THE HISTORY OF GASTRIC SURGERY

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The history of gastric surgery is one of the most complex in the annals of medicine. The practice of this surgery depended upon the growing knowledge of the pathology of gastric diseases. This knowledge, together with animal experiments and the introduction of anaesthesia during the last century, led to the first successful planned operation for a disease of the stomach. The last 20 years of the nineteenth century saw the introduction of many gastric operations, some of which were to become established and modified during the ensuing years.

In the writings of Celsus[14] in the first century and Galen[29] in the second century, vague references were made to ulcers of the stomach, but it was not until the revival of medicine in the sixteenth century, with its attendant increase in post-mortem examinations, that further examples were recorded.

In 1596 Marcellus Donatus[21] described the autopsy on a man of 59 years, who was found to have a gastric ulcer. Littré[46] reported, from the diary of a Lady-in-Waiting to Henrietta Anne, Duchess of Orleans and daughter of King Charles I of England, how the Duchess had died, in 1670, from a perforated gastric ulcer, following years of dyspepsia. The writings of John Bauhin in the Sepulchretum of Boneti[10] in 1679 give a full description of a physician's wife, aged 19, who died from a perforated gastric ulcer.

The first accurate and extensive description of gastric ulcers and cancer is attributed to Mathew Baillie in 1793[2]. Duodenal ulceration was not recognized until the early part of the nineteenth century when Benjamin Travers[76] reported on two cases which had died of perforations. This was followed by an excellent description by John Abercrombie[1] in his Pathological and Practical Researches on the Diseases of the Stomach published in 1830.

Experimental surgery on the stomach began in 1810 when Karl Theordor Merrem,[51] a student at the University of Giessen, demonstrated that the pylorus of dogs could be removed successfully, and without any apparent effect on their well-being.

In 1876, Carl Gussenbauer and Von Winiwarter[31] performed many successful pylorectomies on dogs, and suggested the feasibility of this procedure on the human subject. At the same time in a clinic in Vienna, Czerny and Kaiser[19] while working as assistants to Billroth, were performing similar experiments. In one instance they resected the entire stomach of a dog, which survived and flourished for five years. Under the guidance of their professor they were beginning to outline the principles of gastric surgery, which were to lead the world in this field.

The first operation is believed to have been the removal of a knife from the stomach of a professional knife thrower, by a barber and surgeon of Prague named Florian Mathies (quoted by von Eiselsberg[26]) in 1602. Thirty-three years later, on July 9, 1635, a similar successful operation was performed in Konigsberg by Christopher Schwabe (quoted by Ehrhardt[23]). He removed by gastrotomy a knife which a young farm hand, named Andrea Grunheide, had swallowed whilst tickling the back of his throat to induce vomiting. This procedure was somewhat barbarous; twice the barbers and theologians strapped their victim to a board before finding and opening the stomach. Both patients survived these ordeals.

No further recorded operation can be found until 1849 when Charles Sédillot, Professor of Surgery at the French School of Military Medicine in Strasbourg, performed a gastrostomy after three experiments on dogs,[72] but the patient succumbed within a few hours of the operation. Thirty-three further unsuccessful attempts were made by Sédillot, but it was not until 1875 that Sydney Jones,[42] an English surgeon, reported the first successful case.

On April 5, 1879, Jules-Emile Péan[63] claimed to have undertaken the first pylorectomy for a pyloro-duodenal cancer, at the Frère St. Jean de Dieu Hospital in Paris, but the patient died on the fifth post-operative day. A post-mortem was unfortunately refused, but it is interesting to note that Péan felt that it might have been wiser to have made the anastomosis with silk rather than catgut, which may have been responsible for its disruption.

FIG. 1.—L. von Rydygier

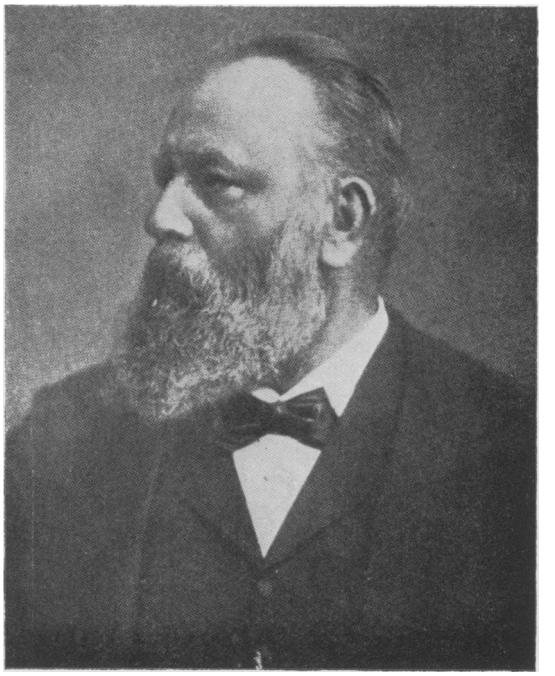

FIG. 2.—T. Billroth.

Nineteen months later, on November 16, 1881, Ludwig von Rydygier[68, 69] attempted the second pylorectomy with the same result. Rydygier was a proud Polish surgeon, who had started a private Clinic in Chelmo, and it was here that he did this second pylorectomy at the age of 30. It is believed that he was the first surgeon to attempt gastro-enterostomy. He performed this operation in 1880[67] on a 63-year-old man named Julius Mickotajewicz who was known to have a duodenal ulcer. Chloroform anaesthesia was used during the 4 hours duration of the operation. The patient succumbed 12 hours later from circulatory failure.

On January 29, 1881, Professor Theodor Billroth at his Clinic in Vienna completed the first successful partial gastrectomy on Therese Heller, a 44-year-old woman who had developed a pyloric carcinoma [8] The first success was not one of chance; for years he and his assistants had worked carefully and methodically to this end, and a few years before[7] while operating on a case of gastric fistula, he had remarked that it was but a short step to the day when the human stomach could be removed surgically. This was to be a bold step, but his foresight had forearmed him against the criticism which he knew would herald this procedure. He knew well the dangers and the mortality which would occur when this operation was performed by surgeons untrained and unskilled. In defence of his operation he said ' To reassure those who are of the opinion that my present operation is a foolhardy experiment on man is beside the question. Resection of the stomach has been as completely worked up anatomically, physiologically and technically by my students and myself as any other new operation. Every surgeon who has had experience in experiments on animals and similar operations on man has reached the conviction that resection of the stomach must and will succeed. To establish the indications and contra-indications, and to work out the technique for the widely different cases, must be our next concern, and the object of our further studies '. He taught his pupils well and sent them out into the cities of Europe to practise and further this type of surgery. His teaching ability is reflected in the names of such men as Czerny, von Mikulicz, Woelfler and von Hacker, who were to lead others in the modifications which Billroth knew to be essential for its ultimate success.

In the following month, in November, Woelfler,[80, 81] when operating upon a 38-year-old man with a pyloric carcinoma, found that the growth had infiltrated the pancreas, which made the case unsuitable for gastrectomy. He therefore

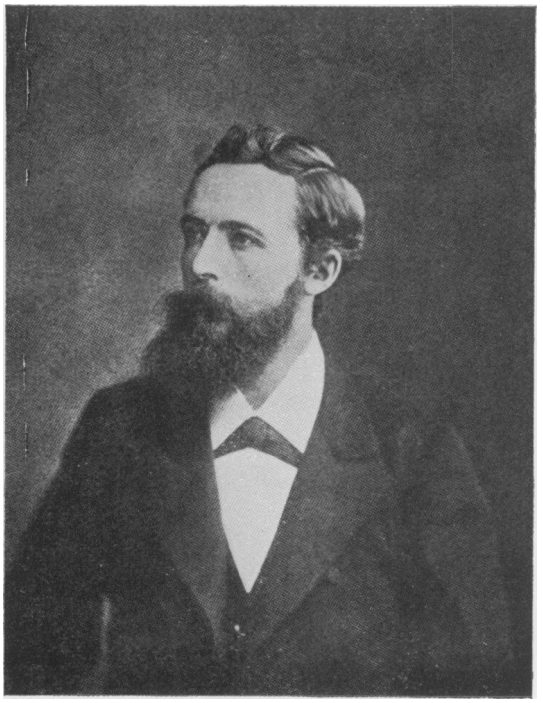

FIG. 3.—J. von Mikulicz-Radecki.

performed a gastrojejunostomy which became the first successful one. Four days later Billroth tried the same procedure, but the patient died on the tenth post-operative day from continuous biliary vomiting. Post-mortem examination revealed a greatly distended afferent loop which communicated with the stomach, but there was only a small narrow stoma to the efferent loop, which was kinked at the site of the anastomosis and was not draining the stomach. Up to 1884 only two of the seven cases of gastroenterostomy which had been reported had survived; it was little wonder that this operation had gained no popularity in its early stages. In 1883[82] Woelfler performed the first anastomosis-en-y in order to prevent the kinking which had occurred in Billroth's case, an operation which was later to be popularized by Roux of Lausanne.[66] In this same year Courvoisier[16] had performed the first 'Gastroenterostomie retrocolique posterieure transmesocolique', with a fatal outcome.

Across the Atlantic, in North America, Phinneas Connor of Cincinnati,[15] in 1884 operated upon a 55-year-old woman with an extensive carcinoma of the stomach involving the cardia. He was forced to attempt total extirpation, but unfortunately the patient died on the table before he had completed the excision. It was an heroic attempt, not to be repeated until 13 years later when Carl Schlatter[71] of Zurich performed the first successful total gastrectomy. He effected communication with the digestive tract by anastomosing a loop of jejunum to the lower end of the oesophagus. The patient recovered and in two months had gained 8 lb. in weight. A second successful case of total gastrectomy was reported from Boston, Massachusetts, in 1898 by Brigham.[12] In this case anastomosis was effected between the oesophagus and the duodenum around a Murphy's button, which had been introduced into surgery some six years previously.

Von Hacker,[32] writing from Billroth's Clinic in 1885, referred to the operation which has become known as the Billroth II partial gastrectomy. Billroth performed a laparotomy on a very debilitated man of 48 with a large but mobile pyloric carcinoma. It was impossible to resect the tumour and perform his original gastroduodenostomy. He, therefore, anastomosed a loop of jejunum to the stomach above the growth in the first instance, and finding the patient had withstood this initial step proceeded to resect the tumour and close the cut ends of the stomach and duodenum.

The high mortality rate gave cause for further thought particularly in non-malignant cases. Loreta[47] had tried digital dilatation of both the cardiac and pyloric orifices through a gastrotomy. The recurrence rate was high and the procedure, therefore, seemed unjustifiable. Heinecke[34] and Mikulicz,[53] working as Billroth's assistants, attempted the first pyloroplasty in 1885. Through a comparatively small abdominal incision they divided longitudinally the white scar tissue, which had replaced the pylorus, and closed the defect transversely with good results.

The next ten years gave time to continue with and modify the procedures of pylorectomy, gastroenterostomy and pyloroplasty, which had become fairly well established. During this period article followed article dealing with successes and failures, and new techniques which were thought to improve upon the old.

Pylorectomy, or partial gastrectomy as it had now become to be known, was established as the correct procedure for operable cases of cancer of the pylorus. A few surgeons, notably Rydygier, had suggested that partial gastrectomy might be of some value in the treatment of simple gastric ulcers, and reported the first case in which he removed part of a stomach containing a large posterior ulcer. On November 21, 1881, Rydygier operated on a 30-year-old woman, Karolina Pfennig, for a posterior gastric ulcer which was lying close to the pylorus, penetrating the pancreas, and had caused a pyloric stenosis.[68] Nineteen

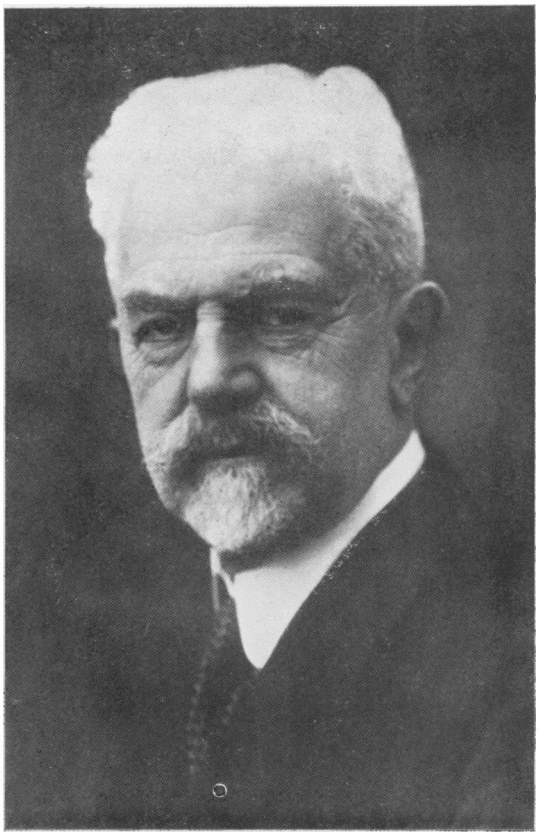

FIG. 4.—A. F. von Eiselsberg.

years later she was in good health and was proudly shown at a surgical congress.[70]

There was little alteration in the technique of both the Billroth I and II procedures, until about the turn of the century. However, von Hacker[33] did express the opinion that he could see no reason why the divided end of the stomach could not be anastomosed directly on to the side of the jejunal loop; it would be both easier and quicker. In 1888 Kroenlein[44] practised this modification on a 24-year-old man with pyloric stenosis, in whom there was a particularly narrow pyloric antrum. This he joined to the side of a loop of jejunum, but the patient died within 24 hours and at autopsy it was shown that the anastomosis was not functioning, because the jejunal loop was kinked at the suture line, with complete obstruction to the afferent loop. Anton von Eiselsberg[24] one year later performed this same manoeuvre with success. This type of anastomosis was to gain in popularity and become recommended by such surgeons as Mikulicz, Reichel, Polya, and Finsterer[28] who said ' It is in my opinion quite indifferent by what name this method is known, but it is reasonable to demand that with a name one is able to draw a correct mental picture, and furthermore be able to execute the method exactly '.

Gastroenterostomy rapidly gained in popularity as a treatment for peptic ulceration and irremovable carcinoma. The two main technical problems were biliary regurgitation and uncertainty over the anastomosis. Loops this way and loops that way were tried. Roux popularized the ' en-y ' type in 1897,[66] formerly described by Woelfler. There were pull-through operations, cones, valves, bone plates, raw hide, decalcified bone bobbins, perforated silver plates and a button, which Murphy[60] introduced in 1892, and was heralded by some as the greatest technical advance in intestinal anastomosis, being held responsible for the falling mortality. It was pertinent when Kocher[43] said ' It is well that Nature is not so ungracious as the surgeon. She allows, just as God allows the sun to shine on good and evil, methods which theoretically are good and bad to be successful '. Biliary regurgitation had become such a problem that some thought it necessary to by-pass the pyloric obstruction by gastro-duodenostomy. This was first carried out by Jaboulay[41] in 1894.

Mortality rates had already begun to fall. Mikulicz[54] in 1897 had said that ' . . . the danger to life from gastric ulcer is at least not less, but probably far greater than the danger of a complete modern operation '. In England Mayo-Robson[50] in 1900 reported a 16.4% mortality on 188 consecutive gastric operations.

More and more stress was being laid upon the importance of early diagnosis of cancer of the stomach. A great advance in this field came in 1895 when Hemmeter,[35] following Roentgen's use of the X-ray, reported a method of visualizing the stomach with radio-opaque lead acetate within a gutta-percha bag. Two years later Kuhn described a spiral sound which he introduced into the stomach, performing a curettage. This, however, was not received very favourably, for it was feared that fragmentation of the cancer cells might lead to spread of the disease. Mikulicz[52] in 1881 had described the use of the gastroscope in differentiating innocent from malignant lesions, but it was not held in high regard for it was difficult, uncertain and caused considerable distress to the patient. It was about this time that Mikulicz became the first surgeon to attempt closure of a perforated gastric ulcer,[55] but the patient died in three hours.

It was now becoming evident that with the lowered mortality rate and longer survival, the end-result of the operation had taken on greater significance. The last 20 years of the nineteenth

century had justified operations upon the stomach, and had made them a relatively safe procedure; the new century turned its energy towards improving this safety, and above all to modifying techniques which would prevent the post-operative syndromes, which were already making their appearance.

Petersen[64] in Germany had been carrying out several experiments which were destined to overcome the major problems in gastroenterostomy. He studied the relation of the highest portion of the jejunum to the stomach, demonstrating that this high loop of jejunum always lay above the greater curvature of the stomach, even in the normal, and would be considerably higher in patients with an enlarged stomach due to pyloric stenosis. He found that it was possible to anastomose this high jejunal loop to the posterior surface of the stomach. This would obviate the long loop, which in the past had so often become obstructed, and would avoid the more complicated Roux-en-y type of anastomosis, which had been designed to accomplish this very purpose. This paper came from Czerny's Clinic, and its importance was recognized throughout the world, particularly by Moynihan in England and by Mayo in America. It formed the basis for the established posterior gastroenterostomy of today. Rydygier[70] still believed that, in cases of gastric ulceration, no less an operation than local excision of the ulcer was justified, condemning gastroenterostomy for gastric ulcer, because he believed that cancer could still develop on the edge of a healed ulcer.

In 1899 Braun[11] described the first jejunal ulcer resulting from a gastroenterostomy, and a short time later it was noted that these ulcers tended to occur more frequently in cases in which a Roux-en-y type anastomosis had been performed.

In 1905 Moynihan[58] described his 'line' for gastroenterostomy. This was situated on the posterior surface of the stomach 1 in. proximal from a line drawn perpendicularly down from the oesophageal-hiatus.

Hertz[37] (later Sir Arthur Hurst) in 1913 published a paper on certain unfavourable after-effects of gastroenterostomy. In 1922 Charles Mix[56] in America published the first article on what he called the 'Dumping Syndrome'. This followed in a patient upon whom an anterior gastroenterostomy had been performed four years previously.

Gastroenterostomy was from now on to change little, and so thoughts were turned once more to the improvements required in gastric resection.

The Billroth I operation had lost some of its original popularity because of the dangers of leakage, and the tension at the anastomosis which did not occur with the Billroth II operation. However, on the continent of Europe it was still in vogue, and its cause was furthered by Burdenko[13] who said that the permanent exclusion of the duodenum might lead to a functional disturbance of the pancreas and eventual atrophy. Against it was the feeling that, in cancer, stenosis was likely to occur if any residual growth was left in the pyloric or supra-pancreatic lymph nodes, or indeed in the pancreas itself, and that this new growth might strangle the anastomosis. In duodenal or prepyloric ulceration the dense adhesions, which so often accompanied these lesions, required division, and it was felt that they would reform in greater strength and tenacity and thus produce kinking with obstruction.

In 1911 Shoemaker[73] introduced his new technique which was reported to make the Billroth I procedure safer. With the use of a special curved clamp he divided the stomach, removing a great portion of the lesser curve, so that a tubular structure formed by the greater curvature was left which would be easily anastomosed to the duodenum.

Finsterer[28] reported that Hofmeister in 1908 described his valve, which he formed by closing the upper end of the stomach first, and then anastomosing a small portion of the stomach at the greater curvature to the jejunal loop, exactly as in the Mikulicz procedure. A search of the literature fails to reveal any scientific publication by Hofmeister himself describing the operation which has come to bear his name, but his use of the valve is reported by Stumpf.[75] He was a great advocate of the short posterior loop and disagreed with Balfour[3] who recommended a long anterior loop, but later[5] modified this with an accompanying enteroenterostomy to prevent retention of pancreatic and biliary juices within the duodenum.

The introduction of partial gastrectomy into the treatment of duodenal ulceration had begun to raise the problem of how to deal with the 'difficult' ulcer, particularly when there was deep penetration into the pancreas, or involvement of the common bile duct by the surrounding inflammatory mass. Eiselsberg in 1895[25] had advocated the use of pyloric exclusion for irremovable cancers of the pylorus. Finsterer in 1918[28] used this principle, but also removed a portion of the stomach above the pylorus, which he closed before performing a gastrojejunostomy. Within a few years he began to get a high incidence of gastrojejunal ulcers. Devine in 1925[20] advocated the old antral exclusion operation of Eiselsberg, whereby the pyloric antrum was divided, the stump closed and the proximal cut end of the stomach anastomosed to a loop of jejunum, but no stomach tissue was removed. Recurrences were still high. In 1932 Bancroft[6] modified the Devine procedure by coring

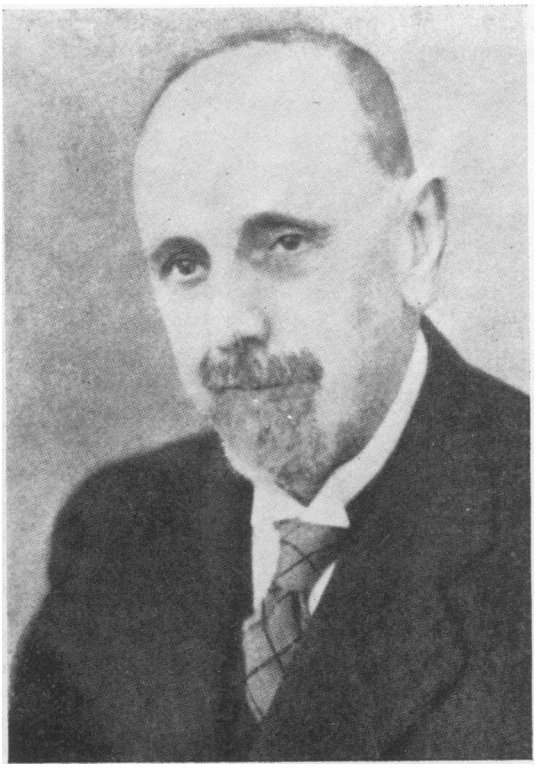

FIG. 5.—H. Finsterer.

out the antral mucosa before closing the seromuscular stump; although he still did not remove any stomach the gastrojejunal ulcer rate began to fall. Finisterer was not satisfied with these methods and combined his original procedure of antral exclusion with partial gastrectomy with the mucosal coring manoeuvre of Bancroft. This method, often referred to simply as the Bancroft procedure, is practised widely today, but it is questionable whether it is better than a method introduced by McKittrick[49] in which the pylorus is excluded, a standard gastric resection performed and the pyloric stump removed six weeks later.

Roscoe Graham[65] of Toronto advocated exteriorization of the duodenal ulcer when it had become fixed to the pancreas. He divided the posterior wall of the duodenum distal to the mobile duodenum. Welch[79] advised a catheter duodenostomy with or without a catheter jejunostomy in cases in which the duodenal stump could not be closed easily.

During the early part of this century gastroduodenal haemorrhage was treated medically, there being no place for surgery. Finisterer in 1923[28] strongly opposed these views and reported on his relative success with early operation. The selection of patients with gastroduodenal haemorrhage, except in some clinics, remained a fairly haphazard procedure until in 1946 Gordon-Taylor[30] recommended ' Selective Surgical Interference ' for which he gave various criteria.

Many modifications were introduced to overcome certain technical difficulties, but few were to become recognized and still fewer to be accepted. Balfour in 1921[4] reported on a method of diathermy excision of gastric lesions, which proved to be safe and effective, but was not destined to replace partial gastrectomy. Pauchet in 1920[61] stressed the importance of removing the greater omentum in continuity with the stomach for carcinoma, and clearing the pyloric and pancreatic lymphatic field. He introduced the now famous wedge excision for high gastric ulcers on the lesser curve.[62]

Moynihan[59] had introduced his two types of gastrojejunal anastomosis following gastric resection. His first modification was the Roux-en-y principle but it did not gain favour. The Moynihan II operation is still practised today by a few surgeons. It consists of an antecolic antiperistaltic anastomosis fashioned from the full width of the gastric remnant.

Connell[17] from Wisconsin suggested ' fundusectomy ' as a rational way of removing the major acid bearing portion of the stomach. A few years later in 1933 George Crile[18] of Cleveland, Ohio, introduced the theory that peptic ulcer formation might be the result of sympathetico-adrenal irritability, which could be controlled by adrenal denervation. Wangensteen introduced two new methods for removal of the acid bearing area of the stomach. The first in 1940[77] removed most of the greater curvature of the stomach, but this failed and had to be abandoned because of the high rate of recurrent ulceration. In 1952[78] he removed all the stomach except for a cuff at the cardia and a portion of the pylorus. He anastomosed the two portions and finished by doing a pyloroplasty. This had been attended with apparent success, but the follow-up period is not sufficiently long for any definite conclusions to be drawn from such a small number of cases.

A new era in the treatment of peptic ulceration was ushered in by Dragstedt and Owens in 1943,[22] when they reported on two cases of duodenal ulcer treated by vagotomy. This was not a new conception in therapy for it was certainly practised in the 1900 to 1920 period. The history at this time is muddled and only a few isolated cases were reported, and it is doubtful whether total vagal section was achieved. Exener,[27] in 1911, referred to two cases and made the clear observation that he had been able to pull down the oesophagus 3 cm. into the abdominal cavity by mobilizing the cardia. He was thus able to make

certain that he had divided all the vagal fibres. Exener was concerned about the failure of the stomach to empty itself during the immediate post-operative phase, and so accompanied the neurosection with a gastrostomy.

In 1920 Bircher[9] reported upon 20 cases of subdiaphragmatic section, but his results were so good that it is doubtful whether he could have divided all the nerves, for none of the patients developed any of the immediate post-operative symptoms, with which we are familiar. Latarjet[45] reported upon 24 cases of incomplete vagotomy. He, like Exener, was concerned about the delayed gastric emptying and suggested that a gastrojejunostomy should complement the operation.

A new form of therapy for gastroduodenal ulceration was introduced by Somervell[74] and Hey[38] who ligated the arterial blood supply to the stomach in an attempt to reduce acidity without mutilation. Hey reported upon nearly 400 cases in which he had divided the arterial supply and accompanied this by a gastroenterostomy in all but six cases. Only one patient died, and one developed a gastrojejunal ulcer. He performed a fractional test meal before and after operation on 160 cases, and showed that in all cases where there had been a pre-operative elevation of the gastric acidity, this acidity had been reduced to normal and remained so for the follow-up period of from four to six years.

Total gastrectomy had become the standard treatment for extensive cancer of the stomach, but the post-operative distress of many of the patients, without any great increase in the survival rate, led many surgeons to alter their opinions about this radical operation. Some believed that, providing the gastric section was well clear of the growth and that an adequate lymphatic clearance could be undertaken, a small portion of the stomach should be left, whether it be at the pyloric or cardiac end. This became known as either a high or low radical subtotal gastrectomy. To overcome the total absence of the stomach several 'replacement' operations were introduced. In 1952 Hunt[40] in America replaced the stomach with a pouch fashioned from a loop of jejunum. The loop of jejunum was anastomosed in the usual end-to-side manner to the oesophagus; the loop was then anastomosed to itself for several inches. He also proposed that this pouch should be swung across and anastomosed to the duodenum as a second stage procedure. McAleese, Perrone and McAleese[48] and Hunnicutt[39] suggested using the right colon, anastomosing the terminal ileum to the oesophagus and the colon to the jejunum. Henley[36] demonstrated the use of an ileal loop, and Moroney[57] used the transverse colon.

A great deal has been omitted in the above account, but an attempt has been made to refer to those men who have done much for gastric surgery, many of whom have been selected because their writings are easily accessible.

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