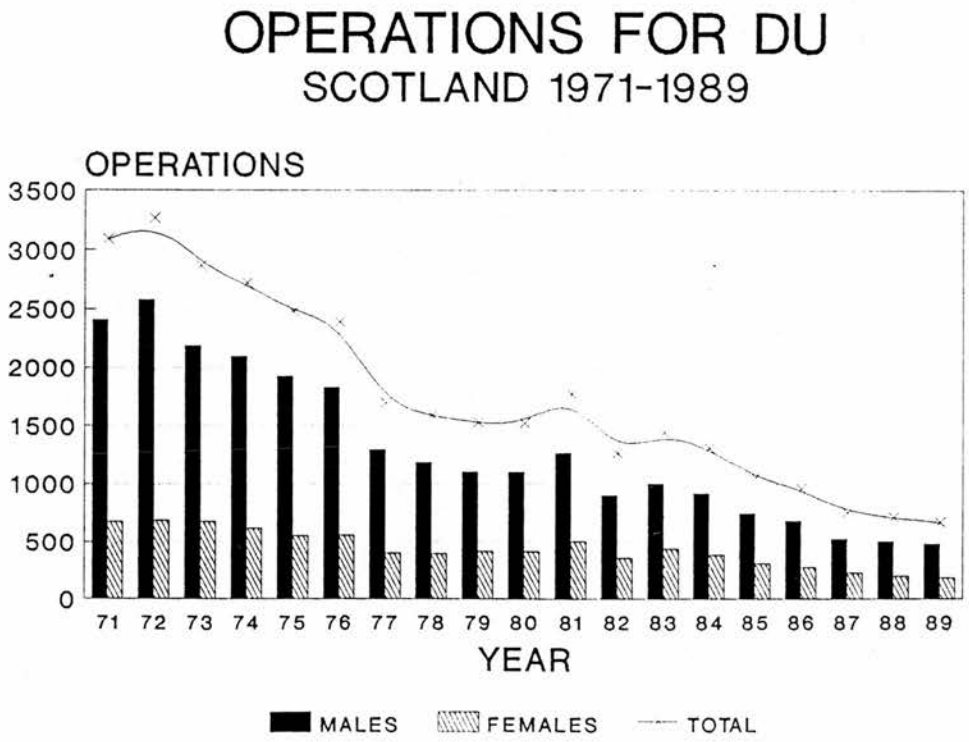


Fig. 9.3

Operations for duodenal ulcer in Scotland 1971-1989 (Information Services Division - Scottish Health Service)

This decline from 3087 procedures in 1971 to 668 in 1989 represents a 78.4% decline over the 18 year period.

In summary duodenal ulcer was difficult to diagnose in life before the turn of the century but autopsy evidence suggests that up until then it was a rare disease, most peptic ulcers occuring in the body of the stomach in young women. Duodenal ulcer, which predominantly affected young men increased from the turn of the century to grow into an epidemic in the 1930's, 40's and 50's. The decline in the incidence since the 1950's has continued, through the 1980's and continues in the 1990's. The mean age has increased, the male to female preponderance continues to decline. Both the numbers and rates of duodenal ulcer perforation have remained stable since about 1970. This may be the result of medical therapy 'suppressing' the ulcer without curing the diathesis, thus producing a larger number of patients with 'suppressed' ulcer which may perforate. This suggestion has been supported by the Cimetidine surveillance survey (Colin-Jones et al 1985).

CHAPTER 10

LONG TERM MORTALITY FOLLOWING PEPTIC ULCER SURGERY

As a result of improvements in peri-operative care, operative mortality rates have fallen over the past 41 years and thus in Chapter 20 it has been possible to report a series of 500 consecutive elective operations for duodenal ulcer without operative mortality. This together with patient satisfaction rates of the order of 85% for ulcer operations on long term follow-up, suggests that modern surgical treatment has reached acceptable standards for uncomplicated ulcer disease.

Yet several studies have suggested that surgery for duodenal ulcer is associated both with an increase in overall long term mortality (shortened life expectancy) and with increase in cause-specific mortality.

OVERALL MORTALITY

Krause (1958) studied 361 patients operated upon in Upsalla, Sweden between 1905-1933 with a follow-up of 23 to 50 years after Billroth II resection. He found a greater than expected mortality from suicide, tuberculosis, and gastric carcinoma.

Ross (1983) analysed data from the Western General Hospital, Edinburgh. In a study of 779 men followed for 15-25 years after operation it was concluded that an operation for peptic ulcer shortened life expectancy by 9 years and that this excess mortality was due to tobacco related disease.

Yet other major studies have failed to confirm these observations. Fischer (1985) followed 1,025 patients who had Billroth II gastrectomy between 1948-1956 giving a follow-up between 22-30 years. There was no overall increase in long term mortality but there was a significant increase confined to males under 44 years.

Eriksson (1983) in Malmo, Sweden followed 1,575 patients who had gastro-enterostomy or gastric resection between 1930-1960. After follow-up for

between 19 and 49 years there was no significant increase of observed over expected deaths unless the operative mortality (within 30 days) was included. When patients under 40 years at the time of operation were analysed separately there was a significant increase in late mortality.

Caygill (1987) reviewed 4,514 patients who had gastric surgery in London between 1940-1960. There was a significant increase in observed over expected deaths only for patients who died more than 20 years after the operation. This increased mortality was seen for "all neoplastic disease" where the ratio of observed to expected deaths was 3.3:1 and for "all non-neoplastic disease" where the ratio was 1.6:1.

CAUSE-SPECIFIC MORTALITY

a) **Suicide**

Increased mortality from several causes have been reported. Krause (1958) was among the first to report an increase in suicide following peptic ulcer surgery. In his study of 361 patients, 9 died as a result of suicide compared to an expected of 2.5 an increased risk of 3.6. This increased risk was confirmed by the reports of Westlund (1963), Viskum (1975), and Eriksson (1983) who found the increased risk to be greater than 3 times.

Knop (1981) reporting a series from Copenhagen of 1,025 patients found that deaths from suicide were 5 times the expected and accounted for 13% of all deaths. Further investigation of this group showed that of those committing suicide, 50% had had a prior psychiatric admission, and 34% had been diagnosed as alcoholics (Fischer 1985). An increase in symptoms of post-gastrectomy sequelae was not found in this group, leading to the conclusion that pre-existing psychiatric illness or personality disorder was an important aetiological factor and that post-operative complications or sequelae were not. Ross (1982) also found a threefold increase in expected deaths from suicide.

Viskum (1975) studied duodenal ulcer patients treated both medically and surgically and found the increased risk of suicide was identical in both groups suggesting that it is the duodenal ulcer diathesis which is associated with a greater risk of suicide rather than the operation.

b) **Gastric Cancer**

Balfour (1922) was the first to describe the phenomenon of gastric cancer following peptic ulcer surgery and many case reports followed. Helsingen (1956) and Krause (1958) were the first to demonstrate an increased risk compared to the expected and since then several series have documented this phenomenon. A review of the series which have compared the observed to the expected number of gastric cancer cases following peptic ulcer surgery has been carried out and the results are shown in Table 10.1.

First Author	Total	Length F.U.	Cancer Observed	Cancer Expected	O/E	95% Confidence Limits
Helsingen (1956)	222	10-34	11	5.2	2.12	1.06-3.79
Krause (1958)	361	23-50	25	11.3	2.21	1.43-3.27
Liavaag (1962)	616	15-35	9	9.6	0.94	0.43-1.78
Domellof (1977)	534	-12+	14	8.2	1.71	0.93-2.86
Ross (1982)	779	15-32	8	10.4	0.77	0.33-1.52
Clark (1983)	225	22-27	1	0.25	4.0	NK
Shafer (1983)	338	-40	2	2.6	0.77	0.09-2.78
Eriksson (1983)	1403	19-49	24	20.7	1.16	0.81-1.38
Fisher (1984)	945	19-29	13	10.6	1.23	0.65-2.10
Pickford (1984)	307	30-40	9	2.6	3.1	NK
Tokudome (1984)	3827	10-33	34	100.6	0.34	0.23-0.47
Watt (1984)	735	15-25	16	4.8	3.3	NK
Caygill (1986)	4466	-20+	32	12	2.67	1.94-3.24
Viste (1986)	3470	25-45	87	41.4	2.10	1.68-2.59
Lundegardh (1988)	6459	20-33	62	37.3	1.66	1.27-2.13
Arnthorsson (1988)	1795	15-48	30	13.8	2.17	1.46-3.10
Offerhaus (1988)	2633	25-59	8	2.5	3.13	NK
Toftgaard (1989)	2975	15-27	15	10.7	1.40	0.91-1.98

Table 10.1

Gastric cancer following previous peptic ulcer surgery in published series

Helsingen and Hillestad from Oslo studied patients who had had a partial gastrectomy between 1919-1944. They found that in the group operated on for gastric ulcer the observed frequency of gastric cancer was three times as high as expected whereas in the group operated on for duodenal ulcer the observed and expected were practically identical. Krause (1958) studied 361 patients who underwent partial gastrectomy between 1905-1933. He was able to trace 94% of these patients and found a significantly higher mortality from carcinoma of the gastric remnant compared to the expected for the Swedish population. Domellof from Umea in Sweden studied 459 patients who had gastrectomy for ulcer disease between 1952-1956 and followed up for 20 years. In 214 of these upper G.I. endoscopy was performed and in this group 6 carcinomas were found. Three patients with gastric carcinoma were found amongst 140 patients who had died. On the basis of this study Domellof recommended regular upper G.I. endoscopy and biopsy from the region of the stoma about 10-15 years

after gastrectomy. Liavaag (1962) reported from Norway 616 patients followed-up at least 15 years after partial gastrectomy. He reported no difference between observed and expected incidents of gastric carcinoma. Nicholls (1974) described a series from Tanner's unit in St. James's Hospital, London. Thirty-six patients presenting with a carcinoma in the gastric remnant represented an incidence of 1 carcinoma for every 76 patients undergoing partial gastrectomy for benign disease. He considered, however, that this increased risk was confined to patients who had their original operation for gastric ulcer. Schrumpf (1977) reported a series of 421 patients from Oslo who had a partial gastrectomy 20-25 years previously. Four patients with gastric cancer were observed although only 1 was expected. Ross (1982) reporting from the Western General Hospital in Edinburgh, studied 779 men who had had surgery for peptic ulcer disease 15 years or more earlier. No increased incidence of gastric cancer was found with 8 cases observed as opposed to 10.4 predicted. Fischer (1983) reported 1,000 patients from Copenhagen who had had Billroth II resection for duodenal ulcer 22-30 years previously. Of 522 deaths, 13 were due to gastric cancer which was not significantly different from the expected number of 10.2. Schafer (1983) reported 338 patients followed up for up to 40 years after peptic ulcer surgery. He found 2 gastric cancers compared to an expected 2.6 and concluded that there was no justification for endoscopic screening of this group. Logan and Langman (1983) reviewing the evidence available at that time concluded that endoscopic screening of patients who had had previous peptic ulcer surgery would not be justifiable. They calculated that as only 1 gastric cancer would be detected for every 125 patients screened and that only 3 deaths would be prevented by 1,000 endoscopies when inoperability, post-operative mortality and death from other causes was taken into account. Clark (1983) reported 225 patients

followed-up between 22 and 27 years after partial gastrectomy. They found 1 gastric cancer which was four times the expected incidence. In reviewing the literature to that time they concluded that routine endoscopic screening was not justified.

The studies which had been reported before 1983 tended to involve small numbers of patients, usually less than 1,000 and with expected numbers of gastric cancers in single figures. After 1983, however, several large scale studies have been reported and these in the main have found a significant increase in gastric cancer in patients undergoing previous peptic ulcer surgery but only after a delay of 15-25 years.

Pickford (1984) reported from the York Gastric Clinic 632 patients who had a partial gastrectomy for peptic ulcer 15-40 years previously. They found 9 gastric cancers compared to the expected 2.8 and found that if gastrectomy was performed for gastric ulcer the risk of later development of cancer was significantly higher than following operation for duodenal ulcer. Caygill (1986) reported 4,466 patients followed-up for 0-20+ years after gastrectomy for peptic ulcer in Tanner's Unit, St. James's Hospital, London. There was no difference from the risk of death of gastric cancer in the first 20 years of follow-up but a 4.5 increase thereafter. For patients who had surgery for duodenal ulcer there was an initial decrease in risk followed by a 3.7-fold increase after 20 or more years. The increased risk 20 years after duodenal ulcer surgery was greater in patients who had had vagotomy than those who had had gastrectomy.

Viste (1986) reported 3,470 patients from Western Norway who had surgery for peptic ulcer between 1900-1969. The risk of cancer at 10-15 years was not higher than expected but increased progressively with each succeeding decade so that 40-45 years after the original surgery it was 7.3

times higher than expected.

Offerhaus (1988) reporting from Amsterdam, followed 2,633 patients. In 741 who had died mortality due to gastric cancer was 5.1%. Of 554 asymptomatic patients subjected to upper G.I. endoscopy 10 were found to have gastric cancer and 7 of these had a radical curative resection. It was concluded that the overall risk increased with increasing length of follow-up and was higher in patients who had their original gastrectomy at an older age.

Arnthorsson (1988) reported 1,795 patients from Iceland followed-up for between 15 and 48 years after gastrectomy. There were 30 observed carcinomas compared to 13.8 expected. In the first 15 years after operation the relative risk was 2.17 (95% confidence limits 1.46-3.10). Lundegardh (1988) followed up 6,459 patients in Uppsala for 25-33 years after partial gastrectomy for peptic ulcer disease. There was no overall increased risk of gastric cancer. After adjustment for potential confounding variables, however, the average adjusted risk increased to 1.28 (95% confidence limits 1.11-1.49) for each successive 5 year interval after operation. The adjusted risk of stomach cancer was greater among women than men and was greater among patients operated on for gastric ulcer than among those operated on for duodenal ulcer. The relative risk decreased with increased age at operation. Between successive decades of age at operation the adjusted risk decreased on average by about half. Toftgaard (1989) reported 4,131 patients from Western Denmark who had peptic ulcer surgery between 1955-1960. Up to 15 years after operation the gastric cancer risk was lower than expected. 20-24 years after operation the relative risk was 1.6 (95% confidence limits 0.5-3.6) and more than 24 years after the operation the relative risk had increased to 1.9 (95% confidence limits 0.04-11).

The relative risk was higher in patients who had had surgery for duodenal ulcer as compared to gastric ulcer. Offerhaus (1988) reported 2,633 patients who had surgery for peptic ulcer in Amsterdam between 1931-1960. The observed versus expected ratio of mortality from gastric cancer was significantly increased among women from 15 years after the original operation (relative risk 4.77) and among men after a post-operative latency of more than 25 years (relative risk 3.13).

One major study from Japan, however, has found no increase in risk after partial gastrectomy for peptic ulcer disease. Tokudome (1984) studied 3,701 patients 10 years after partial gastrectomy. Eleven gastric cancers were observed compared with an expected 52.8. The length of follow-up after original gastric surgery is considered inadequate to enable valid observation about cancer in the gastric remnant.

Two studies have suggested an increased risk of gastric cancer in smokers (Hirayana 1975, Noruma 1990). In Noruma's study an increased risk of cancer (relative risk 2.7) was found in cigarette smokers (Noruma 1990).

c) **Other Cancers**

Ross (1982) reporting the Western General Hospital experience, studied 779 men followed for 15-32 years. There was an increase in observed over expected deaths from bronchogenic carcinoma (47:35.7 $p<0.05$), carcinoma of colon and rectum (16:8.9 $p<0.01$) and carcinoma of pancreas (11:3.9 $p<0.01$) but no increase in carcinoma of oesophagus.

Eriksson (1983) from Lund found an increase compared to expected in bronchogenic carcinoma (41:17.8 $p<0.001$). Watt (1984) from Belfast found an increase of 3.53-fold ($p<0.0001$) in bronchogenic carcinoma and 2.3-fold ($p<0.05$) for carcinoma of colon and rectum. There was no increase in other cancers.

Fischer (1986) found no increase in mortality from any malignant disease.

Toftgaard (1990) followed 4,107 Danish patients and found a significant increase in bronchogenic carcinoma (relative risk 1.66 $p<0.001$) and bladder cancer (relative risk 1.44 $p<0.01$).

Caygill (1987) following 5,018 patients from St. James's Hospital, London found no increase in mortality from any cancers for the first 15 post-operative years. From 20 years after operation there was a significant excess of large bowel cancer (1.6-fold), bronchus (3.9-fold), pancreas (4.0-fold), biliary tract (9.1-fold), oesophagus (2.3-fold), bladder (2.4-fold) and breast (4.0-fold).

d) **Other Diseases**

Ross (1982) found a significant increase in deaths from cirrhosis ($p<0.05$) but no increase in observed deaths from ischaemic heart disease, chronic bronchitis and emphysema. When all "smoking related" diseases were grouped there was an increase in observed over expected ($p<0.025$).

Eriksson (1983) found an increase in observed over expected death from generalised arteriosclerosis (WHO 440-448) with 41 deaths compared to 21.3 expected ($p<0.01$). He also found an increase in death from bronchopneumonia (61:25.8 $p<0.001$). He found no increase in ischaemic heart disease or cerebro-vascular disease.

Watt (1984) found significant increases in deaths from bronchopneumonia (17:4.4 $p<0.0001$), cerebro-vascular disease (29:18.5 $p<0.05$) but no increase in cirrhosis or chronic bronchitis. Fischer (1986) found no increase in mortality from cardio-vascular disease, respiratory disease or cirrhosis.

Mortality in patients with duodenal ulcer not having surgery

The studies discussed above have led to the hypothesis that it is the lifestyle which accompanies the duodenal ulcer diathesis that is responsible for the excess mortality on long term follow-up - in particular cigarette smoking and alcohol abuse (Ross 1982). In our series between the years 1948-1968 76.8% (1,063/1,384) of patients having surgery for duodenal ulcer were cigarette smokers: 82.9% of males (914/1,103) and 53% (149/281) of females compared to 61% of the U.K. population in 1951 and 54% of males and 43% of females in 1968 (Tobacco Research Council 1972) (Table 10.2).

	% Smokers	
	M	F
Gastro-enterostomy (1948-1968)	75.0%	49.0%
TV + GE (1948-1968)	82.1%	54.5%
TV + P (1960-1968)	80.9%	78.3%
Polya gastrectomy (1948-1968)	83.9%	46.4%
All operations (1948-1968)	82.9%	53.0%
U.K. population (1951)	61%	40.0%*
U.K. population (1968)	54%	43%
Scottish population (1972)	54%	43%

* Data for females first became available in 1955

Table 10.2

Smoking habits of patients having operations for duodenal ulcer Western General Hospital 1948-1968 compared with population

The figures for the Scottish Population first became available in 1972 (Scottish Health Statistics 1988) and were identical to the U.K. figures for 1968.

If this hypothesis were correct then those patients with duodenal ulcer not coming to operation would be expected to show a similar excessive mortality from tobacco and alcohol related disease, provided their cigarette consumption was similar to those coming to operation.

This has been studied by Lee (1988) who found no increased mortality in

2,529 Japanese patients with peptic ulcer followed for between 9 and 23 years. This study must be interpreted with caution because another study from Japan (Tokodume 1984) was one of the few to show no increase in any cancers after surgical treatment of peptic ulcer.

In the only large scale European study in which cause of death after non-surgical treatment of duodenal ulcer has been studied Bardhan (1991) found no significant increase in cancer deaths compared with expected after follow-up of up to 12 years.

PART II

METHODOLOGY

CHAPTER 11

THE GASTRIC FOLLOW-UP CLINIC

The Gastro-Intestinal Unit at the Western General Hospital, Edinburgh was established in 1948. Founded jointly by a physician (Dr. Wilfred Card) and a surgeon (Mr. John Bruce) it pioneered the concept of combined care in gastroenterology (Bruce and Card 1958). The problem which dominated gastroenterology in the next three decades was peptic ulcer disease and its complications. It was natural therefore that a special interest in duodenal ulcer disease should develop.

Early research interest in acid output (Adam, Card, Riddell, Roberts, Strong and Woolf 1954), resulted in trials to assess the effect of "tailoring" the operation for duodenal ulcer. In 1953 the Gastric Follow-Up Clinic was established to follow-up these and all other patients having primary and revisional surgery for peptic ulcer disease. The clinic was established by Mr. W. P. Small who described the techniques in the clinic in a series of publications over the next 20 years (Small 1964, Leading article 1966, Leading article 1967, Small 1971, Small, Philip, Cay, Neilson, Henderson 1978).

The clinic recruited patients from the theatre operations book. A clerical officer completed a proforma with the patients' biographical details. The details of investigation, operation and post-operative complications were completed by a surgeon in the Follow-Up clinic. The proforma is shown in Appendix A. Follow-up was planned to take place 6 months and 12 months after the operation and then annually. The clerical officer arranged for those patients able to travel to the hospital to attend an evening clinic, where follow-up data was added to the proforma. Those patients in Lothian unable to attend the clinic were visited by the clinic visitor who obtained the follow-up data and completed the form. For patients who lived outwith the Lothians a postal questionnaire was sent with a reply paid

envelope. Visick grading was performed on the basis of this data.

As the reputation of the Gastro-Intestinal Unit spread, a large practice in peptic ulcer surgery built up. The numbers of patients and the volume of data brought their own problems. By 1985 over 4000 patients had been registered in the Gastric Follow-Up Clinic each with over 100 items of standard data collected on proformas. Although provision had been made for a coding system, the data was not coded so that all analysis had been done manually. To facilitate analysis of these data a quality of life questionnaire was devised which allowed calculation of a quality of life score (Small, Philip, Cay, Neilson, Henderson 1978). Whilst this readily identified those patients in whom an operation had failed, it did not allow detailed analysis of symptoms or complications.

The second problem was of the decline in the incidence of peptic ulcer disease which is discussed in detail in Chapter 9.

From 1985 the methods of patient recruitment and data storage analysis were changed with the introduction of computer technology. An account of these changes is given in Chapter 12.

CHAPTER 12

THE SURGICAL REVIEW OFFICE

The Surgical Review Office was a natural evolution from the Gastric Follow-Up Clinic. The decline in incidence of duodenal ulcer disease, described in detail in Chapter 9, resulted in a progressive decline in operations. This decline was accelerated by the introduction of H2 receptor antagonists in 1975 and the proton pump antagonist Omeprazole in 1987. The need to diversify into follow-up of other procedures was recognised in the early 1980's and the documentation of patients with gastric carcinoma began. The establishment of the Surgical Review Office in 1986 saw the audit process extend into operations for gastro-oesophageal reflux, gastric carcinoma, diverticular disease and the increasing problem of large bowel carcinoma.

The increasing number of patients being recruited required the introduction of new techniques to recruit, document, analyse and follow-up patients in these various groups, as well as to analyse the 4,000 or so patients being followed-up after duodenal ulcer surgery. The following description is confined to the technique devised for those patients with duodenal ulcer.

EXISTING METHODS

The methods used by the Gastric Follow-Up Clinic have been described in detail in Chapter 11. In summary these were as follows:

Recruitment and Documentation

Patients were recruited to the Gastric Follow-Up Clinic by a clerical officer who consulted the operation book in theatre. This system relied on the entries into the operation book by nursing staff being accurate and complete. It also relied on the clerical officer being able to recognise all primary, emergency and revisional operations for duodenal ulcer.

Patient data was then stored manually on a proforma (Appendix A). Although allowance had been made for coding this information, the coding system had not been used. Furthermore much of the important follow-up data from clinics was recorded in freetext and was unstructured. This meant that the only method by which this data could be analysed was manually. Given over 4,000 patients, each with over 100 items of information a comprehensive analysis would have been a formidable and time consuming task.

Follow-Up

Follow-up had been carried out at an evening clinic, timed so as to allow patients to attend without losing work. As the patient population aged and many moved from the area, this became a less effective method of obtaining follow-up information. Furthermore the increasing financial pressures made a hospital clinic an expensive option. Patients, symptomfree following an operation many years previously, came increasingly to regard a hospital visit as irrelevant and compliance in patient attendance had fallen.

INNOVATIONS

The innovations included changes in documentation, patient recruitment, data collection, computerisation, patient follow-up, data analysis and techniques used to accurately establish date and cause of death.

Documentation

A decision was first made on which of the existing data should be recorded. Although much of this was structured most follow-up data was in freetext. A computer file was designed which incorporated structured and freetext data from the original proformas. This included biographical data such as sex and date of birth; pre-operative data such as admission and operation type (elective/emergency); indication; smoking habits; acid output

studies; operative details; post-operative complications; long term complications and re-operations; post-operative acid output studies; Visick grading; death certificate cause of death. In addition a standard follow-up questionnaire which could be used for each follow-up visit was designed (Appendix B). This allowed the same information to be recorded irrespective of whether it had been obtained by clinic attendance, home visit or postal questionnaire. The follow-up questionnaires scores could be read by superimposing a transparent acetate over the answers (Appendix C). All the biographical, pre-operative, operative, follow-up data and questionnaire scores were keyed into the computer.

Computer hardware and software

The choice of computer system was governed by the need for a 20 megabyte hard disc for storage, the desire for IBM compatibility, ease of servicing and low cost. In the event an NCR PC8 with 100% IBM compatibility was donated by a patient (Mr. George Munro). This ran under DOS using a 286 processor and had 20 Mbytes storage on hard disk. Of the software then available, DBase III Plus (Ashton Tate Inc.) had the advantages of power and speed to analyse large data sets, ease of operator use and the prospect of regular up-dates. The original data set was therefore recorded as a single file "Ulcer" containing 47 fields. The file structure is shown in Appendix D. The Harvard Graphics software was used to generate graphics.

Recruitment, Documentation, Follow-Up

The methods of patient recruitment, documentation and follow-up are summarised in Fig. 12.1.

. Recruit : From operation note

. Document : "Identifying data" by clerical officer
medical/surgical data by doctor
keyed by higher clerical officer

. Follow-up : as shown below

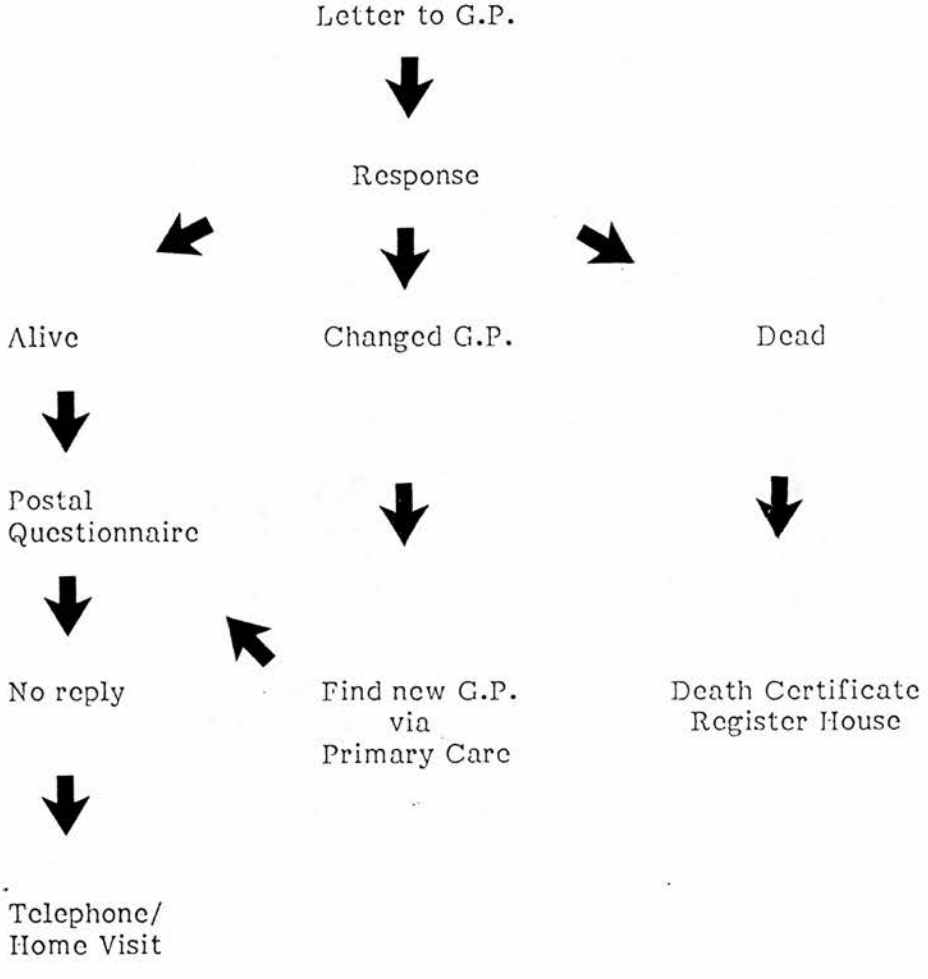


Fig. 12.1

Summary of methods used by Surgical Review Office

Patients are recruited to the register from the operation note, copies of which are sent daily to the office. Standard biographical information is entered on the proforma by the clerical officer taking information from the case notes. The medical and surgical details are entered from the

case notes by the surgeon or attached G.P. The information is then keyed into the computer by the higher clerical officer. Before any patient is approached for review a letter is written to the G.P. to establish vital status to avoid any distress to relatives in the event of death of the patient (Appendix E). If the General Practitioner indicates that the patient is alive the standard postal questionnaire is sent with a business reply envelope. If no reply is obtained a second questionnaire is sent and if this fails a home visit is made by the clerical officer or the patient interviewed by telephone. If the patient has changed G.P. then the new G.P. is established from the Primary Care Division of the Lothian Health Board and a letter to establish vital status sent to this G.P. If the G.P. indicates that the patient is dead or this emerges from subsequent follow-up the certified cause of death is obtained from a search of the records at Register House. If the patient is not found on the records at Register House or is thought to have died in another part of the United Kingdom a further search is made at the Scottish National Health Service register at Ladywell House.

The questionnaire sent to patients is designed to elicit information both about symptoms and quality of life, and is shown in Appendix B and is discussed in detail in Chapter 13.

The questionnaire used to elicit symptoms from patients who had closure of perforated duodenal ulcer or highly selective vagotomy is shown in Appendix F. This took account of the considerable analytical power available with the arrival of computer technology allowing, easily and speedily, individual symptoms to be analysed and correlated with the need to resort to a symptom score. This questionnaire is shown in Appendix F.

Analysis

By the end of 1990 it had been possible to transfer data into computer for

all patients undergoing operation between 1948 and 1968 inclusive. These patients thus have a minimum of 22 years and maximum of 42 years of follow-up. It is this group who have been subjected to analysis in the following chapters.

CHAPTER 13

METHODS USED TO MEASURE QUALITY OF LIFE AND SYMPTOMS AFTER OPERATIONS FOR DUODENAL ULCER. METHODS USED TO MEASURE ACID OUTPUT. STATISTICAL METHODS.

Florence Nightingale was one of the first to try to measure the outcome of surgical treatment. Her assessment of the results of treatment as "improved, disimproved, died" although seemingly primitive was little improved upon by surgeons for over 60 years. Perhaps it was not surprising, because so much surgical interest was (and is) devoted to improving diagnostic and operative techniques, that outcome assessment should have attracted less attention. For this reason end points like for example recurrent ulcer in ulcer surgery, resectability in cancer surgery, and operative mortality came to dominate the surgical literature. From Visick's pioneering work in the 1940's, techniques for measuring quality of life after surgical operations have been developed and improved. Yet it was not until 1976 that "quality of life" appeared as a leading article in Index Medicus. Now in the 1990's "outcome audit" has been given a new impetus by enshrinement in the Health Act (1990) and a great variety of techniques or more precisely instruments to measure quality of life are now available and have been validated.

This chapter describes the techniques used to measure quality of life, and assesses their strengths and weaknesses. In particular the methods which have been applied to operations for duodenal ulcer will be described. The instrument developed in the Western General Hospital, Edinburgh, is described in detail.

The Development of Measurement of Quality of Life

The name of Visick is known to every surgeon because of the classification which he developed and which carries his name. His was the first to attempt to quantify the results of duodenal ulcer surgery (Visick 1948). His scoring system used a numerical score of 1 to 4 for each of 13 clinical features (Table 13.1), where 1 was the best and 4 the worst result. The highest score in any one of these was recorded as the "Visick grading".

Ulcer pain	Early dumping
Other pain	Late dumping
Nausea	Flatulence
Bile vomiting	Heartburn
Food vomiting	Dysphagia
Anorexia	Bowel function
Epigastric fullness	

Table 13.1

Parameters used to score the Visick classification

The Visick grading was classified as follows:

Visick 1 - No symptoms
Visick 2 - Mild symptoms easily controlled
Visick 3s - Mild symptoms not controlled (satisfactory)
Visick 3u - Mild symptoms not controlled (unsatisfactory)
Visick 4 - Symptoms not improved or worse. Recurrent ulcer

It is surprising from the perspective of the 1990's that the concept of quantifying clinical parameters was not more widely adopted for many years. One of the earliest and probably the best known scoring system was that devised by Apgar to evaluate the vitality of the newly born infant (Agpar 1953). Yet it was not until the 1970's that scoring systems became widely accepted in medical practice.

Techniques, or instruments, to measure quality of life were developed to assess the outcome of treatment or to monitor its continuing effects, particularly in chronic, malignant or terminal disease.

Such instruments can be classified into general and disease specific. General measures of quality of life will be considered first.

The first index to measure quality of life was the Karnofsky Performance Status Index. Originally devised to measure the results of nitrogen mustard chemotherapy in the treatment of patients with bronchogenic carcinoma, it has become one of the most widely used and provided standards which others were to follow (Karnofsky 1948). The Karnofsky Index comprises an eleven point scale from 0 to 100% with 10% increments ranging from normal

(100%) to dead (0%). Although this index is no longer used it had an important influence on future developments.

Perhaps the simplest method of measuring quality of life is the visual analogue scale. Quality of life can be measured using a 10cm. line between two extremes of health such as "best imaginable state", and "worst imaginable state". Despite the apparent advantage of simplicity many patients find these difficult to understand. In an attempt to overcome this Aitken (1969) suggested that guiding statements could be written along this line. Yet some studies to investigate this showed that the addition of such statements biased the results (Osborne 1975). The validity of the linear scale in measuring quality of life was supported by Matell (1971) and Remington (1979).

The Visick scale and linear analogue scale have both been compared with the quality of life instrument used in the current study.

As the population in the 1960's came to contain an ever increasing proportion of elderly patients, the need to assess the quality of life in the elderly became increasingly important. The Barthel Index (Mahoney and Barthel 1965) measured independence in the chronic sick and elderly.

In the 1970's two important methods for assessing quality of life were published - the Sickness Impact Profile in the United States (Bergner et al 1976), and the Nottingham Health Profile (McDowell et al 1978). These have been well validated and remain widely used today. The Sickness Impact Profile contains 136 statements covering physical, psychological and social aspects of life. The Nottingham Health Profile contains questions classified under six categories: pain, sleep, energy, social isolation, emotional reaction, and physical mobility.

Cay and Small Quality of Life Score

Neither of these had been formally validated when, at much the same time, the quality of life instrument subsequently used to assess the results of duodenal ulcer surgery at the Western General Hospital, Edinburgh, was devised (Cay et al 1975). This was based on statements made by 500 patients who were asked for their opinion about the outcome of the operation. These statements were reduced to 53 questions which were compiled into a questionnaire. This was then tested on 63 patients and compared to Visick grading. As a result of this pilot study the number of questions was reduced to 22 and the possible answers to each question weighted to take account of a gradation of response by grading the answers from 0 to 3. The 22 questions are shown in Appendix B. This was then compared to Visick grade, to the 100 mm. line test (where the patient grades the result from "worst possible" at 0 mm. to "best possible" at 100 mm.) and to post-operative alkali consumption. The results of this validation were published in 1978 (Small et al 1978). In the 47 patients tested there was a significant correlation between the Q.O.L. score and Visick grade, but neither of these correlated with the 100 mm. line test or alkali consumption (Table 13.2). The closest correlation between the Q.O.L. score and Visick grade occurred when the Q.O.L. scores were classified into 'good', 'moderate' and 'bad' as shown in Table 13.2.

Q.O.L. score	Assessment	Patients	Visick grade	100mm line test
40-66	Good	20	19 (I+II)	21
40-45	Moderate	13	14 (III)	17
0-39	Bad	14	14 (IV)	9

Table 13.2

Comparison of Q.O.L. score, Visick grading and 100mm line test (from Small et al 1978)

Of the 22 questions eight (Nos. 5,7,8,11,16,19,20,21) were regarded as assessing physical symptoms while the remaining 14 assessed psychosocial factors. The former were added separately to obtain a "physical symptom" score with a possible total of 24; the latter can be totalled to give a "psychosocial" score with a possible total of 42. By combining the two a total or "quality of life" score is obtained with a possible total of 66. For ease of interpretation and to allow for a readily understandable interpretation of the result of the operation, the convention of subdividing total scores into "good" (score 45-66), "moderate" (score 40-45), or "bad" (score 0-39) was devised and correlated with Visick grades as described above. The component parts, the psychosocial and physical symptom scores, can also be classified in this way. The psychosocial scores of greater than 34 are classified "good", 26-34 as "moderate" and 0-25 as "bad". The physical symptom scores of greater than 20 are considered "good", 13-19 as "moderate" and 0-12 as "bad".

This allocation of questions into two groups by these authors was necessarily arbitrary and has produced apparent anomalies. Thus questions 8 and 19 which quantify the patient's assessment of the operation have been included in the "physical" score group whilst questions 1,2,10 and 22 which relate to bowel function, wind and dizzy spells have been included in the "psychosocial" score. Arguably these could have been included in either group. Because the original questionnaire was validated using that classification it has been retained.

Since this questionnaire was validated the quality of life assessment has been answered by over 1200 patients in most instances sequentially over many years. This has allowed assessment of these changes with time and ageing. It has also permitted the comparison of the results of various operations performed for duodenal ulcer.

In the present study Visick grading has not been applied to patients after highly selective vagotomy. This was because in the Visick system recurrent ulcer was automatically graded as Visick IV irrespective of symptoms. As endoscopy was increasingly used in follow-up it became apparent that some patients with recurrent ulcer, particularly small, superficial or acute ones had minimal, and in some cases no symptoms. Visick grading therefore seemed increasingly inappropriate particularly with the advent of computer technology which allowed analysis of and correlation between individual symptoms in large patient groups.

For four operations - Polya gastrectomy, gastro-enterostomy, truncal

vagotomy and gastro-enterostomy and truncal vagotomy and pyloroplasty - both Visick grading and Quality of Life scores have been performed.

The results of this assessment of quality of life have not previously been analysed. They form one of the largest studies ever made to measure the results of surgical treatment of duodenal ulcer.

Symptom Questionnaires

For two of the operations studied (highly selective vagotomy and closure of perforated ulcer) it has been possible because of computer technology to analyse and correlate symptoms in their own right in large patient groups. To do this a questionnaire was devised in which patients were asked to select from four options whether symptoms were experienced "every day, most days, occasionally, never" (Appendix F).

In addition to symptoms the patients were asked about ability to eat a normal meal, about enjoyment of food and appetite. They were asked about consumption of H2 receptor antagonists and antacids. Patients were also asked if the original problem was cured/improved/same or worse and whether they regarded the operation as a success.

Techniques to measure acid output

Acid output has been measured at the Western General Hospital since 1956 by a series of nurses trained in the techniques of gastro-intestinal investigation. Maximal acid output pre-operatively was measured until 1966 by the augmented histamine test (Kay 1953) as modified by Card and Sircus (1958) using histamine (0.04mg/kg.). After 1966 pentagastrin (Peptavlon, ICI) was used in a dose of 6ug/kg. (Makhlouf 1966).

All subjects were fasted and a naso-gastric tube placed into the most dependent part of the antrum and the position confirmed by fluoroscopic

screening. From 1972 the water recovery test (Finlay 1972) was used to ensure that the tube lay in the antrum. Aspiration was continued for 1 hour before stimulation and for 2 hours after.

Post-operative acid output was determined in this way. In addition, for patients undergoing vagotomy, the vagally mediated acid output was measured by the technique of insulin (0.2 I.U./kg.) induced hypoglycaemia initially by bolus injection and latterly by the infusion technique (Carter 1972). In 1982 this technique was superseded by the sham feeding test (Kronborg and Anderson 1980).

All aspirates were divided into 15 minute aliquots, the volume recorded and total HCL concentration was calculated by titration. Acid output was calculated for both the first and second post stimulation hours.

No calculation was made to take account of transpyloric loss of acid. Basal and maximal acid outputs have been recorded.

Statistical techniques

The CIA statistical software package (Gardner and Altman 1989) was used, where appropriate, to calculate the following:

1. Mean and standard error determinations for single observations eg. quality of life scores.
2. Difference of mean between paired observations.
3. 95% confidence limits for single and paired observations and 95% confidence limits for differences of mean between paired observations eg. pre- and post-operative maximal acid output.

Probability values for differences between the operations of complications was calculated using a Chi square test. Cox proportional hazard analysis was used to calculate the significance of individual risk factors e.g.

a) the pre-operative possible risk factors associated with recurrence after highly selective vagotomy.

b) the association between 6 factors present in patients with perforated duodenal ulcer and the need for subsequent definitive operation.

Life table analysis using the Kaplan-Meier product limit technique was used to calculate actuarial cumulative recurrence rate eg. recurrence rate after highly selective vagotomy.

CHAPTER 14

LONG TERM MORTALITY FOLLOWING DUODENAL ULCER SURGERY - METHODOLOGY

The long term survival and ultimate cause of death following operations for duodenal ulcer has received increasing attention since Krause (1958) demonstrated an excessive mortality in the years following partial gastrectomy. Since then there have been several other studies following up larger numbers of patients over a longer period of time (McLean Ross 1982, Stemmermann 1984, Lundegardh 1991).

There are differences between the conclusions of each of these studies almost certainly because of important differences in methodology.

Krause in 1958 obtained the cause of death from sources which included local parish registers, relatives and the hospital at which the patient had been treated rather than the exclusive use of death certificates. The expected mortality was calculated by the person years at risk technique. Krause describes the technique as follows: "Mortality in different age groups at different periods from 1911 to 1950 was calculated on the basis of data from official Swedish statistics. The resulting death rate was applied to the number of years the patients in the series survived in the different age groups and at the different periods". Thus Krause's study has not taken account of gender nor does he describe the age bands used. Furthermore the series was a small one studying only 361 patients operated on between 1905 and 1933 and drawing conclusions from 210 deaths. Nonetheless Krause's paper was an important landmark as it was the first time the causes of death had been analysed in this group of patients. This was the first study to conclude a higher than expected incidence of long term mortality from gastric cancer after partial gastrectomy.

This study also showed the increased risk of death from pulmonary tuberculosis after partial gastrectomy, a conclusion subsequently confirmed by Balint (1958).

The study by McLean Ross and co-workers (1982) on patients from the Western General Hospital, Edinburgh, used a different method of calculation of expected deaths. Survival curves using life table analysis were drawn for each of three 10 year age groups and these were then compared with survival curves calculated for the general population from life table figures supplied by the Faculty of Actuaries.

Expected deaths from individual diseases were calculated using a proportional analysis technique. Two methods were used. Firstly for those diseases for which the death rate per 10^5 population was available from the Registrar General for Scotland (ischaemic heart disease, chronic bronchitis and emphysema and carcinoma of the lung) the standard mortality ratio was used. For the causes of death where the death rate was not available this was calculated. Both methods of analysis "took account of variations in causes of death with age and time".

This study was confined to men and concluded that there was an excess mortality with expectation of life being reduced by 9.1 years. They further concluded that excess mortality was due to smoking associated disease by adding together all those which had been suggested to be tobacco related.

The study by Lundegardh (1991) used a person year at risk technique. The observed survival rate in the patient group was compared with the expected survival rate obtained from Swedish population tables by age (at 5 year intervals), gender and calendar year. The cause of death was that given by the death registry. Following a cohort of 6,459 patients for 27-35 years after operation they demonstrated "a slight but significant decrease in relative survival rate to 92% (95% C.L. 87-97%). No decrease in relative survival rate was observed during the first 20 years after operation".

The major studies which have analysed mortality from individual causes of death have all used person year at risk methodology (Dommelof 1977, Schafer 1983, Fischer 1983, Tokudome 1984, Caygill 1986, Watt 1984, Toftgaard 1989).

Method used in the current study

The person years at risk technique was used. This technique takes into account the number of persons under observation and the duration of observation of each person. This is particularly appropriate in assessing mortality after a particular operation as the size of the cohort changes during the period of observation. This is because rate of entrance to the study varies depending on the date of operation and individuals will be lost from the cohort because of death or loss to follow-up. The technique also takes into account the differences in different age bands in disease specific mortality. The changes in mortality from certain diseases from year to year are also taken into account. These changes occur either because some illnesses are becoming more prevalent (e.g. colon cancer) or mortality from an illness is decreasing (e.g. pulmonary tuberculosis). The person years at risk method in this study used the computer program described by Coleman and colleagues (1986).

The cause of death in each instance was taken from the death certificate. These were obtained from Register House, Edinburgh, and then coded to the 9th Revision of the International Classification of Disease (ICD9). The ICD coding rules were observed. Thus any malignant process in part I(b) or I(c) of the death certificate was coded as cause of death. Any malignant process in part 2 was coded only if it was considered causally related to a diagnosis in Part I.

An analysis of mortality from individual causes of death was made using ICD9 codes as follows:

Cause of Death	ICD9 Code
Death from all causes	1-999
Death from all circulatory diseases	390-429 and 440-458
Death from all digestive diseases	520-577
All neoplasms	140-239
Carcinoma of oesophagus	150
Carcinoma of stomach	151
Carcinoma of colon	153
Carcinoma of rectum	154
Carcinoma of pancreas	157
Carcinoma of bronchus	162
Carcinoma of female breast	174
Carcinoma of urinary bladder	188
All lymphomas	200-202
All leukaemias	204-208
Cirrhosis of liver	571

Expected deaths were divided by 5 year age bands from 0-85 years and for 5 year calendar periods 1946-1988 and were calculated separately and then in total for each gender.

To assess the specific effect of the operation as opposed to the disease diathesis or associated life style factors, the data was analysed to show separately deaths in the first post-operative year and the remainder of the study period. A further analysis was performed showing separately deaths in the first 19 post-operative years and those 20 or more years post-operatively to enable the effect of any long term risk factor to be demonstrated.

In the study group the date at which patients were recorded as lost to observation was the last date at which they were known to be alive. Survival rate after medical intervention in this method is computed by computing 5 year survival rates obtained by amalgamating yearly fatality rates in life table form. The standard mortality ratio for each cause of death was obtained from the Registrar General for Scotland statistics (Scottish Health Statistics). Relative risk for each cause of death was obtained by dividing the observed by the expected number of cases. The probability levels were calculated on the assumption that the number of cases followed a Poisson distribution.

PART III

LONG TERM RESULTS OF DUODENAL ULCER SURGERY – WESTERN GENERAL HOSPITAL, EDINBURGH

CHAPTER 15

TRENDS IN THE SURGICAL TREATMENT OF DUODENAL ULCER AT THE WESTERN GENERAL HOSPITAL, EDINBURGH

The records of the Gastric Follow-Up Clinic began on 1st August 1947. The first complete year for which records are available is 1948 and this year has therefore been taken as the starting point for the study. The total numbers of operations done between 1948 and 1990 inclusive are shown in Fig. 15.1

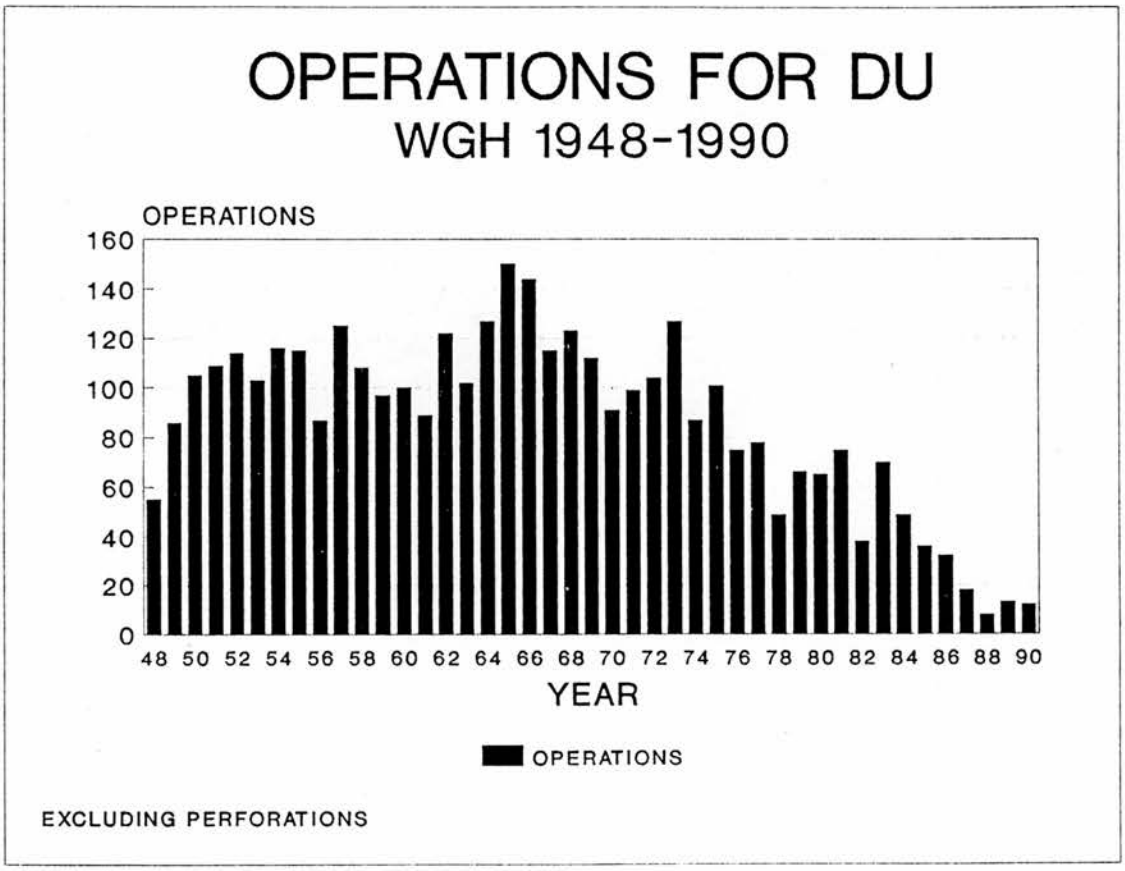


Fig. 15.1

Operations for duodenal ulcer (excluding perforations)
Western General Hospital 1948-1990

As can be seen from this chart the total annual numbers peaked in 1965 when 150 operations were performed. Since that year there has been a trend to a decrease in annual numbers with a more marked decrease after 1983. The total of 12 operations in 1990 represents a mere 8% of the 1965 total.

The trends in the individual operations performed are shown in Fig. 15.2.

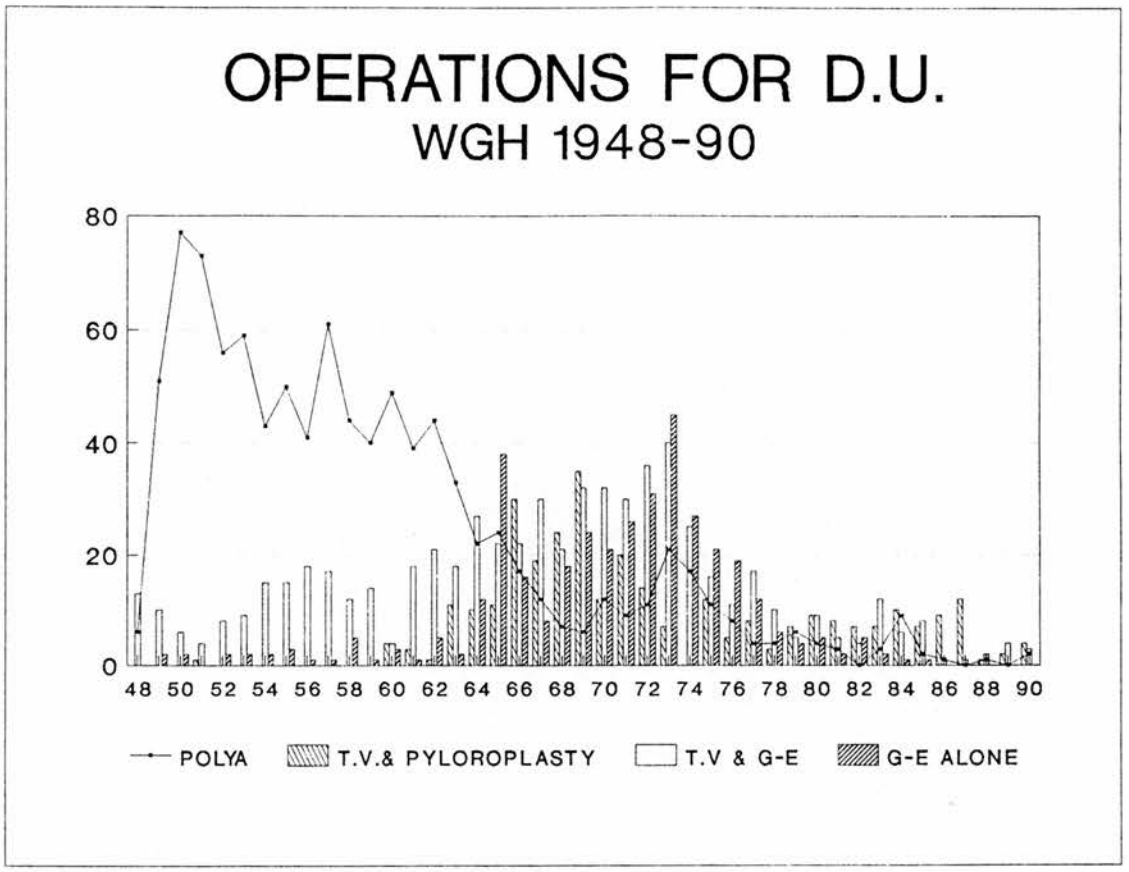


Fig. 15.2

Totals for specific operations for duodenal ulcer
Western General Hospital 1948-1990

Polya gastrectomy reached a peak in 1950 after which it was gradually replaced by truncal vagotomy and gastro-enterostomy. This procedure in turn reached its zenith in 1973 the same year as gastro-enterostomy alone. Thereafter highly selective vagotomy became the most popular operation reaching a peak in 1981 (Fig 15.3).

The unit was unusual in its advocacy of gastro-enterostomy alone into the 1980's as part of the continuing policy of tayloring the procedure according to the maximal acid output, a policy described in Chapter 3.

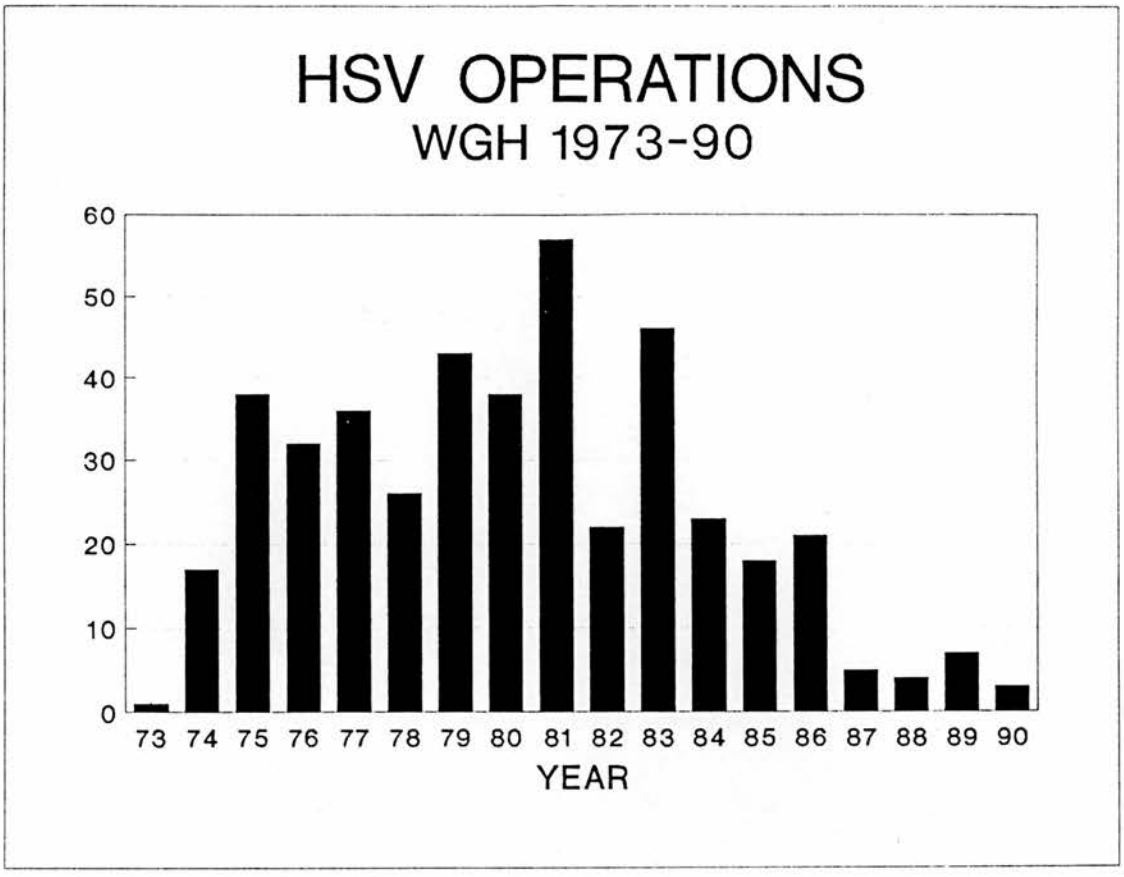


Fig. 15.3

Highly selective vagotomy Western General Hospital 1973-1990

CHAPTER 16

THE RESULTS OF BILLROTH II (POLYA) GASTRECTOMY FOR DUODENAL ULCER

The trend toward Billroth II (Polya) gastrectomy as the operation of choice for duodenal ulcer in the U.K. in the years following the Second World War has been outlined in Chapter 2. When the Gastro-Intestinal Unit at the Western General Hospital, Edinburgh, was established in 1947 the senior surgeon was Mr. (later Sir) John Bruce. In common with other former Army surgeons he returned to post-war civilian practice with the clear belief that Billroth II gastrectomy should be the elective operation for duodenal ulcer and this policy was followed at the Western General Hospital from that time.

This chapter is concerned with the long term results of those Billroth II partial gastrectomies performed in the 20 year period 1948-1968.

Although individual operation notes are not available the operation was a standard one, the result perhaps of a discipline persisting from wartime service days. The resection was a two-thirds to three-quarters gastrectomy leaving a gastric remnant measuring some 5 inches from the fundus. The gastro-jejunostomy was antecolic and isoperistaltic with an afferent loop some 10 inches long taken to lesser curve. The stoma was valved by using a Friedrich stapling clamp to close the superior aspect of the divided stomach to leave a stoma measuring no more than 2 inches.

For some 2 years between 1950 and 1952 the more extensive seven-eighths gastrectomy which had been advocated by Visick was used but the available records do not indicate in which patients this was performed.

The results of this 20 year experience with Billroth II gastrectomy are considered in terms of operative mortality, revisional surgery, Visick grading, quality of life, and long term mortality.

For purposes of this study operative mortality is defined as death

occuring within 30 days of operation.

The sub group proceeding to revisional surgery comprise a relatively small number of patients undergoing different revisional procedures for a variety of indications without a uniform policy. This makes an analysis difficult so that only the number, type and result of the revisional procedures have been presented.

Two methods of quality of life assessment have been used - Visick grading and the Cay and Small quality of life and pain score. The Visick grading (Visick 1948) and the pain and quality of life score (Cay et al 1975) described in detail in Chapter 12, were both devised to allow the symptomatic result of the operation to be expressed in simple numerical terms. The application of computer technology, which was not available when those scoring systems were first described, has allowed the analysis of individual symptoms from a large number of patients. The progression of Visick and quality of life scores over a 20-40 year period paints a picture of the effects of the operation throughout and in many cases beyond the working lifetime of a large group of patients.

Between 1st January, 1948 and 31st July, 1968 a total of 847 patients underwent Polya partial gastrectomy for duodenal ulcer at the Western General Hospital. Of these 736 were male (90.1%). The mean age was 46.0 years with a range of 15-80 years. All procedures were elective but 16 were performed 'urgently' for bleeding. The distribution of the operations performed between 1948 and 1990 is shown in Fig. 16.1.

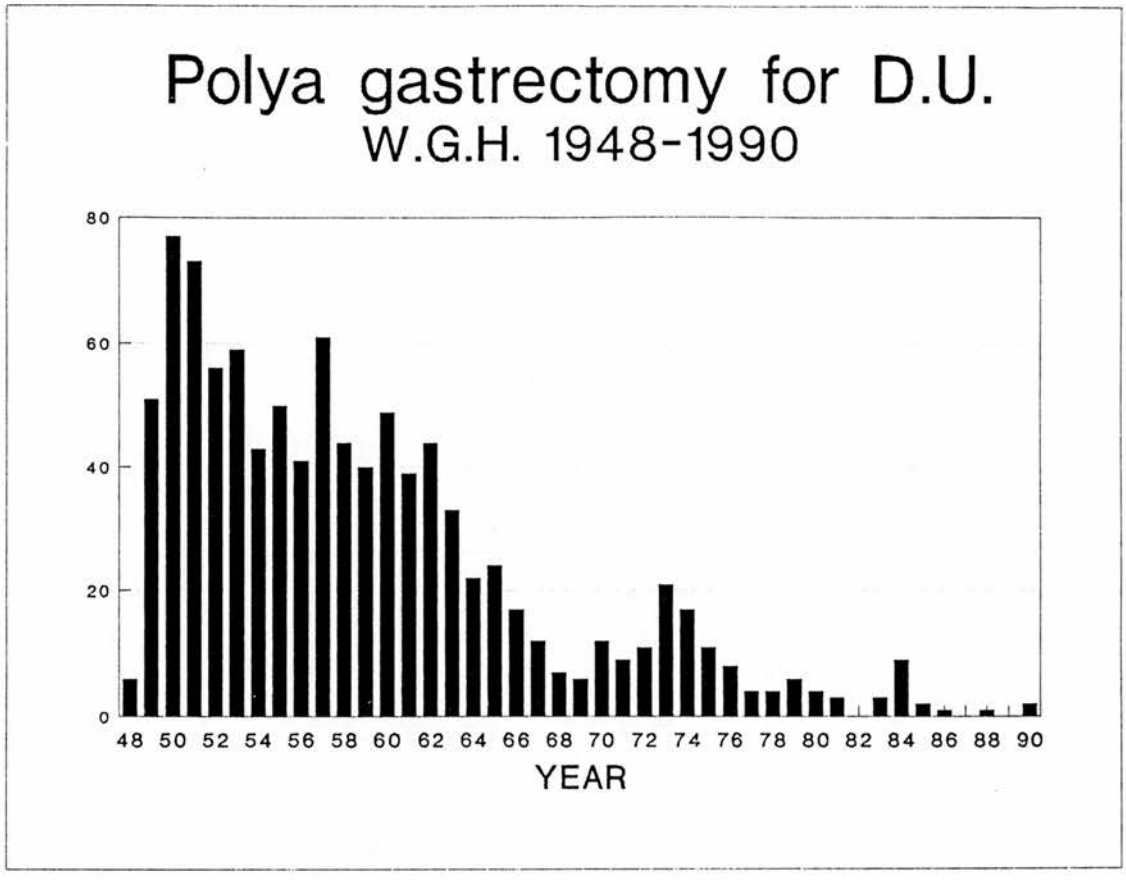


Fig. 16.1

Number of Polya gastrectomies performed annually at Western General Hospital 1948-1990

Previous complications of the ulcer were noted as possible indicators of the aggression of the ulcer diathesis. Previous haemorrhage was noted in 167 (19.7%) and previous perforation in 108 (12.7%). 679 patients (80.2%) were cigarette smokers.

RESULTS

Operating Surgeons

The majority of the procedures, 617 (72.9%), were performed by four consultants (Table 16.1) the remainder by trainee surgeons.

Consultant	Operations
J.B.	249
C.W.A.F.	188
W.P.S.	109
A.N.S.	71

Table 16.1

Number of Polya gastrectomies performed by 4 consultant surgeons

Operative Mortality

The overall 30 day operative mortality was 1.9% (16/847). Three of these patients had emergency gastrectomy for haemorrhage and died of continuing haemorrhage. The operative mortality excluding these urgent cases was 1.6% (13/847). The cause of death in the 13 patients who died within 30 days of elective operation is shown in Table 16.2.

Pneumonia	3
Pulmonary embolus	3
Peritonitis	3
Shock	2
Intestinal obstruction	1
Pancreatitis	1

Table 16.2

Cause of death in 13 patients dying within 30 days of elective Polya gastrectomy

Complications on Follow-Up

Complications observed during the 22-40 years of follow-up are shown in Table 16.3. The diagnosis of complications such as dumping and diarrhoea and bile vomiting were made on review at the follow-up clinic, home visit or from postal questionnaire. All recurrent or stomal ulcers were confirmed either at laparotomy, barium meal or upper endoscopy.

Dumping (early and late)	36 (4.3%)
Diarrhoea	27 (3.2%)
Bile vomiting	46 (5.5%)
Stomal ulcer	24
Recurrent duodenal ulcer	3 (3.2%)
Anaemia (iron and B12 def.)	19
Steatorrhoea	9 (1.1%)
Duodenal stump dehiscence (late)	3
Duodenal fistula	1
Stammers hernia	2
Late subphrenic collection	2
Pulmonary T.B.	4
Dysphagia	1

Table 16.3

Complications related to gastrectomy observed on long term follow-up. (%ages expressed of 831 survivors)

Revisional Operations

A total of 69 revisional operations were performed in 63 patients (7.6% of the 831 survivors). Only those operations for complications of the original operation have been considered. Thus procedures such as further resection for carcinoma of the gastric remnant have not been included. The revisional operations are shown in Table 16.4.

Truncal vagotomy	20
Roux-en-Y conversion	19
Entero-enterostomy	11
Billroth I conversion	8
Jejunal interposition	4
Completion gastrectomy	3
S.V./H.S.V.	2
Closure perforation	2
Gastro-duodenostomy	1

Table 16.4

Revisional procedures in 63 patients

Acid output studies

Maximal acid output (MAO) was measured in 537 patients pre-operatively using maximal histamine stimulation. The mean pre-operative MAO was 39 (range 1-113) mMols. in the post-histamine hour. Post-operatively MAO was measured in 120 patients, the mean MAO was 6 mMols. in the post-histamine hour with a range from 0-28 mMols.

Visick Grading

Visick grading was performed on at least one occasion on all patients who survived for a minimum of six months and who were available for follow-up. A first Visick assessment was recorded for 754 patients (90.7%) of the 831 patients who survived for more than 30 days post-operatively. Where grading was performed on several occasions those assessments made closest to the fifth anniversary and the fifteenth anniversary have been selected for ease of analysis. The results of the first Visick assessments are shown in Table 16.5.

Patients graded Visick 1	469 (62.2%)
Patients graded Visick 2	133 (17.6%)
Patients graded Visick 3	68 (9.0%)
Patients graded Visick 4	84 (11.1%)

(mean time to grading 6.4 years
range 6 months to 28.3 years)

Table 16.5

Results of first Visick grading in 754 patients

The range in timing is large because eleven patients assessed within 5 years subsequently died before formal assessment at 5 years have produced a short interval to first grading. On the other hand eight patients lost to follow-up were subsequently traced and assessed and they account for the long delay to first grading.

The results of the second Visick grading performed in 333 patients are shown in Table 16.6. The reasons for the large range in timing are as given above. Where serial assessments have been made, the Visick score closest to the 15th anniversary of the procedure has been selected for ease of analysis and presentation of data.

Patients graded Visick 1	194 (58.2%)
Patients graded Visick 2	68 (20.4%)
Patients graded Visick 3	41 (12.3%)
Patients graded Visick 4	30 (9.0%)

(mean time to 2nd grading 17.2 years
range 3.8 - 34.8 years)

Table 16.6

Results of 2nd Visick grading in 333 patients

The differences in mean scores between first and second assessment are not statistically significant. These results are expressed graphically in Fig. 16.2.

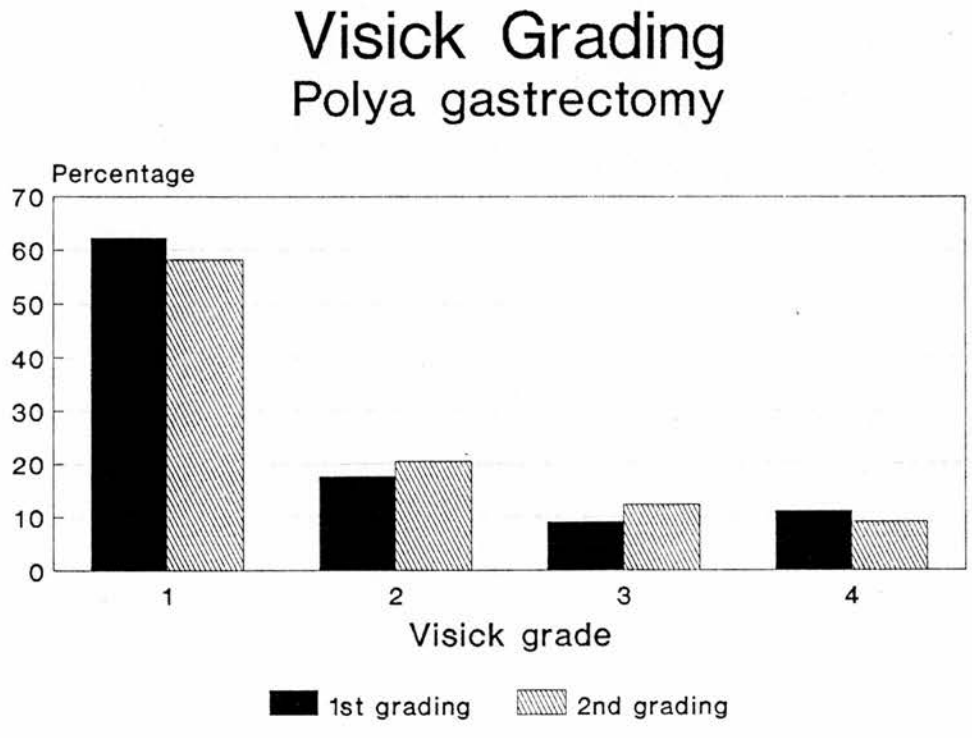


Fig. 16.2

Results of 2 Visick gradings after Polya gastrectomy

Quality of Life Assessment

Quality of life was assessed using the technique of Cay and Small on one occasion in 313 patients, on two occasions in 178, and on three occasions in 77.

The quality of life questionnaire was developed over several years and became available in its final form in 1978. Thus the delay to first assessment was at least 10 years. As described in Chapter 13 the Cay and Small quality of life assessment gives three scores i.e. psychosocial score, physical symptoms score and the two combined giving a 'quality of life' (Q.O.L.) score. The results of the first quality of life assessment in 313 patients are shown in Table 16.7.

Mean psychosocial score	30.2±1.14 (28.7-32.1) [5-42]
Mean physical score	20.7±0.97 (18.4-22.9) [2-24]
Mean Q.O.L. score	50.9±1.11 (47.1-55.0) [7-66]

Table 16.7

Mean scores in 1st psychosocial and physical symptom assessment (n=313): 95% C.L. in () Range in []

The Q.O.L. scores have been classified into the range bands described in Chapter 13, to give an assessment of the quality of life as "good", "moderate", or "bad". These results are shown in Table 16.8.

Good (score 46-66)	223 (71.2%)
Moderate (score 40-45)	51 (16.3%)
Bad (score 0-39)	39 (12.5%)

(mean time to assessment 21.9 years range 11.1-30.0)

Table 16.8

Results of 1st psychosocial and physical symptom assessment (n=313)

A second assessment was performed in 178 patients, a mean of 24.2 years, after operation (range 16.0-34.7), and a third in 77 patients, a mean of 26.5 years, after operation (range 17.7-36.7 years). These results are shown in Table 16.9.

	% of Patients		
	1st Assess. (n=313)	2nd Assess. (n=178)	3rd Assess. (n=77)
Good (score 46-66)	71.2%	71.4%	77.9%
Moderate (score 40-45)	16.2%	14.0%	14.3%
Bad (score 0-39)	12.4%	14.6%	7.8%

Table 16.9

Results of three quality of life assessments (Total scores i.e. psychosocial + physical symptom scores)

The differences in mean scores between the three assessments is not statistically significant.

These results of the three assessments are shown graphically in Fig. 16.3.

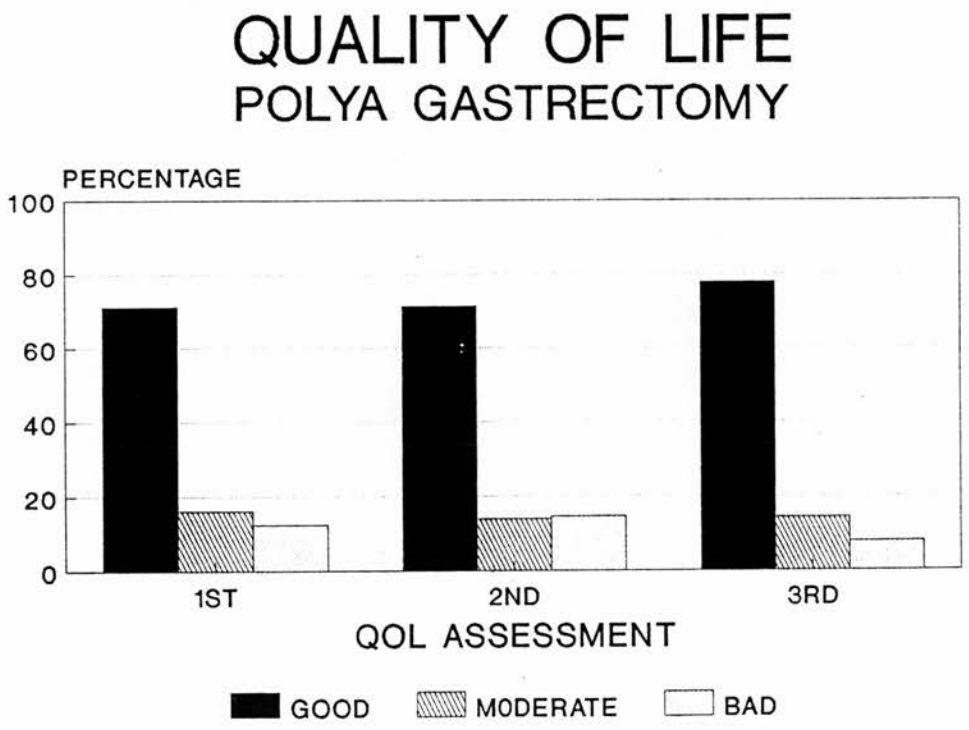


Fig. 16.3

Results of three quality of life assessments after Polya gastrectomy

The results are in keeping with the Visick assessment. The Visick assessment was made by the surgeon at follow-up whereas the quality of life

total score is calculated from the patient responses. It is of interest that some 80% of patients score Visick I or II on first assessment while 87% score "good" or "moderate" on first quality of life testing. The quality of life score is shown graphically in Fig. 16.4 as an area curve. The percentage of patients achieving each score between 5 and 42 is shown.

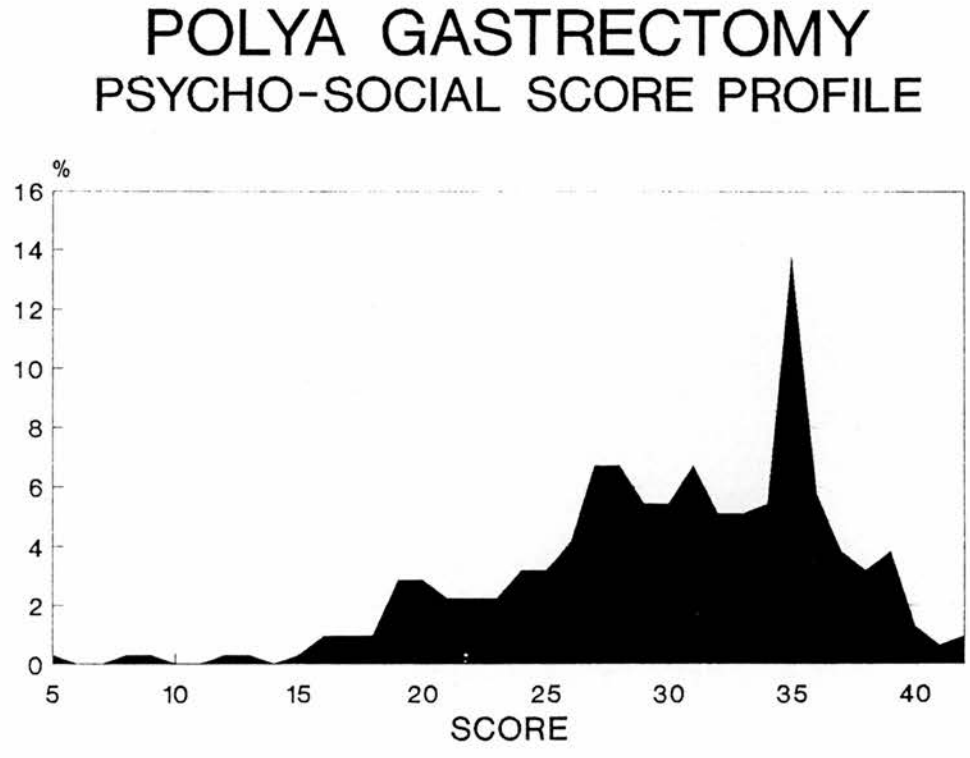


Fig. 16.4
Polya psychosocial curve

The physical symptom score has been expressed graphically in the same way. The percentage of patients achieving each score between 2 and 24 is shown in Fig. 16.5.

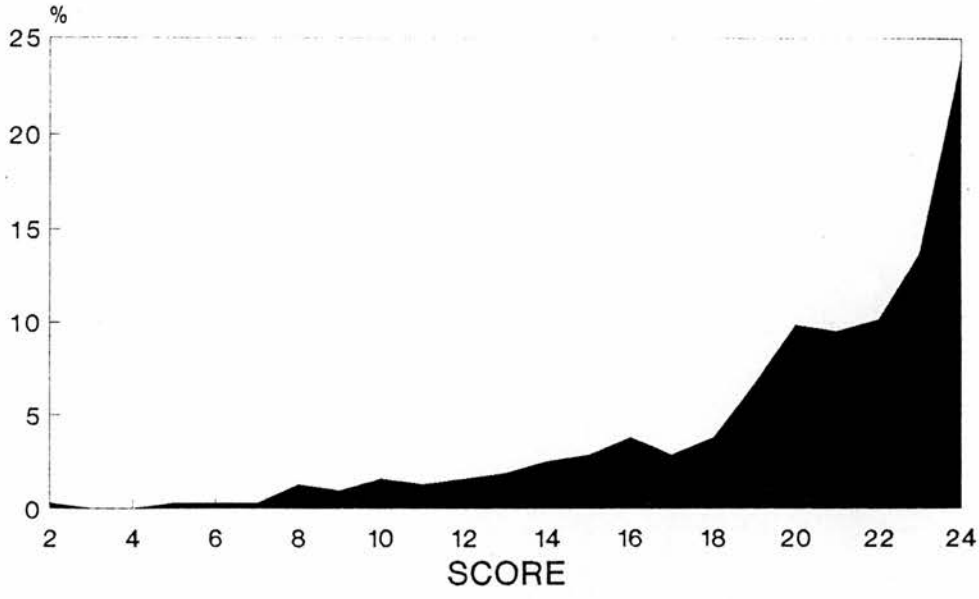


Fig. 16.5

Polya physical symptom score curve

Correlation between Visick grading and Quality of Life scores

The correlation between Visick grading on first assessment and Q.O.L. scores on first assessment is shown in Table 16.8. The mean Q.O.L. score in the patients graded Visick 1 is significantly superior to the other Visick gradings ($p<0.05$). The differences in Q.O.L. score between the patients allocated to three remaining Visick gradings are not significant.

	Q.O. L. score			
Visick Grade	0-39	40-45	46-66	Mean ± S.E.
4	9	10	18	45.0±1.91 [41.1,48.8]
3	9	6	18	45.3±2.13 [40.9,46.9]
2	14	12	33	46.1±1.21 [43.7,45.8]
1	6	23	148	53.4±1.28 [50.9,55.9]

Table 16.8

Correlation between Q.O.L. score and Visick grading after Polya gastrectomy. 95% C.L. in []

Conclusions

In this study Polya gastrectomy has been shown to have a relatively low mortality of 1.6% for elective cases. Bearing in mind that these operations were performed between 1948 and 1968 this could be expected to be lower today. It has been shown that operative mortality following gastrectomy for gastric cancer has fallen significantly in the past 30 years (Macintyre 1991).

The incidence of dumping (4.3%) and bile vomiting (5.5%) are in keeping with the results from other published series. The stomal/recurrent ulcer rate (3.2%) is low compared to those from other contemporary series (Table 2.2).

Using the convention that Visick I + II means a satisfactory result, 79.8% of patients had such a result after first grading and 78.6% after second.

Similarly 87.5% had a good or moderate result using the quality of life assessment. As with Visick grading this result did not worsen over 15 years.

The quality of life score appears to be more appropriate than the Visick grading. Of 37 patients graded Visick 4, eighteen (48%) enjoyed a quality of life score in the "good" range. On the other hand of the 177 graded Visick 1 only six (3.4%) scored in the "bad" range for quality of life.

By these criteria Polya gastrectomy appears to be a useful operation for duodenal ulcer. The all-important long-term nutritional and metabolic sequelae which caused the operation to fall from favour have not been examined in this study.

CHAPTER 17

THE RESULTS OF GASTRO-ENTEROSTOMY FOR DUODENAL ULCER

The policy pursued at the Western General Hospital of tailoring the operations to acid output has been described in earlier chapters. This policy resulted in gastro-enterostomy alone being carried out on patients with maximal acid output of less than 30 mM. as late as 1985 some 50 years after the operation had been abandoned by most surgeons in the English speaking world. This has provided an unusual opportunity to review a relatively large number of patients 22-42 years post-operatively.

Between 1st January 1948 and 31st December 1968 a total of 113 gastro-enterostomies were performed for duodenal ulcer at the Western General Hospital. The annual distribution of these operations between 1948 and 1990 is shown in Fig. 17.1.

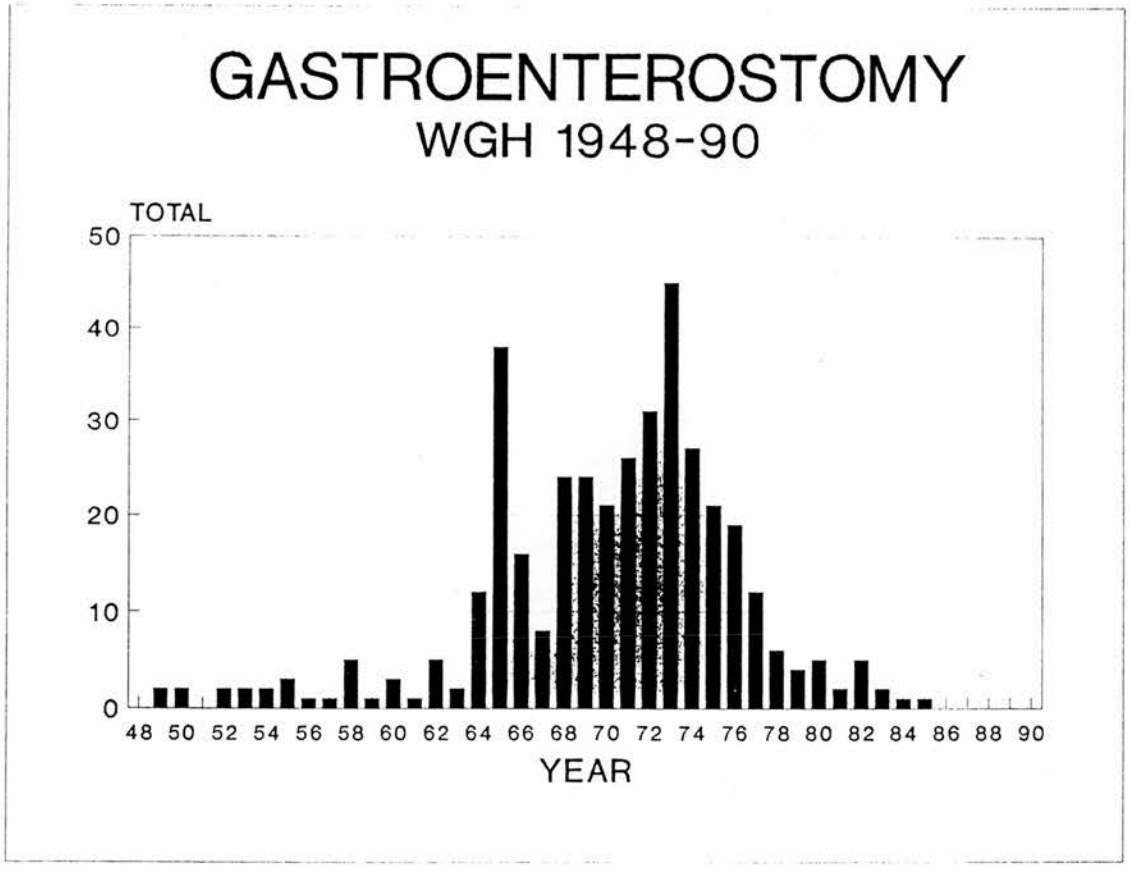


Fig. 17.1

Annual number of gastro-enterostomies performed at the Western General Hospital 1948-1990.

There were 60 males (53%) and 53 females with a mean age of 54 years (range 18-88). All procedures were elective. Of the 113 patients 30 (26.5%) had had a previous haemorrhage, 6 (5.3%) a previous perforation. 71 (62.8%) were cigarette smokers.

RESULTS

Operative mortality

The 30 day operative mortality was 0.9% (1/113). The one patient who died was a 60-year-old man who died of post-operative pneumonia. The surviving patients have now been available for follow-up between 22 and 42 years.

Complications on Follow-Up

Complications observed during the 22-40 years of follow-up are shown in Table 17.1.

Dumping (early and late)	3 (2.7%)
Diarrhoea	5 (4.5%)
Bile vomiting	9 (8.0%)
Stomal ulcer	13 (11.6%)
Stomal obstruction	1
Recurrent duodenal ulcer	2 (1.8%)
Gastric ulcer	7 (6.2%)
Pulmonary T.B.	1

Table 17.1

Complications related to gastro-enterostomy observed on long term follow-up (percentages expressed of 112 survivors beyond 30 days)

Revisional operations

Revisional operations were performed on 19 occasions (16.8% of 30 day survivors). Of these 9 were gastrectomies, 6 truncal vagotomies, 1 HSV, 2 revision of the gastro-enterostomy and one 'take-down' of the gastro-enterostomy.

Acid output studies

The maximal acid output (MAO) was measured in 79. The mean MAO in these 79 patients was 23 mMol. in the first post-stimulation hour

(range 4-51 mMol.) in keeping with the policy which aimed to reserve this operation for patients with an MAO of less than 30 mMol.

The MAO was measured post-operatively in 28 patients. The mean MAO post-operatively in these patients was 16 mMol. in the post-histamine/post-pentagastrin hour. The pre- and post-operative results are shown in Table 17.2.

Pre-Operative MAO	Post-Operative MAO
25	6
5	4
30	27
28	29
30	11
30	26
15	4
26	13
29	27
26	28
15	4
13	4
38	36
25	27
28	7
26	11
28	6
15	5
28	23
35	23
25	16
25	26
18	7
38	35
14	5
15	4
28	3
25	15

Table 17.2

Pre- and post-operative MAO measured in 28 patients before and after gastro-enterostomy

In these patients the mean pre-operative MAO was 24 mMol. and post-operatively was 16 mMol., a mean reduction for this group of 33.3%. The mean of the differences was 8.9 (S.E. $\pm$ 1.44) and 95% confidence limit for mean difference is 6.0 to 11.9.

Visick Grading

Visick gradings were performed at approximately 5 year intervals. 109 of the 112 patients who left hospital were subsequently assessed and given a Visick grade. The first Visick grading was allocated between 6 months and 14.4 years with a mean of 4.4 years interval since the procedure. Gradings were allocated thereafter at approximately 5 year intervals. The results of the first two Visick gradings are shown in Table 17.3.

	1st Grading (n = 109)	2nd Grading (n = 66)
Visick 1	67 (61.5%)	24 (36.4%)
Visick 2	17 (15.6%)	24 (36.4%)
Visick 3	7 (6.4%)	9 (13.6%)
Visick 4	18 (16.5%)	9 (13.5%)

Table 17.3

If the accepted convention of combining Visick 1 with 2 and 3 with 4 is used, then at the first assessment 77.1% were in the former group and 22.9% in the latter. By the second assessment there was no significant change with 72.4% classed as Visick 1 or 2 and 27.6% as Visick 3 or 4.

The results of the two Visick gradings are shown graphically in Fig. 17.2.

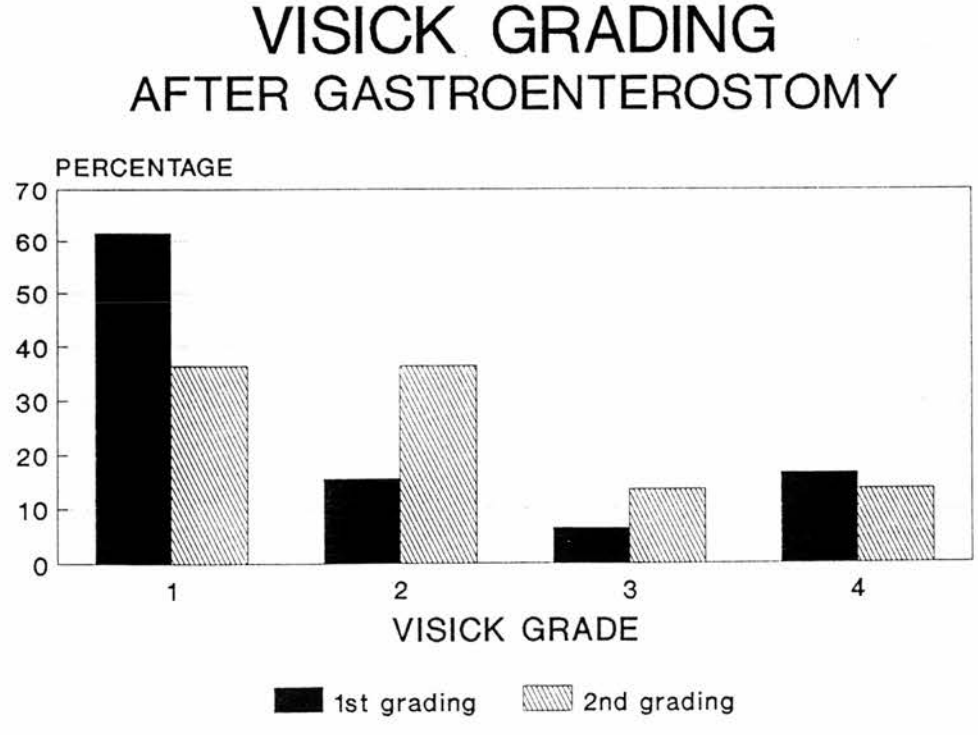


Fig. 17.2

Visick grading after gastro-enterostomy

This demonstrates that combining the Visick scores has hidden a significant fall in the percentage of patients graded Visick 1 from 61.0% to 36.2% ($p<0.001$) those patients being downgraded to Visick 2 or 3 at the second assessment.

Quality of Life Assessment

When the quality of life assessment was developed it was applied post-operatively to those surviving patients not lost to follow-up. It became available for the first time in 1978 and the assessment therefore involves a smaller number of patients than the Visick grading. The results of these assessments are shown in Table 17.4 where psychosocial score and physical score are added to give a quality of life (Q.O.L.) score.

	1st Assessment (n = 58)	2nd Assessment (n = 37)
Mean psychosocial score	29.8±0.79 (28.2-31.4)	30.3±1.10 (28.1-32.6)
Mean physical score	18.8±0.71 (17.3-20.2)	19.4±0.7 (18.0-20.8)
Mean Q.O.L. score	48.6±0.91 (45.5-51.6)	49.7±1.8 (46.1-53.4)

Table 17.4

Mean scores ± S.E.M. in 1st and 2nd psychosocial and physical symptom assessments
(95% confidence limits in brackets)

This shows no deterioration in either component or the total Q.O.L. score between the two assessments. The quality of life scores in these two successive assessments is shown graphically in Fig. 17.3 expressed as percentages of patients in the "good", "moderate" and "bad" result bands as determined by total score.

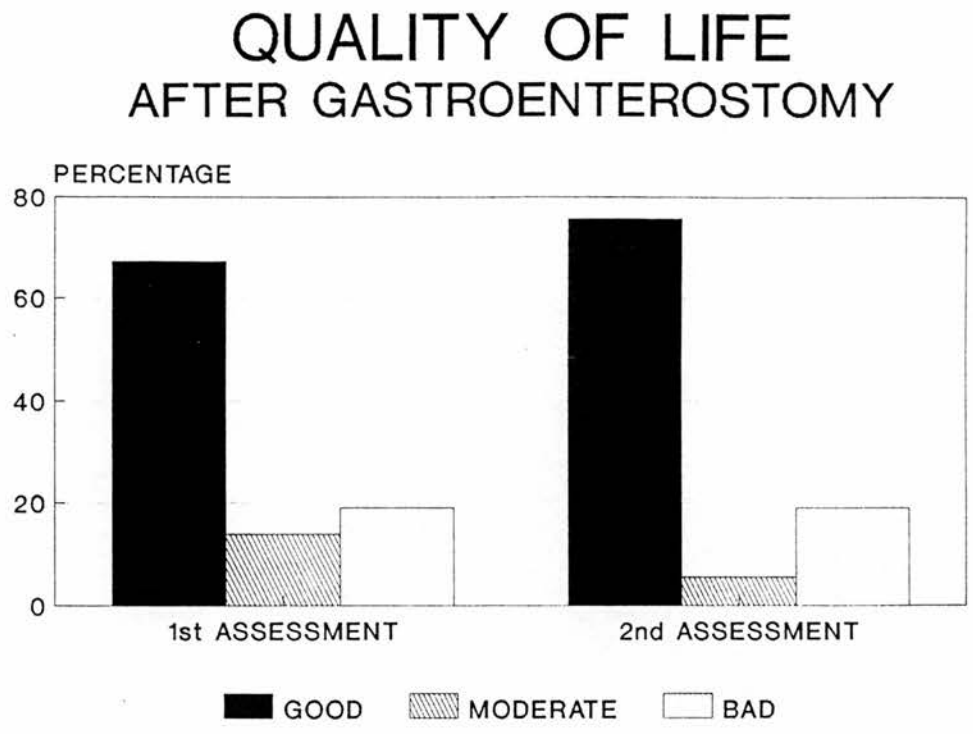


Fig. 17.3

Results of 2 quality of life assessments following gastro-enterostomy

These results are shown in tabular form in Table 17.5 after classification by score into "good", "moderate" and "bad".

Result	1st Assessment (n = 58)	2nd Assessment (n = 37)
Good (46-66)	39 (67.2%)	28 (75.7%)
Moderate (40-45)	8 (13.8%)	2 (5.4%)
Bad (0-39)	11 (19.0%)	7 (18.9%)

Table 17.5

Quality of life results calculated on the basis of total score

The psychosocial score at the first assessment has been calculated as an area graph (Fig. 17.4).

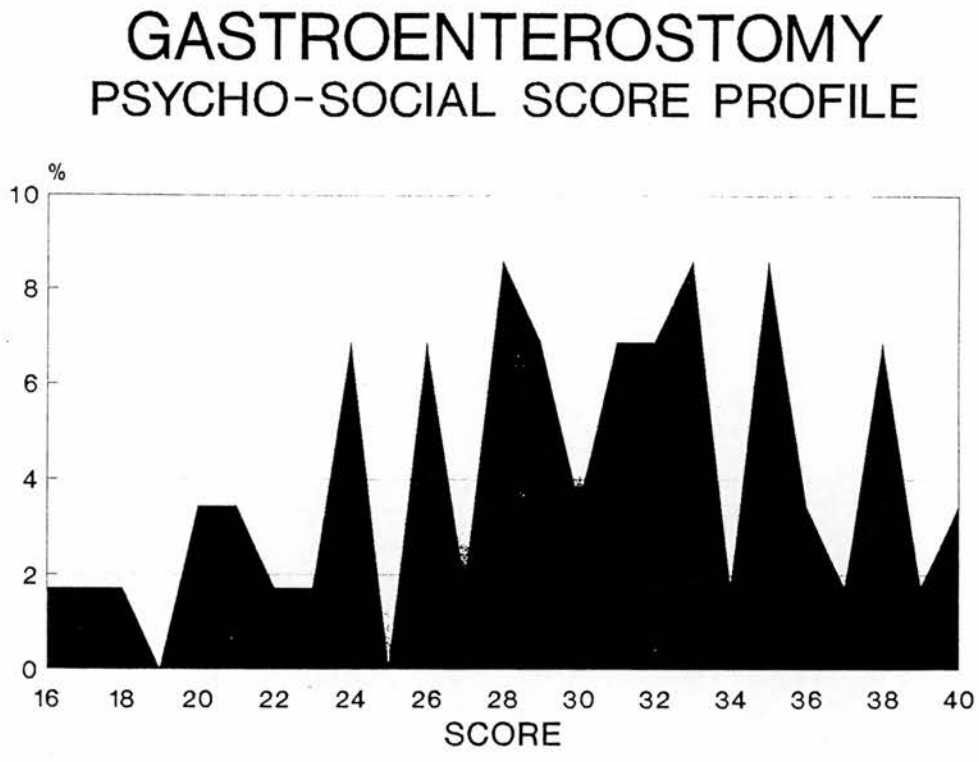


Fig. 17.4

Psychosocial score profile after gastro-enterostomy

This shows the percentage of patients who scored each possible score between 16 (the worst score) and 40 (the best score).

This depicts the profile of the operation in terms of psychosocial score - the more the area under the curve is moved to the right, the better the result. The graph demonstrates that gastro-enterostomy is associated with a broad scatter of low and medium scores indicating a poor overall result from this operation in terms of psychosocial symptoms.

The physical symptom scores at first assessment have also been calculated as an area graph in the same way.

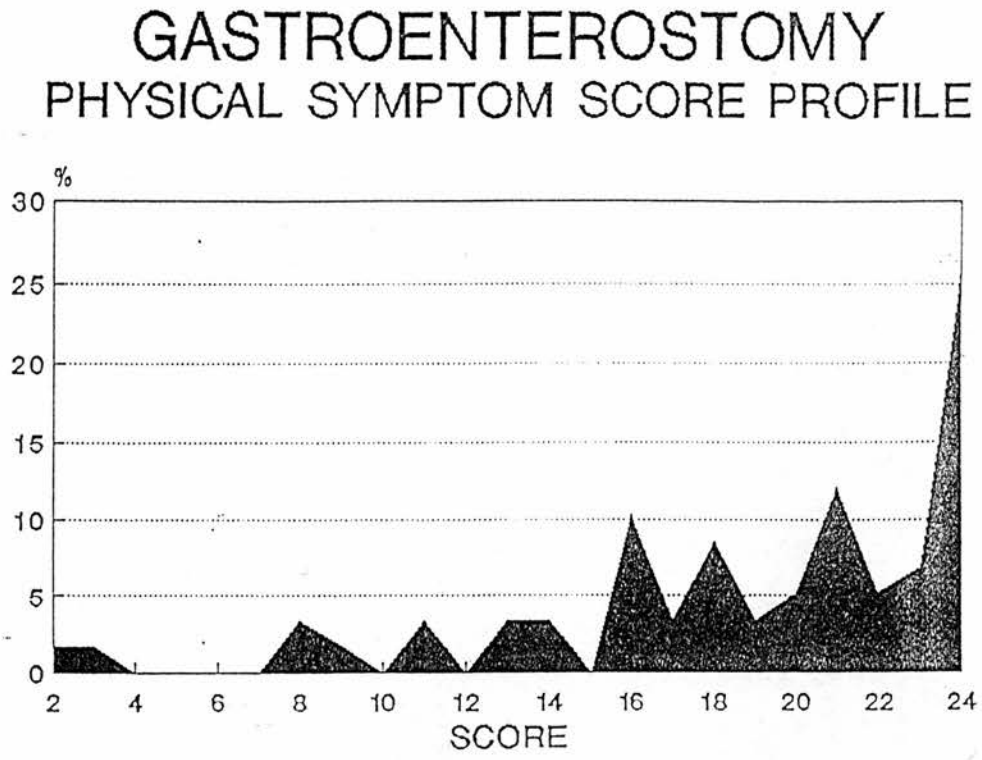


Fig. 17.5

Area graph physical after gastro-enterostomy

This demonstrates a much better result in terms of physical symptom scores compared to psychosocial score following gastro-enterostomy.

Correlation between Visick grading and Quality of Life Score

Correlation between first Visick grading and first Q.O.L. score is shown in Table 17.6

	Q.O.L. Score			
Visick Grading	0-39	40-45	45-66	Mean ± S.E.
4	2	1	1	43.1±4.48 [32.2,54.1]
3	3	1	1	44.4±2.12 [39.3,49.5]
2	4	4	5	38.6±6.14 [21.6,55.6]
1	2	2	28	52.8±1.37 [49.7,55.3]

Table 17.6

Correlation between Visick grading and Q.O.L. score after gastro-enterostomy. 95% C.L. in []

The patients classified Visick 1 have a significantly better mean score than all other Visick grades ($p<0.05$) but the differences between the mean scores obtained between the other 3 Visick grades are not significant.

Conclusions

Despite the policy of gastro-enterostomy being reserved for patients with an MAO of less than 30 mM, gastro-enterostomy has been shown in this study to be an unsatisfactory operation for duodenal ulcer. The recurrent ulcer rate (stomal, gastric and duodenal) of 19.6% is in keeping with those in other published reports (Chapter 3).

Furthermore the rates of dumping (2.7%), diarrhoea (4.5%) and bile vomiting (8.0%) are similar to those after gastrectomy.

The unsatisfactory long term outcome is reflected in the poor Visick grading and quality of life scores.

There was no decline either in the Visick scores or the Quality of Life score with the passage of time in the group overall.

CHAPTER 18

THE RESULTS OF TRUNCAL VAGOTOMY AND GASTRO-ENTEROSTOMY FOR DUODENAL ULCER

Truncal vagotomy and gastro-enterostomy was first performed in the Western General Hospital in 1948, the year after Dragsted and his colleagues had described the technique of trans-abdominal truncal vagotomy (Dragsted 1947). Between 1948-1968 a total of 317 such procedures were performed. The distribution between the years 1948-1990 is shown in Fig. 18.1.

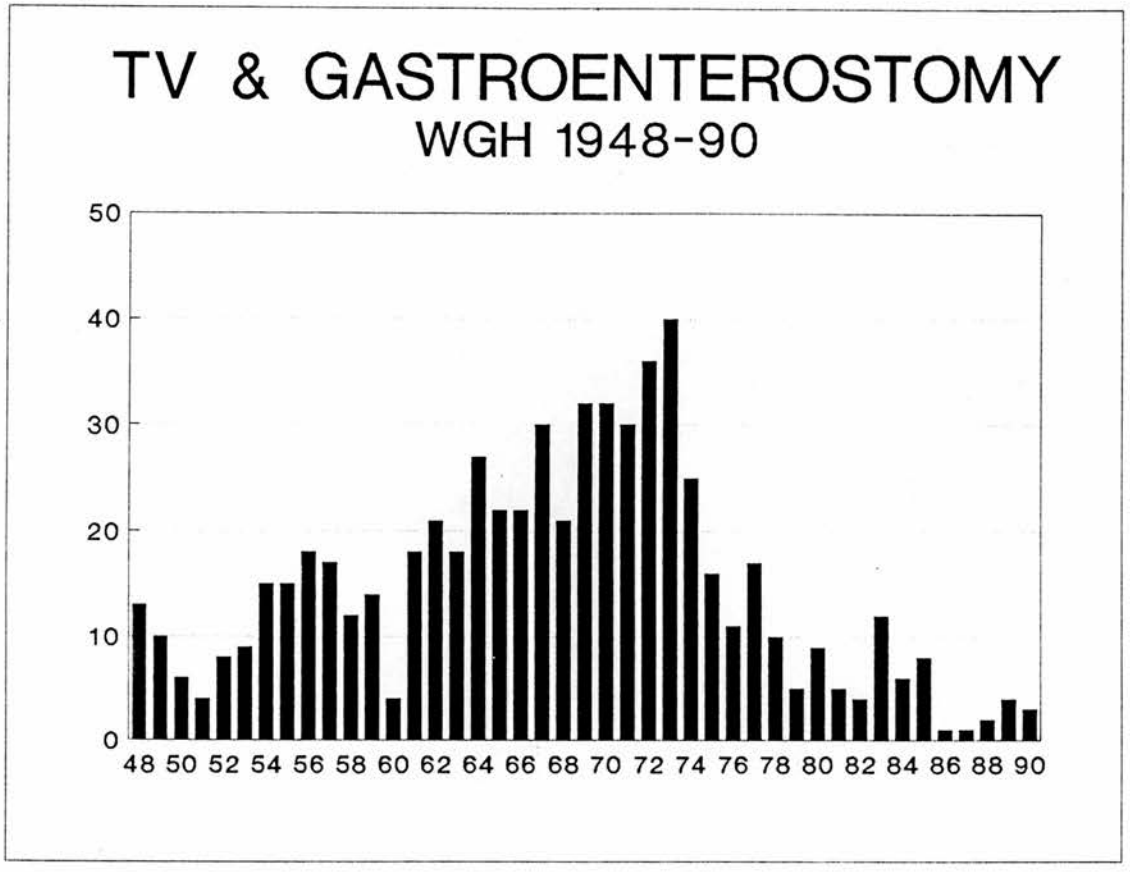


Fig. 18.1

Annual number of truncal vagotomy and gastro-enterostomy procedures for duodenal ulcer Western General Hospital 1948-1990

There were 196 males and 121 females so that males formed 61.8% of the series. The mean age at operation was 47.1 years with a range of 18-81 years.

There were 227 cigarette smokers (71.6%). 66 patients (20.8%) had had a previous haemorrhage from the ulcer and 25 (7.9%) a previous perforation.

RESULTS

Operative mortality

Five patients died post-operatively giving an operative mortality of 1.58%. The cause of death in these 5 patients was massive pulmonary embolism in three, cerebral embolism in one patient who had mitral valve disease with atrial fibrillation, and pneumonia leading to massive pulmonary consolidation in the fifth.

Complications on Follow-Up

Complications observed during the 22-40 years of follow-up are shown in Table 18.1.

Dumping (early and late)	19 (6.1%)
Diarrhoea	26 (8.3%)
Bile vomiting	21 (6.7%)
Stomal ulcer	8 (2.6%)
Recurrent duodenal ulcer	5 (1.7%)
Gastric ulcer	3 (0.9%)
Anaemia (iron and B12 def.)	18
Stomal obstruction	4
Steatorrhoea	3
Pulmonary T.B.	1

Table 18.1.

Complications related to truncal vagotomy and gastro-enterostomy observed on long term follow-up (percentage expressed on 312 survivors beyond 30 days)

Revisional operations

36 revisional operations were recorded in 33 patients representing 10.6% of the 312 patients who survived the 30 day post operative period. The operations are shown in Table 18.2.

Polya gastrectomy	12
Billroth I gastrectomy	1
Take down G.E. and pyloroplasty	9
Take down G.E.	2
Revision gastro-enterostomy	1
Re-vagotomy	8
Roux-Y conversion	1
Entero-enterostomy	1

Table 18.2

Revisional operations after T.V. and gastro-enterostomy

Acid output studies

Pre-operative MAO was measured in 225 patients. The mean MAO was 31 mMol. in the first post stimulation hour with a range of 2-93 mMol. MAO was measured post-operatively in 106 patients who had a mean MAO of 8 mMol. with a range of 1-48 mMol. This represents a mean reduction in MAO for this group of 77%.

Visick Gradings

At least one Visick grading was carried out on 286 patients (91.7% of the 30 day survivors) and a second assessment on 141. The mean time to first grading was 6.22 years with a range of 1.9 to 21.8 years and mean time to second grading was 15.29 years with a range of 3.9 to 30.2 years. The results of these are shown in Table 18.3.

	1st Grading (n = 286)	2nd Grading (n = 141)
Visick 1	142 (49.7%)	59 (41.8%)
Visick 2	63 (22.0%)	34 (24.1%)
Visick 3	45 (15.7%)	31 (22.0%)
Visick 4	36 (12.6%)	17 (12.1%)

Table 18.3

Results of Visick grading after truncal vagotomy and gastro-enterostomy - Western General Hospital

These results are shown graphically in Fig. 18.2.

There were no significant differences between Visick gradings on first and second assessment.

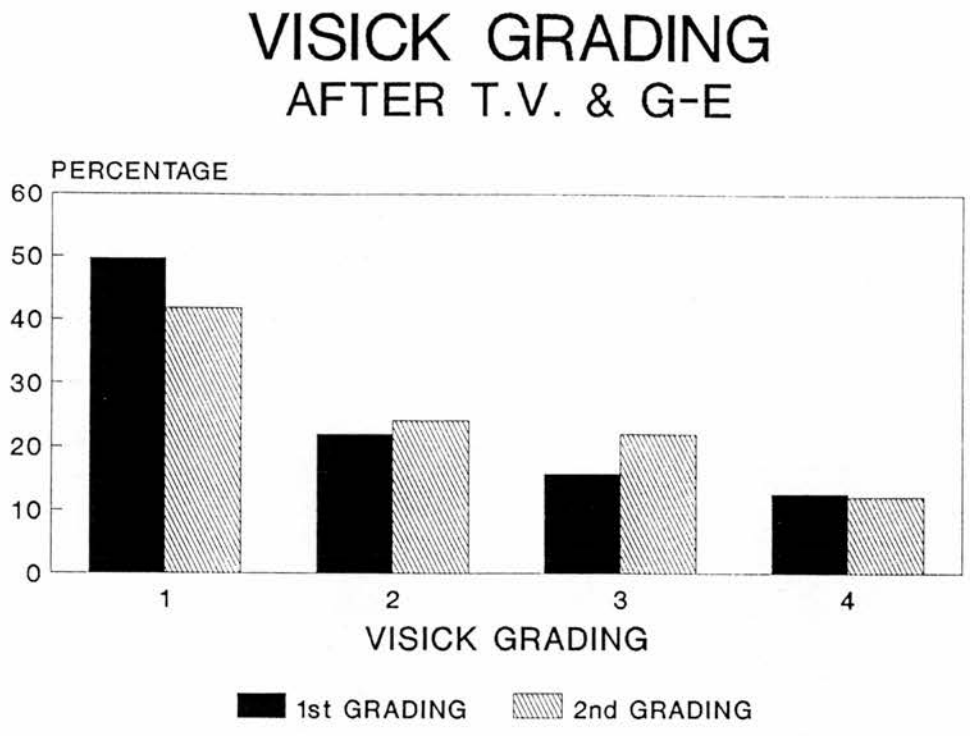


Fig. 18.2

Visick grading after truncal vagotomy and gastro-enterostomy
Western General Hospital

Quality of life assessment

Quality of life assessments were performed on at least one occasion on 140 patients and twice on 73. The mean interval to first assessment was 18.5 years with a range of 6.0 to 30.2 years and the mean time to second assessment was 21.8 with a range of 12.2 to 34.5 years.

	1st Assessment (n = 140)	2nd Assessment (n = 73)
Mean psychosocial score	29.6±0.59 (28.4-30.7) [13-41]	29.1±0.82 (27.4-30.7) [5-41]
Mean physical score	19.4±0.38 (18.7-20.2) [4-24]	19.2±0.62 (18.0-20.4) [3-24]
Q.O.L. score	49.0±0.97 (47.1-50.9) [17-65]	48.3±1.44 (45.4-51.1)

Table 18.4

Mean scores ± S.E. in 1st and 2nd quality of life assessment after truncal vagotomy and gastro-enterostomy.
95% C.L. in () Range in []

The Q.O.L. scores have been classified into the range bands described in Chapter 13, to give an assessment of the quality of life as "good", "moderate", or "bad". These results are shown in Table 18.5.

Good (score 46-66)	97 (69.3%)
Moderate (score 40-45)	15 (10.7%)
Bad (score 0-39)	28 (20.0%)

(Mean time to assessment 18.5 years
Range 6.0-30.2)

Table 18.5

Results of 1st Q.O.L. assessment
(n=140)

A second assessment was performed in 73 patients a mean of 21.8 years after operation (range 12.2-34.5). These results are shown in Table 18.6.

	Patients	
	1st Assessment (n = 140)	2nd Assessment (n = 73)
Good (score 46-66)	97 (69.3%)	51 (69.7%)
Moderate (score 40-45)	15 (10.7%)	9 (12.3%)
Bad (score 0-39)	28 (20.0%)	13 (17.8%)

Table 18.6

Results of two quality of life assessments

There is no significant difference between results on first and second assessment. The results are shown graphically in Fig. 18.3.

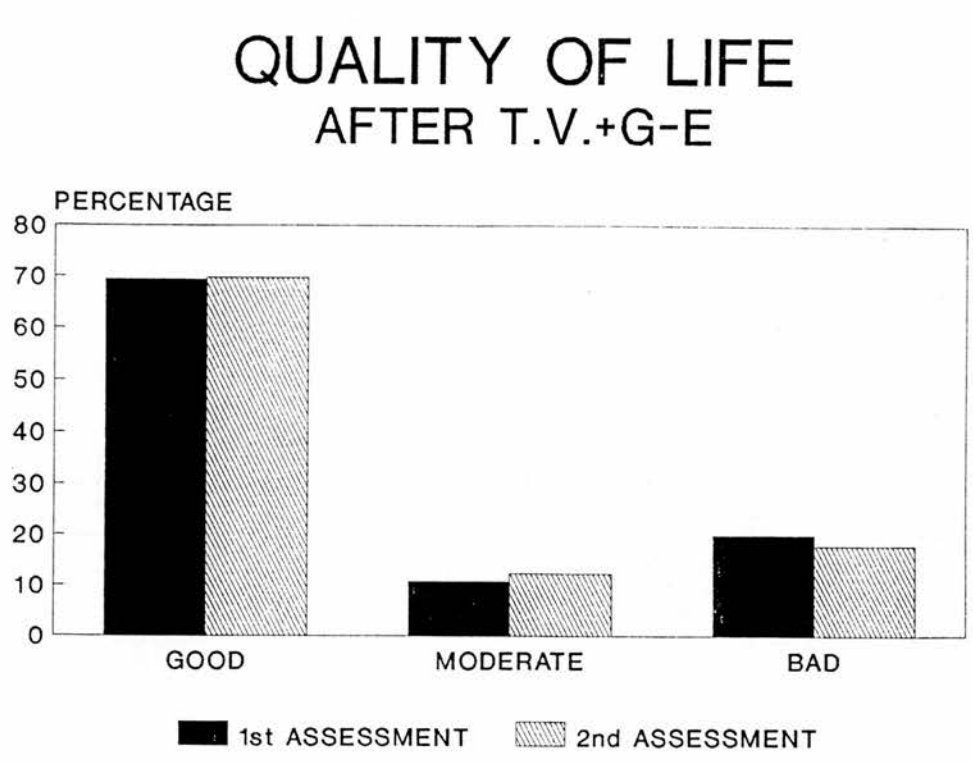


Fig. 18.3

Results of successive quality of life assessments after truncal vagotomy and gastro-enterostomy - Western General Hospital

The psychosocial score at the first assessment has been calculated as an area graph (Fig. 18.4). The percentage of patients who scored each possible score between 13 and 14 has been recorded.

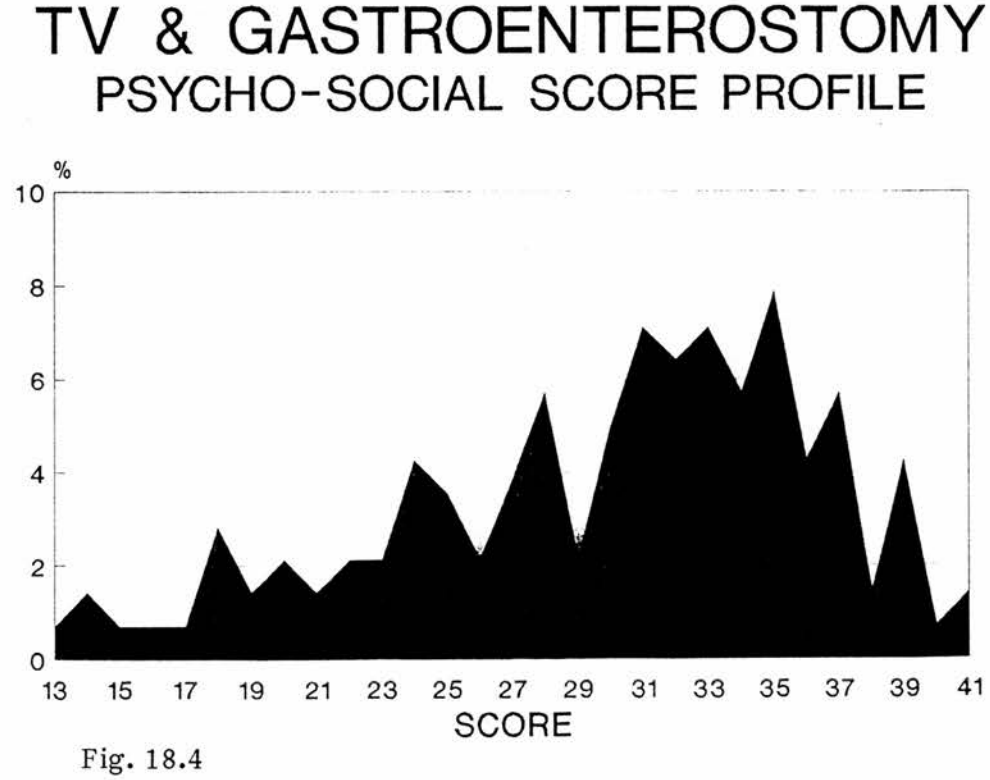


Fig. 18.4

Psychosocial score after truncal vagotomy and gastro-enterostomy: area curve

The further to the right the area under the curve the better the result profile.

The physical score has also been expressed graphically in the same way in Fig. 18.5.

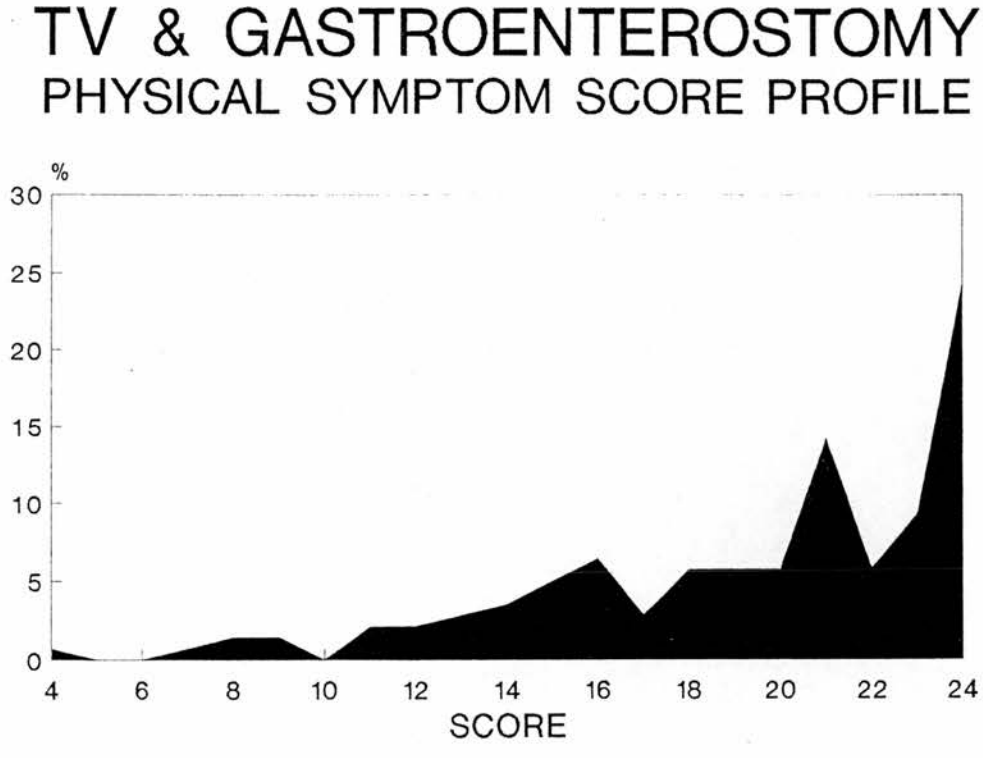


Fig. 18.5

Physical score after truncal vagotomy and gastro-enterostomy: area curve

Correlation between Visick gradings and Q.O.L. score

The correlation between Visick gradings and Q.O.L. score is shown in Table 18.7. The number of patients in each Visick grade who attained the "good", "moderate" and "bad" quality of life scores have been tabulated. The mean quality of life score of each of the four Visick groups is also shown.

Visick Grading	Q.O.L. Score 0-39	40-45	46-66	Mean ± S.E.
4	9	2	8	40.4±2.75 [34.6,46.2]
3	7	6	16	45.9±1.94 [41.9,49.8]
2	4	3	17	49.0±1.87 [45.1,52.9]
1	7	4	54	52.8±0.96 [50.9,54.7]

Table 18.7

Correlation between first grading and Q.O.L. score after truncal vagotomy and gastro-enterostomy. 95% C.L. in []

Those patients graded Visick 1 have significantly higher mean score than any of the other three Visick groups ($p<0.05$). The differences between the mean scores of the three remaining Visick groups is not statistically significant.

Conclusions

Truncal vagotomy and gastro-enterostomy was the preferred operation in the Western General Hospital in the 1960's, although, for reasons described in detail earlier, gastro-enterostomy without vagotomy was also popular at this time and indeed in one year (1965) surpassed truncal vagotomy and gastro-enterostomy.

Whilst the incidence of dumping and bile vomiting does not differ from gastrectomy or gastro-enterostomy, the incidence of diarrhoea (8.3%) is higher than after either of these procedures. The incidence of recurrent ulcer (stomal, duodenal and gastric) was 5.2%, significantly lower than after gastro-enterostomy alone (19.6%) and, surprisingly, than truncal vagotomy and pyloroplasty (14.0%). .

The Visick gradings showed no change between the first and second assessment. By the time of the second assessment truncal vagotomy and

gastro-enterostomy scores were significantly worse than Polya gastrectomy (Visick 1+2 = 65.9% compared to Visick 1+2 = 78.6% ($p<0.01$)).

The Cay and Small quality of life score showed no difference in "good" results from the three other operations but significantly more "bad" results than Polya gastrectomy.

CHAPTER 19

THE RESULTS OF TRUNCAL VAGOTOMY AND PYLOROPLASTY FOR DUODENAL ULCER

Truncal vagotomy and pyloroplasty was first performed in the Western General Hospital in 1951, four years after Dragsted and his colleagues had described the technique of trans-abdominal truncal vagotomy (Dragsted 1947). Thereafter the operation was not performed again until 1960. Between 1948-1968 a total of 107 such procedures were performed. The distribution over the 21 year period is shown in Fig. 19.1.

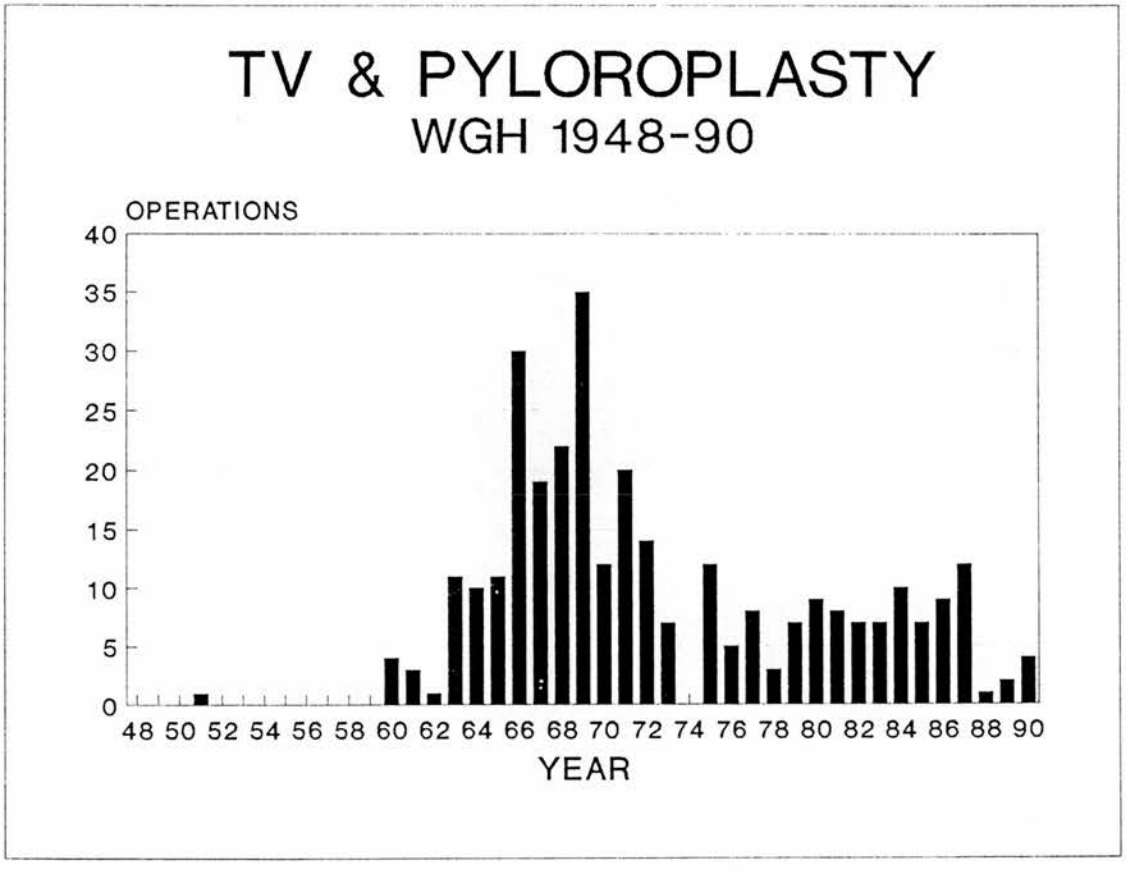


Fig. 19.1

Annual numbers of truncal vagotomy and pyloroplasty procedures for duodenal ulcer, Western General Hospital

There were 84 males and 23 females so that males formed 78.5% of the series. The mean age at operation was 40.0 years with a range of 15-75 years.

There were 86 cigarette smokers (80.4%). 35 patients (32.7%) had had a previous haemorrhage from the ulcer and 4 (3.7%) a previous perforation.

RESULTS

Operative mortality

There were no post-operative deaths.

Complications on Follow-Up

Complications observed during the 22-40 years of follow-up are shown in Table 19.1.

Dumping (early and late)	7 (6.5%)
Diarrhoea	11 (10.3%
Bile vomiting	6 (5.6%)
Recurrent duodenal ulcer	12 (11.2%)
Gastric ulcer	3 (2.8%)
Steatorrhoea	9
Delayed gastric emptying	3

Table 19.1

Complications related to truncal vagotomy and pyloroplasty observed on long term follow-up (percentage expressed of 107 survivors beyond 30 days)

Revisional Operations

16 revisional operations were recorded in 16 patients representing 14.9% of the 107 patients. The operations are shown in Table 19.2.

Polya gastrectomy	7
Re-vagotomy	1
Gastro-enterostomy	1
Re-vagotomy with Polya gastrectomy	2
Roux-Y conversion	1
Dilation of pyloroplasty	1

Table 19.2

Revisional operations after truncal vagotomy and pyloroplasty

Acid output studies

Pre-operative MAO was measured in 91 patients. The mean MAO was 35 mMol. in the first post stimulation hour with a range of 4-73 mMol. MAO was measured post-operatively in 63 patients who had a mean MAO of 9 mMol. with a range of 1-48 mMol. This represents a mean reduction in MAO for this group of 74.3%.

Visick Gradings

At least one Visick grading was carried out on 100 patients (93.5%) and a second assessment on 60. The mean time to second grading was 13.8 years with a range of 5.0 to 29.8 years. The results of these are shown in Table 19.3.

	1st Grading (n = 100)	2nd Grading (n = 60)
Visick 1	32 (32%)	18 (30.0%)
Visick 2	34 (34%)	14 (23.3%)
Visick 3	17 (17%)	20 (33.3%)
Visick 4	17 (17%)	8 (13.3%)

Table 19.3

Results of successive Visick gradings following truncal vagotomy and pyloroplasty

These results are expressed graphically in Fig. 19.2. The differences between Visick grading on first and second assessment were not statistically significant.

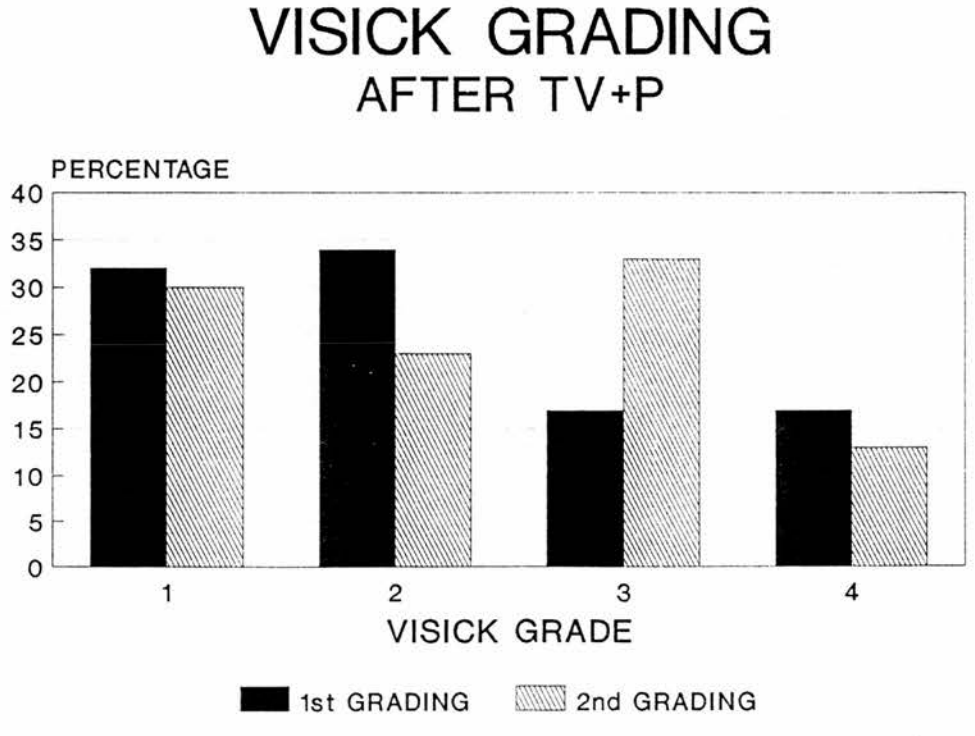


Fig. 19.2

Results of successive Visick gradings after truncal vagotomy and pyloroplasty

Quality of Life Assessment

Quality of life assessments were performed on at least one occasion on 67 patients and twice on 36. The mean interval to first assessment was 15.1 years with a range of 10.2 to 27.1 years and the mean time to second assessment was 18.1 with a range of 11.9 to 33.2 years. The results of mean scores are shown in Table 19.4.

	1st Assessment (n = 67)	2nd Assessment (n = 36)
Mean psychosocial score	28.6±0.83 (27.0-30.3) [10-39]	29.0±1.00 (27.0-31.0) [12-39]
Mean physical score	18.7±0.59 (17.5-19.9) [6-24]	19.7±0.72 (18.2-21.1) [11-24]
Mean Q.O.L. score	47.3±1.42 (44.5-50.2) [16-65]	48.7±1.72 (45.2-52.1) [23-61]

Table 19.4

Mean scores ± S.E. in first and second quality of life assessments after truncal vagotomy and pyloroplasty. 95% C.L. in () Range in []

The Q.O.L. scores have been classified into the range bands described in Chapter 13, to give an assessment of the quality of life as "good", "moderate", or "bad". These results are shown in Table 19.5.

	n = 67
Good (score 46-66)	40 (59.7%)
Moderate (score 40-45)	14 (20.9%)
Bad (score 0-39)	13 (19.4%)

(Mean time to assessment 15.1 years
Range 10.2-27.1)

Table 19.5

Results of 1st quality of life assessment (n = 67)

A second assessment was performed in 36 patients a mean of 18.1 years after operation (range 11.9-33.2). These results are shown in Table 19.6.

Result	Patients 1st Assessment (n = 67)	2nd Assessment (n = 36)
Good (score 46-66)	40 (59.7%)	25 (69.4%)
Moderate (score 40-45)	14 (20.9%)	4 (11.1%)
Bad (score 0-39)	13 (19.4%)	7 (19.5%)

Table 19.6

Results of two quality of life assessments

There were no significant differences between first and second assessment.

These results are shown graphically in Fig. 19.3.

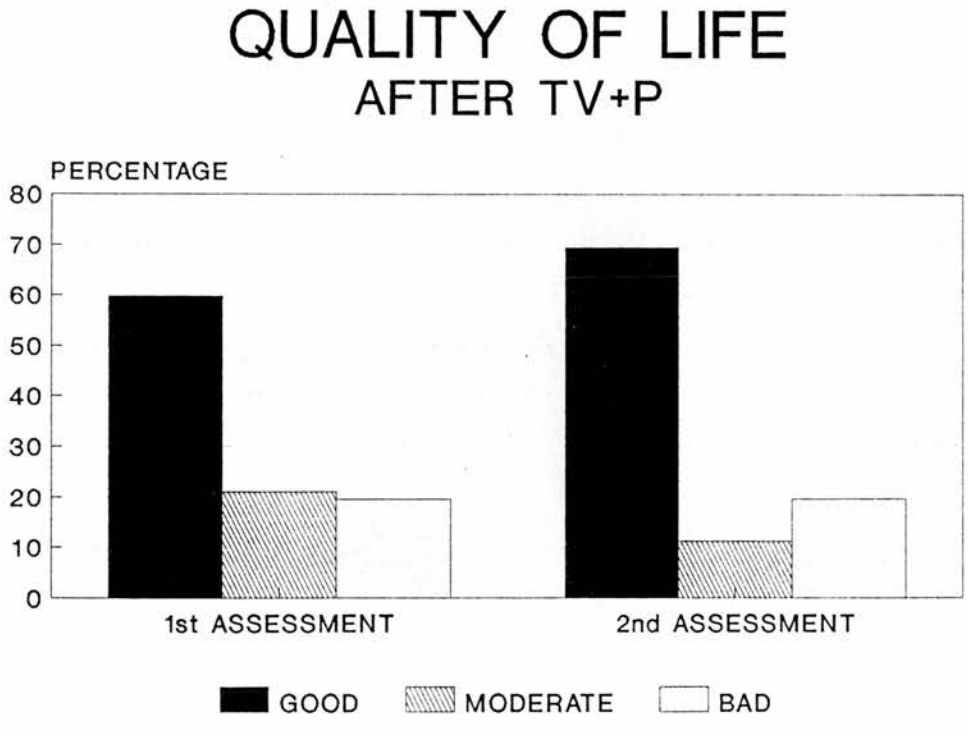


Fig. 19.3

Results of successive quality of life assessments after truncal vagotomy and pyloroplasty

The psychosocial score at the first assessment has been calculated as an area graph (Fig. 19.4).

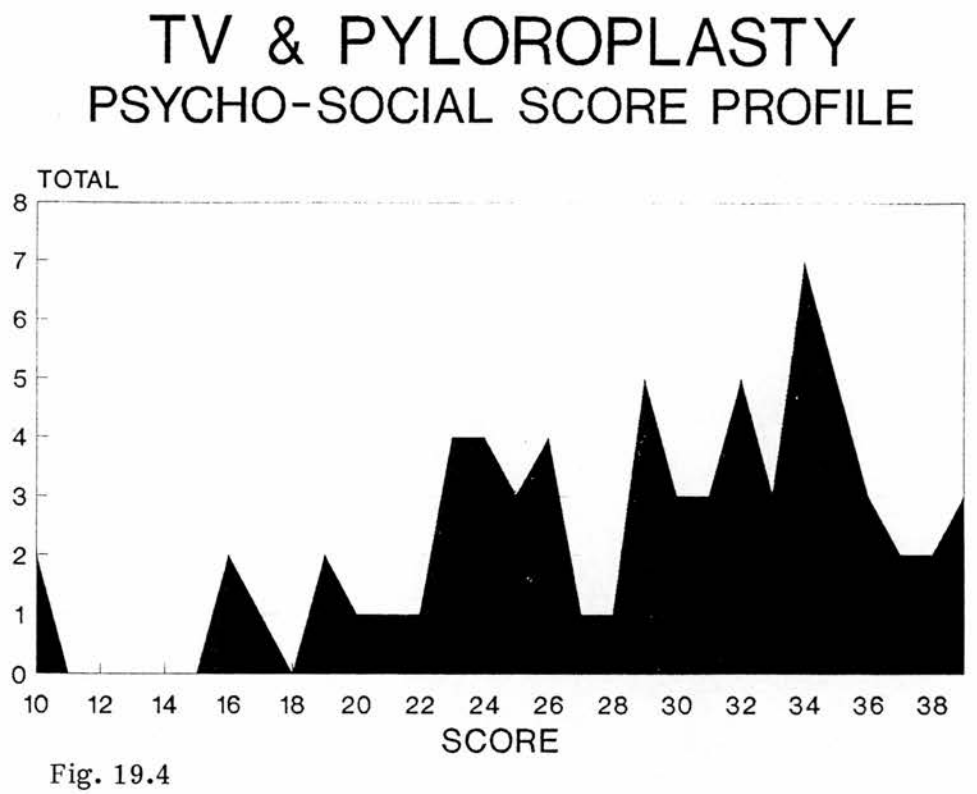


Fig. 19.4

Psychosocial area graph after truncal vagotomy and pyloroplasty

This shows the percentage of patients who scored each possible score between 16 and 40. The physical score has been expressed graphically in the same way in Fig. 19.5.

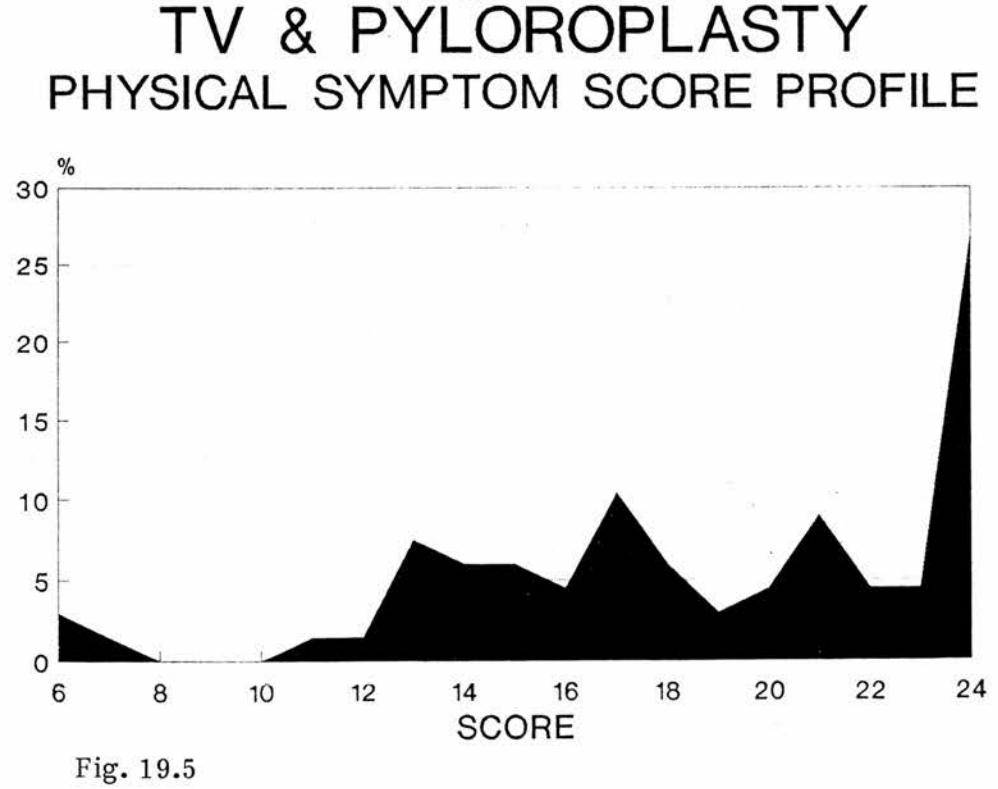


Fig. 19.5

Physical area curve after truncal vagotomy and pyloroplasty

Correlation between Visick grading and Q.O.L. scores

Correlation between Visick grading and Q.O.L. scores is shown in Table 19.7. The mean scores of each Visick group is not significantly different from that of any of the others.

	Q.O.L. Score			
Visick Grading	0-39	40-45	46-66	Mean ± S.E.
4	1	3	6	48.8±3.06 [41.9,55.7]
3	4	4	6	43.0±3.33 [35.8,50.2]
2	4	7	13	47.2±2.17 [42.7,51.7]
1	4	0	15	50.4±1.98 [46.3,54.6]

Table 19.7

Correlation between first Visick grading and first Q.O.L. score after truncal vagotomy and pyloroplasty. 95% C.L. in []

Conclusions

This study has shown that the recurrent ulcer rate after truncal vagotomy and pyloroplasty (14.0%) lies between that for Polya gastrectomy and gastro-enterostomy. The rates of bile vomiting (5.6%) and dumping (6.5%) are similar to those for other operations. The incidence of diarrhoea, however, is significantly higher (10.3%) than after either Polya gastrectomy (3.2%) or gastro-enterostomy (4.5%).

The Visick gradings were significantly worse than those following Polya gastrectomy with only 66% of patients graded Visick 1+2 compared to 79.8% following Polya gastrectomy. Similarly patients have a worse quality of life score after truncal vagotomy and pyloroplasty than after any of the other operations. Only 59.7% of patients attained a "good" score after truncal vagotomy and pyloroplasty compared to 71.2% (Polya), 69.3% (truncal

vagotomy and gastro-enterostomy) and 67.2% (gastro-enterostomy).

This finding, surprising given that truncal vagotomy and pyloroplasty remains the standard operation for duodenal ulcer in many centres, suggests that this view should be reconsidered.

CHAPTER 20

HIGHLY SELECTIVE VAGOTOMY

Highly selective vagotomy (H.S.V.) may prove to be the last contribution by surgeons to the elective treatment of duodenal ulcer. The development of the operation was the culmination of increasing understanding about the control of secretion of gastric acid and the role of that secretion in the aetiology of duodenal ulcer disease. The evolution of truncal, selective and highly selective vagotomy has been described in Chapters 4 and 5. The pressure to develop increasing selectivity in vagotomy was brought about both by the side effects of intestinal parasympathetic denervation, particularly diarrhoea and bloating, and also by the consequences of gastric incontinence. While H.S.V. fulfilled its promise in the reduction of side effects this was apparently at the expense of an increased recurrent ulcer rate as compared to truncal vagotomy or Polya gastrectomy.

The first published accounts of the procedure in clinical practice appeared in 1969 (Johnston and Wilkinson 1969, Amdrup and Jensen 1969). It was first introduced to the Western General Hospital in Edinburgh three years later and rapidly became the procedure of choice in that hospital and also in the surgical unit at Leith Hospital which was linked with the Western General in 1979.

The annual number of operations performed between 1973 and 1990 is shown below in Fig. 20.1.

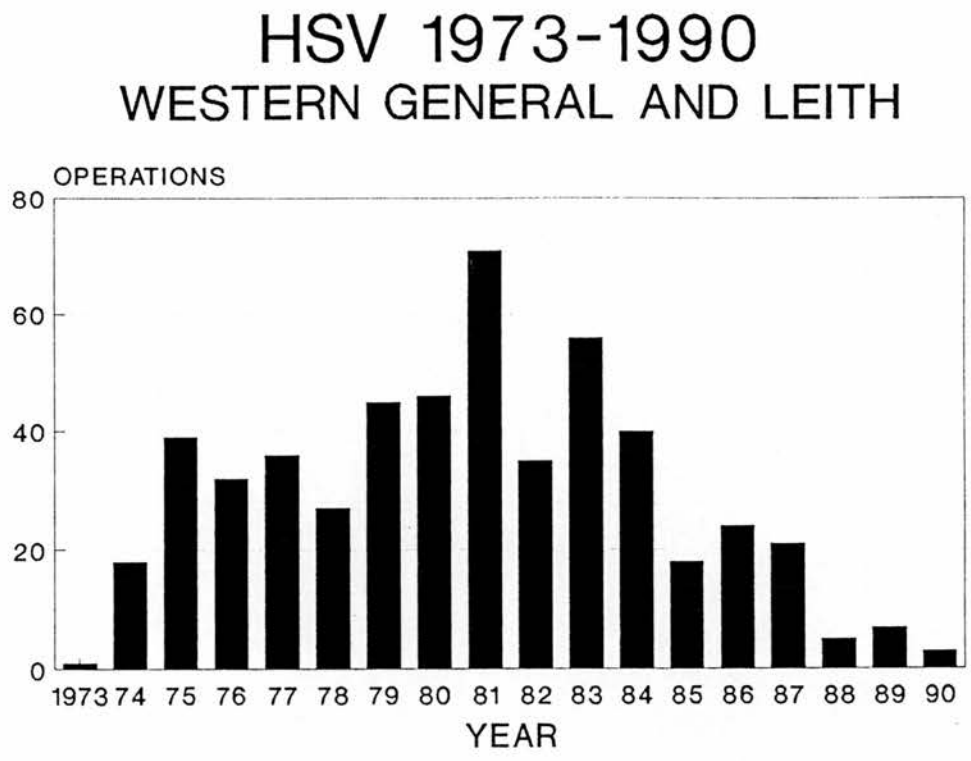


Fig. 20.1

Operations per year 1973-1990 Western General Hospital and Leith Hospital

Since the peak of 70 procedures in 1981 there has been a progressive decline to a mere 3 in 1990. By the end of 1988 a total of 500 operations had been performed making this one of the largest series in the world literature. It is an account of the results of these which forms the basis for this chapter. The results in this group of patients are considered under two main headings: Recurrent Ulcer and Symptoms.

1. RECURRENT ULCER

For a given recurrence rate to be meaningful the length of follow-up of the series is crucial. It has been well established that recurrent ulcer after highly selective vagotomy continues to present throughout the length of follow-up so that those series with long follow-up will have higher recurrence rates (Taylor 1988). Indeed in one of the series with the

longest follow-up yet available (Hoffman 1988) only one-third of recurrences were manifest at 5 years.

For several reasons the concept enunciated by Visick that every recurrent ulcer be deemed a failure (Visick IV) has been questioned (Martin 1989). In this study the Visick grading system has not been used. The techniques of information storage and analysis now available on computer allow detailed conclusions about the effect and behaviour of recurrent ulcer which were not previously possible.

Possible risk factors associated with recurrent ulcer have also been analysed. In particular the association of age, sex, acid secretion, smoking, previous complications and the effect of the operating surgeon have been examined. A report from one of the units which pioneered the procedure (Primrose 1988) claimed that patients whose ulcers were "resistant" to H2 receptor antagonist therapy, did badly following H.S.V., with a recurrent ulcer rate of 30% at 5 years. Others, however, have failed to find this (Goodman 1987). It is an important controversy to resolve as all patients coming to elective operation now or in the future will have had (or should have had) treatment with H2 receptor antagonists.

The recurrent ulcer rate in this study is based on symptomatic recurrence as we did not, in common with other published series, subject asymptomatic patients to endoscopy.

2. SYMPTOMS

It is tempting to use recurrent ulcer as the yardstick for success or failure of the operation. An easily calculated numeric indicator has the attractions of clarity and simplicity. Indeed in the days before accurate diagnosis by endoscopy and effective medical treatment by H2 receptor

antagonists, recurrent disease was the most appropriate method of assessment of operations for ulcer.

Today endoscopy can diagnose tiny transient and acute ulcers which may resolve spontaneously and which may not represent the continuing ulcer diathesis. Such ulcers may not be associated with other than minor or transient symptoms. In this series 48 patients with recurrent ulcer answered the question about whether they considered the operation a success. Of these 33 considered the procedure a success and only 15 regarded the operation as a failure. It may therefore not be appropriate to equate recurrent ulcers with failure. Also included in recurrence rate are those more significant ulcers which can nevertheless be cured by a single course of H2 blocker. Symptoms may therefore be regarded as a more appropriate measure of success or failure. The use of symptoms in assessment, however, is valid only if complications like bleeding or perforation which are not always preceded by symptoms, are successfully abolished by the procedure. In this series that condition appears to have been satisfied to a large extent. Pre-operatively 133 patients had bled and 32 had previously perforated and 12 had had both bleed and perforation. After the operation only 15 patients had a bleed and 2 a perforation.

The symptoms experienced by patients have therefore been analysed and form the basis on which the efficacy of the procedure has been assessed.

The principal advantages claimed for H.S.V. over older operations was a virtual abolition of operative mortality and a reduction in the side effects such as dumping, bile vomiting and diarrhoea. In this study the incidence of these side effects has been established by a series of specific questions on structured questionnaire (Appendix F).

Patients and Methods

The techniques used to recruit patients, methods of documentation and techniques of follow-up have been described in detail in Chapters 11 and 12.

All patients who had highly selective vagotomy for duodenal ulcer in the Western General Hospital and the associated surgical unit at Leith Hospital have been studied between August 1973 and December 1988. A total of 500 patients underwent the operation without operative mortality. The mean age was 39.7 years with a range of 12 to 71 years. The male to female ratio was 365/135 (73%/27%). 382 patients (76.4%) were cigarette smokers while 45 (9.0%) were ex-smokers and 73 (14.6%) non smokers.

Previous ulcer complications were recorded as possible indicators of the severity of the ulcer diathesis. Out of the 500 patients, 326 (67.1%) had had no previous complications. Of the 174 with previous complications 133 (26.6%) had had haemorrhage, 29 (5.8%) a perforation and 12 (2.4%) both haemorrhage and perforation.

All patients had been kept under regular review by the Gastric Follow-Up Clinic run by Mr. W. P. Small (Small 1971) and subsequently by the Surgical Review Office (Macintyre 1988). All patients known to be alive were contacted during 1989/90. The review was timed so as to give a maximum follow-up of 16 years a minimum follow-up of 2 years with a mean of 5.7 years. Review was conducted by postal questionnaire shown in Appendix F). In those cases where this was not returned a home visit was made to those patients resident in Lothian and the questionnaire completed or left in their home.

RESULTS

Operative Complications

Two patients sustained oesophageal tears during the oesophageal dissection.

One was treated by Thal patch and the other by direct closure. Both patients made uneventful recoveries and have remained symptomfree over the subsequent 4 and 9 years respectively. Three patients required splenectomy for splenic trauma. None subsequently demonstrated infective complications and none has developed overwhelming post splenectomy infections.

Post-Operative Mortality

No patient died during the post-operative in-patient stay or in the 30 days following operation.

Post-Operative Morbidity

No patients had myocardial infarction or pulmonary embolism diagnosed in the post-operative period. Post-operative complications recorded are shown in Table 20.1.

Pulmonary infection	101
Wound infection/abscess/dehiscence/haematoma	47/1/1/3
Intra-abdominal haemorrhage/requiring splenectomy	11/1
Subphrenic collection	11
Intestinal obstruction/prolonged ileus	1/2
Acute gastric dilatation/gastric stasis	1/1
Lesser curve necrosis	2
Acute retention of urine	2
Atrial fibrillation	1
Superficial thrombo-phlebitis	1
Anaemia (requiring transfusion)	1
Perforated D.U.	1
Prolapsed haemorrhoids	1

Table 20.1

Immediate post operative complications

Chest infection was defined as clinical or radiological signs of infection with the production of purulent sputum. 91 (90%) of the 101 chest infections occurred in smokers. Wound infection was defined as wound erythema with the production of pus or fluid from which pathogenic organisms were grown. Intra-abdominal haemorrhage included those patients in whom the diagnosis was made clinically or on the basis of vital signs, excess drainage or fall in

haemoglobin/haematocrit. Four patients required transfusion of whole blood or red cell concentrate and one of these required laparotomy and splenectomy. Of the 2 patients who developed lesser curve necrosis, one was successfully treated conservatively, the other required a laparotomy to drain a lesser sac abscess and, at a further laparotomy 17 days later, a partial gastrectomy was performed. The patient who developed a perforated duodenal ulcer on the eighth post-operative day was a 12-year-old boy (the youngest patient in the series). This was treated by laparotomy with simple closure.

Length of In-Patient Stay

The total number of in-patient days for the 500 patients was 5,491 giving an average hospital stay of 10.9 days. The median post-operative stay was 7.71 days with a range of 2-70 days. 22 patients had a post-operative stay of more than 14 days and 6 of more than 21 days. The complications which resulted in prolonged stay in these patients are shown in Table 20.2.

	Sex	Age	Post-Op. Stay	Complications
1.	M	40 year	23 days	Intra-abdominal haemorrhage Splenectomy. Wound infection.
2.	F	46 year	70 days	Lesser curve necrosis. Laparotomy and drainage of abscess in lesser sac. Second laparotomy and partial gastrectomy.
3.	M	38 year	22 days	Prolapsed piles - haemorrhoidectomy.
4.	M	52 year	31 days	Subphrenic abscess, laparotomy and drainage.
5.	M	48 year	39 days	Pulmonary infection.
6.	M	12 year	54 days	Perforated D.U. Laparotomy.

Table 20.2

Reasons for in-patient stay exceeding 21 days

Long Term Mortality

On review 22 patients had died. The causes of death taken from death certificates are shown below in Table 20.3.

Carcinoma of bronchus	3	C.V.A.	1
Carcinoma of pancreas	3	Aortic aneurysm	1
Carcinoma of larynx	1	Pneumonia	1
Carcinoma of brain	1	Septicaemia	1
Carcinoma of colon	1	Hepatic failure	1
Carcinoma of oesophagus	1	Heroin overdose	1
Myocardial infarction	5	Violence	1

Table 20.3

Cause of death in 22 patients

The small numbers and relatively short follow-up does not permit any conclusions about differences between observed and expected deaths.

46 patients were lost to follow-up leaving 432 (87.1%) available for review. Of the 64 patients who had died or were lost to follow-up 7 were shown to have had recurrent ulcer before being lost to the study and these recurrent ulcers have been included in the calculation of recurrent ulcer rate.

Recurrent Ulcer

By the end of 1990, when follow-up ranged from 2-16 years, 62 patients were diagnosed as having recurrent ulcer. 59 of these have been fully documented whilst the remaining 3 were diagnosed in other centres.

i) Time to Recurrence

Recurrent ulcer was diagnosed between 8 months and 15 years post-operatively. Life table analysis of ulcer recurrence is shown graphically in Fig. 20.2.

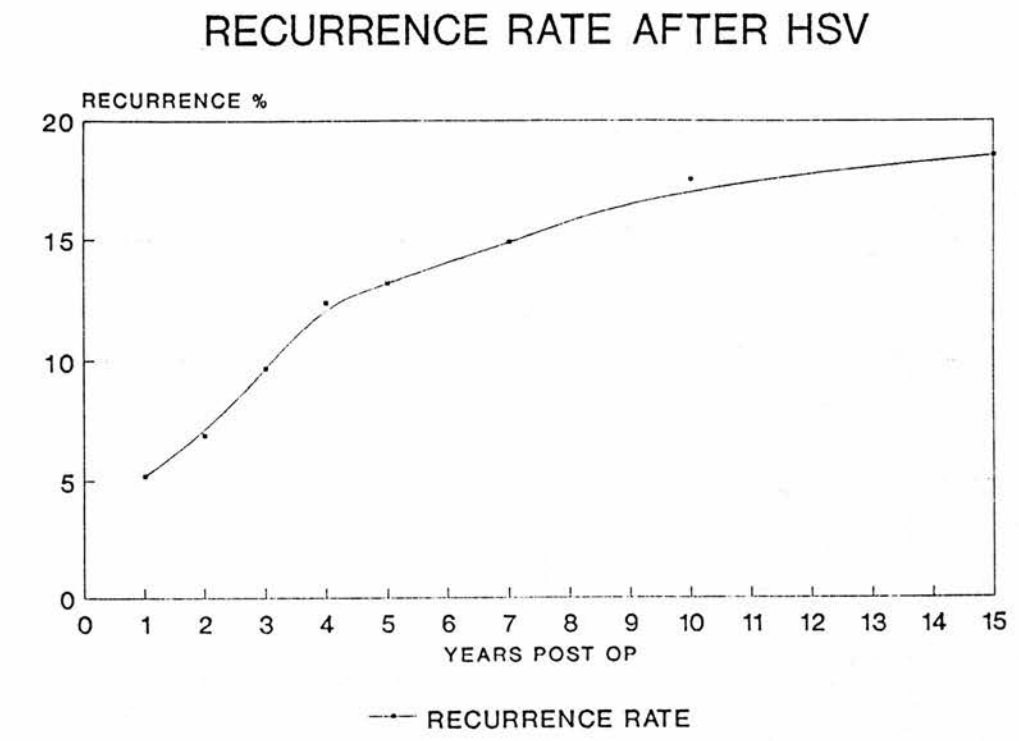


Fig. 20.2

Cumulative recurrence rate after highly selective vagotomy: Western General and Leith Hospitals

This life table analysis represents a cumulative ulcer recurrence rate of 17.5% by 10 years and 18.5% by 15 years, as can be seen from Table 20.4.

Year of Follow-Up	% Ulcer Recurrence (S.E.)
1	5.2 (1.0)
2	6.9 (1.2)
3	9.7 (1.4)
4	12.4 (1.6)
5	13.2 (1.6)
7	14.9 (1.8)
10	17.5 (2.1)
15	18.5 (2.4)

Table 20.4

Life table analysis of ulcer recurrence rate after H.S.V.

Upper gastro-intestinal bleeding from recurrent ulcer occurred in 14 patients. Only 2 had a subsequent perforation including the 12-year-old boy described above.

ii) Risk Factors

Possible risk factors for recurrence are shown in Table 20.5 which compares those with recurrence to those without.

	Recurrence (n=59)	No Recurrence (n=437)	Significance
Male	41 (69.5%)	322 (73.6%)	n.s.
Mean age at operation	38.1 years	39.9 years	n.s.
Mean length history	5.42 years	4.47 years	$p<0.01$
Cigarette smokers	50 (84.7%)	327 (74.8%)	$p<0.01$
Previous haemorrhage	15 (25.4%)	118 (27.0%)	n.s.
Previous perforation	4 (6.8%)	23 (5.2%)	n.s
Previous haemorrhage and perforation	3 (5.1%)	9 (2.1%)	n.s.

Table 20.5

H.S.V. - Possible risk factors compared in patients with recurrent ulcer and those without

Differences between possible risk factors were tested using Cox proportional hazards analysis. There was no significant difference in the proportion of males or the mean age between the groups. The mean length of history prior to operation was one year longer in those developing recurrence ($p<0.01$).

The proportion of cigarette smokers was also higher in the recurrence group at 84.7% compared to 74.8% in non smokers ($p<0.01$). The incidence of previous haemorrhage or perforation did not differ between the two groups.

The recurrence rate was not increased in patients whose ulcers were "resistant" to H2 receptor antagonists. Of the 157 patients whose ulcers had failed to heal on these drugs 16 developed recurrence (10.2%) while 24 out of 214 patients (11.2%) who relapsed after an initial response developed recurrent ulcer.

iii) Acid Secretion Studies

The emphasis on gastric acid output in the assessment and treatment of duodenal ulcer has decreased since its heyday in the 1950's and 60's when operations were selected on the basis of acid secretion (Bruce, Card, Marks, Sircus 1959). In this series pre-operative acid output was performed in about 90% of the patients because of continuing interest in various aspects of acid secretion in ulcer disease in the Gastro-Intestinal Unit. Acid output was not, however, used in the selection of a particular type of operation. In this series pre-operative acid output in response to pentagastrin was measured in 442 (89.1%) but post-operatively in only 195 (39.3%). A post-operative insulin test or sham feed test was performed in a further 66. Thus 259 patients had post-operative acid secretion studies.

Details of the techniques used to measure acid output are described in Chapter 10.

Those patients with a high pre-operative maximal acid output were not at greater risk of recurrence (Table 20.6).

MAO*	n	Recurrence	No Recurrence
<30	153	13 (8.5%)	140
31-40	151	18 (11.9%)	133
41-50	95	16 (16.8%)	65
51-60	34	4 (11.7%)	25
>60	9	1 (11.11%)	8
TOTAL	442	52 (11.7%)	390

Table 20.6

H.S.V. - Recurrence in relation to pre-op. MAO
(*MAO expressed as mMol in post pentagastrin hour)

In this table the maximal acid output has been divided into 5 bands after Johnstone (1987). The first consists of those with an output of less than 30 mMol. in the post pentagastrin hour, the next 3 bands each with an increment of 10 mMol. and final band contains those patients whose maximal acid output was greater than 60 mMol. The recurrent ulcer rate in each of these bands has then been calculated. The highest recurrent ulcer rate was in fact in the 41-50 mMol. band. The differences between the bands were not statistically significant.

Nor was it possible to distinguish those at risk from recurrence on the basis of the mean pre-operative MAO of the two groups (Table 20.7).

	Recurrence	No Recurrence
Mean pre-op MAO (Pentag.)	37.1 (56 patients)	35.4 (366 patients)
Mean post-op MAO (Pentag.)	25.3 (44 patients)	18.6 (151 patients)
% reduction in MAO	32.4%	48.6%
Mean post-op MAO (Insulin)	13 (16 patients)	6 (50 patients)

Table 20.7

H.S.V. - Mean acid output in patients with recurrence compared to those without

The mean post-operative MAO in response to pentagastrin in the group with recurrent ulcer was 25.3 mMol. compared to 18.6 mMol. in the group

with no recurrence, a statistically significant difference ($p<0.01$). The mean percentage reduction in maximal acid output post-operatively was also significantly less ($p<0.001$) in patients with recurrence (32.4%) compared to those without (48.6%).

As can be seen from Table 20.8, in 44 patients with recurrent ulcer, post-operative MAO in response to pentagastrin was measured post-operatively. Only 42 of these 44 patients had MAO in response to pentagastrin measured both pre- and post-operatively, however. The values for each of these measurements for individual patients are shown in Table 20.8 below.

Patient	Pre-op. MAO (mMol)	Post-op. MAO (mMol)	% Reduction
26	28	19	32%
44	34	14	58%
45	45	29	35%
46	40	22	45%
47	44	41	6%
54	32	11	65%
74	33	40	Higher
81	33	22	33%
95	33	24	27%
116	21	20	4%
117	29	31	Higher
127	37	21	43%
131	38	40	Higher
133	54	35	35%
135	54	13	75%
136	48	36	25%
137	42	31	26%
191	19	8	57%
197	64	41	35%
207	19	20	Higher
208	37	34	8%
209	28	22	21%
211	41	24	41%
221	15	22	Higher
236	50	18	64%
243	32	30	6%
244	31	21	32%
248	44	39	11%
250	43	23	23%
251	32	20	25%
263	30	24	20%
291	15	11	26%
298	32	28	12%
310	49	23	53%
348	25	16	36%
360	47	31	34%
380	51	36	29%
382	37	0	72%
389	48	19	60%
399	40	34	15%
425	42	43	Higher
428	54	10	81%

Table 20.8

H.S.V. - 42 patients with recurrent ulcer who had both pre-op. and post-op. MAO estimations

As can be seen in 6 of these patients (numbers 74, 117, 131, 207, 221 and 425) the post-operative response to pentagastrin was actually higher than it had been pre-operatively. Only 9 patients show a reduction of 50% or more in maximal acid output as a result of the operation.

iv) Operating Surgeon

The operations were performed by a total of 41 surgeons - 6 consultants

and 35 surgeons in training. The consultants performed 240 operations (48.0%) and surgeons in training 260 (52.0%). The number of operations performed by each of the 6 consultants is shown in Table 20.9 below.

Consultant	Operations	Recurrence (%)	Mean Length F.U.
Cons. 1 ANS	59	4 (6.7%)	7.34 years
Cons. 2 JHS	58	4 (8.6%)	3.94 years
Cons. 3 WPS	44	10 (22.8%)	6.55 years
Cons. 4 IMCM	41	1 (2.4%)	3.83 years
Cons. 5 CWAF	22	1 (4.5%)	8.14 years
Cons. 6 CVR	16	3 (18.7%)	10.74 years

Table 20.9

Operations performed by 6 consultant surgeons with individual recurrence rates

There were 24 recurrent ulcers following initial H.S.V. performed by a consultant. As always when considering recurrence rates the length of follow-up is crucial. There is a trend toward higher recurrence with increasing length of follow-up. Nonetheless there do appear to be striking differences between, for example consultant 3 (21.8%) recurrence after mean F.U. of 6.55 years) and consultant 5 (4.5% recurence after mean F.U. of 8.14 years) but these differences do not reach statistical significance.

The number of operations, recurrence rates together with mean follow-up and range of follow-up for those 6 surgeons in training who had performed most operations is shown in Table 20.10 below.

	Operations	Recurrence	Mean F.U.
Reg. 1 (CG)	41	6 (14.6%)	5.33
Reg. 2 (HT)	36	7 (19.4%)	3.25
Reg. 3 (AW)	28	6 (21.4%)	7.87
Reg. 4 (GB)	27	3 (11.1%)	8.04
Reg. 5 (SN)	14	0 (0%)	3.75
Reg. 6 (GW)	12	2 (16.6%)	1.71

Table 20.10

Operations, Recurrence and Mean Follow-Up for 6 surgeons in training who performed most operations

iv) Family History

Life table analysis showed a significant difference when the number of first degree relatives with duodenal ulcer was compared (Table 20.11).

		5 Years	10 Years
Number of first degree	0	9.7 (2.3)	13.5 (3.0)
relatives with D.U.	1	11.2 (3.7)	17.2 (5.0)
	>1	25.9 (5.8)	33.2 (7.4)

Table 20.11

Estimated percent recurrence (S.E.) at 5 and 10 years according to family history

v) Behaviour of Recurrent Ulcer

The rate of recurrent ulcer by itself gives no indication of the severity of the recurrent disease. There has been controversy in the literature as to whether recurrent ulcer after highly selective vagotomy behaves aggressively (Hoffman 1988) or whether the operation has modified the diathesis such that recurrent ulcer represents less aggressive disease which is much easier to treat (Johnston 1987). The natural history of recurrent ulcer has therefore been assessed in terms of symptoms, treatment, response to treatment and complications. Of the 59 recurrent ulcers, 19 (32.2%) could be considered "innocuous" and 40 (67.8%) "malevolent" using the classification suggested by Hoffman (1988). Of the 19 innocuous ulcers 10 required no treatment because

symptoms were minimal or the patient did not feel that any treatment was required. Five patients required occasional antacid or other drug treatment but not H2 receptor antagonist, while 4 required either a single course of H2 receptor antagonist or no more than occasional therapy.

The "malevolent" ulcers comprised 15 who required repeated or frequent courses of H2 receptor antagonist and 25 who required a further operation.

vii) Drug Treatment

402 patients answered questions about current medication for ulcer disease. The medication taken for dyspeptic symptoms is shown in Table 20.12.

	All Patients (n=402)	Patients with Recurrence (n=48)	Patients without Recurrence (n=354)
H2 receptor antagonists	47	15	32
Antacid	47	10	37
Any medication for dyspepsia	47	25	39

Table 20.12

Consumption of medication for dyspepsia every day or most days

Overall 47 (11.7%) took H2 receptor antagonists or antacids every day or most days and 10 of these took antacids on the same basis. Of the 48 patients with recurrence 25 (52.0%) took medication for dyspepsia but of these only 15 required H2 receptor antagonists. On the other hand only 39 (11.0%) of 354 patients without recurrent ulcer took H2 receptor antagonist or antacids every day or most days.

Revisional Operations

34 patients in this series underwent a further operation. Of these 27 were for recurrent ulcer and 7 for gastric stasis. The 27 operations for recurrent ulcer are shown below (Table 20.13).

Polya gastrectomy	11
Roux-en-Y gastrectomy	1
Billroth I gastrectomy	4
Truncal vagotomy and antrectomy	3
Truncal vagotomy and drainage	6
Truncal vagotomy alone	1

Table 20.13

Revisional operations for recurrent ulcer

In addition 2 patients had simple closure of perforated duodenal ulcer both within 2 months of the original procedure suggesting that the ulcer was residual rather than recurrent.

Of the 7 operations for gastric stasis, 4 were gastro-enterostomies, (2 with truncal vagotomy), 1 gastro-duodenostomy, 1 pyloroplasty and 1 Polya gastrectomy. The revisional operations were performed by 5 consultants and three senior registrars for both recurrent duodenal ulcer, without and without pyloric stenosis, and for pyloric and prepyloric ulcers.

There was again no operative mortality. The most serious complications were an anastomotic leak after a roux-en-y gastrectomy which was successfully treated conservatively and efferent loop obstruction following a Polya gastrectomy which also resolved successfully on conservative therapy. Eight patients developed pulmonary infection and 3 wound infection. One developed intra-abdominal haemorrhage following a Polya gastrectomy but a laparotomy was not required.

Symptoms

Of the 432 patients available for review, 402 (93%) answered a detailed symptom questionnaire. The symptoms of upper abdominal pain, flatulence (or excessive belching) and heartburn were recorded as being experienced every day, most days, occasionally or never. The percentage of patients who experienced these symptoms every day or most days is shown in Table 20.14.

	All Patients (n=402)	Patients with Recurrence (n=48)	Patients without Recurrence (n=354)
Upper abdominal pain	39 (9.7%)	10 (20.8%)	29
Flatulence	89 (22.1%)	19 (39.5%)	70
Heartburn	46 (11.4%)	9 (18.7%)	37

Table 20.14

Symptoms on follow-up experienced every day or most days

Side Effects

The incidence of side effects after the operation was established by specific questions about nausea, vomiting, a bloated ("bagged-up") feeling, difficulty in swallowing or food sticking. The results expressed both as numbers and percentages experiencing these symptoms every day or most days are shown in Table 20.15.

	All Patients (n=402)	Patients with Recurrence (n=48)	Patients without Recurrence (n=354)
Nausea	24 (6.0%)	6 (12.5%)	18 (5.1%)
Vomiting	8 (2.0%)	5 (10.4%)	3 (0.8%)
Bloating	93 (23.1%)	19 (40.0%)	74 (20.9%)
Dysphagia	2 (0.5%)	0 (0%)	2 (0.5%)

Table 20.15

Side effects on review

Patients were asked about their ability to eat and enjoy a normal meal asking about appetite and enjoyment of food and food intolerance. The results are shown in Table 20.16 below.

	All Patients (n=402)	Patients with Recurrence (n=48)	Patients without Recurrence (n=354)
Appetite good	343 (85.3%)	35 (72.9%)	308 (87.0%)
Enjoy food	387 (96.2%)	43 (90.0%)	344 (97.1%)

Table 20.16

Appetite and enjoyment of food

The incidence of specific side effects of peptic ulcer surgery was

established by asking about sweaty or dizzy spells after meals. Questions about diarrhoea included the patients subjective response to this question together with the more objective record of frequency of bowel function. The results are shown in Table 20.17. 11 patients had more than 2 bowel movements per day and only 3 had more than 3 per day.

	All Patients (n=402)	Patients with Recurrence (n=48)	Patients without Recurrence (n=354)
Diarrhoea	16 (4.0%)	1 (2.1%)	15 (4.2%)
Dumping	22 (5.5%)	6 (12.5%)	16 (4.5%)

Table 20.17

Diarrhoea and dumping every day or most days

Finally patients were asked about their opinion of the operation. Overall 356 of the 418 patients who answered the question (85.1%) felt that the operation had been a success. Of the 48 patients with recurrent ulcer only 15 (31.25%) replied that the operation had not been a success.

Conclusions

Highly selective vagotomy has been shown in this study to be safe. There was no operative mortality. Second operations in the early post-operative period were required in only 7 patients. The most serious operation specific complication of lesser curve necrosis was seen in 2 patients (0.4%) and only 1 of these required reoperation.

The recurrent ulcer rate of 18.5% at 15 years appears at first to be similar to that following gastro-enterostomy but there are important differences. Firstly the rate of recurrent ulceration rises less sharply after 12 years and others have found recurrence after 15 years uncommon (Hoffman 1987, Johnston 1991).

Secondly the behaviour of recurrent ulcer following H.S.V. suggests

that it should not necessarily be equated with failure. Only 52% of patients diagnosed as recurrent ulcer required any form of medication on a daily or regular basis. 32.2% of recurrent ulcers were regarded as innocuous in that they required no therapy or a single course of H2 receptor antagonist. Furthermore 68.7% of patients with recurrent ulcer regarded the operation as a success.

Cigarette smoking, family history of ulcer and operating surgeon are associated with increased risk of recurrence whilst acid output, resistance to H2 receptor antagonists and previous ulcer complications are not.

CHAPTER 21

THE MANAGEMENT AND RESULTS OF TREATMENT OF PERFORATED DUODENAL ULCER

From 1966 clinical details of all patients diagnosed as perforated duodenal ulcer were collected by the Gastric Follow-Up Clinic. Clinical details were recorded on a standard proforma. By 1986 some 185 patients had been documented giving a minimum follow-up of 4 years when the analysis was performed in 1989. This resulted in one of the largest series of perforated duodenal ulcer reported in the English language literature in the preceding 20 years. In Scotland incidence of duodenal ulcer is amongst the highest in the world. It is surprising therefore that the three major published Scottish series published to date (Weir 1960, MacKay 1966, Dark and MacArthur 1983) have all considered perforated peptic ulcer, when the aetiology and management of the perforated gastric and duodenal ulcer is so different.

The aims of the study were to establish the outcome of simple closure of perforated duodenal ulcer in terms of symptoms and the need for subsequent definitive surgery. In particular the study sought to establish the effect of the advent of H2RA on the symptomatic outcome after simple closure after perforated duodenal ulcer.

Patients and Methods

All patients from the Western General Hospital, Edinburgh, between the years 1966 and 1986 with a diagnosis of perforated duodenal ulcer were studied. These patients were documented prospectively on a standard proforma (Appendix A).

Of the 185 patients, 107 were treated by simple closure (Group 1) and 58 by simple closure plus H2 receptor antagonists for at least one month post-operatively (Group 2). The remaining 20 patients had been treated by immediate definitive surgery (truncal vagotomy and drainage in 15 and Polya gastrectomy in 5). The patients were initially followed up by the

Gastric Follow-Up Clinic and latterly by the Surgical Review Office using techniques described in detail in Chapter 11. In 1989 a standard symptom questionnaire was sent to all known survivors (Appendix B).

A comparison between the original groups in terms of age, sex, cigarette smoking, consumption of non-steroidal anti-inflammatory drugs and steroids, and previous diagnosis or family history of peptic ulcer is shown in Table 21.1.

	Simple Closure (n=107)	Closure +H2RA (n=58)	Definitive Surgery (n=20)
Median age (range)	52 (12-86)	59 (19-86)	73 (36-88)
M:F	2.0:1	2.0:1	1.9:1
Cigarette smokers	78 (72.9%)	40 (69%)	13 (65%)
NSAID consumption	13 (12.1%)	17 (29.3%)	3 (15%)
Steroid consumption	5 (4.7%)	7 (12.0%)	1 (5%)
Previous P.U.	28 (25.7%)	8 (13.8%)	11 (55.0%)
Family history of P.U.	22 (20.6%)	4 (7%)	0 (0%)

Table 21.1

The groups compared

The association between each of these factors and subsequent definitive surgery was analysed using Cox proportional hazard regression. Differences between the groups in terms of subsequent definitive surgery have been analysed using log-rank tests. Fishers exact test was used to assess differences in symptoms between the groups.

The distribution over the 21 years of the three procedures is shown in Fig. 18.1. All of the patients who had H2 receptor antagonists were treated after 1977.

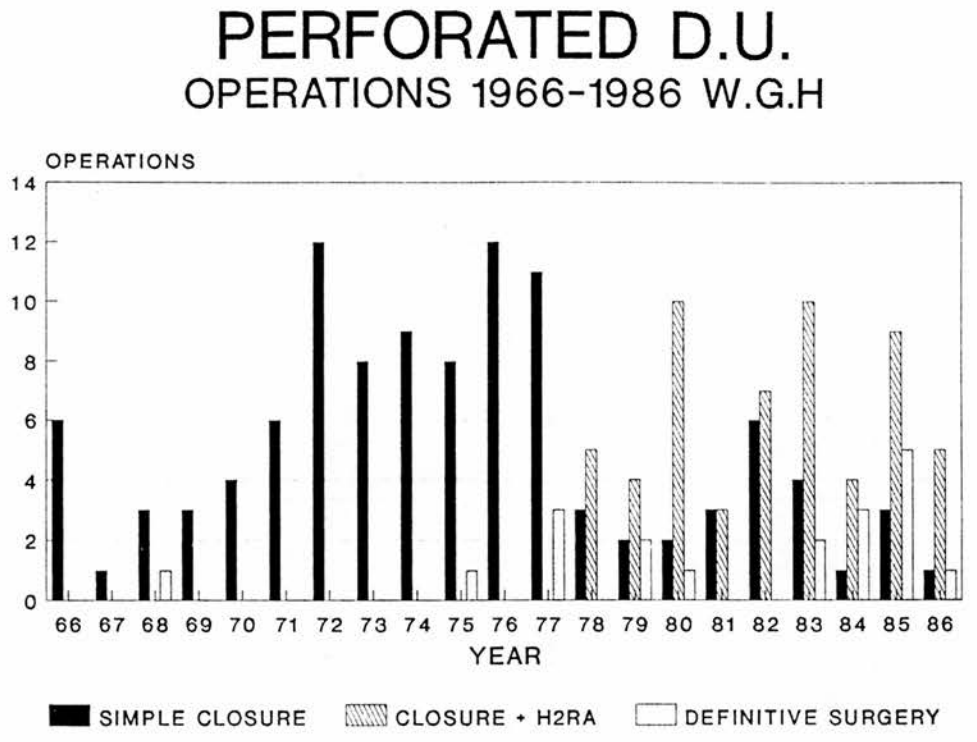


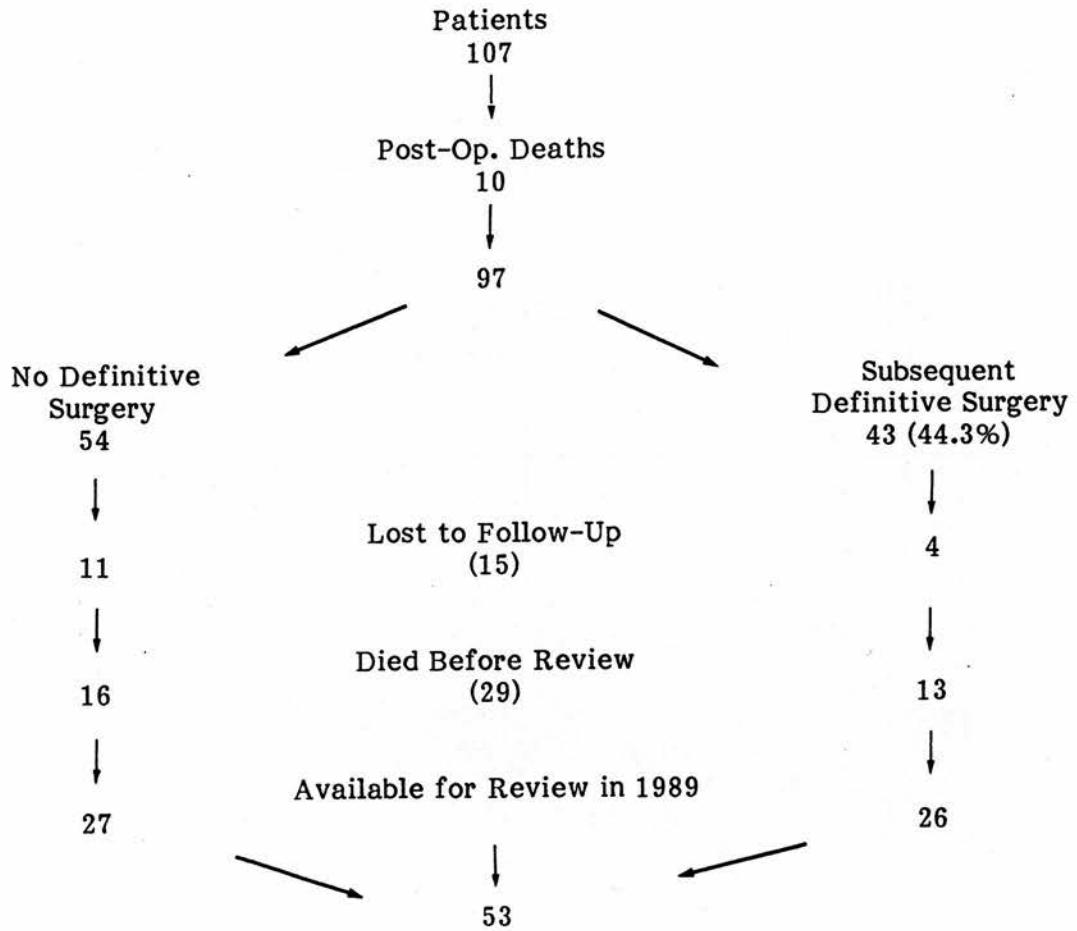
Fig. 21.1

Annual distribution of perforated duodenal ulcer
Western General Hospital

Results

The operative mortality was 5.9% with no deaths following definitive surgery. The outcome of patients in the three groups is shown in Figs. 21.2 - 21.4.

Simple Closure Alone

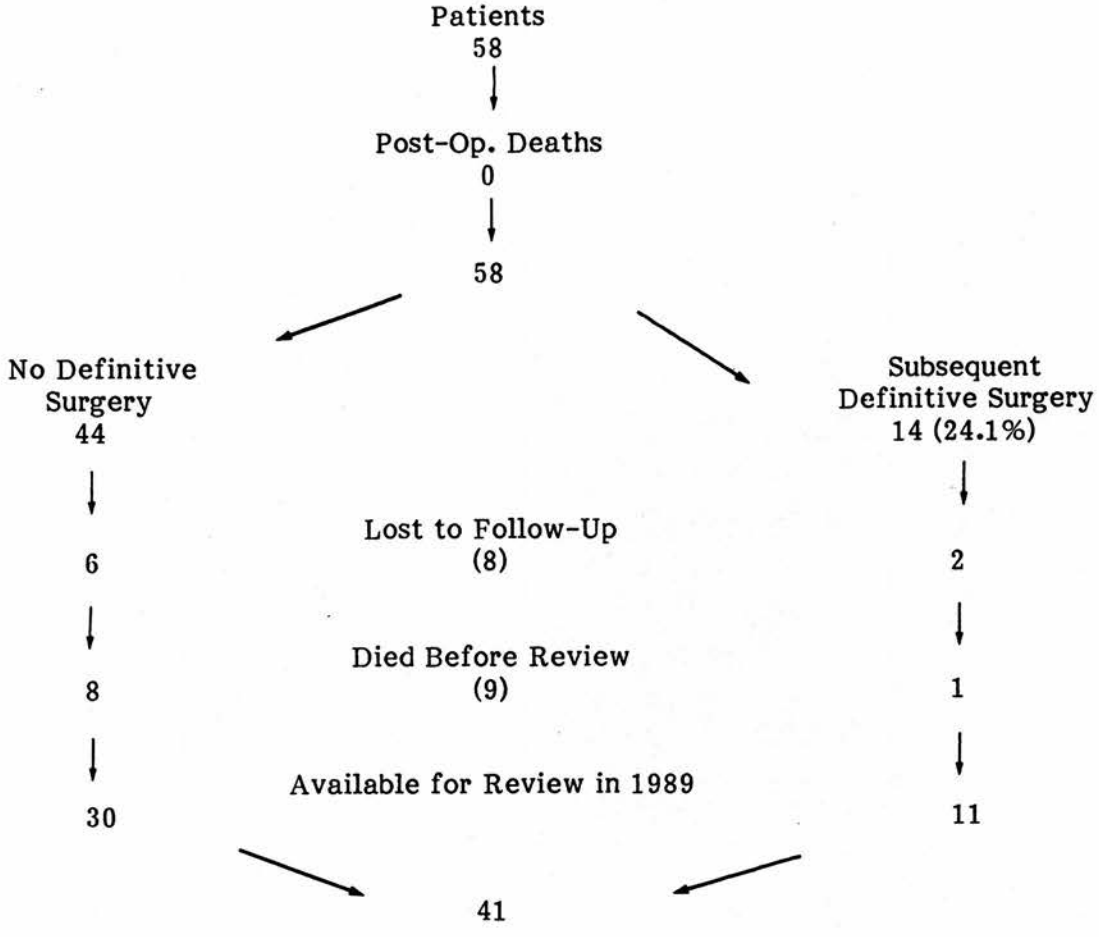


(Mean duration F.U. - 13.57
Range 4.32 - 22.71)

Fig. 21.2

Follow-up of 107 patients having simple closure

Simple Closure and H2RA Post-Op.

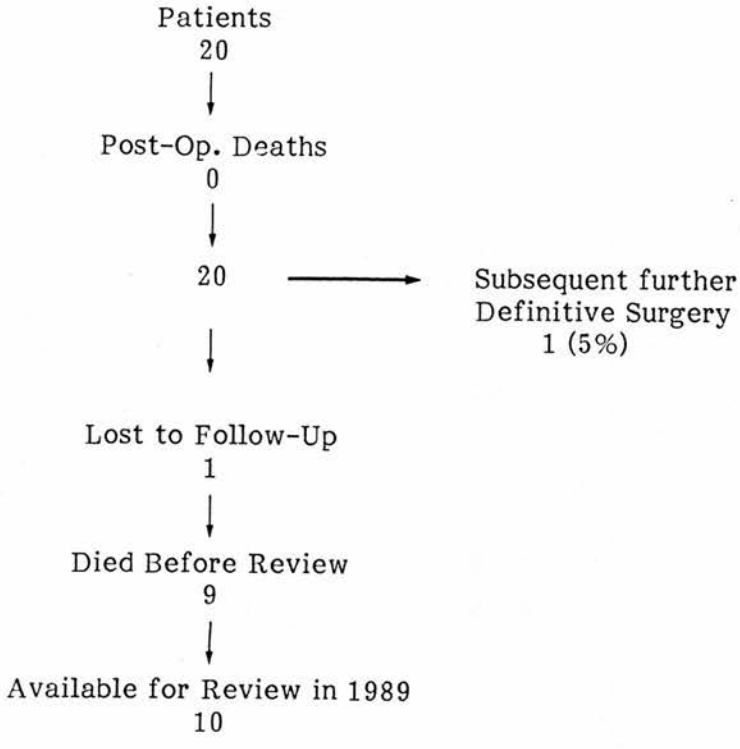


(Mean duration F.U. - 6.49
Range 2.22 - 11.2)

Fig. 21.3

Follow-up of 58 patients having simple closure + H2RA

Immediate Definitive Surgery



(Mean duration F.U. - 5.85
Range 2.06 - 13.36)

Fig. 21.4

Follow-up of 20 patients after immediate definitive surgery

Further definitive surgery was performed in 37.2% of eligible patients; in 43 of the 97 patients who survived simple closure (44.3%) but in only 14 (24.1%) of the 58 patients who survived simple closure with immediate prescription of H2 receptor antagonists. One of the 20 patients who had definitive surgery required revisional operation - a resection of small bowel and plication of afferent and efferent loops for retrograde jejuno-gastric intussusception described in detail elsewhere (Newell and Macintyre 1973).

The rate of definitive surgery in Groups 1 and 2 over 10 years of

follow-up is shown in Table 21.2 and graphically in Fig. 21.5.

		Percentage (S.E. having definitive surgery subsequently	
		Simple closure Group 1 (n=37)	Simple closure +H2RA Group 2 (n=58)
Years after perforation	1	18.05% (3.8)	13.3% (4.6)
	2	30.2% (4.7)	19.7% (5.6)
	5	39.7% (5.1)	29.1% (7.2)
	10	44.7% (5.6)	42.0% (13.1)

Table 21.2

Life table analysis showing rates of subsequent definitive surgery in Groups 1 and 2

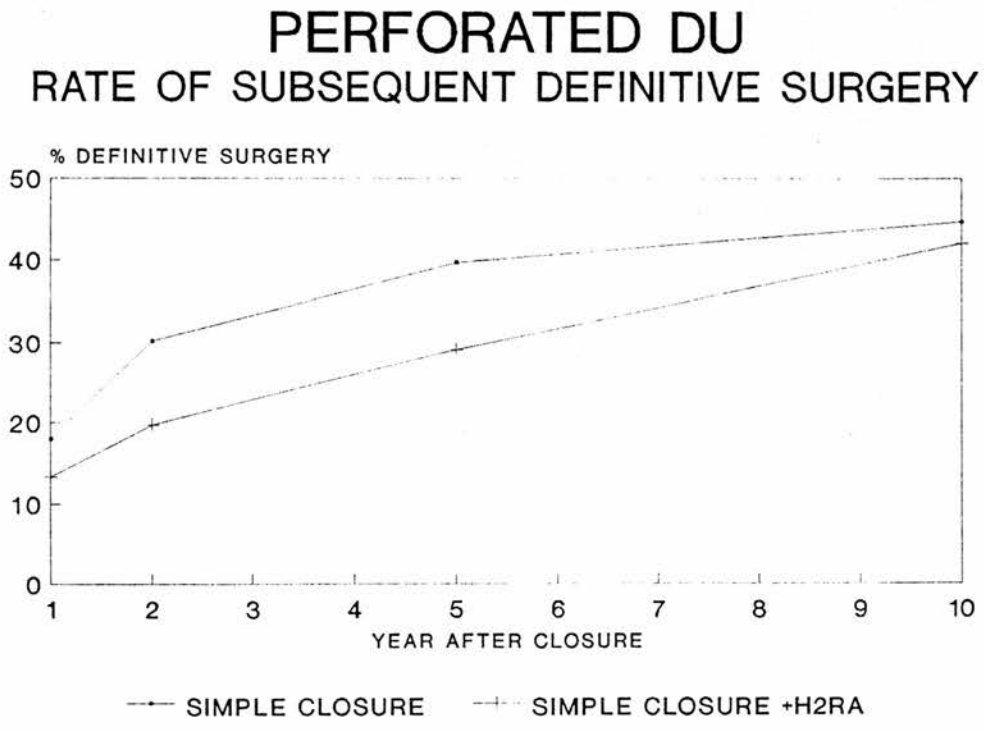


Fig. 21.5

The percentage rose from 18% at one year to 44.7% at 10 years in the simple closure group. In Group 2 the rise was from 13% at one year to 42.0% at 10 years. The differences between the groups were not significant (p=0.15).

57 patients died before review in 1989 and 24 were lost to follow-up leaving 104 available for review in 1989. The follow-up period ranged from 2 to 22 years with a mean of 10.12 years.

Symptomatic Result at long term Review

The symptoms experienced every day or most days by these patients are shown in Table 21.3.

	Simple closure (n=53)	Simple closure + H2RA (n=41)
Epigastric pain	4/53 (7.5%)	1/41 (2.4%)
Heartburn	3/53 (5.7%)	0/41 (0%)
Nausea	1/53 (1.9%)	1/41 (2.4%)
Vomiting	0/53 (0%)	1/41 (2.4%)
Bloating	7/53 (13.2%)	0/40 (0%)
Diarrhoea	3/51 (5.9%)	1/41 (2.4%)

Table 21.3
Symptomatic outcome

There were no significant differences between the groups.

The patients' appetite, ability to eat a normal meal, and to enjoy food are shown in Table 21.4. There were again no significant differences between these groups.

	Simple closure (n=53)	Simple closure +H2RA (n=41)	Definitive surgery (n=10)
Good appetite	45/52 (86.5%)	38/41 (92.7%)	8/9 (88.9%)
Eat normal meal	43/53 (81.1%)	35/41 (85.4%)	8/9 (88.9%)
Enjoy food	49/51 (96.1%)	39/41 (95.1%)	8/10 (80%)

Table 21.4

Patients Opinion

Patients in Group 2 were more likely to continue to take H2 receptor antagonists every day or most days, 12 out of the 40 patients (30%) compared to only 4 out of 48 (8.3%) treated by simple closure alone ($p=0.05$).

The one pre-operative factor which was significantly associated with subsequent definitive surgery was NSAID consumption. Patients taking NSAIDs at the time of perforation were significantly less likely ($p<0.05$) to proceed to subsequent definitive surgery (Table 21.5).

		Percent (S.E.) coming to definitive surgery	
		NSAID (n=33)	No NSAID (n=151)
Years after simple closure	1	10.0% (5.5)	15.5% (3.0)
	2	10.0% (5.5)	27.5% (3.9)
	5	15.0% (7.1)	37.3% (4.4)
	10	15.0% (7.1)	47.4% (5.1)
	15	15.0% (7.1)	47.4% (5.1)

Table 21.5

Life table analysis showing relation between NSAIDs and subsequent definitive surgery

There was a highly significant relationship between year of operation and outcome ($p<0.01$), with more recent cases less likely to come to definitive surgery (Table 21.6).

		Percent (S.E.) coming to definitive surgery		
		1966-1975 (59)	1976-1980 (51)	1981-1986 (55)
Years after perforation	1	17.1% (4.9)	20.0% (5.4)	6.8% (3.3)
	2	31.5% (6.2)	27.7% (6.1)	14.0% (5.0)
	5	44.8% (6.7)	33.8% (6.5)	21.8% (8.7)
	10	56.6% (7.1)	39.6% (7.1)	-
	15	56.6% (7.1)	-	-

Table 21.6

Life table analysis of patients having definitive surgery in 3 consecutive periods

For those having simple closure, a multivariate Cox regression involving year of operation, use of NSAIDs and whether or not H2RA was used immediately post-operatively showed no significance for the last factor when adjusted for the other two. Year of operation remained significant at $p<0.05$.

A dyspeptic history of more than 3 months prior to perforation was not a significant predictor of the need for subsequent definitive surgery.

Conclusions

Whilst elective operations for duodenal ulcer have fallen markedly in the last decade, the incidence of perforated duodenal ulcer remains static in the U.K. (Bardham 1989). The controversy about whether it should be treated by immediate definitive surgery has continued throughout this century. The difficulty has arisen from inability to select, at the time of the emergency operation, those patients who require definitive surgery. Selection on the basis of preceding history (King 1987) or whether the ulcer was judged acute or chronic by the surgeon (Khan 1970) has failed to identify patients who require definitive surgery. Backgaard's study suggested that as many as 50% of patients were classified incorrectly (Backgaard 1979). A blanket policy of definitive surgery for all will result

		Percent (S.E.) coming to definitive surgery		
		1966-1975 (59)	1976-1980 (51)	1981-1986 (55)
Years after perforation	1	17.1% (4.9)	20.0% (5.4)	6.8% (3.3)
	2	31.5% (6.2)	27.7% (6.1)	14.0% (5.0)
	5	44.8% (6.7)	33.8% (6.5)	21.8% (8.7)
	10	56.6% (7.1)	39.6% (7.1)	-
	15	56.6% (7.1)	-	-

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in unnecessary operations with their attendant side effects (Drury 1978).

As H2 receptor antagonists, supplemented latterly by Omeprazole, have now largely replaced definitive surgery in the treatment of elective ulcer disease, it seemed logical to explore the hypothesis that these should also replace definitive surgery in the treatment of perforated ulcer. These drugs have rekindled interest in conservative treatment of perforation. The present study has shown that simple closure with the immediate prescription of H2 receptor antagonists was associated with a reduction in subsequent definitive operations but this was not significant.

NSAID consumption prior to perforation was the only pre-operative factor significantly associated with subsequent definitive surgery. The lower rate of subsequent definitive surgery in these patients suggests that ulcers in such patients may be acute rather than chronic.

A comparison of the symptomatic outcome of those patients in Groups 1 and 2 with a separate group of 36 patients who had highly selective vagotomy for duodenal ulcer in our hospital, following a previous perforation elsewhere, and who had symptomatic review carried out 5-15 years post operatively is shown in Table 21.7

	Simple closure (n = 53)	Simple closure plus H2 receptor antagonists (n = 41)	HSV following previous perforation (n = 36)
Epigastric pain	4/53 (8)	1/41 (2)	5/36 (14)
Heartburn	3/53 (6)	0/41 (0)	2/34 (6)
Bloating	7/53 (13)	1/41 (2)	8/34 (24)
Vomiting	0/53 (0)	0/40 (0)	0/36 (0)
Diarrhoea	3/51 (6)	1/41 (2)	2/36 (6)
H2 blockers	4/48 (8)	12/40 (30)	3/32 (9)

Values in parentheses are percentages

Table 21.7

Symptomatic outcome of groups 1 and 2 and elective highly selective vagotomy (HSV) following previous perforation

The symptomatic outcome of all patients in Groups 1 and 2 who had no subsequent definitive surgery has been compared with that in the group of 36 patients who had highly selective vagotomy following a previous perforation. This is shown in Table 21.8.

	Simple closure plus no definitive surgery (n = 57)		HSV following previous perforation (n = 36)
Epigastric pain	1/57 (2)	P = 0.08	5/36 (14)
Heartburn	2/57 (4)		2/34 (6)
Bloating	2/57 (4)	P = 0.02	8/34 (24)
Vomiting	0/56 (0)		0/36 (0)
Diarrhoea	2/55 (4)		2/36 (6)
H2 blockers	10/53 (19)		3/32 (9)

Values in parentheses are percentages

Table 21.8

Symptomatic outcome of patients having simple closure and no subsequent definitive surgery, and patients having highly selective vagotomy (HSV) following previous perforation

Bloating, a recognised complication of H.S.V., is the only symptom significantly different in both cases. These comparisons have not taken place as part of a controlled study and those patients coming to H.S.V. will include some with a more aggressive diathesis.

On the basis of this study a policy of simple closure for all patients who present with perforated duodenal ulcer is recommended. The side effects of definitive surgery are avoided and the symptomatic results in the long term are no worse. Immediate prescription of H2RA is recommended on the basis of Simpson's study (Simpson 1987) which showed short term benefit from this treatment, although the present study shows no significant long term benefit from this practice. However, the significant decline in the rate of subsequent definitive surgery is almost certainly the result of the increasingly widespread use of H2RA in symptomatic patients.

CHAPTER 22

LONG TERM MORTALITY FOLLOWING DUODENAL ULCER SURGERY AT THE WESTERN GENERAL HOSPITAL

All patients undergoing an operation for duodenal ulcer at the Western General Hospital between 1st July, 1947 and 31st July, 1968 were included. Patients were followed until death, loss to follow-up or 31st December, 1988 when the study closed. Of the 2241 patients included 222 (9.9%) were lost to follow-up and 726 were known to be alive leaving 1293 for further analysis. Of the 1387 who died, 94 were aged 85 or more at the time of death and in keeping with accepted convention were excluded. The cause of death could be ascertained from the death certificate in 1251. Of the patients who died only those patients in whom a death certificate was traced were included in the study (Table 22.1).

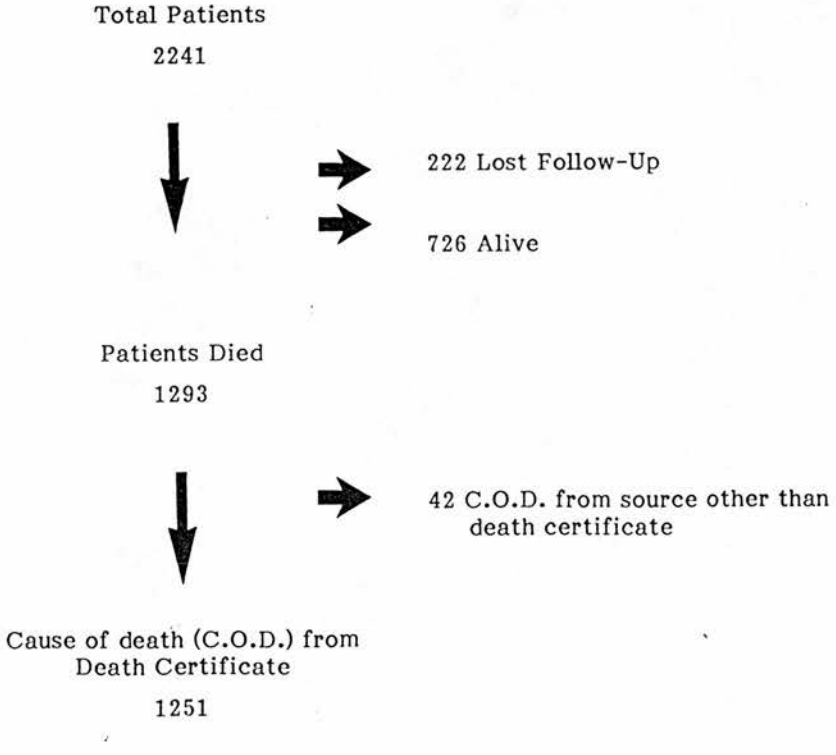


Table 22.1
Summary of patients studied

Deaths from all causes in these 1251 patients is shown in Table 22.2.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	101	32.68	3.09	0.000
Total M+F	2-19	2138	791	772.78	1.02	0.261
Total M+F	20-40	1176	401	333.75	1.20	0.000
Total M+F	0-40	2241	1293	1139.21	1.13	0.000

Table 22.2

Deaths from all causes (ICD 1-999)

The observed deaths in the first post-operative year exceeds expected by a factor of 3.09 ($p<0.001$). The increase in observed over expected deaths between years 1 and 19 is not statistically significant. Between the 20th and 40th post-operative year, however, the observed deaths exceed expected by a ratio of 1.2, a highly significant increase ($p<0.001$). Thus overall the ratio of observed to expected deaths is 1.13, a significant increase largely accounted for by the excessive mortality in the year following operation.

The death rates for all neoplasms (ICD9 Codes 140-239) are shown in Table 22.3.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	11	7.27	1.51	0.119
Total M+F	2-19	2138	215	180.53	1.19	0.007
Total M+F	20-40	1176	110	80.23	1.37	0.001
Total M+F	0-40	2241	336	268.03	1.25	0.000

Table 22.3

Deaths from all neoplasms (ICD 140-239)

The deaths from all neoplasms exceeded the observed in the immediate post-operative year in the ratio of 1.5:1 but the difference failed to reach significance. From the 1st to the 19th post-operative year, however, the observed mortality from all neoplasms significantly exceeded the expected

and this increase was maintained between the 20th and 40th post-operative years. Overall there is a significant increase in deaths from all neoplasms.

Deaths from stomach cancer (ICD9 Code 151) are shown in Table 22.4.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	3	1.05	2.86	0.089
Total M+F	2-19	2138	19	20.23	0.94	0.638
Total M+F	20-40	1176	8	6.72	1.19	0.359
Total M+F	0-40	2241	30	28.00	1.07	0.377

Table 22.4

Deaths from stomach cancer (ICD 151)

There is a significant increase in deaths from stomach cancer in the first post-operative year which, in common with other series, almost certainly represents "missed" gastric cancers occurring either with or without concomitant duodenal ulcer disease. Neither in the first 19 nor in the subsequent 41 years, however, was there a significant increase in deaths from stomach cancer with 30 observed compared to 28 expected. It is, however, of note that since the study closed no fewer than 6 further deaths from gastric cancer have occurred in the cohort.

Deaths from colon cancer (ICD9 Code 153) shown in Table 22.5, showed a significant increase in the initial post-operative year.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	3	0.65	4.62	0.028
Total M+F	2-19	2138	20	14.42	1.39	0.095
Total M+F	20-40	1176	6	6.06	0.99	0.564
Total M+F	0-40	2241	29	21.13	1.37	0.060

Table 22.5

Deaths from colon cancer (ICD 153)

Again in common with other groups these deaths probably represent undiagnosed carcinomas of the right side of the colon occurring with or without concomitant duodenal ulcer disease. Between the 1st and the 19th post-operative year there was a significant increase in deaths from colon cancer but no increase between the 20th and 40th post-operative year. Overall the number of deaths from colon cancer remain significant. At no time in the study did deaths from rectal cancer (ICD9 Code 154) exceed the expected (Table 20.6).

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poiss 1-sidc
Total M+F	0-1	2241	0	0.35	0.00	1.000
Total M+F	2-19	2138	7	7.97	0.88	0.682
Total M+F	20-40	1176	5	3.34	1.50	0.244
Total M+F	0-40	2241	12	11.66	1.03	0.499

Table 22.6

Deaths from rectal cancer (ICD 154)

Deaths from oesophageal cancer (ICD9 Code 150) exceeded the expected in the 1st and 19th post-operative year in a ratio of 1.4:1 and in the 20th to 40th post-operative year by 1.6:1. Overall deaths from oesophageal carcinoma significantly exceeded the expected in a ratio of 1.48:1 (Table 22.7).

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	0	0.20	0.00	1.000
Total M+F	2-19	2138	8	5.57	1.44	0.199
Total M+F	20-40	1176	5	3.02	1.65	0.189
Total M+F	0-40	2241	13	8.79	1.48	0.110

Table 22.7

Carcinoma of oesophagus (ICD 150)

Deaths from carcinoma of lung and pleura (ICD9 Codes 162 and 163) are shown in Table 22.8.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	3	2.27	1.32	0.397
Total M+F	2-19	2138	81	65.41	1.24	0.034
Total M+F	20-40	1176	50	30.33	1.65	0.001
Total M+F	0-40	2241	134	98.01	1.37	0.000

Table 22.8

Carcinoma of lung and pleura (ICD 162,163)

While there is no increase in deaths in the initial post-operative year, between years 1 and 19 and between years 20 to 40 there are significant increases in observed over expected deaths from carcinoma of lung and pleura.

No increase was found in carcinoma of the bladder, lymphoma or leukaemia. These have been shown together in Table 22.9 together with carcinoma of the pancreas.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Bladder						
Total M+F	0-1	2241	0	0.21	0.00	1.000
Total M+F	2-19	2138	7	6.23	1.12	0.430
Total M+F	20-40	1176	4	3.08	1.30	0.371
Total M+F	0-40	2241	11	9.52	1.16	0.357
Pancreas						
Total M+F	0-1	2241	0	0.28	0.00	1.000
Total M+F	2-19	2138	13	7.76	1.68	0.053
Total M+F	20-40	1176	1	3.43	0.29	0.968
Total M+F	0-40	2241	14	11.47	1.22	0.264
Lymphoma						
Total M+F	0-1	2241	1	0.16	6.21	0.149
Total M+F	2-19	2138	3	3.78	0.79	0.728
Total M+F	20-40	1176	1	1.55	0.65	0.787
Total M+F	0-40	2241	5	5.49	0.91	0.641
Leukaemia						
Total M+F	0-1	2241	0	0.14	0.00	1.000
Total M+F	2-19	2138	2	3.35	0.60	0.847
Total M+F	20-40	1176	3	1.48	2.03	0.185
Total M+F	0-40	2241	5	4.96	1.01	0.553

Table 22.9

Deaths from carcinoma of bladder (ICD 188), pancreas (ICD 157), all lymphomas (ICD 200-202) and all leukaemias (ICD 204-208)

Between years 2 and 19 post-operatively an increase in expected deaths from carcinoma of the pancreas was observed which just failed to reach significance at the 5% level.

In female deaths carcinoma of breast, uterus and ovary (ICD9 Codes 174, 180-182, 183) were not greater than expected.

	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson 1-sided
Breast (ICD 174)	0-40	559	8	8.72	0.92	0.642
Uterus (ICD 180-182)	0-40	559	5	3.18	1.57	0.217
Ovary (ICD 183)	0-40	559	4	2.79	1.43	0.306

Table 22.10

Deaths from cancers specific to females

In male deaths carcinoma of prostate (ICD9 Code 185) showed no increase but there was an increase in carcinoma of testis (ICD9 Code 186) which was just significant at the 5% level.

	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Prostate (ICD 185)	0-40	1682	17	12.47	1.36	0.129
Testis (ICD 186)	0-40	1682	2	0.35	5.79	0.048

Table 22.11

Deaths from cancers specific to males

Deaths from cirrhosis of the liver (ICD9 Code 571) are shown in Table 22.12.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson) 1-sided
Total M+F	0-1	2241	0	0.16	0.00	1.000
Total M+F	2-19	2138	9	4.17	2.16	0.027
Total M+F	20-40	1176	2	1.75	1.14	0.523
Total M+F	0-40	2241	11	6.09	1.81	0.046

Table 22.12

Deaths from cirrhosis of liver (ICD 571)

Between years 2 and 19 post-operatively there is a 2.16 increase in observed over expected deaths from this cause, between years 20 and 40 after the operation there is no significant difference. However, overall the ratio of observed over expected deaths remains significant at 1.8:1.

The considerable excess in deaths from all circulatory diseases (ICD9 Codes 390-420) and all respiratory diseases (ICD9 Codes 460-519) and digestive diseases (ICD9 Codes 520-577) is shown in Table 22.13.

Study Group	Years since First exposed	No. in group	Observed Deaths	Expected Deaths	Ratio O/E	P (Poisson 1-sided
Circulatory Disease						
Total M+F	0-1	2241	23	12.43	1.85	0.005
Respiratory Disease						
Total M+F	0-1	2241	11	3.09	3.56	0.000
Digestive Disease						
Total M+F	0-1	2241	24	1.12	21.46	0.000

Table 22.13

Death from all circulatory diseases (ICD 390-429), respiratory disease (ICD 460-519) and digestive disease (ICD 520-577) in the first post-operative year

Each of these is highly significant. For circulatory disease 23 deaths occurred compared to 12.4 expected, a ratio of 1.85:1; for respiratory disease 11 deaths occurred compared to the expected of 3, a ratio of 3.56:1 and for digestive diseases 24 deaths occurred compared to an expected 1.1.

PART IV

CONCLUSIONS

CHAPTER 23

THE OPERATIONS COMPARED

Despite the fact that duodenal ulcer is a common condition and, until the 1980's treatment by operation was also common, it has proved difficult to compare all available operations by prospective randomised controlled trial. Many trials have reported comparisons between two operations and some, notably the Leeds/York trial (Goligher 1968) have compared three. Ironically this, arguably one of the best such studies to be published, found in favour of gastric resection at a time when gastric resection for duodenal ulcer was becoming uncommon in the U.K.

Furthermore such controlled trials report largely short term results, whereas long term results should determine the efficacy of operations for duodenal ulcer.

In this chapter the results of five operations for duodenal ulcer are compared. This was not a randomised study, and a degree of selection for operations took place on the basis of acid output. Nonetheless 4 of the operations were performed in the same hospital, by the same surgical teams, over the same 20 year period, and patients have been followed using the same techniques for at least 20 years after the operation. Such a comparison has not, to our knowledge, been made before.

The principle comparisons have been made between Polya gastrectomy, gastro-enterostomy, truncal vagotomy with pyloroplasty and truncal vagotomy with gastro-enterostomy. Comparison of these with highly selective vagotomy has only been made where considered justified as the latter operation was performed in a later time period and follow-up is therefore shorter. The patients, methods, and results have been described for individual operations in earlier chapters.

Possible risk factors

Possible factors which might increase the risk of recurrent ulcer or a

poor operative result were considered. A comparison of the groups in terms of age, sex, previous perforation or haemorrhage, and cigarette smoking is shown in Table 23.1.

	Polya (n = 847)	G-E (n = 113)	TV + GE (n = 317)	TV + P (n = 107)	HSV (n = 500)
Mean age	46	54	47	40	39.7
% Males	90.1	53.1	61.8	78.5	73.0
Prev. haemorrhage (%)	19.7	26.5	20.8	32.7	26.6
Prev. perforation (%)	12.7	5.3	7.9	3.7	5.8
Cig. smokers (%)	80.2	62.8	71.6	80.4	76.4

Table 23.1

Comparison of age, sex, previous complications and smoking

This reflects the policy of avoiding gastrectomy in females. The smaller percentage of cigarette smokers in the gastro-enterostomy groups reflects the smaller proportion of females who smoked.

Acid output studies

The mean pre-operative MAO for each group is shown in Table 23.2.

	Polya (n = 537)	G-E (n = 79)	TV + GE (n = 225)	TV + P (n = 91)	HSV (n = 500)
Pre-operative mean MAO	39	23	31	35	35.9

Table 23.2

Mean pre-operative MAO in the five groups

The lower mean in the two gastro-enterostomy groups reflects the policy of selection according to acid output described above. The higher MAO in the Polya group may also reflect this policy.

Operative mortality

The 30 day operative mortality for each procedure is shown in Table 23.3.

	Polya (n = 847)	G-E (n = 113)	TV + GE (n = 317)	TV + P (n = 107)	HSV (n = 500)
Operative mortality (%)	1.6	0.9	1.6	0	0

Table 23.3

Operative mortality (30 day)

Complications and sequelae

A comparison of the commoner complications, sequelae and side effects of the five operations is shown in Table 23.4.

	Polya (n = 831)	G-E (n = 112)	TV + GE (n = 312)	TV + P (n = 107)	HSV * (n = 500)
Dumping	4.3%	2.7%	6.1%	6.5%	5.5%
Diarrhoea	3.2%	4.5%	8.3%	10.3%	4.0%
Bile vomiting	5.5%	8.0%	6.7%	5.6%	0.9%
Recurrent ulcer	3.2%	19.6%	5.3%	14.0%	18.5%

Table 23.4

Complications, sequelae and side effects
(* follow-up 2-18 years)

The operative mortality for Polya gastrectomy of 1.6% is similar to that recorded by Stammers and Williams (1963) as is the recurrent ulcer rate of 3.2%. As expected the incidence of diarrhoea after truncal vagotomy is significantly higher than after other operations ($p<0.01$). The incidence of dumping did not significantly differ between any of the operations. Bile vomiting, however, was significantly less common after H.S.V. than Polya gastrectomy ($p<0.001$), gastro-enterostomy ($p<0.001$), truncal vagotomy with gastro-enterostomy ($p<0.001$) and truncal vagotomy and pyloroplasty ($p<0.01$).

The recurrent ulcer rate after H.S.V. (18.5%) and gastro-enterostomy (19.6%) is significantly higher than after Polya gastrectomy ($p<0.001$) and truncal vagotomy and gastro-enterostomy ($p<0.01$). As described in Chapter 19 recurrent ulcer after H.S.V. proved in the majority of cases to be amenable to medical treatment, reflected in the significantly lower rate for revisional surgery after H.S.V.

Revisional surgery

The rate of revisional operations is shown in Table 23.5.

	Polya (n = 831)	G-E (n = 112)	TV + GE (n = 312)	TV + P (n = 107)	HSV * (n = 500)
Rate of revisional operations	7.6%	16.8%	10.6%	14.9%	6.8%

Table 23.5

Rate of revisional operations (* follow-up 2-18 years)

Revisional surgery was significantly less common after Polya gastrectomy than gastro-enterostomy ($p<0.001$) and truncal vagotomy with pyloroplasty ($p<0.01$). The rate after H.S.V. was less than gastro-enterostomy ($p<0.001$) and truncal vagotomy and pyloroplasty ($p<0.01$).

RESULTS

Visick grading

The results of each of the operations has been described in previous chapters on the basis of a Visick grading and of a quality of life score. Results of the first Visick grading for the four operations after which they were performed are shown in Table 23.6.

	Polya	G-E	TV + GE	TV + P
Patients first Visick grading	754	109	286	100
% 1+2 at first grading	79.8%	77.1%	71.7%	66.0%
Mean interval to 1st grading	6.4 yrs	4.4 yrs	6.2 yrs	5.7 yrs
Patients second Visick grading	333	66	141	60
% 1+2 at 2nd grading	78.6%	72.8%	65.9%	53.3%
Mean interval to 2nd grading	17.2 yrs	10.5 yrs	15.3 yrs	13.8 yrs

Table 23.6

Results of first and second Visick gradings

These results show that truncal vagotomy and pyloroplasty gives significantly worse results than Polya gastrectomy ($p<0.01$) at first and second

grading. At second grading Polya gastrectomy gives significantly better results than both truncal vagotomy and pyloroplasty ($p<0.001$) and truncal vagotomy and gastro-enterostomy ($p<0.01$). Truncal vagotomy and gastro-enterostomy also scores significantly worse than Polya particularly by the time of the second assessment.

The differences between first and second gradings suggest a tendency for results of duodenal ulcer surgery to deteriorate with time although this is not statistically significant.

Cay and Small Quality of Life Assessment

The technique of assessment using the Cay and Small Quality of Life instrument has been described in earlier chapters. For purposes of comparison the psychosocial scores and physical symptom scores have been assessed both separately and together to give a quality of life score.

a) Psychosocial scores

The mean psychosocial scores for four operations are shown in Table 23.7.

	Polya (n = 313)	G-E (n = 58)	TV + GE (n = 140)	TV + P (n = 67)
Mean psychosocial score ± S.E. (95% C.L.)	30.2±1.14 (28.7,32.1)	29.8±0.79 (28.2,31.4)	29.6±0.59 (28.4,30.7)	28.6±0.83 (27.0,30.3)

Table 23.7

Mean psychosocial scores after 4 operations

There are no differences between the groups, indeed the similarity between the groups in mean psychosocial scores is striking. This suggests firstly that pre-operative psychiatric illness, personality disorder and social abilities was similar between the groups and that no one operation had a more detremental effect than the others on the group as a whole.

The scoring system is designed, however, to be applied to individuals and particularly to discriminate those with a bad result.

The psychosocial scores have therefore been classified into three groupings, described as 'good', 'moderate' and 'bad'.

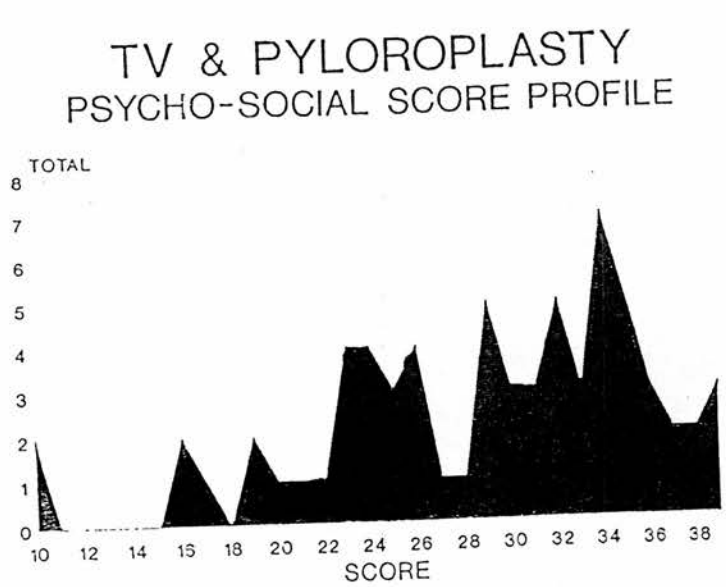
	Polya (n = 313)	G-E (n = 113)	TV - GE (n = 317)	TV + P (n = 71)
Good > 34	84 (26.8%)	15 (13.3%)	36 (11.4%)	14 (19.7%)
Moderate 26-34	155 (49.5%)	30 (26.5%)	69 (21.8%)	32 (45.1%)
Bad 0-25	74 (23.6%)	68 (60.2%)	212 (66.9%)	25 (35.2%)

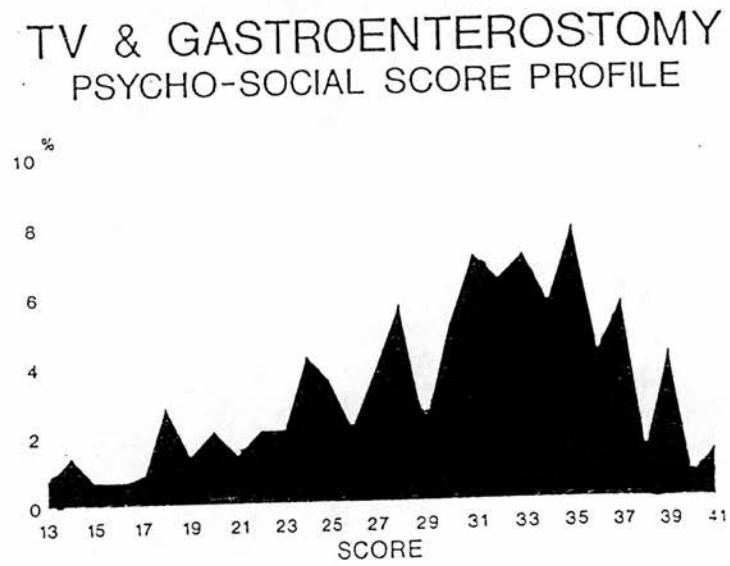
Table 23.8

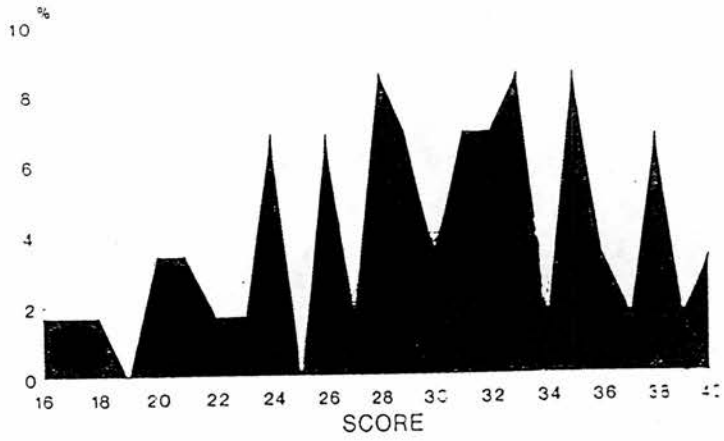
Psychosocial scores classified into good, moderate and bad

This demonstrates that significant differences emerge in the distribution of patients between these groups. Significantly fewer have a 'bad' result (score 0-25) in terms of psychosocial score after Polya gastrectomy compared to truncal vagotomy and gastro-enterostomy ($p<0.001$) and gastro-enterostomy alone ($p<0.001$).

These scores have also been plotted as an area curve showing the percentage of patients achieving each score (Fig. 23.1). In this way the area under each cover is identical and the further to the right the curve the better the result. This confirms that gastro-enterostomy alone and with vagotomy are associated with the poorest results in terms of psychosocial scores and Polya gastrectomy the best.







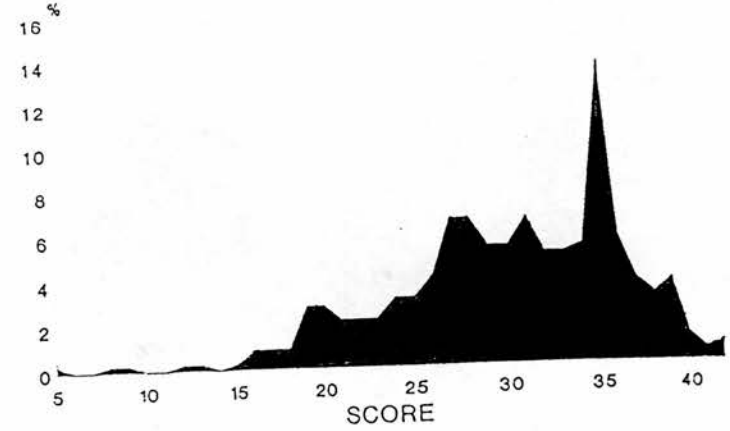


Fig. 23.1

Psychosocial score profiles graphed as percentage of patients achieving each score

b) Physical symptom scores

The mean physical symptom scores for the four operations are shown in Table 23.9. As with psychosocial symptom scores the differences between the mean physical symptom scores are not statistically significant. Indeed these mean scores are strikingly similar.

	Polya	G-E	TV + GE	TV + P
Mean physical symptom score ± S.E. (95% C.L.)	20.7±0.97 (18.4,22.9)	18.8±0.71 (17.3,20.2)	19.4±0.38 (18.7,20.2)	18.7±0.59 (17.5,19.9)

Table 23.9

Mean physical symptom scores after 4 operations

This serves to emphasise once more that, when averaged, the scoring system is not a good discriminant between operations when mean values are used but is designed to identify those patients or groups of patients with poor results and those with good results. Even when grouped into three groups as already described no significant differences between the operations emerge (Table 23.10).

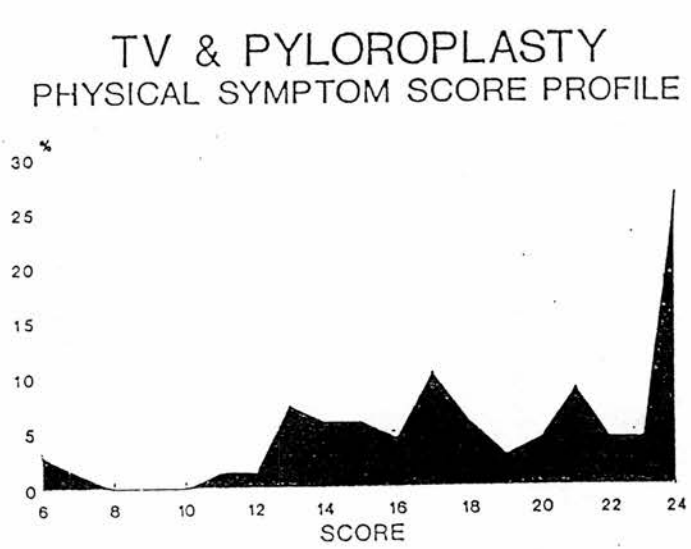
	Polya (n = 313)	G-E (n = 58)	TV + GE (n = 140)	TV + P (n = 67)
Good > 20	180 (57.5%)	29 (50.0%)	75 (53.6%)	30 (44.8%)
Moderate 13-19	77 (24.6%)	19 (32.8%)	45 (32.14%)	29 (43.3%)
Bad 0-12	25 (8.0%)	7 (12.1%)	12 (8.6%)	5 (7.5%)

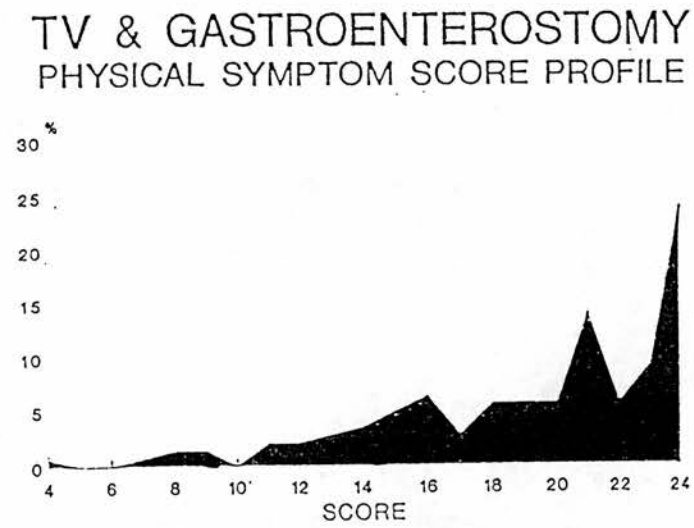
Table 23.10

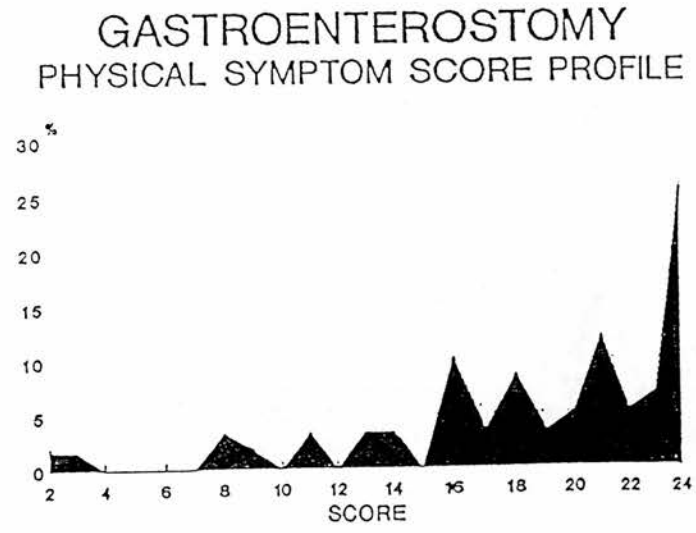
Physical symptom scores grouped into bad, moderate and good

None of these differences reach statistical significance.

The physical score profiles have also been plotted as an area curve (Fig. 23.2) in the same way as the psychosocial scores. This confirms the similar patterns in physical symptom scores between the four operations.







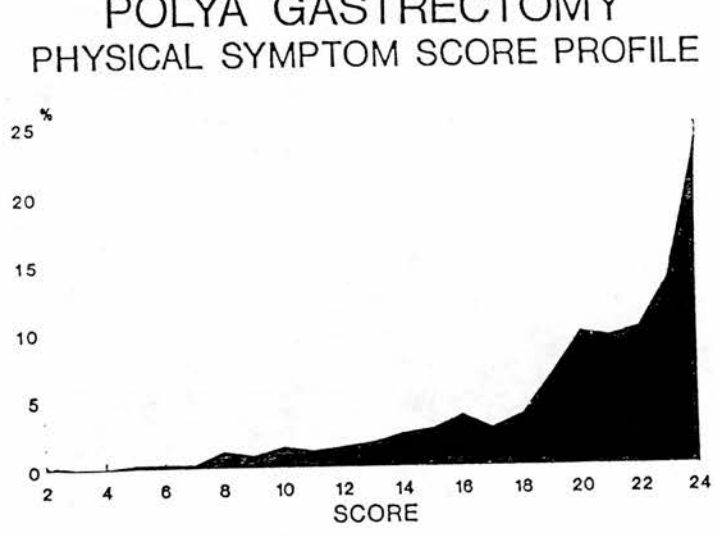


Fig. 23.2

Physical symptom scores graphed as the percentage of patients achieving each score

c) Quality of Life scores

The psychosocial and physical scores have been added to give a "Quality of Life" score for each operation and the results are shown in Table 23.11, grouped into the three classifications by score as described in Chapter 13.

	Polya (n = 313)	G-E (n = 58)	TV + GE (n = 140)	TV + P (n = 67)
% Good (46-66)	71.2	67.2	69.3	59.7
% Moderate (40-45)	16.2	13.8	10.7	20.9
% Bad (0-39)	12.4	19.0	20.0	19.4

Table 23.11

Quality of Life scores grouped into good, moderate and bad

This demonstrates that Polya gastrectomy has significantly fewer "bad" results than the other 3 operations ($p<0.01$).

CHAPTER 24

CONCLUSIONS

It seems appropriate, almost exactly 100 years after the introduction of surgery for duodenal ulcer, to take stock of the contribution that surgery has made to the treatment of ulcer disease.

The strategy of treating uncomplicated duodenal ulcer by surgery had several problems. The aetiology of the disease was not, and indeed is not, fully understood. When surgery was first applied in the 1880's and 1890's the role of acid was not appreciated. This role was emphasised by Schwarz in 1910 and his dictum of "no acid no ulcer" was to dominate future surgical thinking on the disease. Gastro-enterostomy, introduced to bypass the inflammatory mass surrounding the ulcer and to "rest" the duodenum, worked almost by chance by diverting alkaline duodenal contents into the stomach. Surgical operations were designed to reduce acid output whilst minimising the effects of gastric incontinence and vagal denervation.

Each new operation has been vigorously advocated in its day. It was ironic that highly selective vagotomy, widely regarded as the most physiological operation and confirmed in this study to be associated with fewer side effects, should have been introduced in an era when the incidence of duodenal ulcer had already begun to fall. Even more ironic was that it should have been followed within a few years by the first effective medical treatment. Indeed Alexander-Williams has already written a "Requiem for Vagotomy" (Alexander-Williams 1991) and major reviews of therapy are now appearing which do not include surgical treatment - even for refractory ulcer (Soll 1990).

There appear then to be four principal reasons for the demise of successive operations.

1. **Complications and sequelae**

These by and large became manifest for the first time several years after the introduction of the procedure. This prompted one writer to remark

that "every new operation for peptic ulcer is hailed as a breakthrough - until it is found out". The "finding out" of gastro-enterostomy was stomal ulceration; of partial gastrectomy the long term metabolic complications; of truncal vagotomy with drainage diarrhoea and dumping; of highly selective vagotomy apparently, recurrent ulceration.

2. **Operations only reduce acid**

It was serendipidy that gastro-enterostomy, introduced to bypass the inflammatory mass around the ulcer, resulted in the healing of many ulcers. This was initially thought to be by "resting" the duodenum until the role of acid in the aetiology of duodenal ulcer was appreciated. The buffering effect of delivering alkaline duodenal content, however, was much less than the acid reduction produced by vagotomy. Yet the best vagotomy, whether truncal or parietal cell, can reduce acid output by only 60%. Only vagotomy and antrectomy can effectively reduce acid secretion but at the cost of the side effects of both vagotomy and gastric resection.

Although Schwarz's dictum of "no acid no ulcer" holds true, many patients with duodenal ulcer have normal acid output (Baron 1963) emphasising that factors other than gastric acid are involved in the aetiology.

The importance of the mucosal barrier in the acid/pepsin - mucosal barrier equation has been increasingly appreciated as techniques to study barrier physiology and pathophysiology have been developed.

There is no evidence to suggest that any of the operations (which were designed to reduce acid) had any effect on the cytoprotective mechanisms of the gastro-duodenal mucosa.

The recognition of the role of Helicobacter Pylori in chronic gastritis and duodenal ulcer as late as 1984 (Marshall and Warren 1984) has in a

remarkably short time led the World Congress of Gastroenterology working group to conclude that H. pylori is the single most important factor in the aetiology of the multifactorial disease entity of peptic ulcer (Tytgat et al 1990).

While the precise role of H. pylori in the pathogenesis of duodenal ulcer remains to be clarified, and whilst an effective treatment regimen to eradicate it permanently is awaited, there is no suggestion that surgery will have any role to play in this treatment.

3. **The declining incidence of uncomplicated duodenal ulcer**

The decline in incidence of duodenal ulcer disease in the developed world first became manifest in the 1960's (Chapter 9). This has resulted in a decline in consultation rates in primary care of patients whose final diagnosis is duodenal ulcer. This has in turn reduced the number of patients referred from general practice. A further cause of decline in referrals for surgery has been the development of effective medical treatment.

4. **The development of effective medical therapy**

The "gastric" diet and antacids were for decades the mainstay of medical treatment for duodenal ulcer. The traditional regimen of hourly milk has been shown to result in a persistently high acid secretion (Kirsner 1940). Antacids, in the conventional doses used in the U.K. do no more than provide symptomatic relief. The intensive therapy of 1000 mM per day can speed ulcer healing but is associated with significant side effects and poor compliance. Side effects limited and subsequently ended the use of anticholinergics introduced to attempt a "medical vagotomy". Carbenoxolone was the first drug in a randomised trial assessed by endoscopy shown to heal duodenal ulcer more rapidly than placebo (Stadelmann 1972) but, yet again side effects (in this case aldosterone-like effects) ended its use. Colloidal bismuth

(tripotassium di-citrato bismuth) has also been shown to be an effective ulcer healing agent (Salmon 1974). Introduced as a mucosal protective agent it has latterly found an additional role as an agent active against H. pylori. The H2 receptor antagonists heal between 80-90% of duodenal ulcers by six weeks and side effects are uncommon. The proton pump inhibitor Omeprazole can heal some 98% of duodenal ulcers by six weeks.

The problem with both of these agents is of ulcer relapse after initial healing. Even with continuous maintenance treatment the one year relapse rate for H2 receptor antagonists is about 25% (Palmer 1990) for Omeprazole 23-27% (Lauritsen 1991) and for citrated bismuth 31% (Dunk 1990). The eradication of H. pylori using colloidal bismuth and two antibiotics is possible in 80% of instances but antibiotic associated morbidity is common and subsequent re-infection is likely.

Yet despite these problems medical therapy is perceived as curing almost all ulcers and offering at least the hope of a reduction in recurrence rate. Cost-effective medical therapy combining acid reduction with eradication of H. pylori seems destined to improve treatment still further making it most unlikely that the balance can be restored in favour of surgery offering as it does only acid reduction.

There are still, however, several problems with current medical therapy which might be summarised as follows:

a) Medical therapy heals the ulcer but does not cure the diathesis.
b) Ulcers recur even in the face of continuous medical treatment with H2 blockers, Omeprazole or citrated bismuth.
c) Long term treatment with Omeprazole is not yet licensed and long term therapy with the triple regimen (citrated bismuth plus two antibiotics) is associated with antibiotic related morbidity and

concerns about bismuth absorption causing toxicity.

d) Long term therapy with medical therapy is associated with poor compliance in the U.K. (68%) (Penston 1989) and this seems likely to be higher in developing countries.

e) Long term maintenance therapy is expensive. Cimetidine, the cheapest of the H2 receptor antagonists costs (at 1991 prices for 800 mg. nightly) some £1800 for 5 year therapy and yet this regimen is associated with recurrence rates as high as 50% (Parente 1989). The costs are likely to make such therapy too expensive for developing countries.

f) There is as yet insufficient information about long term morbidity and mortality in patients receiving medical therapy for duodenal ulcer. Cimetidine, for example, by its inhibition of the cytochrome P450 enzyme system can prolong the half life of drugs like Warfarin, Propranolol and Diazepam. In some individuals Cimetidine produces anti-androgenic effects and all H2 receptor antagonists stimulate prolactin secretion and can impair vasopressin secretion. It remains to be seen whether these produce any untoward effects when the drugs are used for long term maintenance therapy. Doubts about possible gastric carcinogenesis following long term exposure to acid reducing agents remain to be resolved.

g) There is also insufficient information about the quality of life in patients undergoing long term medical therapy for duodenal ulcer.

On the other hand the acid lowering operations have provided long term cure for the diathesis in between 80% and 98% of patients. In this study the worst results in terms of recurrent ulcer followed highly selective vagotomy with a cumulative ulcer recurrence rate of 18.5% at 18 years but this should not be regarded as failure. It has been shown that recurrence after 15 years is uncommon (Mullen 1991). Furthermore this study has shown that recurrent

ulcer after highly selective vagotomy is more amenable to medical therapy and, because the recurrence group includes acute, superficial, and small ulcers many require no treatment at all. The present study showed that 48% of patients with recurrent ulcer did not require any treatment at all and that 69.7% of patients with recurrent ulcer regarded the operation as successful. This has also been observed by others (Hoffman 1987). Thus the Visick grading which has for 4 decades provided a gold standard against which any operation can be assessed, no longer seems appropriate. This is firstly because the Visick system scores recurrent ulcer as failure, and secondly because computer technology now allows analysis and correlation of symptoms and symptom complexes in large groups of patients. The present study has shown that a quality of life scoring system measuring both physical symptoms and psychosocial factors is a more sensitive and more appropriate measure of outcome.

Using this technique the present study has shown that after 20 years Polya gastrectomy is associated with fewer "bad" results than the three other operations assessed so that any possible metabolic or nutritional sequelae do not appear to be perceived by patients 20 years post-operatively. Gastro-enterostomy even when confined to the low acid output group fails because of a high stomal ulcer rate in the long term, a problem not amenable to modern medical therapy. This failure is further manifest by higher revisional surgery rate and lower Visick gradings and quality of life score when compared to Polya gastrectomy.

Truncal vagotomy and drainage was associated more frequently with diarrhoea. Truncal vagotomy with pyloroplasty was followed more often by revisional surgery than Polya gastrectomy and was associated with significantly poorer Visick gradings. By the time of second Visick grading vagotomy with gastro-enterostomy also scores significantly lower than Polya

gastrectomy.

Using the quality of life scoring system truncal vagotomy both with pyloroplasty and with gastro-enterostomy give more bad results than Polya gastrectomy.

These results call into question the use of truncal vagotomy and drainage in modern surgical practice. It is worth noting that in Scandinavia Polya gastrectomy remained the operation of choice until the 1970's when it was superceded by highly selective vagotomy. In this study the two best operations as assessed by long term symptomatic outcome were Polya gastrectomy and highly selective vagotomy. Whilst Polya gastrectomy is unlikely ever to be restored to first line therapy it can be confidently recommended to the small minority of patients who, having relapsed after highly selective vagotomy, fail to respond to medical therapy.

Of patients having H.S.V. some 85% regarded the operation as successful and even 69.7% of these with recurrent ulcer regarded the operation as successful. Whilst medical therapy must remain the first line of treatment and should improve in future, the prospects of successful treatment of the ulcer diathesis resistant to medical therapy are high using H.S.V. as the initial procedure.

For perforated peptic ulcer the evidence from this study suggests that simple closure accompanied by H2 receptor antagonists is the treatment of choice, largely because it is not possible to predict pre-operatively those who require definitive surgical treatment.

The decline in surgical treatment for uncomplicated and bleeding duodenal ulcer seems likely to continue.

This study has demonstrated the value of auditing outcome of treatment

by long term follow-up and of a quality of life scoring system to assess that outcome.

The study has shown that there is an increased disease specific mortality 20 to 40 years post-operatively. Some of these are undoubtedly a reflection of the higher proportion of cigarette smokers in the population coming to duodenal ulcer compared to the population at large. The increase in deaths from cirrhosis of the liver is a further indication of the sequelae of the lifestyle common in patients with duodenal ulcer coming to surgery in this period.

Although a significant increase in observed over expected cases of gastric cancer was not demonstrated the large number of gastric cancers occurring after the study closed suggests that, as others have shown, this risk continues to rise with time. This has been attributed to a combination of high intragastric pH, damaged mucosal defences, increased N-nitrosocompounds resulting from altered bacterial flora and bile reflux.

The greatest increase demonstrated, however, was from circulatory, respiratory and digestive disease in the first post-operative year. This is a reflection of the surgical operations in the period 1948-1968 and should be compared to the results from highly selective vagotomy between 1973-1990 where there was no 30 day mortality in 500 patients and neither of the two deaths within one year could be attributed to the operations.

The era of elective operations for peptic ulcer has drawn to a close. In the first five months of 1991 no elective operations for duodenal ulcer were performed at the Western General Hospital.

What the late Sir Charles Illingworth called "the great human experiment" appears to have ended. Studies of the long term effects, such as mortality and quality of life following medical therapy must now begin.

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APPENDICES

Appendix 1: Proformas

a) Gastric Follow-Up Clinic Proforma
b) Surgical Review Office Registration Proforma
c) Quality of Life Questionnaire
d) Quality of Life scoring system
e) Symptom Questionnaire
f) Surgical Review Office Follow-Up Proforma
g) Recurrent ulcer / Revisional surgery Proforma
h) G.P. Proforma

Appendix 2: Structure of ulcer data file

Appendix 3: Published papers

a) Highly Selective Vagotomy for Duodenal Ulcer. Proc. R. Coll. Phys. Edin. 1988; 18: 59-62

b) Auditing outcome after Gastro-intestinal operations - the evolution and work of a Surgical Review Office. Health Bulletin 1988; 46/6: 307-310.

c) Extending Surgical audit: the assessment of postoperative outcome. Br. J. Surg. 1989; 76: 531-532.

d) Highly Selective Vagotomy 5-15 years on. Br. J. Surg. 1990; 77: 65-69.

e) Impact of H2 receptor antagonists on the outcome of treatment of perforated duodenal ulcer. J. R. Coll. Surg. Edin. 1990; 35: 345-352.

f) Highly Selective Vagotomy - a safe operation for duodenal ulcer. Eur. J. Surg. 1991; 157: 261-265.

SHEET 1 **GASTRIC FOLLOW-UP CLINIC**

Patient's Name ..... Hosp. No. _____

Address ..... Card Type (1-2) _____

..... Follow-Up No. (3-6) _____

Sex: (9) Male = 1. Female = 2. Age (7-8) _____

Occupation: .....

Date of Operation (10-15) _____

Civil State: (16)

1 Married
2 Single
3 Widowed
4 Separated or Divorced
5 Not known

Social Grade: (17)

1 Higher admin.
2 Int. admin.
3 Skilled Worker
4 Semi-skilled
5 Unskilled
6 Retired
7 Unemployed
8 N/A
9 Not known

Blood Group: (18)

A	B	AB	O	Not known
1	2	3	4	5

Weight: (Kgms) (19-21) _____

Best Weight: (Kgms) (22-24) _____

Standard Weight: (Kgms) (25-27) _____

Height: (cms) .....

Admission: (28) ^{1}Emerg. / ^{2}W.L. Operation: (29) ^{1}Emerg. / ^{2}Cold

Primary: (30-36) DIAGNOSIS

30 Gastric Ulcer
31 Duodenal Ulcer
32 Erosions
33 Adult Hypertrophic Pyloric Stenosis
34 Hiatus Hernia
35 Second Part DU
36 Duodenal Ileus

Secondary: (37-43)

37 None
38 Perforation
39 Stenosis
40 Haemorrhage
41 Carcinoma
42 Oesophagitis
43 Oesophageal Stricture

Duration of symptoms in years (if less than a year = 1) (44-45) _____

Previous ulcer complications: (46-49)

46 None
47 Haemorrhage
48 Perforation
49

Other Related conditions: (50-56)

50 None
51
52 Pulmonary TB
53 Steroid/aspirin therapy
54 P.O.W.
55 Cholelithiasis
56 Cirrhosis

SHEET 2

Familty History: (57)	Smoking: (58)	Alcohol: (59)
1 None	1 Not known	1 Not known
2 Not known	2 Non-Smoker	2 T.T.
3 1-2 sibs or relations	3 Previously Smoked	3 Previously Drank
4 Exceptional	4 Smoker	4 Mod. Drinker
		5 Heavy

INVESTIGATIONS

Pre-operative Insulin Test: (60-61) .....
(not known/not done = X)

Pre-operative Stimulation Test: (62-63) .....
(not known/not done = X)

Type of Stimulation Test: (64)

1 Histamine	4 Pentagastrin	5
2 Maximal Histamine	3	6

Oesophagoscopy/Gastroscopy: (65-73)

65 Not done/no records

66 Failure to pass gastroscope

67 Failure to pass fibroscope

68 Gastroscopy complicated by Trauma

69 Fibroscopy complicated by Trauma

70 Gastroscopy correct interpretation

71 Gastroscopy incorrect interpretation/
or ulcer not seen

72 Fibroscopy correct interpretation

73 Fibroscopy incorrect interpretation/
or ulcer not seen

Barium Meal: (74-80)

74 Not done / no record

75 Incorrect interpretation - reported normal

76 Incorrect interpretation - ca reported

77 Correct interpretation

78

79

80

SHEET 3

Card Type (1-2

Follow-Up No. (3-6)

TREATMENT

Surgeon:

Primary Surgical Treatment: (7-20)

7 Polya Gastrectomy
8 Billroth I Gastrectomy
9 Gastroenterostomy
10 Pyloroplasty
11 Closure of Perforation
12 Total Gastrectomy
13 Repair of hiatus hernia
14 Vagotomy - Truncal
15 Vagotomy - Selective
16 Entero-anastomosis
17 Excision of ulcer
18 Suture of Ulcer (bleeding)
19 Blind resection (bleeding)
20 Cholecystectomy

Immediate complications of Primary Surgical Treatment: (21-49)

21 None
22 Death +/- Revisionary surgery
23 Peritonitis
24 Subphrenic Abscess
25 Necrotising enteritis
26 Leaking stump
27 Anastomotic Leak

---

28 Damage to C.B.D.
29 Damage to spleen
30 Damage to Oesophagus
31 1 Stomal obstruction
2 Intestinal obstruction
32 Paralytic Ileus
33 Stammers hernia

---

34 Haem. post-op from anastomosis
35 Haem. post-op intra-peritoneal
36 Pulmonary Infection/ Collapse
37 Pulmonary embolism

---

38 Deep Venous Thrombosis
39 Coronary Thrombosis
40 Cardiac Arrest
41 Shock
42 Oliguria, uraemia
43 Dysphagia
44 Diarrhoea
45 Pancreatitis
46 Burst wound
47 Wound infection
48
49

Revisionary and Additional Surgical Treatment during first Admission: (50-65)

50 None
51 Conversion of Billroth I to Polya
52 Conversion of G.E. to Polya
53 Vagotomy - Truncal
54 Vagotomy - Selective
55 Entero-anastomosis
56 Gastroenterostomy
57 Polya gastrectomy
58 Division of adhesions
59 Drainage of Abscess
60 Jejunostomy
61 Pyloroplasty
62 Resuture of burst Abdomen
63
64
65

SHEET 4 Follow-up and Assessment Card Type (1-2)

Name of Patient: ..... F.U. No. (3-6)

1 Address: (15) ..... No. of Exam. (7-8)

2 Changed-U.K. ..... Date of Exam. (9-14)

3 Emigrated .....

1 Doctor: (16) .....

2 Changed (diff. practice) .....

Length of F.U. (years): (17-18)

Length of convalescence after operation/work loss since last report 8weeks) (19-21)

Post-operative Insulin Test: (22-23) .....
(not known/not done = X)

Post-operative Stimulation Test: (24-25) .....

Type of Stimulation Test: (26)

1 Histamine	4 Pentagastrin	5
2 Maximal Histamine	3	6

Interpretation of Secretory Tests: (27)

1 Vag. comp.
2 Vag. Incomp.
3 Ant. Comp. - Referable to
4 Ant. Incomp. Gastrectomy only

5 Vag. Comp./Ant. Comp.
6 Vag. Comp./Ant. Incomp.
7 Vag. Incomp./Ant. Comp.
8 Vag. Incomp./Ant. Incomp.
9 N.A. eg. Pyloroplasty, G.E. etc.

Change of Job: (28-30)

Death during follow-up: (31) Date of Death (32-37)

Main cause of death: (38-39)

1 Coronary Thrombosis
2 C.V.A.
3 Ca Lung
4 Ca Stomach
5 Ca Colon
6 Ca Pancreas
7 Other abdo Ca
8 Pulmonary T.B.
9 Suicide
10 Accident
11 Senility
12 Intestinal Obstruction
13 Further Ulcer
14
15
16

SHEET 5

Complications during follow-up (40-55)

40 None
41 Bile Vomiting
42 Dumping
43 Iron Deficiency Anaemia
44 Macrocytic Anaemia
45 Malabsorption
46 Diarrhoea
47 Cholelithiasis
48 Wound Hernia
49 Stomal Obstruction
50 Intestinal Obstruction
51 Ulcer recurrence - Jejunal
52 Ulcer recurrence - Gastric
53 Ulcer recurrence - Suture Line
54 Ulcer Reactive Duodenal
55 Pulmonary T.B.

Psychiatric State: (56-61)

56 Not known
57 Satisfactory

New (not present pre-op)

58 Alcoholism
59 Received Psychiatric treatment
60 Attempted suicide

Where abnormal pre-op

61 1 ISQ
2 Deteriorated
3 Improved

Further surgical Treatment (62-76)

62 None
63 Polya Gastrectomy
64 Gastroenterostomy
65 Pyloroplasty
66 1 Polya to Billroth I
2 G.E. to Billroth I
3 Pyloroplasty to Billroth I
67 1 G.E. to Polya
2 Billroth I to Polya
3 Pyloroplasty to Polya
68 Polya to Higher Polya
69 1 G.E. to Pyloroplasty
2 Billroth I to Pyloroplasty
70 Interposition of jejunal loop
71 Entero-anastomosis
72 1 Vagotomy - Truncal
2 Vagotomy - Selective
3 Vagotomy - Completion
73 Repair of Hiatus Hernia
74 Repair of Incis. Hernia
75 Division of Adhesions
76 1 Cholecystectomy
2 Radiotherapy

Date: .....

Hospital: (if other than WGH) .....

Weight (77-79) ..... (Kgms)

Visick Grading: (80)

1 = 1
2 = 2
3 = 3s
4 = 3u
5 = 4
6 = N/A (death since last assessment)

PEPTIC ULCER SURGERY

BASE DATA

Date: .....

Name: ..... F.U. No.: P. .....

Address: ..... Hospital: .....

..... Hospital No.: .....

General Practitioner: ..... Date of Birth: .....

..... Sex: .....

Date of Diagnosis: .....

Date of Operation: .....

Admission Type: Emergency / Elective

Operation Type: Emergency / Elective

Operation: .....

Second Operation: .....

Third Operation: .....

Surgeon's Name: .....

Surgeon's Grade: .....

Cigarettes: Yes / No / Ex. / Not Known

Alcohol: Yes / No / Not Known / Heavy

Weight: ..... (kilograms) Height: ..... (centimetres)

Diagnosis: D.U. / G.U. / P.P.U. / Other

Secondary Diagnosis: None / Stenosis / Haemorrhage / Oesophagitis /
Oesophageal stricture / Other (specify) .....
.....

Pre-Operative symptoms:

Epigastric pain	Yes / No	Duration ..... (months)
Heartburn	Yes / No	Duration ..... (months)
Vomiting	Yes / No	Duration ..... (months)
Dysphagia	Yes / No	Duration ..... (months)
Weight loss	Yes / No	Duration ..... (months)

Previous Complications: None / Haematemesis / Perforation / Other (specify)
.....

Family History: ..... (number of first degree relatives with proven D.U.)

H2 Blockers Pre-op.: Not Known | No | Yes - Failed to respond | Yes - Relapsed after course | Yes - Sustained remission

Other Drugs: Aspirin / NSAID / Steroid

Pre-op. MAO / Pentagastrin: ..... mMol. ..... Date

Post-op. Complications: None | Gas bloat syndrome | Intra-abdominal haemorrhage | Diarrhoea | Pulmonary infection | Wound infection | D.V.T. | Wound dehiscence | Pulmonary embolism | Lesser curve necrosis | Dysphagia | Death | Gastric stasis | Other

Date of Admission: .....

Date of Discharge: .....

Post-op. MAO / Pentagastrin: ..... mMol. ..... Date

Post-op. MAO / Sham feed: ..... mMol. ..... Date

Interpretation of Test: 0 1 2 3 4 5 (Number of criteria for incomplete vagotomy)

COMMENTS:

LOTHIAN HEALTH BOARD NORTHERN GENERAL, ROYAL VICTORIA AND WESTERN GENERAL UNIT

Western General Hospital

SURGICAL REVIEW OFFICE
ALEXANDER DONALD BUILDING

Crewe Road, Edinburgh EH4 2XU Telephone 031-332 2525

Your Ref
Our Ref IMCM/AWW
Date
Enquiries to Mrs. Wood
Ext. No. 8319

Dear

You have been kind enough to help our studies into the long term effects of stomach operations and I would again be very grateful if you could complete a short questionnaire.

I would also like to ask for your help in another way. We would like to find out more about the operation you had all those years ago and to do this one of our nurses visits people at home to weigh them and take a blood test. It would be of great help to us and to others who may need the operation if you would be willing to help in this way. Could you please complete the questionnaire and return it in the pre-paid envelope provided.

With many thanks in anticipation.

Yours sincerely,

I. M. C. Macintyre
Consultant Surgeon

[Please circle the answer which applies to you]

1. I am bothered with diarrhoea:

   every day **often** **occasionally** **never**

2. I get sweaty and/or dizzy spells after meals:

   after every meal **often** **occasionally** **never**

3. I tend to be bad tempered:

   always **often** **occasionally** **never**

4. I have no social life:

   true **mostly true** **mostly false** **false**

5. I take antacids/stomach tablets:

   every day **often** **occasionally** **never**

6. I get on with other people:

   true **mostly true** **mostly false** **false**

7. I have had no pain at all since the operation:

   true **mostly true** **mostly false** **false**

8. I can enjoy getting out of the house:

   true **mostly true** **mostly false** **false**

9. I can enjoy going away for holidays and outings:

true **mostly true** **mostly false** **false**

10. My bowel movements are regular:

always **usually** **rarely** **never**

11. I have not needed antacids/stomach tablets since the operation:

true **mostly true** **mostly false** **false**

12. I can enjoy going out for a meal:

always **usually** **rarely** **never**

13. I enjoy alcoholic refreshment:

regularly **often** **occasionally** **never**

14. I do not seem to be able to put on any weight:

true **mostly true** **mostly false** **false**

15. I have given up going on holiday:

true **mostly true** **mostly false** **false**

16. I am hardly ever sick:

true **mostly true** **mostly false** **false**

17. I have gained some weight:

true **false**

18. I enjoy my food:

true **false**

19. I wish I had never had the operation:

true **false**

20. I am sick most days:

true **false**

21. I get attacks of pain:

every day **often** **occasionally** **never**

22. I get a lot of wind:

every day **often** **occasionally** **never**

23. Place of Birth: .....

24. Date of Birth: .....

25. If married woman enter maiden name: .....

26. N.H.S. number (if known): [this is on your brown N.H.S. card] .....

27. I am willing for a nurse to visit me to take a blood test: **YES / NO**

Signed: .....

Thank you for your help

LOTHIAN HEALTH BOARD NORTHERN GENERAL, ROYAL VICTORIA AND WESTERN GENERAL UNIT

Western General Hospital

SURGICAL REVIEW OFFICE
ALEXANDER DONALD BUILDING

Crewe Road, Edinburgh EH4 2XU Telephone 031-332 2525

Your Ref
Our Ref
Date
Enquiries to
Ext. No.

Dear

The Follow-Up Clinic at the Western General Hospital was set up to monitor the long term results of different types of operations. To do this successfully we count on th cooperation of patients who have had the operations (sometimes many years before) to tel us how they are getting on by answering a few simple questions.

We would greatly appreciate if you could spare a few moments to answer the following questionnaire about your ulcer or hiatus hernia operation. I enclose a pre-paid envelope for your reply.

With thanks,

Yours sincerely,

Iain Macintyre

I. M. C. Macintyre
Consultant Surgeon

[Please circle the answer which applies best to you]

I get stomach pain:	Every day / Most days / Occasionally / Never
I get flatulence: [excessive belching]	Every day / Most days / Occasionally / Never
I get heartburn:	Every day / Most days / Occasionally / Never
I get nausea:	Every day / Most days / Occasionally / Never
I vomit:	Every day / Most days / Occasionally / Never
I feel bloated: [bagged-up]	Every day / Most days / Occasionally / Never
I am able to eat normal sized meal:	Every day / Most days / Occasionally / Never
I have difficulty in swallowing or feel food sticking:	Every day / Most days / Occasionally / Never

My appetite is:	Poor / Good
In general I enjoy my food:	Yes / No
Since operation my weight has:	Increased / Decreased / Remained same
I get sweaty/dizzy spells after meals:	Every day / Most days / Occasionally / Never
Certain foods disagree with me:	Yes / No If YES specify .....
My bowels move:	..... times a day
I get diarrhoea:	Every day / Most days / Occasionally / Never
Since operation my original problem has been:	Cured / Improved / Same / Worse
My operation has been a success:	Yes / No
Please state how many cigarettes you smoke per day:	..... cigarettes a day
Alcohol:	I don't drink alcohol / Would like to drink but cannot / Drink alcohol as I want
I take Tagamet (Cimetidine):	Every day / Most days / Occasionally / Never
I take Zantac (Ranitidine):	Every day / Most days / Occasionally / Never
I take Antacids (eg Aludrox, Maalox, Gaviscon, Asilone, Mucaine, Gastrocote, Rennies, Bisodol):	Every day / Most days / Occasionally / Never
Place of birth:	.....
Date of birth:	.....
If married woman enter maiden name:	.....
N.H.S. number (if known): [this is on your brown NHS card]	.....

[Please list any hospital admissions since last follow-up]

Date	Hospital	Problem

PEPTIC ULCER SURGERY

FOLLOW-UP AND ASSESSMENT

Name: ..... Date of Review: .....

Address: ..... F.U. No.: P .....

..... Date of Birth: .....

General Practitioner: ..... Weight: ..... (kilograms)

..... Height: .....(centimetres)

Stomach pain:	Every day / Most days / Occasionally / Never
Belching:	Every day / Most days / Occasionally / Never / Unable To
Heartburn:	Every day / Most days / Occasionally / Never
Nausea:	Every day / Most days / Occasionally / Never
Vomiting:	Every day / Most days / Occasionally / Never / Unable To
Bloating (bagged-up) after meals:	Every day / Most days / Occasionally / Never
Able to eat normal sized meal:	Yes / No
Unable to eat specific food:	Yes / No (specify) .....
Difficulty in swallowing/ food sticking:	Yes / No
Appetite:	Poor / Good
Enjoying food:	Yes / No
Since operation my weight has:	Increased / Decreased / Remained Same
Sweaty dizzy spells after meals:	Every day / Most days / Occasionally / Never
How often do bowels move:	..... times / week
Diarrhoea:	Every day / Most days / Occasionally / Never
Since operation problem has been:	Cured / Improved / Same / Worse
Operation been a success:	Yes / No
Average time off work due to stomach problems:	..... (days per month)

Cigarette smoker:	Non / Ex.
If smoker how many:	..... / day
Alcohol:	T.T. / Unable / Drink normally
Drugs:	
H2 Blockers:	Every day / Most days / Occasionally / Never
Antacids:	Every day / Most days / Occasionally / Never
NSAID/Steroid/Aspirin:	Every day / Most days / Occasionally / Never
Hospital admissions since last follow-up:	Yes / No (specify)
	.....
	.....
Further surgery since last follow up:	.....
	.....
Ulcer recurrence since last follow-up:	Yes / No
Overall (Visick) Grade:	1 2 3 4

COMMENTS:

RECURRENT ULCER/REVISIONAL SURGERY

Name: ..... F.U. No.: .....

Previous Operations 1: .....

Previous Operations 2: .....

Previous Operations 3: .....

Hospital of Original Operation: .....

Date of Initial Operation: ..... Interval to Recurrent Symptoms: .....

Cigarettes: Yes / No / Ex. / Not Known Weight: ..... (kilo)

Alcohol: Yes / No / Not Known / Unable Height: ..... (cms.)

Presenting Symptoms:

- Epigastric pain
- Nausea
- Vomiting
- Haemorrhage
- Heartburn
- Back pain
- Bloating
- Anaemia
- Perforation
- Other (specify)

.....

Method Diagnosis: Endoscopy / Barium meal / Other (specify) .....

Diagnosis: .....

Date of Diagnosis: .....

Medical Treatment: Yes / No

- Cimetidine
- Denol
- Ranitidine
- Gastrozepin
- Sucralfate
- Other (specify)

.....

Success of Medical Treatment:

- Not Known
- Ulcer failed to respond
- Ulcer symptoms relapsed after course
- Ulcer healed and ulcer symptoms relieved
- Symptomfree on definitive medical treatment

Revisional Operation 1: .....

Revisional Operation 2: .....

Date of Operation: .....

Operation Type: Elective / Emergency

Surgeon's Name: .....

Surgeon's Grade: .....

Post-operative Complications:

None	Pulmonary infection
Intra-abdominal haemorrhage	D.V.T.
Pulmonary embolism	Dysphagia
Gastric stasis	Diarrhoea
Sub-phrenic abscess	Wound infection
Wound dehiscence	Death

Other (specify) .....

Date of Admission: .....

Date of Discharge: .....

COMMENTS:

LOTHIAN HEALTH BOARD NORTHERN GENERAL, ROYAL VICTORIA AND WESTERN GENERAL UNIT

Western General Hospital

SURGICAL REVIEW OFFICE
ALEXANDER DONALD BUILDING

Crewe Road, Edinburgh EH4 2XU Telephone 031-332 2525

Your Ref
Our Ref
Date
Enquiries to
Ext. No.

Dear

re: _____

The Surgical Review Office aims to review the long term outcome in patients having gastro-intestinal operations in this hospital.

To do this we are dependant on the help of G.P. colleagues and I would be very grateful for the following information on the above patient.

N.H.S. Number .....

Is the patient still alive ? .....

If YES any change of address .....

.....

If DEAD date and certified cause of death .....

.....

.....

I enclose a prepaid envelope. Thank you for your help.

Yours sincerely,

Iain Macintyre

I. M. C. Macintyre
Consultant Surgeon

Enc.

PN86

APPENDIX 2

STRUCTURE OF ULCER DATA FILE

STRUCTURE FOR DATABASE

Field	Field Name	Type	Width
1	Funumber	Character	8
2	Recno	Character	4
3	Surname	Character	20
4	Maidname	Character	20
5	Forename	Character	20
6	Address	Character	100
7	Ageatop	Numeric	2
8	Birthdate	Date	8
9	Birthplace	Character	20
10	Sex	Character	1
11	Hospnumber	Character	10
12	NHSnumber	Character	20
13	NInumber	Character	20
14	Dateop	Date	8
15	Admission	Character	2
16	Optype	Character	2
17	Diagop1	Character	6
18	Diagop2	Character	6
19	Diagop3	Character	6
20	Preulcomp	Character	2
21	Cigs	Character	2
22	Alcohol	Character	2
23	MAO	Numeric	3
24	Surgeon	Character	15
25	Surgrank	Character	2
26	Postcomp	Character	50
27	Secondop	Character	6
28	Opdate2	Date	8
29	Optype2	Character	2
30	Opdiag2	Character	18
31	Surg2	Character	15
32	Surgrank2	Character	2
33	Opcomp2	Character	50
34	Dead	Character	2
35	Lostfu	Character	2
36	Lostdied	Date	8
37	Datelost	Date	8
38	Lostfuexpl	Character	100
39	PostopMAO	Numeric	2
40	InterpMAO	Character	2
41	Fucomp	Character	100
42	Causedied	Character	100
43	Causedied2	Character	100
44	Causedied3	Character	100
45	Cod_code	Character	6
46	Sourceinfo	Character	2
47	Revisop	Character	18
48	Visick1	Character	2
49	Date1	Date	8
50	Visick2	Character	2
51	Date2	Date	8
52	Visick3	Character	2
53	Date3	Date	8
54	QOL1	Numeric	2
55	Pain1	Numeric	2
56	Res1	Character	1

Field	Field Name	Type	Width
57	Dateqp1	Date	8
58	QOL2	Numeric	2
59	Pain2	Numeric	2
60	Res2	Character	1
61	Dateqp2	Date	8
62	QOL3	Numeric	2
63	Res3	Character	1
64	Pain3	Numeric	2
65	Dateqp3	Date	8
66	QOL4	Numeric	2
67	Pain4	Numeric	2
68	Res4	Character	1
69	Dateqp4	Date	8
70	Tests	Character	1
71	Ulcerful	Character	1
72	Datefu1	Date	8
73	Fulrecno	Character	4
74	QP5	Character	1
75	Dateqp5	Date	8
76	Comments	Memo	10

APPENDIX 3a

HIGHLY SELECTIVE VAGOTOMY FOR DUODENAL ULCER

Surgical Science for Physicians

HIGHLY SELECTIVE VAGOTOMY FOR DUODENAL ULCER

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As the incidence of duodenal ulceration declines and medical treatment becomes ever more potent, highly selective vagotomy, sometimes called proximal gastric vagotomy, may represent the end of the era of surgical treatment.

The physiological basis for vagotomy as an acid reducing procedure was well established by the early years of this century. Claude Bernard and Pavlov realised the potential of vagal section in acid reduction, paving the way for Exner and Schwarzmann[1] to report a series of patients in whom anterior truncal vagotomy was successfully performed. The credit for the detailed description of the anatomy of the vagal supply to the stomach goes to Latarjet.[2] He described a procedure which attempted to divide the secretory and motor nerve fibres to the body of the stomach to the parietal cells whilst preserving the purely motor supply to the antrum. Yet his report was ignored by, or unknown to, mainstream surgical opinion until highly selective vagotomy was described in the late 1960s. Although gastric resection remained the standard surgical approach for peptic ulceration, the short term sequelae (dumping, bile vomiting) and the long term complications (osteomalacia, malnutrition, anaemias) forced surgeons to seek a less radical alternative. The report by Dragstedt[3] of truncal vagotomy in 1943 established the basis of modern surgical practice. No sooner had the need for a drainage procedure been appreciated, than the problems from the resulting gastric incontinence became apparent. Indeed one surgical cynic was prompted to remark that 'every operation for duodenal ulcer is a success—until it is found out.'[4]

Although Holle and Hart[5] described fundal denervation in man in 1967 it was the independent reports of Amdrup[6] and Johnston[7] in 1970 that heralded the introduction of highly selective vagotomy to modern clinical practice.

The theoretical advantages of denervation of the parietal cell mass, with preservation of antral emptying and thus avoidance of a drainage procedure, have been amply borne out in practice. Many series attest to the reduction in morbidity from dumping, bile vomiting and diarrhoea, and in mortality.[8, 9, 10] Similarly early anecdotal reports of lesser curve necrosis following the procedure have subsequently been shown to be associated with the use of diathermy or accompanying fundoplication.[11] The reported incidence of this complication was 0·2 per cent in one large series[12] and is even lower or absent in later series. In the Lothian Health Board Area of South East Scotland the operative mortality over the past eight years has been 0·05 per cent.[13]

If highly selective vagotomy has been 'found out' it is in the area of recurrent ulcer. Some early series reported recurrence rates of the order of 20 per cent.[14, 15] It seems likely that these resulted from an inadequate vagotomy. By measuring intra-operative gastric pH, Johnson[16] was able to define those anatomical areas in which surgeons commonly missed secretory vagal fibres.

As a result the operation has evolved and improved. Denervation of the entire intra-abdominal oesophagus and denervation of the fundus to divide the 'criminal nerve' of Grassi[17] are now practised as standard. Furthermore the length of antrum to remain innervated has been reduced from 10 cm in the original reports to 6–7 cm in the modern operation. Several series published since this was adopted have reported five year recurrence

rates varying between 1·5 and five per cent.[18–20] In general results are better in single surgeon series than in multiple surgeon series.[21]

A study from Copenhagen reports long term follow-up 14–18 years after the procedure.[22] Although the recurrence rate is an alarming 30 per cent, the procedures were performed between 1969–73 and may have been inadequate by modern standards. Furthermore 40 per cent of the ulcers operated upon were pyloric or prepyloric which are now known to do so badly following highly selective vagotomy that mainstream surgical opinion no longer regards them as an indication for the procedure. Long term follow-up of operations performed during 1975–80 will provide a more accurate test of the operation.

What is disturbing from the Copenhagen series is that only one third of the recurrences were manifest at five years—some presented 16 years post-operatively—and it seems likely that more will occur with time. This suggests, as the possible explanation, nerve regeneration by sprouting from the antral and oesophageal mucosal plexuses but further studies are required to validate this.

Before rejecting the operation on the grounds of a high long term recurrence rate we should bear in mind that recurrent ulcer following peptic ulcer surgery no longer carries the serious prognosis that once it did. Before H2-receptor blockers became available recurrent ulceration following vagotomy and drainage, or Polya gastrectomy, was regarded as a disaster which usually required further operation. All that has changed. Recurrent ulcer following highly selective vagotomy usually heals rapidly with H2-receptor blockers.[23, 24] Thus although the operation has failed in its objective of abolishing the ulcer diathesis it has reduced the aggression of the disease. Nor should we lose sight of the fact that even in the worst series 70 per cent of patients remain free of recurrence and most published series claim a recurrence rate at 10 years of less than 10 per cent.

What should be the place of the procedure in the modern management of peptic ulcer disease? Most agree that it has no place in the emergency treatment of the bleeding or perforated ulcer. It is too time consuming and technically demanding. In pyloric stenosis the operation is not indicated (Johnston's suggestion[25] of pyloric bouginage has failed to convince many surgeons). Failure of medical treatment remains the principle indication for the procedure. The criteria of failure, however, remain subjective and vary widely between clinicians.

In choosing between long term H2-receptor blockade and highly selective vagotomy the clinician should remember also that H2-receptor blockade does not abolish the diathesis. The more rigid standards by which surgery is assessed is exemplified by the different ways in which studies of drug treatment and surgical treatment are reported. For drugs we read of 'healing rates at eight weeks'; for operation of 'recurrent rates at five years'. Those studies which directly compared highly selective vagotomy and long term H2-receptor blockers show an overwhelming advantage for the operation.[26, 27]

Do physicians, conditioned by drug induced healing rates at eight weeks, overlook the failure of the drugs to control the disease in the long term? The ulcer recurrence rate after a course of cimetidine, and the other H2-receptor blockers are little different, at one year is 80–90 per cent.[28] Even on low dose maintenance therapy the relapse rate is 30 per cent per year.[29]

The failure of short term courses of ulcer healing agents to prevent recurrence of the disease in the long term has prompted Wormsley[30] to observe that '. . . maintenance treatment is necessary for the duration of the disease and since we do not know how long the relapsing tendency lasts the treatment may be required throughout life'.

The prospect facing the clinician and the patient with the duodenal ulcer diathesis is not

merely a short term course of an effective, safe and cheap preparation, but of maintenance therapy for life with the attendant problems of compliance and cost and the concern about carcinogenesis. Studies comparing the cost of the operation with maintenance Cimetidine show drug costs equalling operation costs at five years and by 10 years the drug is £3,000 more expensive.[31] Whilst the possible role of H2-receptor blockers in causing some forms of gastric cancer must await long term follow-up, it is worrying that several animal models develop stomach cancer when powerful ulcer healing drugs are given long term.[32] It is reassuring that no such reports concerning man have emerged about HSV almost 20 years since its introduction into clinical practice.

Will highly selective vagotomy prove the final surgical offering in the treatment of duodenal ulceration? Taylor's[33] seromyotomy, a variation on the theme involving division of the vagal branches by a single incision of the serosa has not found favour with many surgeons and it is difficult to envisage any further refinements of denervation of the parietal cells. Stripping of the human antral mucosa has not yet been reported but in dogs it produces similar acid reduction to vagotomy and antrectomy whilst preserving normal gastric emptying.[34] Until such time as more powerful long acting ulcer suppressing drugs are developed and shown to be free of the risk of cancer, highly selective vagotomy seems destined to remain the best surgical contribution to the treatment of peptic ulceration and probably the last one.

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APPENDIX 3b

AUDITING OUTCOME AFTER GASTRO-INTESTINAL OPERATIONS - THE EVOLUTION AND WORK OF A SURGICAL REVIEW OFFICE

Auditing Outcome After Gastro-Intestinal Operations—The Evolution and Work of a Surgical Review Office

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Edinburgh EH4 2XU

Introduction

The move to greater accountability affects everyone involved in health care. Clinicians increasingly have to provide performance indicators demonstrating their workload and the cost effectiveness of the management of their patients. Surgeons, particularly gastro-intestinal (GI) surgeons, were pioneers of auditing process. Theodore Billroth, Professor of Surgery in Vienna towards the end of the last century, began a system of recording the number and types of operations performed in his hospital and of the outcome in hospital. In Edinburgh after the Second World War, James Learmonth established a system of documenting a yearly record of operations and of post operative deaths in each surgical unit which has developed subsequently into the Edinburgh Surgical Audit. This system[1], now computer based, audits process, allowing for the accurate and rapid analysis of operative procedures. The natural corollary to this is the need for a system which will audit outcome.

This paper describes such a system which audits the outcome following gastro-intestinal surgery.

Historical Background

The Gastro-Intestinal Unit at the Western General Hospital was established in 1948. The most common surgical procedures on the GI tract over the next two decades were for peptic ulcer disease and its complications. As there was little in the way of effective medical treatment most patients came to surgery.

The Gastric Follow-Up Clinic was established in 1959 for the long term follow-up of patients following peptic ulcer surgery. The problems associated with long term follow-up of patients and how these can be resolved have been outlined in earlier publications[2, 3].

As the reputation of the GI Unit spread a large clientele of peptic ulcer surgery was built up. The sheer numbers of patients and the volume of data, however, brought further problems.

Problems

By the early 1980s over 4,000 patients had been registered each with over 100 items of standard data collected on proformas. Although provision had been made for a coding system all analyses had to be done manually. In addition the follow-up information was recorded in freetext and unstructured. To ease analysis of these data a 'quality of life'

questionnaire was devised which allowed calculation of a quality of life score[4]. Whilst this readily identified those patients in whom the operation had failed it did not allow detailed analysis of symptoms or complications.

The second problem was of the decline in incidence of peptic ulcer disease which began in the Western World in the 1960s. The introduction of H2 receptor antagonists in the mid 1970s further exaggerated this fall[5]. By the mid 1980s operations for peptic ulcer had fallen to less than one quarter of the 1960s peak and revisional operations for peptic ulcer disease had virtually disappeared. Pari passu operations for gall stones and large bowel disease now began to increase. The need to diversify into the follow-up of other procedures was apparent.

Solutions

The obvious solution to the problem of data volume was a computer system. In preparation for this it was first necessary to decide on which data to record, to structure the freetext data and to devise a standard follow-up questionnaire to be used for each follow-up contact whether by post, phone, clinic or home visit.

The choice of hardware was governed by the need for a 20 M byte hard disc for storage, the desire for IBM compatibility and cost. An NCR-PC with 100% IBM compatibility was selected.

Of the software then available, D Base III Plus had the advantages of being tried and tested, of power and speed to analyse large data sets, ease of operator use and the prospect of regular software updates.

The original data set has been recorded as a single file 'ULCER' containing 47 fields and 4,300 patients.

The need to diversify was achieved by setting up further data sets for different GI operations (Table I). Each of these has a common stem of identical biographical data and the same uniform structure. The files can be linked to enable interrogation of the entire data set, as required for enquiries under the Data Protection Act.

Table I: File Names and Contents

ULCER	Operations for peptic ulcer from 1947
PUSURG	Operations for peptic ulcer—prospective
PERFPU	Operations for perforated peptic ulcer—retrospective
HSV	Highly selective vagotomy—prospective
RECULCER	Recurrent ulcer after peptic ulcer surgery
FUNDO	Fundoplication—prospective
BOWELCA	Colon and rectal cancer—prospective
GASTRICA	Gastric carcinoma—prospective

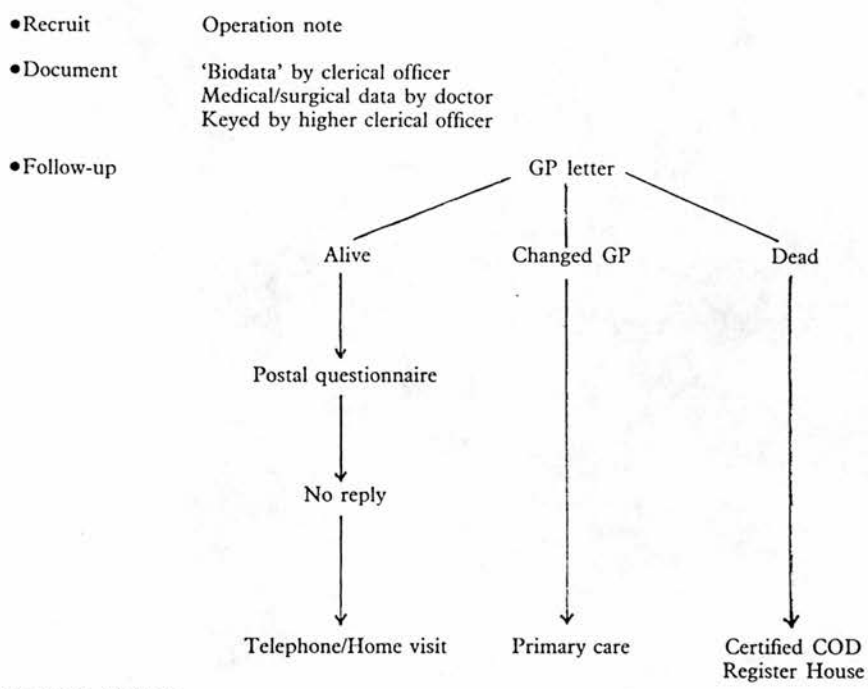

Figure 1. Methods

Methods

The methods used by the Surgical Review Office are shown in Figure 1.

Patients are 'recruited' to the register from the operation note, copies of which are sent daily to the office. Standard biographic information is entered on the appropriate proforma by a clerical officer from the case notes. The medical and surgical details are entered from the case notes by a surgeon and the information keyed by a higher clerical officer.

The follow-up is carried out annually. A letter is first sent to the general practitioner (GP) to find out whether the patient is alive and remains on the practice list. If so a postal questionnaire is sent. If no reply is received the patient is contacted by home visit or telephone. If the patient has changed GP the new GP is located through the Primary Care Division of the appropriate Health Board.

If the patient has died the certificated cause of death is found from Register House.

Discussion

Process has, and always will be, easier to measure especially for surgeons. Enumeration of out-patients seen, operations performed and post-operative deaths is a basic indicator of the performance of a unit[6, 7, 8, 9, 10]. The statistics derived from this are valuable when planning the deployment of medical manpower and resources, and have become a pre-requisite for the recognition of units for surgical training. The Royal College of Surgeons of Edinburgh for example requires unit audit if a training post is to be recognised.

However, such figures have their limitations. They indicate *quantity* of workload but not *quality* of medical care. How can we best assess quality control? Firstly the patients must be followed-up. Prolonged follow-up in the traditional way at the out-patient clinic is becoming less practical as staff and resources are reduced. Nor is it appropriate for patients to return year after year to repeatedly report no ill effects after a long forgotten operation.

A postal questionnaire is more convenient and less time consuming for patients and doctors and is less expensive for the Health Service. It is important to establish that the patient is alive before the questionnaire is sent. Yet follow-up must also be long term. Initial reports about the results following highly selective vagotomy claimed that the recurrent ulcer rate was about 1% after 2–3 years follow-up[11]. After 14–19 years follow-up the recurrence rate on the same patients is 30%[12].

The deficiencies of retrospective studies from case notes are well known. Case notes are frequently missing, incomplete and unstructured, making information difficult to find. Nor is it fair to expect the notes to contain information relevant to the disease under study. 'How can the man who recorded the note guess that years later some investigator will require to know whether Pumpernikel's sign was present?'

The epitome then of good follow-up is that it should be prospective, structured and long-term. It must be recorded in a form which collects all relevant information.

Review of outcome in this way seems likely to become an established part of surgical practice. Audit must move on. Our political masters will not merely ask 'How many operations did you do?'—both they and our patients will wish to know 'What are your results like five, 10 or even 20 years on?'

Surgical Review is easy to establish—continuing improvements in computer technology will make it progressively easier. It requires from managers a very modest resource allocation and from clinicians a commitment to quality control of their work.

Acknowledgements
I would like to thank Mr W P Small through whose foresight and diligence the Gastric Follow-Up Clinic was established and flourished; the staff of the Surgical Review Office who make it all work; and Professor A N Smith reading the manuscript. The computer was the generous gift of the late George Munro.

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APPENDIX 3c

EXTENDING SURGICAL AUDIT: THE ASSESSMENT OF POSTOPERATIVE OUTCOME

Br. J. Surg. 1989, Vol. 76, June, 531–532

Extending surgical audit: the assessment of postoperative outcome

Everyone involved in health care is subjected increasingly to greater accountability. The present Government's concept of 'value for money' seems destined to be applied more and more to the Health Service; a policy that will inevitably involve auditing not only resources but results. If surgeons are to 'sell' their skills on an internal National Health Service market, what criteria will be used to judge which hospital or firm or consultant is best for a particular referral? In many instances personality or geographical proximity will remain the major determinants. In other cases general practitioners and their patients may be guided more by proven results. Surgical audit seems destined to increase.

Auditing of process is already with us in the form of performance indicators of workload such as numbers of new out-patients, admissions and operations, and these are now applied to most surgeons in the UK. Yet the present emphasis on resources and their management has diverted attention from the aspect of more concern to doctors and patients – the outcome of surgical treatment. There is little merit in a clinician topping a league table for operations performed if these are inappropriate or the results are bad.

The case for surgical audit is now well established. Audit has advantages across the spectrum of those involved in patient care. It can tell surgeons how their results compare with those of their peers – an important contributor to job satisfaction perhaps, or a stimulus to improved technique. It can tell both surgeons and managers whether better performance indicators and lower costs are achieved at the expense of, for example, increased re-admission and complication rates. In short it can tell us all whether we are achieving our aims in surgical care.

Surgeons, especially gastrointestinal surgeons, were pioneers of auditing long-term outcome in their patients. Billroth was not only the father of gastrointestinal surgery but was the originator of surgical audit. In the UK, Tanner[1] and Visick[2] demonstrated both the feasibility and the value of long-term follow-up after peptic ulcer operations. These and a few others like them established exhaustive and detailed follow-up after gastric surgery and with them began reliable follow-up where only clinical impression had gone before. For example, in 1928 the largest prospective study then published, involving some 744 patients, reckoned the recurrent ulcer rate after gastroenterostomy at 2·8 per cent[3]. Even centres of excellence were not immune from dubious results; the recurrence rate at the Mayo Clinic was claimed to be 3·5 per cent after a minimum follow-up of 5 years[4]. These results we now know reflect inadequacy of follow-up rather than operative success. Has the audit of surgical outcome improved 60 years on?

Individual surgeons do not have the resources to follow up all cases in the long term. It is difficult enough for most surgeons to follow up those groups of patients in whom they have a particular interest. Pressure on hospital resources has squeezed out-patient clinics, making increasingly inappropriate the continued review of patients who remain well years after long-forgotten operations. How, then, can individual surgeons know whether their results compare with those published in the literature? How can individual surgeons know, for example: whether their recurrence rate after surgery for duodenal ulcer is 5 per cent or 40 per cent; whether their 5-year survival rate after resection for colorectal cancer is 40 per cent or 70 per cent; what the symptomatic results of their transurethral resections are after more than 1 year (how many of their patients are incontinent and how many require a further resection); whether their palliative resections for gastric cancer improve the quality of life or whether the patient is better off without surgery? It is unlikely that these questions can be answered by follow-up at the routine out-patient clinic without a structured document for collecting the data. Most surgical clinics are too busy to allow this additional time-consuming chore. It is equally unlikely that surgeons would take time to analyse such documents manually. If an audit system is to succeed it must involve minimal extra work for clinicians and secretarial or clerical staff; it must be cheap and easy to use; and it must provide relevant results which are wanted by the clinician.

The origins and working of our Surgical Review Office formed a logical, natural progression from a gastric follow-up clinic. The decline in incidence of peptic ulcer since the 1960s and the even more dramatic decline in its surgery in the 1980s necessitated diversification into other areas. Our system now audits operations for peptic ulcer (elective and emergency), gastric cancer, gastro-oesophageal reflux and colorectal cancer. The detailed techniques of recruitment, documentation and follow-up have been described elsewhere[5].

Who should do the audit? Registrars and research fellows are employed on a short-term basis. As a result, short-term follow-up studies abound, as do 'snapshot' studies of the last 50 '-ectomies' or '-plasties'. But to obtain a sustained long-term audit of a consultant's results requires that the consultant should make time to do it personally. Only the consultant has the

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continuity of employment to sustain the continuing organization of a long-term audit system.

Whilst enthusiasts have and will continue to audit their results for self-assessment, others remain to be convinced. There are some who believe that if our political and managerial masters wish to know the results of our clinical endeavours it is they and not we who should do the auditing. This option, which would involve employing medically qualified 'assessors' working for the manager, is an option that would be much less attractive to most clinicians and unacceptable to many.

Deciding which groups of patients to study in a consultant's or firm's practice and what information to collect about them involves little time and no financial outlay. The powerful commercial database packages now widely available for modern microcomputers make design of the collecting documents easy – the days of elaborate codes and margins full of numbered boxes are over. The proforma should record biographical, clinical and follow-up data. Follow-up will be increasingly carried out by postal questionnaire worded in a form that all patients can understand. The answers should be capable of direct entry on to a computer without any data manipulation or analysis.

The choice of a computer system assumes little computer knowledge and less enthusiasm, although this is progressively changing as consultants are appointed from a computer-literate generation. The system should be on the list approved by the Health Authority, should be able to run a 'friendly' commercial database, and should have at least 20 megabytes of hard disk storage. Computer costs are falling and will continue to fall.

Having said this, the decision about who should pay for the exercise should be clarified from the outset. Enthusiasts like Visick established follow-up systems out of their own pockets, but today most are financed by 'soft' money. As has happened in Lothian, UK, consultant commitment to audit can result in the Health Authority subsequently funding the system[6]. Few managers are likely, even in the current climate, to view this as a priority. Consultant commitment to the principle and a system bought with soft money will continue to be the most common method of starting up.

If auditing of outcome is to become widely established, however, it must have the support of the Royal Colleges. If they are to retain their role as guardians of quality control of a self-regulating profession they should ensure that only those units that practice audit are recognized as training posts. The Government, as paymaster of the National Health Service, has a vested interest in establishing formal quality control. The recommendations of the National Audit Office report *Quality of care in the NHS*[7] seem likely to be implemented.

Surgical audit is here to stay and destined to increase. The enumeration of patients seen and operations performed is a prerequisite in assessing performance of a surgical firm. Such statistics enable the rational planning of medical manpower and funds. Basic audit within a firm must be a criterion for recognition of surgical posts for training. Yet they only show one side of the coin – the quantity of workload but not the quality of care. Meaningful audit must include the assessment of outcome. This means prospective and long-term follow-up, which should be as complete as possible.

A postal questionnaire is more convenient and less time consuming for patient and surgeon and is cheaper for the National Health Service. Follow-up must also be long term. The early results of highly selective vagotomy claimed a recurrence rate of about 1 per cent after 2–3 years[8]. After 14–19 years the recurrence rate on the same patients was 30 per cent[9].

The audit of outcome therefore must be prospective, structured, long term and computer based. It is easy to establish. Its continued success requires from surgeons a commitment to the quality control of their work and from managers a modest resource allocation.

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APPENDIX 3d

HIGHLY SELECTIVE VAGOTOMY 5–15 YEARS ON

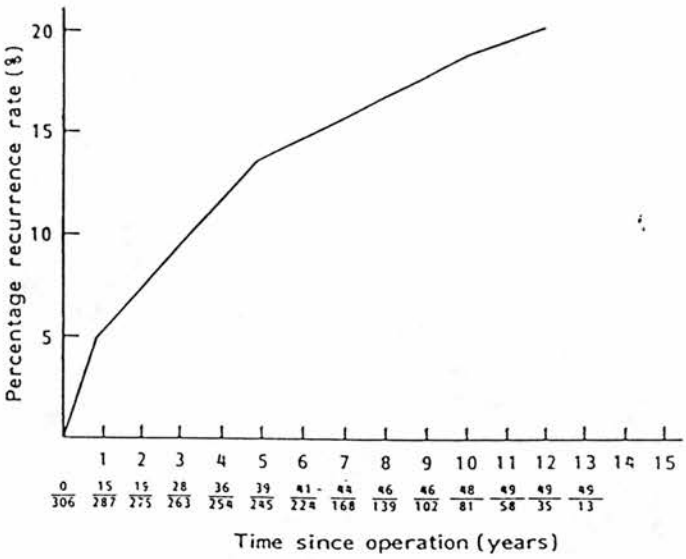

Figure 1 *Recurrent ulcer rate after highly selective vagotomy. Numbers shown on the horizontal axis are the number of patients with recurrent ulceration over those eligible for analysis at each point*

ulcer after HSV was less aggressive both in terms of presenting features and ease of treatment. In other words did 'failed' HSV convert an aggressive ulcer diathesis into a milder innocuous version, with minimal symptoms, more easily treated. We also aimed to test the hypothesis that ulcers that had failed to respond to H_2-receptor antagonists did badly with HSV. Finally we sought to determine the symptoms experienced and the need for medical treatment 5–15 years after HSV.

Patients and methods

All patients undergoing surgery for peptic ulcer disease in our hospital are documented and followed up by the Gastric Follow-Up Clinic[20]. Those patients having HSV for duodenal ulcer between 1 January 1973 and 1 January 1983 were reviewed annually by postal questionnaire or at an evening clinic or by home visit. A total of 307 operations were performed without operative mortality. The median age was 39·6 years with a range of 12·6–70·6 years. The male to female ratio was 229:78. Seventy-six per cent (234) were cigarette smokers.

Previous ulcer complications were recorded as possible indicators of severity of the ulcer diathesis. One hundred and ninety one had no previous complications, while 92 patients had previous complications; 74 had bled from the ulcer (eight with a concomitant or subsequent perforation) and 18 had a perforation alone.

Pentagastrin tests were conducted using a dose of 6 μg/kg without correction for gastric loss and duodenal reflux. Maximal acid output (mmol/h) was calculated as the acid output during the four 15 min periods after pentagastrin administration.

Only those patients with a minimum follow-up of 5 years were considered. Ten patients had died and 14 were lost to follow-up within 5 years of the operation leaving 283 (92·2 per cent) with a minimum follow-up of 5 years. In 1988 all surviving patients were reviewed by the Surgical Review Office[21] giving a 5–15 year follow-up. By this time a total of 19 patients had died and 38 had been lost to follow-up leaving 250 (81·4 per cent) available. Current symptoms and medical treatment were analysed in this group.

The first 2 years of the study antedated the introduction of H_2-receptor antagonists and most of the 103 patients not treated by H_2-receptor antagonists came from this period. Of the patients 70 had failed to heal on an H_2-receptor antagonist regimen and 101 relapsed on maintenance treatment or after cessation of treatment. No patients in the series admitted to taking aspirin and one only was on steroid therapy. Three were taking non-steroidal anti-inflammatory drugs.

Information from our standard questionnaire was transferred to an NCR-PC microcomputer and analysed using D Base III Plus (Ashton-Tate, Maidenhead, UK). The recurrence rate was estimated by life table methods and the significance of preoperative factors in predicting subsequent recurrence was tested by Cox proportional hazards regression.

Results

Of the 283 patients available for review more than 5 ye after operation, 49 (17·3 per cent) were diagnosed as hav recurrent ulcer. The cumulative recurrence rate (*Figure 1*) v 13·2 per cent at 5 years rising to 19·4 per cent at 12 years. M patients presented with epigastric pain with or without ot symptoms (*Table 2*). One patient was known to have asymptomatic recurrence revealed by routine endoscopy. It v not our policy, however, to endoscope all asymptoma patients, so that the 'silent' recurrence rate is not known. the 49 recurrent ulcers, 41 were duodenal, two gastric, th prepyloric and three pyloric. Thirty-nine ulcers were diagno at endoscopy, six at barium meal and two at laparotomy. T remaining two were diagnosed in other centres without method of diagnosis being recorded.

Risk factors

Possible risk factors are compared in *Table 3* contrast patients with and without recurrence. There was no signific difference between the two groups in age or length of hist (defined as interval between diagnosis and operation). Analy of preoperative symptoms and their duration showed significant difference between the groups. Patients present with vomiting were at higher risk at the 5 per cent level significance. There were relatively fewer recurrences in men a relatively more in cigarette smokers but neither reach statistical significance.

A previous complication of ulcer was not associated w an increased chance of recurrence. About one-third in e group had had a previous bleed and/or perforation. Nor w those ulcers resistant to H_2-receptor antagonists more lik to recur after HSV. Of the 49 patients with recurrent ulcer, (26 per cent) had failed to heal on H_2-receptor antagoni while 66 of 234 (28 per cent) without recurrence had failed respond to H_2-receptor antagonists. (*Table 4*).

Table 2 *Presentation of recurrent ulcer in 49 patients*

Epigastric pain	36	(21 had other symptom
Haemorrhage	3	(1 had other symptoms
Nausea	7	(all had other symptom
Vomiting	18	(16 had other symptom
Heartburn	7	(5 had other symptoms
Weight loss	2	(both had other sympt
Anorexia	3	(all had other symptom
Perforation	1	
No symptoms	1	
Not known	2	

Table 3 *Recurrent ulcer – possible risk factors*

	Recurrence ($n = 49$)	No recurren ($n = 234$)
Age*	37·1 (range 12·6–67·7)	40·4 (range 16·9–
Length of history*	2·1 (range 0·15–29·4)	2·1 (range 0·01–
Male†	33 (67)	180 (76·9) n.
Cigarette smokers†	42 (86)	174 (74·4) n.
Non-cigarette smokers†	7 (14)	60 (25·6) n.
Previous complications†		
none	33 (67)	158 (67·5) n.
bleed	11 (22)	55 (23·5) n.
perforation	4 (8)	14 (6·0) n.
both	1 (2)	7 (3·0) n.

* Median (range in parentheses); † number of patients (percenta parentheses); n.s., not significant

Table 4 *Resistance to H_2 blockers and recurrent ulcer*

	Recurrence ($n=49$)	No recurrence ($n=234$)	Total ($n=283$)
Failed to respond to H_2 blocker	13 (26·5)	66 (28·2)	79
Relapsed after course of H_2 blocker	18 (36·7)	83 (35·5)	101
No H_2 blocker	18 (36·7)	85 (36·3)	103

Values are numbers of patients (percentages in parentheses)

Table 5 *Percentage recurrence at 5 and 10 years according to family history*

Number of first degree relatives with diagnosis of duodenal ulcer	5 years	10 years
0	9·7 (2·3)	13·5 (3·0)
1	11·2 (3·7)	17·2 (5·0)
>1	25·9 (5·8)	33·2 (7·4)

Values are percentage (s.e.) recurrence

Table 6 *Preoperative maximal acid output studies*

	Recurrence ($n=48$)	No recurrence ($n=225$)
Preoperative maximal acid output (mmol/h)*	15–54	12–75
Preoperative maximal acid output (mmol/h)†	36·8 (10·6)	36·1 (11·3)

* Range; † mean(s.e.)

Patients with a strong family history of duodenal ulcer had a significantly higher rate of ulcer recurrence (*Table 5*).

Acid secretion studies

Maximal acid output in response to pentagastrin was recorded before operation in 273 patients and after operation in 140. The preoperative maximal acid output did not identify those at risk of recurrence (*Table 6*). Using life table analysis, postoperative maximal acid output was significantly higher ($P<0·05$) in patients who subsequently developed recurrent ulcer. The percentage reduction in maximal acid output was not, however, significantly different in the two groups. In the recurrent ulcer group, however, 10 of the 34 patients (29 per cent) showed an acid reduction of less than 20 per cent and thus could be considered to have had an inadequate vagotomy. This contrasts with only 12 out of 106 (11·3 per cent) patients without recurrence who had an incomplete vagotomy by these criteria.

Operating surgeons

Of the 19 surgeons involved in the series, five were consultants and 14 surgeons in training. The individual recurrence rate varied from 5 per cent (1 of 19) to 26 per cent (10 of 39). While the differences between the best and the worst of each group were large they were not significant and the overall consultant recurrence rate of 15·2 per cent was not significantly different from the overall recurrence rate of the surgeons in training, 19·6 per cent.

Behaviour of recurrent ulcer

Ulcer recurrence continued to present throughout the period of follow-up (*Figure 1*), the interval to recurrence varying from 1 month to 128 months after operation. The cumulative recurrent ulcer rate increased from 13·2 per cent at 5 years to 19·4 per cent at 12 years.

The treatment of the recurrent ulcers is summarized in *Figure 2*. Of the recurrent ulcers in our series, 19 could be considered innocuous, and 30 malevolent according to the classification suggested by Hoffman *et al.*[1]. Of the innocuous ulcers, five required no therapy because of minimal symptoms and three required occasional antacid or other drug treatment but not H_2-receptor antagonists. Eleven required either a single course of H_2-receptor antagonist or occasional treatment only.

The 30 malevolent ulcers included 10 which required repeated or frequent courses of treatment with H_2-receptor antagonist and 20 which required a further operation. The operations performed are shown in *Table 7*. There was no operative mortality following these revisional operations. Of the 30 malevolent recurrent ulcers, three presented with haemorrhage and one with perforation.

Current symptoms

The symptoms experienced by 250 patients 5–15 years after operation are shown in *Table 8*, comparing those with known recurrent ulcer with the others. The results are expressed as a percentage of those who had symptoms every day or most days. Overall 8·9 per cent had epigastric pain, 11·8 per cent had heartburn, 5·4 per cent dumping and 4·1 per cent diarrhoea. The commonest symptom was postcibal bloating in 21·4 per cent.

Drug treatment

Of the 240 patients who answered the question 26 (10·8 per cent) took H_2-receptor antagonists every day or most days (*Table 9*).

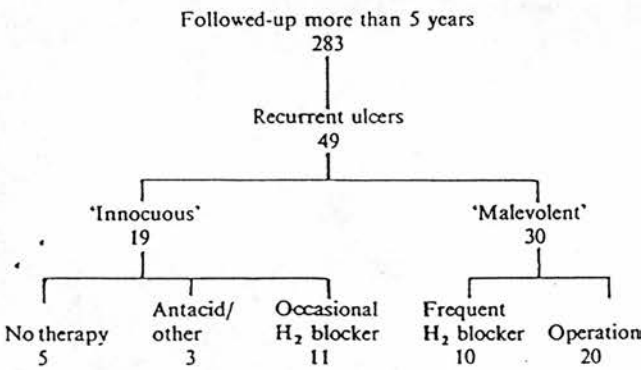

Figure 2 *Behaviour of recurrent ulcer in 49 patients*

Table 7 *Operations in patients with recurrent ulcer*

Polya gastrectomy
Billroth I gastrectomy
Truncal vagotomy and antrectomy
Truncal vagotomy and pyloroplasty
Truncal vagotomy and gastroenterostomy
Truncal vagotomy with pyloric dilatation
Gastroenterostomy
Simple closure of perforated duodenal ulcer

Table 8 *Percentage of patients 5–15 years after operation with various symptoms every day or most days* (n = 250)

	All patients	Recurrence	No recurrence
Epigastric pain	8·9	22	6·3
Heartburn	11·8	23·1	9·7
Bloating	21·4	37·5	18·3
Vomiting	1·3	5·3	0·5
Dumping	5·4	15	3·5
Diarrhoea	4·1	2·4	4·4
H_2 blocker	10·7	30·8	6·9

Table 9 *Need for H_2 receptor antagonists 5–15 years after operation (eight patients did not answer this question)*

	Recurrence ($n=39$)	No recurrence ($n=203$)	All ($n=242$)
H_2-receptor antagonists every day or most days	12 (30·8)	14 (6·9)	26 (10·7)
H_2-receptor antagonists occasionally or never	27 (69·2)	189 (93·1)	216 (89·3)

Values are numbers of patients (percentages in parentheses)

Almost one-third of patients in the recurrent ulcer group took H_2-receptor antagonists on this basis and almost one-third of these took antacids in addition.

Patients assessment

Of the 239 patients who responded to the question about the success of the operation 203 (84·9 per cent) considered the operation to have been a success while 218 (91·2 per cent) considered that their symptoms were cured or improved.

Discussion

The continuing rise in ulcer recurrence rate with time emphasizes the need for long-term follow-up in the assessment of highly selective vagotomy. The reasons for this recurrence seem to fall into two groups. First there are those in whom a seemingly satisfactory reduction in acid output has been achieved. Only one of the possible risk factors that we studied has proved to be implicated – a strong family history of ulcer disease. This raises the possibility that the aggression of the ulcer diathesis is genetically determined but not mediated through acid output. In the second group with recurrence, acid secretion studies suggest an incomplete vagotomy. We have confirmed the large individual variation between surgeons and shown that this does not correlate with seniority or experience. Although recurrence varied greatly between individual surgeons these differences were not statistically significant. The preoperative maximal acid output is not a predictor of success or failure in either group.

Our series was performed in the era of a more complete oesophageal denervation and extension of the distal denervation of the parietal cell mass. We believe that the superiority of our results compared with Hoffman's may well be explained by these improvements in technique although our follow-up period is shorter.

In studies of more radical forms of surgery[22] we have shown that patients who 'earn' their operation by enduring symptoms for many years fare no better than those with a short preoperative history. Our present study confirms that this applies also to HSV. A previous haemorrhage from or perforation of the ulcer did not predispose to recurrence after HSV. Both of these complications remain important contributors to the indications for elective duodenal ulcer surgery. It is important to know that they do not in themselves indicate an aggressive ulcer diathesis and thus do not decrease the chances of a successful HSV.

Only seven of our 49 patients with recurrent ulcer were non-smokers and two of those were considered by subsequent acid studies to have had an unsatisfactory vagotomy. Although not statistically significant this trend may mean that cigarette smoking having contributed to the failure of medical treatment can also influence surgical failure.

In this series, like those of Weaver and Temple[23] and Goodman *et al.*[24], prior resistance to H_2-receptor antagonists was not associated with increased failure of HSV, in contrast to other series[2,25]. This difference may be explained by differing definitions of failure and differences in patient compliance between the series. It is important to resolve this controversy since all patients now coming to elective surgery will have had H_2-receptor antagonists. Furthermore it is those very patie in whom these agents have failed who are selected out surgery. This study shows clearly that a high maximal a output, a previous ulcer complication and resistance to I receptor antagonists are not associated with a poorer resul

It should be emphasized that the aim of the surgi procedure is to prevent complications and abolish sympto Since only four patients in our series had a bleed or perforat after HSV compared with 92 before the operation, procedure is clearly successful in preventing these complicatior

It is also successful in abolishing symptoms or reducing th to acceptable levels in about 90 per cent of patients. commonest symptom is postcibal bloating caused by the l of adaptive relaxation as a result of denervation of the fun and body. We have shown that this symptom persists in long term in some 20 per cent of patients. Our practice is warn patients before operation of the possibility of symptom although it is regarded as a problem by very f The incidence of diarrhoea every day or most days 4·1 per cent, similar to that reported in other series. Simila only 5·4 per cent complained of symptoms of dumping and all of these the symptoms were readily controlled by medi means. Furthermore as Salaman *et al.*[26] and Muller *et a* have demonstrated these symptoms may be present in 5 per c of subjects who have not had a vagotomy.

Approximately 10 per cent of patients overall had dyspep symptoms every day or most days and were required to t daily or regular antacids or H_2-receptor antagonists to cont them.

This level of symptom control 5–15 years after operat indicates that the operation is successful in controlling disease in the long term. To assess results simply in terms recurrent ulcer can be misleading. We would support the v of Busman and Munting[28] and Byrne *et al.*[29] that measurem of symptom control is a more appropriate measure of succ or failure than recurrence rate alone. We have shown 40 per cent of recurrent ulcers are readily treated or require treatment at all. Furthermore the side effects which resulted the demise of gastrectomy and truncal vagotomy are frequent and occur in a milder, less distressing form after H The mortality rate in the Lothian Health Board area for H is 0·05 per cent in over 800 procedures confirming it as the sa operation for peptic ulcer disease[30].

We judge HSV a success in providing a disease-free inte of 15 years in about 80 per cent of patients and curing improving symptoms in some 90 per cent.

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APPENDIX 3e

IMPACT OF H2 RECEPTOR ANTAGONISTS ON THE OUTCOME OF TREATMENT OF PERFORATED DUODENAL ULCER

Impact of H_2-receptor antagonists on the outcome of treatment of perforated duodenal ulcer

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One hundred and eighty-five patients were perforated duodenal ulcer were treated at one hospital over the 21-year period which straddled the introduction of H_2-receptor antagonists. Of these 107 had simple closure, 58 simple closure with immediate H_2-receptor antagonists and 20 immediate definitive surgery. The overall operative mortality rate was 5.4%. The rate of subsequent definitive surgery declined significantly in the years after the introduction of H_2-receptor antagonists. Only a minority of those who came to subsequent definitive surgery had done so within the first year, the percentage rising from 16% at 1 year to 43.7% at 10 years. Of the patients treated by simple closure alone, 44.3% had subsequent definitive surgery compared with 24.1% having H_2-receptor antagonists in addition, but this difference was not statistically significant using life table analysis. Review of the 104 patients available in 1989 showed no significant differences in symptoms between the treatment groups. The only preoperative predictor of subsequent definitive operation was non-steroidal anti-inflammatory drug consumption which showed a negative correlation. A 3-month history of dyspepsia before perforation did not predict the need for subsequent surgery. The symptomatic results in a different group of patients who had undergone highly selective vagotomy subsequent to a previous perforation were no different from patients treated by simple closure alone or with immediate prescription of H_2-receptor antagonists. Bloating, however, was significantly more common after highly selective vagotomy. We believe that perforated duodenal ulcer should be treated by simple closure. While other studies have shown a short-term benefit from the immediate prescription of H_2-receptor antagonists, this study has shown no long-term benefit from this practice. It seems likely, however, that the significant reduction in definitive surgery after perforation is the result of the introduction of H_2-receptor antagonists into the community.

Keywords: duodenal ulcer, perforation, operation, H_2-receptor antagonists

Since the first successful procedure for perforated duodenal ulcer in 1894[1], there has been controversy about the best operation. Each new definitive operation has had its advocates in the immediate management of perforation. Although several series[2–5] had claimed good results with immediate gastrectomy, Graham's powerful advocacy[6] of simple closure (based on his series with a 2% operative mortality rate) continued to influence surgical thinking well into the 1950s. By 1960 Harkins[7] reported that three methods – simple closure, immediate vagotomy and drainage and immediate gastrectomy – were all widely practised at that time by American surgeons. The next 20 years saw the controversy change to simple closure *versus* definitive surgery, but the lack of prospective controlled trials meant that there was little scientific evidence on which to base a decision. Many surgeons adopted the policy first suggested by Illingworth *et al.*[8] in 1946 that only those patients with a prior dyspeptic history of 3 months or more should have a definitive procedure. In the 1960s and 1970s several series[9–11] showed that definitive surgery was possible without any increase i operative mortality. There remained, however, consic erable disagreement about the natural history c perforated ulcer after simple closure and the need fc subsequent definitive surgery. Reports of the need fc subsequent definitive surgery ranged from 27–71% (*Table 1*)[9,12–21].

Table 1 Further surgery after simple closure of perforated duoden ulcer

Study	*n*	Subsequent definitiv surgery (%)
Skovgaard (1977)[12]	111	71
Wagensteen *et al.* (1972)[13]	89	70
Griffin and Organ (1976)[14]	122	58
Gillen *et al.* (1986)[15]	54	57
Jarrett and Donaldson (1972)[16]	297	45
Backgaard *et al.* (1979)[17]	80	43
Nemanich and Nicoloff (1970)[18]	79	43
Heuman *et al.* (1983)[19]	77	42
Boey and Wong (1987)[20]	393	39.5
Sawyers *et al.* (1975)[9]	254	37
King and Ross (1987)[21]	86	27

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The greatest advance in the elective management of duodenal ulcer has undoubtedly been the introduction of H_2-receptor antagonists. In this study we have examined the effect of the introduction of H_2-receptor antagonists on the need for a definitive operation. Several studies in the 1980s, well into the era of the H_2-receptor antagonists, have come to differing conclusions. Simpson and co-workers[22] in 1987 demonstrated that cimetidine prescribed immediately after surgery reduced subsequent dyspepsia and ulcer complications in the short-term. By contrast Gillen *et al.*[15] found that the introduction of H_2-receptor antagonists did not reduce the need for subsequent definitive surgery which remained at a rate of 57.4% in their hands. They concluded that perforated duodenal ulcer should be treated by definitive surgery wherever possible, a view supported recently by two controlled studies[20,23] and three retrospective studies[24–26].

We, therefore, aimed in this study to determine the effect of the immediate prescription of H_2-receptor antagonists on (a) the need for subsequent definitive surgery and (b) the symptomatic outcome in patients with perforated duodenal ulcer.

Patients and methods

All patients from the Western General Hospital, Edinburgh between the years 1966 and 1986 with a diagnosis of perforated duodenal ulcer were studied to allow comparison between the patients presenting before and after the introduction of H_2-receptor antagonists. All patients were documented prospectively on a standard proforma by the Gastric Follow-up Clinic[27].

Of the 185 patients, 107 were treated by simple closure (group 1) and 58 by simple closure plus H_2-receptor antagonists for at least 1 month after operation (group 2). The remaining 20 patients had been treated by immediate definitive surgery (truncal vagotomy and drainage in 15 and Polya gastrectomy in five). The patients were initially followed up by the Gastric Follow-up Clinic and latterly by the Surgical Review Office using techniques described in detail elsewhere[28,29]. In 1989 a standard symptom questionnaire was sent to all known survivors.

A comparison between the original groups in terms of age, sex, cigarette smoking, consumption of non-steroidal anti-inflammatory drugs and steroids, and previous diagnosis or family history of peptic ulcer is shown in *Table 2*. The association between each of these factors and subsequent definitive surgery was analysed using Cox proportional hazard regression. Differences between the groups in terms of subsequent definitive surgery have been analysed using log-rank tests. Fisher's exact test was used to assess differences in symptoms between the groups.

The distribution over the 21 years of the three procedures is shown in *Figure 1*. All of the patients who had H_2-receptor antagonists were treated after 1975.

Results

Postoperative complications

The operative mortality rate was 5.4% with no deaths following definitive surgery.

Table 2 Comparison of the groups

	Simple closure ($n = 107$)	Closure plus H_2-receptor antagonists ($n = 58$)	Definitive surgery ($n = 20$)
Median age (range) years	52 (12–86)	59 (19–86)	73 (36–88)
Male:female ratio	71:36 (2.0:1)	39:19 (2.0:1)	13:7 (1.9:1)
Cigarette smoking	78 (72.9)	40 (69)	13 (65)
NSAID consumption	13 (12.1)	17 (29)	3 (15)
Steroid consumption	5 (4.7)	7 (12)	1 (5)
Total NSAID plus steroids	18 (16.8)	24 (41)	4 (20)
Previous diagnosis of peptic ulcer	28 (26.2)	8 (14)	11 (55)
Previous history of peptic ulcer	22 (20.6)	4 (7)	0 (0)

NSAID, non-steroidal anti-inflammatory drug. Values in parentheses are percentages

Outcome

The outcome of patients in the three groups is shown in *Figure 2*. Further definitive surgery was performed in 36.8% of eligible patients: in 43 of the 97 patients who survived simple closure (44.3%) but in only 14 of the 58 patients (24.1%) who survived simple closure with immediate prescription of H_2-receptor antagonists. One of the 20 patients who had definitive surgery required revisional operation – a resection of small bowel and plication of afferent and efferent loops for retrograde jejunogastric intussusception described in detail elsewhere[30].

The rate of definitive surgery in groups 1 and 2 over 10 years of follow-up is shown in *Table 3*. The percentage rose from 18.0% at 1 year to 44.7% at 10 years in the simple closure group. In group 2 the rise was from 13.3% at 1 year to 42.0% at 10 years. The differences between the groups were not significant ($P = 0.15$).

Fifty-seven patients died before review in 1989 and 24 were lost to follow-up leaving 104 available for review in 1989. The follow-up period ranged from 2 to 22 years with a mean of 10.12 years.

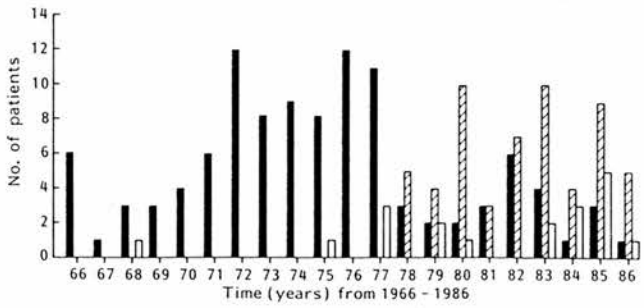

Figure 1 Distribution over 21 years of the three groups of operation for perforated duodenal ulcer: ■, simple closure; ▨, closure plus H_2-receptor antagonists; □, definitive surgery

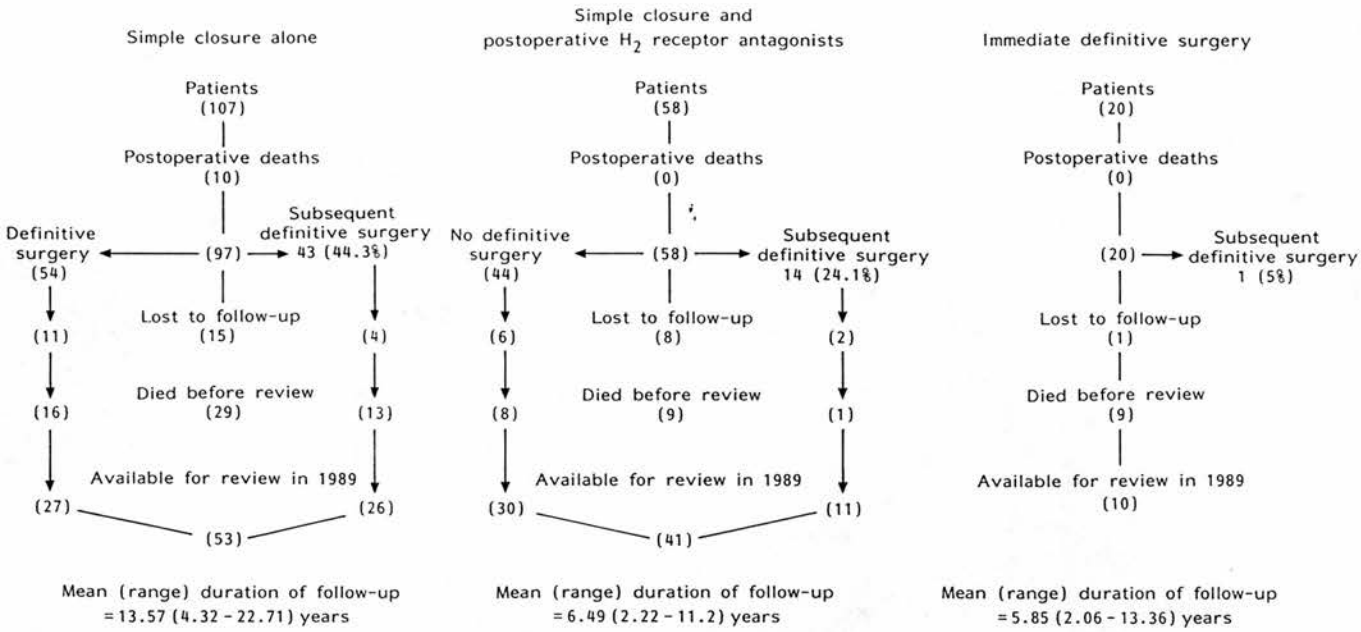

Figure 2 Mortality, definitive surgery and follow-up

Symptomatic result at long-term review

The symptoms experienced every day or most days by these patients are shown in *Table 4*. The patients' appetite, ability to eat a normal meal and to enjoy food are shown in *Table 5*, together with their opinion on whether the operation was a success. There were no significant differences between these groups.

Patients in group 2 were more likely to continue to take H_2-receptor antagonists every day or most days, 12 out of 40 patients (30%) compared with only four out of 48 (8%) treated by simple closure alone ($P = 0.05$).

The one preoperative factor which was significantly associated with subsequent definitive surgery was consumption of non-steroidal anti-inflammatory drugs. Patients taking these drugs at the time of perforation were significantly less likely ($P < 0.05$) to proceed to subsequent definitive surgery (*Table 6*).

There was a highly significant relationship between year of operation and outcome ($P < 0.01$), with more recent cases less likely to come to definitive surgery (*Table 7*). For those having simple closure, a multivariate Cox regression involving year of operation, use of non-steroidal anti-inflammatory drugs and whether or not H_2-receptor antagonists were used immediately after surgery showed no significance for the last factor when adjusted for the other two. Year of operation remained significant at $P < 0.05$.

A dyspeptic history of more than 3 months before perforation operation was not a significant predictor of the need for subsequent definitive surgery.

Discussion

Whilst elective operations for duodenal ulcer have fallen markedly in the past decade, the incidence of perforated duodenal ulcer remains static in the UK[31]. The controversy about whether it should be treated by

Table 3 Life table analysis showing relation between groups 1 and 2 and subsequent definitive surgery

Years after perforation	Percentage(s.e.m.) coming to definitive surgery	
	Simple closure Group 1 ($n = 97$)	Simple closure plus H_2-receptor antagonists Group 2 ($n = 58$)
1	18.0(3.8)	13.3(4.6)
2	30.2(4.7)	19.7(5.6)
5	39.7(5.1)	29.1(7.2)
10	44.7(5.6)	—

Table 4 Symptomatic outcome (symptoms present every day or most days)

	Simple closure ($n = 53$)	Simple closure plus H_2-receptor antagonists ($n = 41$)
Epigastric pain	4/53 (8)	1/41 (2)
Heartburn	3/53 (6)	0/41 (0)
Nausea	1/53 (2)	1/38 (3)
Vomiting	0/53 (0)	1/41 (2)
Bloating	7/53 (13)	0/40 (0)
Diarrhoea	3/51 (6)	1/41 (2)

Values in parentheses are percentages

Table 5 Patients' opinions on success of operations

	Simple closure ($n = 53$)	Simple closure plus H_2-receptor antagonists ($n = 41$)	Definitive surgery ($n = 10$)
Good appetite	45/52 (87)	38/41 (93)	8/9 (89)
Eat normal food	43/53 (81)	35/41 (85)	8/9 (89)
Enjoy food	49/51 (96)	39/41 (95)	8/10 (80)

Values in parentheses are percentages

immediate definitive surgery has continued throughout this century. The difficulty has arisen from our inability to select, at the time of the emergency operation, those patients who require definitive surgery. Selection on the basis of preceding history[21] or whether the ulcer was judged acute or chronic by the surgeon[32] has failed to identify patients who require definitive surgery. Backgaard and co-workers' study suggested that as many as 50% of patients were classified incorrectly[17]. A blanket policy of definitive surgery for all will result in unnecessary operations with their attendant side effects[33].

As H_2-receptor antagonists, supplemented latterly by omeprazole, have now largely replaced definitive surgery in the treatment of elective ulcer disease[34], it seemed logical to explore the hypothesis that these should also replace definitive surgery in the treatment of perforated ulcer. These drugs have rekindled interest in conservative treatment of perforation. The present study has shown that simple closure with the immediate prescription of H_2-receptor antagonists was associated with a reduction in subsequent definitive operations but this was not significant.

Consumption of non-steroidal anti-inflammatory drugs before perforation was the only preoperative factor significantly associated with subsequent definitive surgery. The lower rate of subsequent definitive surgery in these patients suggests that ulcers in such patients may be acute rather than chronic.

We have compared the symptomatic outcome of those patients in groups 1 and 2 with a separate group of 36 patients who had highly selective vagotomy for duodenal ulcer in our hospital, following a previous perforation elsewhere, and who had symptomatic review carried out 5–15 years after operation. The comparison is shown in *Table 8*. We have also compared the symptomatic outcome of all patients in groups 1 and 2 who had no subsequent definitive surgery with the group of 36 patients who had highly selective vagotomy following a previous perforation. This is shown in *Table 9*. Bloating, a recognized complication of highly selective vagotomy, is the only symptom significantly different in both cases. These comparisons have not taken place as part of a controlled study and those patients coming to highly selective vagotomy will include some with a more aggressive diathesis.

We recommend a policy of simple closure for all patients who present with perforated duodenal ulcer. The side effects of definitive surgery are avoided and the symptomatic results in the long-term are no worse. We would recommend immediate prescription of H_2-receptor antagonists on the basis of the study by Simpson and co-workers[22] which showed short-term benefit from this treatment, although our study shows no significant long-term benefit from this practice. However, the significant decline in the rate of subsequent definitive surgery is almost certainly the result of the increasingly widespread use of H_2-receptor antagonists in symptomatic patients.

Table 6 Life table analysis showing relation between non-steroidal anti-inflammatory drugs (NSAID) and subsequent definitive surgery

Years after simple closure	Percentage(s.e.m.) coming to definitive surgery	
	NSAID ($n = 33$)	No NSAID ($n = 151$)
1	10.0(5.5)	15.5(3.0)
2	10.0(5.5)	27.5(3.9)
5	15.0(7.1)	37.3(4.4)
10	15.0(7.1)	47.4(5.1)
15	15.0(7.1)	47.4(5.1)

$P < 0.05$ for patients proceeding to definitive surgery

Table 7 Life table analysis of patients having definitive surgery in three consecutive periods

Years after perforation	Percentage(s.e.m.) coming to definitive surgery		
	1966–1975 ($n = 59$)	1976–1980 ($n = 51$)	1981–1986 ($n = 55$)
1	17.1(4.9)	20.0(5.4)	6.8(3.3)
2	31.5(6.2)	27.7(6.1)	14.0(5.0)
5	44.8(6.7)	33.8(6.5)	21.8(8.7)
10	56.6(7.1)	39.6(7.1)	—
15	56.6(7.1)	—	—

$P < 0.01$ for year of surgery

Table 8 Symptomatic outcome of groups 1 and 2 and elective highly selective vagotomy (HSV) following previous perforation

	Simple closure ($n = 53$)	Simple closure plus H_2-receptor antagonists ($n = 41$)	HSV following previous perforation ($n = 36$)
Epigastric pain	4/53 (8)	1/41 (2)	5/36 (14)
Heartburn	3/53 (6)	0/41 (0)	2/34 (6)
Bloating	7/53 (13)	1/41 (2)	8/34 (24)
Vomiting	0/53 (0)	0/40 (0)	0/36 (0)
Diarrhoea	3/51 (6)	1/41 (2)	2/36 (6)
H_2-blockers	4/48 (8)	12/40 (30)	3/32 (9)

Values in parentheses are percentages

Table 9 Symptomatic outcome of patients having simple closure and no subsequent definitive surgery, and patients having highly selective vagotomy (HSV) following previous perforation

	Simple closure plus no definitive surgery ($n = 57$)		HSV following previous perforation ($n = 36$)
Epigastric pain	1/57 (2)	$P = 0.08$	5/36 (14)
Heartburn	2/57 (4)		2/34 (6)
Bloating	2/57 (4)	$P = 0.02$	8/34 (24)
Vomiting	0/56 (0)		0/36 (0)
Diarrhoea	2/55 (4)		2/36 (6)
H_2-blockers	10/53 (19)		3/32 (9)

Values in parentheses are percentages

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APPENDIX 3f

HIGHLY SELECTIVE VAGOTOMY - A SAFE OPERATION FOR DUODENAL ULCER

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HIGHLY SELECTIVE VAGOTOMY—A SAFE OPERATION FOR DUODENAL ULCER

Immediate and Long-term Complications and Sequelae in 500 Patients

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bstract. The safety and efficacy of highly selective vagotmy were assessed in a prospective series of 500 patients ho underwent the operation during a 15-year period. There as no peroperative or immediate postoperative mortality. one of the 22 late deaths was attributable to the operation. n six cases complications prolonged the hospital stay beond 21 days, requiring a second laparotomy in four. The te of ulcer recurrence was 18.5% by 15 years. Bloating was ne commonest long-term complication (8.8%), but half of ese patients regarded the operation as successful. Less ommon were dumping (5.4%), diarrhoea (3.8%) and gasic stasis (1.4%). Revisional surgery was performed on 37 atients—for recurrent ulcer in 28, for gastric stasis in seven nd for perforation in two. Although almost 20% of the eviewed patients continue to required regular or frequent edication, the study shows that highly selective vagotomy an be therapeutically effective for duodenal ulcer, particurly in preventing haemorrhage and perforation in patients ho have previously suffered these complications. Above all is a safe operation with low long-term morbidity.

ey words: highly selective vagotomy, prospective study, uodenal ulcer.

lthough the need for surgical treatment of uncomplited duodenal ulcer has been reduced, initially by 2 receptor antagonists and latterly by proton pump ntagonists, highly selective vagotomy (HSV) reains an important—in many centres the most imortant—surgical contribution to the management of is condition. The immediate and long-term sequee of H2 receptor antagonist treatment have been haustively researched in what is arguably the most orough post-marketing surveillance study to which ny new drug has been subjected (4–6). The aim of e present study was to document the complications nd side effects of HSV. For this purpose 500 cases ere analysed to assess the safety of the operation in th the short and the long term.

MATERIAL AND METHODS

e series comprised 500 consecutive patients who underent HSV over a 15-year period, from August 1973, in the strointestinal Unit or the Surgical Unit of the Western neral Hospital or the associated Surgical Unit at Leith spital. The case distribution per year is shown in Fig. 1. All cases were documented prospectively, and all complications diagnosed during the postoperative in-patient stay were recorded. The patients were thereafter followed up either at an evening clinic, or by postal questionnaire or a home visit supplemented, when necessary, with telephone calls, using procedures described in detail elsewhere (10, 11, 18).

Before patients were approached for follow-up, their general practitioners were contacted for information regarding vital status. If patients had died, the cause of death was obtained from the death certificate.

All but one of the 500 operations were elective. The male/female ratio was 365/135 (73%/27%) and the median age was 39 (range 12–71) years. Table I shows that at the time of operation 76.4% of the patients were cigarette smokers. Previous complications of the ulcer were perforation in 29 cases (5.8%), haemorrhage in 121 (24.2%) and both haemorrhage and perforation in 12 (2.4%).

The operations were performed by eight consultants (235 operations), nine senior registrars and 29 registrars (39 and 226 operations). Concomitantly performed surgical procedures are listed in Table II. Unit policy dictated that all patients aged $\geqslant 40$ years and all those considered to be at high risk routinely received low-dose subcutaneous heparin. Prophylactic antibiotics were not used. Recurrence rates were calculated with Cox hazards regression analysis.

RESULTS

Peroperative complications. An oesophageal tear occurred during dissection of the oseophagus in two patients. It was repaired with suture in one case and Thal patch in the other. Both patients made an uneventful recovery and have remained symptom-free for 4 and 9 years, respectively. Splenic trauma necessitated splenectomy in three patients, none of whom subsequently had infective complications. No patient died during the postoperative hospital stay or in the 30 days after surgery.

Postoperative morbidity. No myocardial infarction or pulmonary embolism occurred in the postoperative period. The postoperative complications are recorded in Table III. Pulmonary infection was defined as clinical or radiologic manifestations and production of purulent sputum, and 90% of these infections occurred in smokers. Wound infection denoted erythema of the wound with production of pus or fluid

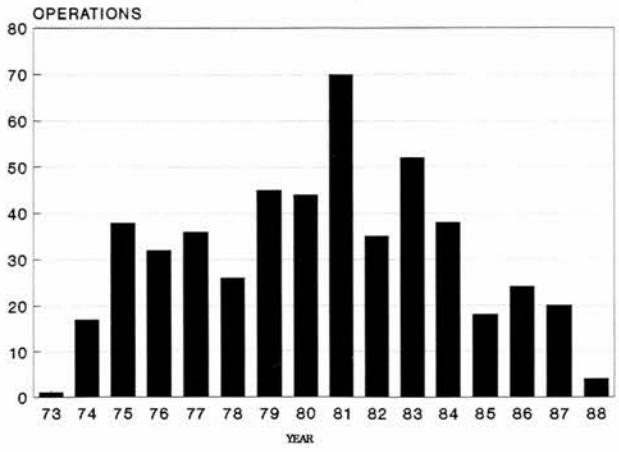

Fig. 1. Number of highly selective vagotomies performed yearly from 1973 and prospectively evaluated.

from which pathogenic organisms were cultured. Intra-abdominal haemorrhage included patients in whom the diagnosis was made clinically or on the basis of vital signs, excessive drainage or fall in haemoglobin/haematocrit. Transfusion of whole blood or red-cell concentrate was necessary in four cases, one requiring laparotomy and splenectomy. One of the two cases of necrosis after the lesser gastric curvature was successfully treated conservatively, but partial gastrectomy had to be performed (after 17 days) in the other. Perforation of duodenal ulcer occurred on postoperative day 8 in a 12-year-old boy (the youngest patient in the series) and was treated with simple closure at laparotomy.

Length of in-patient stay. The total hospital stay for the 500 patients was 5 491 days, i.e. an average of 10.9 days, with 7.8 (range 2–70) days postoperatively. The postoperative stay exceeded 14 days in 22 cases, and in six it was more than 21 days. The complications in these six cases are summarized in Table IV.

Long-term mortality. Fifty patients had been lost to follow-up by August 1990. Twenty-two of the remaining 450 had died. The causes of death are listed in Table V. The numbers are too small to permit analysis of or conclusions on the influence of the operation on postoperative survival or cause of death. The remaining 428 patients responded to a standardised questionnaire.

Table I. *Preoperative smoking habits*

	Males	Females	Total
Smokers	271	111	382 (76.4%)
Ex-smokers	34	11	45 (9.0%)
Non-smokers	60	13	73 (14.6%)
Total	365	135	500

Table II. *Surgical procedures concomitant with highl selective vagotomy*

Concomitant surgery	No. of patients
Fundoplication	19
Cholecystectomy	14
Splenectomy	3
Repair of oesophageal injury	2
"Take down" gastroenterostomy	2
Appendectomy	1
Small-bowel resection for carcinoma	1
Gastrotomy	1
Vasectomy	1

Recurrent ulcer and its complications. At follow-u ranging from 1 to 16 years, 64 patients had had recu rence of ulcer. With life table analysis this represent a cumulative ulcer recurrence rate of 17.5% by 1 years and 18.5% by 15 years (Table VI), figures i keeping with our previously published (11) recurrenc rate.

Upper gastrointestinal bleeding from recurrent u cer in the duodenum or stomach occurred in 14 pa tients. Only two had subsequent perforation, incluc ing the previously mentioned 12-year-old patient.

Late postoperative complications. Gastric stasis de veloped in seven patients, all within 12 months of th original operation. In each case the disordered moti ity was demonstrated by barium meal. Treatmer consisted of truncal vagotomy and gastroenterostom (2 cases), gastrojejunostomy alone (2), pyloroplast alone (2) and Polya gastrectomy (1). The incidence c stasis and other late postoperative complications i shown in Table VII, where the differences in liste

Table III. *Immediate postoperative complications*

Complications	No. of patients
Pulmonary infection	101
Wound infection/abscess/dehiscence/ haematoma	47/1/1/3
Intra-abdominal haemorrhage/requiring splenectomy	11/1
Anaemia (requiring transfusion)	1
Subphrenic collection	11
Intestinal obstruction/protracted ileus	1/2
Acute gastric dilatation/gastric stasis	1/1
Necrosis of lesser gastric curvature	2
Perforated duodenal ulcer	1
Prolapsed haemorrhoids	1
Atrial fibrillation	1
Superficial thrombophlebitis	1
Acute urinary retention	2

Table IV. *Complications in patients with postoperative stay > 21 days*

Case no.	Sex/ age	Days of stay	Complications
	M/40	23	Intra-abdominal haemorrhage, splenectomy, wound infection
	F/46	70	Necrosis of lesser curvature, laparotomy and drainage of abscess in lesser sac Second laparotomy—partial gastrectomy
	M/38	22	Prolapsed piles—haemorrhoidectomy
	M/52	31	Subphrenic collection—laparotomy, drainage
	M/48	39	Pulmonary infection
	M/12	54	Perforated duodenal ulcer—laparotomy

otal cases resulted from failure of patients to reply to ne specific question. Only four of the 16 patients who omplained of diarrhoea stated that it was a daily ccurrence, with stools averaging 25 per week. No atient had had explosive diarrhoea or faecal incontience. Dumping symptoms were reported by 22 patents (7.3%) but occurred daily in only 17. Bloating as the commonest postoperative symptom occurng in 36 (8.8%) but 16 of the patients with daily loating nonetheless regarded the HSV as successful.

Medication. Of the 413 patients who answered the uestion on medication, 47 were taking antacids daily r on most days, and 16 of these also took H2 receptor ntagonists at similar intervals. A total of 50 patients 2.1% of the responders) took H2-blockers daily or most days. Altogether 79 (19.1%) required medication for dyspepsia regularly or frequently.

Revisional surgery. The revisional operations for perforation or stasis after the original HSV have already been described. They are listed in Table VIII along with 28 revisional procedures for recurrent ulcer. These latter were performed by five consultants and three surgeons in training (23 and 5 operations, respectively). There was no operative mortality. The most serious complications were anastomotic leak after a Roux-en-Y gastrectomy and efferent loop obstruction following a Polya gastrectomy. Both complications were successfully managed conservatively. Pulmonary infection developed in eight patients and wound infection in three. Intra-abdominal haemorrhage occurred after Polya gastrectomy in one case, but did not require laparotomy.

The surgical treatment was judged to have been successful by 375 (85.8%) of the 437 patients who answered the relevant question, while 62 (14.2%) considered it unsuccessful.

Table V. *Causes of death during follow-up*

auses of death	No. of patients
arcinoma:	
Bronchus	3
Pancreas	3
Larynx	1
Brain	1
Colon	1
Oesophagus	1
yocardial infarction	5
erebrovascular accident	1
ortic aneurysm	1
neumonia	1
pticaemia	1
epatic failure	1
eroin overdose	1
olence	1
tal	22

Table VI. *Life table analysis of ulcer recurrence rate*

Year of follow-up	% recurrence (SE)
1	5.2 (1.0)
2	6.9 (1.2)
3	9.7 (1.4)
4	12.4 (1.6)
5	13.2 (1.6)
7	14.9 (1.8)
10	17.5 (2.1)
15	18.5 (2.4)

DISCUSSION

The decline in elective surgery for duodenal ulcer during the period of the present study (Fig. 1) reflects the trend throughout the western world (1–3, 8, 12, 19). Omeprazole seems certain to bring about further reduction of referrals for surgery from primary care

Table VII. *Late postoperative complications experienced daily or on most days*

Complications	No. with complication/ total replying to question
Gastric stasis	7/491 (1.4%)
Bloating	36/409 (8.8%)
Dysphagia	2/353 (0.6%)
Dumping	22/300 (7.3%)
Diarrhoea	16/417 (3.8%)

Table VIII. *Revisional surgery*

Revision required by	Revisional operation	No. of cases
Perforation	Simple closure	2
Gastric stasis	Truncal vagotomy + gastroenterostomy	2
	Gastroenterostomy only	2
	Pyloroplasty	2
	Polya gastrectomy	1
Recurrent ulcer[a]	Polya gastrectomy	9
	Roux-en-Y anastomosis	1
	Billroth I gastrectomy	4
	Truncal vagotomy + antectomy	3
	Truncal vagotomy + gastroenterostomy	3
	Truncal vagotomy + pyloroplasty	3
	Truncal vagotomy only	1
	Gastroenterostomy only	4

[a] Recurrent duodenal ulcer with or without pyloric stenosis and pyloric or prepyloric ulcer.

and medical units. H2 receptor antagonists are demonstrably safe. The evidence for possible carcinogenicity is slim (9, 14). The weight of opinion against carcinogenicity of Omeprazole (15) was demonstrated by release of the drug onto the market.

Against this impressive pharmacological competition, is there still a role for highly selective vagotomy in the treatment of duodenal ulcer? For long-term prevention of ulcer recurrence HSV is more effective than H2 receptor antagonists. In a previous analysis of series with more than 5 years of follow-up we found cumulative rates of ulcer recurrence around the mid-teens of percentage in most studies (11). In one long-term follow-up after H2 receptor antagonist treatment, the symptomatic recurrence rate at 6 years was 16% (16), and in a study from general practice 76% of patients given continuous therapy over 5 years and 100% of those treated intermittently developed clinically important symptoms (20).

Among patients receiving Ranitidine for 2 years as maintenance treatment after haemorrhage from duodenal ulcer, 44% were reported to have recurrence of ulcer or erosions (13). Our study, like many others, showed HSV to be effective in preventing haemorrhage and perforation in patients who originally presented with these complications.

We believe that ulcer recurring after HSV represents a less aggressive form of the disease, resulting in fewer perforations and bleeds and more amenable to medical therapy. For this reason the Visick system, which assigns to grade 4 any recurrent ulcer, is no longer felt to be appropriate in assessing the outcome of surgery for duodenal ulcer.

Like other investigators (7, 21), we previousl showed (10) that the failure rate after HSV is nc higher in ulcers "resistant" to H2 blockers than i ulcers that initially responded and subsequently re lapsed. At least one study, however, did not share th conclusion (17).

If the effectiveness of HSV in controlling ulcer di ease is equal to or exceeds that of H2 receptor antago nists, relegation of HSV as a treatment method mus result from concern that it is less safe. The presen study showed that HSV can be performed withou immediate or long-term mortality. Serious postope ative complications arose in only three of the 50 patients (Cases 1, 2 and 4 in Table IV), and in none c the three was the complication life-threatening or pro ductive of long-term sequelae.

Has HSV been discredited by the postoperativ sequelae that brought about the demise of previou ulcer operations? In this series 5.4% of the patient complained of dumping and 3.8% of diarrhoea. Th explosive, urgent diarrhoea described after trunca vagotomy was never experienced.

This study has shown HSV to be a safe operatio for duodenal ulcer disease. It appeared to cure th ulcer diathesis during the period of the review i more than 80% of patients. HSV was found to b particularly effective in preventing the complication of duodenal ulcer in patients who had previousl experienced such complications, and in our hand proved effective in patients with ulcers resistant t H2 receptor antagonists. The sequelae which dogge earlier ulcer operations were much less common while the incidence of complications specific t HSV—antral stasis and lesser curve necrosis—wa 1.4% and 0.4%, respectively.

It is ironic that HSV, having been shown to be saf and effective, is now disappearing from the surgica armamentarium and may prove to be the last surgica contribution to management of duodenal ulcer di ease.

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