A HUNDRED YEARS OF GASTRIC SURGERY

An expanded version of an address delivered at the Centenary Meeting of
the American Medical Association at Atlantic City on 11th June 1947

by

Sir Heneage Ogilvie, K.B.E., M.Ch., F.R.C.S.

Vice-President of the Royal College of Surgeons of England

A HUNDRED years is a long time, and the last hundred years have seen greater changes in the structure of human society than all the million ages that preceded them. In that century gastric surgery has been born, and grown to maturity.

About a hundred years ago, to be exact in 1850, the great physician Charles Meigs, of Philadelphia, wrote that he "frankly detested all abdominal surgery, save such as was warranted by imminent death." Yet in those years the foundations of abdominal surgery were laid. In 1846 Morton, a dentist and a medical student at Harvard, gave the first anaesthetic for a major abdominal operation performed by Dr. Warren. In 1849 the first known operation on the stomach, a gastrostomy for oesophageal obstruction, was performed, unfortunately without success, by Sedillot. Anaesthesia was the first of four advances that made the planned and curative gastric surgery of to-day possible. The others were the demonstration of the causes of infection by Lister in 1865, the discovery of X-Rays by Röntgen in 1895, and the evolution by Cannon in 1897 of a practical plan for visualising the digestive tract by radiography.

But while gastric surgery had perforce to await these discoveries, the study of gastric disease, which laid the basis of pathological knowledge on which gastric surgery is founded, proceeded with the progress of learning. In 1586 Marcellus Donatus of Mantua performed a post-mortem examination on one Camillus Jacinus, a man "of bilious disposition," who died after an acute illness during which he vomited three to five "pounds of phlegm" at a time. He describes how "in the lower part of the stomach at the pylorus or lower orifice the inner coating was ulcerated, and we had no doubt that this had been the cause of his malady." In 1737 Morgagni described gastric ulcer. In 1793 Matthew Baillie gave an account of the gross pathology and symptoms of gastric ulceration. In 1817 Travers reported two cases of duodenal ulcer in *The Transactions of the London Medico-Chirurgical Society*. In 1829 Cruveilhier drew for the first time a clear distinction between cancer, gastritis and simple ulcer, but failed to mention ulceration of the duodenum. In 1830 John Abercrombie,

NOTE.—Printed by kind permission of The American Medical Association.

CHARLES MEIGS

LISTER

of Edinburgh, described five cases of duodenal ulcer, and gave the first clear description of the clinical aspects of the disease. In 1842 Curling reported for the first time the association of acute duodenal ulceration with burns.

Thus one hundred years ago the three diseases with which gastric surgery is concerned, gastric cancer, gastric ulcer and duodenal ulcer, were already well known. The first recorded operation on the stomach was Sedillot's gastrostomy in 1849, and two others, which survived two and four days respectively, were done at Guy's Hospital in 1858 and 1859 by Mr. Cooper Forster. It was not till 1875 that Sydney Jones performed the first successful gastrostomy. The same year, 1875, saw the first partial gastrectomy by Péan, but the first successful operation of this type was that of Billroth in 1881. Gastro-jejunostomy for cancer was performed in 1881 by Wolfler, of Vienna, and in the same year Courvoisier made an unsuccessful attempt to perform the operation on a patient with ulcer. In 1883 Kocher performed the first successful suture of a gunshot wound of the stomach. Langenbeck, in the Archives of Clinical Surgery, first proposed the suture of perforations, but Miculicz was the first to suture a perforated gastric ulcer, which he diagnosed by puncturing the distended abdomen with a trocar, and obtaining "inflammatory gas which stank of alcohol." Heusner, of Bremen, did the first successful suture of a perforated ulcer in a private house in 1892, taking three hours for the operation. Hastings Gilford, in 1893, was the first to suture a perforation in Great Britain, and Morse, of Norwich, was the first to report a success; he writes "the stomach was washed out and the hole was closed with Lemberts, and then the abdomen was washed out with 17 pints of hot water at a temperature of 105°." In those pioneer days the courage of the surgeons was matched by the toughness of the patients.

From these early beginnings, gastric surgery developed rapidly, and, with the elimination of the bad and the dissemination of the good, it gradually came to assume a recognized structure. Gastro-jejunostomy by the posterior route, advocated by von Hacker in 1885, became the preferred method. In 1894 Jaboulay suggested gastro-duodenostomy, and in 1902 Roux advocated his method of gastro-jejunostomy en Y, a technique which now has a historic interest only. Partial gastrectomy soon became an established procedure. Randolph Winslow, of Baltimore, was the first surgeon to perform the operation in the United States, but by 1893 it was sufficiently standardised to call for a review in the Annals of Surgery of the resections performed up to that date, which showed a mortality of 41 per cent. Total gastrectomy was first attempted in 1884 by Phineas Connor, of Cincinnati, but Schlatter, of Zurich, was the first surgeon to remove the whole stomach successfully, a success repeated by McDonald in the United States in 1898. In 1929 Finney and Rienhoff were able to collect 122 cases of complete gastrectomy from the literature with a mortality of 41 per cent.

MORGAGNI

Within the second fifty years of the centenary under review the literature of gastric surgery has been too voluminous for analysis, but it may be said that since the beginning of the present century the technique of operation has been so perfected and the mortality so reduced that discussion has passed from the possibility or permissibility of gastric surgery to the technique of operations. In 1900 Mayo Robson claimed that all chronic gastric ulcers not responding to medical treatment should be subjected to surgery while the patient was still a good risk. In the same year W. J. Mayo declared cancer of the stomach to be a surgical disease. In 1905 Moynihan published the first book on the treating of gastric and duodenal ulcers, and the Mayo Clinic reported a series of 500 cases treated by operation.

In the early days of gastric surgery, when anaesthesia, instruments, materials, theatre technique, and pre- and post-operative methods were all crude according to modern standards, the choice of operation was dictated, above all, by considerations of the patient's safety. For cancer gastrectomy, growing more and more radical as technique improved, was, from the first, the recognised treatment. For ulcer, a distressing but not a mortal malady, the attempt to find an operation which would give permanent relief at small risk led to the adoption of a number of procedures which varied as views on the aetiology of ulceration changed. At first, the operation of gastro-jejunostomy held pride of place. It was simpler and safer than gastrectomy, and, after the first difficulties had been overcome, it was eminently satisfactory. The posterior operation became the rule, and, with the adoption of the no-loop or short-loop type of anastomosis, the mechanical obstruction which was a common sequel of the first operations was avoided. The operation was originally performed for cancer and for duodenal ulceration with pyloric stenosis, but, so excellent were the results, that it came later to be applied to the treatment of all ulcers, even those with no stenosis or even delay. Failures appeared, but at first they were few. In 1899 Braun described a post-operative jejunal ulcer. In 1905 Mayo Robson wrote a paper on gastro-jejunal ulceration, but looked upon it as a rare complication. With the increase in gastric surgery however, and particularly with the application of gastro-enterostomy to the treatment of earlier ulcers in younger patients, stomal ulceration became a problem to be reckoned with. Surgeons first sought for the explanation in some technical error, in the use of clamps or unabsorbable sutures or in the site or size of the opening, but they came to realise that the fault lay rather in performing the operation at all in patients with high acid and rapid emptying. Gastro-jejunostomy had its heyday from 1900 to 1925. In the early twenties doubts of its efficacy began to appear, and a group of operations round the pylorus, gastro-duodenostomy, pyloroplasty, Finney's operation, and other variations of gastro-duodenal anastomosis, were introduced to overcome pyloric stenosis or spasm and promote early neutralisation of the gastric contents.

J. M. T. FINNEY

THE FOUNDATION HOUSE
CHARLES MAYO (seated), WILLIAM MAYO (standing)

A HUNDRED YEARS OF GASTRIC SURGERY

FIG. 1

These operations, in turn, shared the fate of gastro-jejunostomy. They proved to be less successful than their authors had hoped, and no more immune than the older operation from recurrent ulceration, and from the late twenties the operation of partial gastrectomy has assumed increasing importance in the treatment of gastric and duodenal ulceration.

One reason for the abandoning of short-circuiting operations was the demonstration that the neutralisation they achieved was illusory, and that the acid level, which showed an apparent drop in the immediate post-operative phase, returned a year later to its pre-operative level, or higher. Others were the increasing safety of the larger operation in practised hands, and the permanent acid reduction achieved by adequate resections. Partial gastrectomy, like gastro-jejunostomy, went through a period of intensive testing, during which the unsatisfactory methods were eliminated and the satisfactory ones improved. It has eventually emerged as a safe and satisfactory though by no means standardised procedure, that in average hands still has a high mortality, but that in the hands of the expert carries no greater risk than the older operations, and a far higher prospect of cure. For the past ten years a radical gastrectomy, that differs in design in different clinics but in all carries out certain basic principles, has been the accepted treatment for peptic ulceration among the great majority of gastric surgeons throughout the world. In experienced hands it has a mortality not exceeding 2 per cent., a cure rate of at least 90 per cent., and an incidence of recurrent ulceration of at most one per cent. Yet because in average clinics the risks of gastrectomy are four or five times as high and the prospects of cure less assured, alternative treatments are constantly sought. Where do we stand to-day?

The literature dealing with the aetiology of ulceration is not merely overwhelming, it is self-cancelling. Whatever we wish to believe, we can find evidence in experimental work to prove our theory. Ulcers have been

produced by dividing the vagi and cured by dividing the vagi ; they have been produced by ligating the gastric vessels and cured by the same means ; they have been produced by transplanting patches of jejunum to the stomach wall and cured by jejunal transplants. Nervous impulses, trauma, toxins, infection, irritants, malnutrition, vitamin deficiency, have all been implicated. Clinically family disposition, smoking, worry, overwork, irregular meals, undernourishment, oral sepsis, and acute infections all seem to play a part. The one factor on which there is unanimity is that of acid. Peptic ulcers occur only when and where there is hydrochloric acid ; they are common where it is high, rare where it is low, unknown where it is absent. Yet, though acid is associated with ulcer, it is not the cause. Most healthy men and women in the prime of life have a high acid level, but very few have ulcer. In their moments of supreme fitness their acid is highest and their chances of ulceration lowest.

On other surfaces, such as the skin or the mucous lining of the mouth, we do not search for one cause of all lesions. Spots on the skin may be due to chemical irritants, thermal or mechanical injury, drugs, local or general infections, specific fevers. These spots usually heal and leave no trace behind them ; but if they occurred on a surface exposed to digestion they would persist and assume a uniform pattern.

An automobile may break down for many reasons. A tyre may go flat, a wheel may come off, a bolt may drop from the steering or transmission, a break may appear in the ignition system, a fly may choke a jet or a drop of water may block a gasoline pipe. The machine stops, the cause of failure is discovered and corrected, and then it goes on again. The mechanism of an aeroplane may go wrong for similar reasons, but in this case the result is usually permanent and usually the same—a mass of crumpled aluminium. We do not however try to prove a common cause. The causes are as varied as those that stop an automobile, but a secondary factor, that of gravity, comes in to make what is a temporary breakdown in the first case a permanent disaster in the second.

It is probable then that the causes of ulcer are as many and varied as the causes of skin spots and automobile breakdowns, but while lesions on the skin and mucous membranes are allowed to heal, those on a surface exposed to acid are digested away and become chronic ulcers, similar in each case whatever their first cause. The common sites of ulcer are not those where the primary lesion occurs most often, but those where the fixity of the part opposes healing and favours auto-digestion. But whether acid be the cause of ulcers or only the cause of their persistence, the surgical treatment of ulcer is bound up with a reduction in the acid level.

Many methods of reducing the acid level have been advocated, but four in particular, the short-circuiting operations, vaso-ligation, vagal section, and gastrectomy, must be considered to-day in relation to the mechanism of acid secretion which they are intended to modify.

A HUNDRED YEARS OF GASTRIC SURGERY

Acid and pepsin are secreted by the principal glands of the stomach which in man occupy the whole body and fundus, in fact all of the stomach except for two areas, a small strip near the cardia and the pyloric antrum, which bear the cardiac and pyloric glands respectively. But the secretion

FIG. 2

potential is not equal throughout this acid-bearing area. In the body the mucous membrane is thick and rugose, carrying deep glands and thrown into numerous tall folds which increase its secreting surface very greatly ; in the fundus it is smooth, thin, and carries simpler and shorter glands. This secreting surface pours out acid in response to stimuli of two kinds, nervous and hormonal. Secretomotor impulses are transmitted by the vagi, and are called forth by the anticipation, sight or smell of food, and by the pleasure in eating which man experiences in the early stages of a meal and the dog at all times ; they are abolished by vagal section. The hormone which evokes acid secretion is formed in the mucous membrane of the pyloric antrum, and to a much lesser extent in that of the duodenum and upper jejunum, in the presence of the products of gastric digestion, such as peptone. The hormonically induced flow of acid remains after vagal section.

The purpose of this double mechanism is clear. Gastric digestion is a prolonged process whose main task is to release meat fibres from their connective tissue envelope and reduce their proteins to simpler fractions. Meat meals, to the animal and to man under natural surroundings, come suddenly and unexpectedly, and some rapid mechanism for preparing a digestive medium into which they shall be received is essential. But when hunger is sated gastric digestion is by no means finished, and the hormone provides a slow and automatically regulated mechanism for keeping up the flow of digestive juice as long as there is anything in the stomach to digest.

The relative part played by these two mechanisms in man is unsettled. Most experiments on gastric digestion have been done on the dog, an animal that eats seldom, but with indecent haste and unconcealed joy. These experiments have led to an undue emphasis on the vagal mechanism in gastric secretion. Man eats from habit rather than hunger, and in decent society he takes about half an hour to get through a meal ; but he retains the meal in his stomach for a further two hours, during the whole of which he is renewing the acid bath in which digestion is taking place. It is therefore reasonable to suppose that in the human stomach the hormonal mechanism exceeds in importance the nervous one, and equally reasonable to suggest that the ulcer diathesis is characterised by hormonal misdemeanour rather than by vagal overaction. The ulcer patient is distinguished, less by his high acid level, than by his habit of secreting acid at all times, not only when he is eating but between meals and when he is asleep.

The acid curve of the usual fractional test meal shows two humps, like the Bactrian camel, a characteristic contour that is usually accepted without comment. It may be suggested, not as a statement of fact but

FIG. 3

as a hypothesis to excite controversy, that the first hump represents the vagal secretion called forth by the meal, the second the late hormonal secretion, and the valley between them the change-over period after the meal is finished and before the after-flow has got into its stride. With this outline of the mechanism of gastric secretion in mind, we may examine the four groups of operations advocated for the cure of peptic ulceration.

The short-circuiting operations do nothing to reduce acid production, but leave unaffected the acid-bearing mucous surfaces and the nervous and hormonal influences which cause them to secrete. They were designed

A HUNDRED YEARS OF GASTRIC SURGERY

to bring about neutralisation of the acid gastric contents by allowing alkaline juices to enter the stomach, a mechanism that was thought to be the normal one. It is however doubtful if any part of the alimentary tract works backwards except in the cow ; on the contrary each segment

FIG. 4

does its allotted job in the digestive process, and hands the result along the production band to the next department. The stomach, having reduced the meal to chyme, pushes it on to the duodenum and shuts down secretion till the next meal. Bile seldom appears in the normal stomach, and still more rarely in the hypertonic and rapidly emptying stomach of the duodenal ulcer patient, either before or after gastro-jejunostomy. The constant result of gastro-enteric anastomosis is that food leaves the stomach shortly after it has been eaten, so that the second wave of acid, when it comes, is poured onto a mucous membrane unprotected by food. The unsatisfactory results of short-circuiting operations when performed on patients whose acid mechanism survives or is capable of survival, are by now notorious.

Vaso-ligation has enjoyed a certain vogue in Britain. The operation consists in ligating so many of the gastric vessels that the blood supply of the stomach is reduced to a point just short of gangrene. It was propounded ten years ago by Wilson Hey of Manchester and has lately been advocated by Somerville of Travancore, and is unique in that it is designed to reduce radically the ability of the gastric membrane to secrete acid while leaving the shape and nerve supply of the stomach intact. In theory it seems unlikely that secretion can be abolished by such means without at the same time harming the neuro-muscular mechanism, and in practice the operation has not been sufficiently successful to persuade those most competent to judge, the colleagues of the authors in Lancashire and India, to adopt it.

Vagal section has a more scientific basis, since all experimental work has emphasised the importance of the nervous mechanism in gastric secretion. Dragstedt's pioneer work on dogs, and the strikingly successful results which he and the many surgeons who have followed him have obtained in treating human beings suffering from peptic ulceration, have placed the operation of supra-diaphragmatic vagotomy in the forefront of contemporary interest. It is odious to criticise the darling of the moment, whether in films, sport or surgical technique, but it would be well, before we rush into the operation wholesale, to ask whether it has drawbacks as well as advantages, whether it is indeed the answer to the gastric surgeon's prayer. Vagotomy diminishes very profoundly the quantity and acid level of gastric secretion in so far as that secretion follows nervous stimuli.

FIG. 5

It does not reduce the glandular basis of acid production, it does not affect the hormonal mechanism of after-secretion, it does not remove the deformity or the fixation to surrounding structures which are the causes of many of the effects of ulceration, and it has a tendency to delay emptying and promote distention. It may be therefore that vagotomy will eventually assume a place akin to that of the flame-throwing tank in modern warfare, a useful weapon for eliminating pockets of stubborn resistance. Those incurably ulcer-prone patients, whose ulcers recur even after the most radical resections skilfully performed, will have cause to bless the name of Dragstedt.

To bring back an old star for an encore while her rival holds the stage is a task as thankless as criticising the new favourite. Nevertheless we must ask ourselves if we have, in fact, any alternative treatment for

A HUNDRED YEARS OF GASTRIC SURGERY

ulceration that can rival radical gastrectomy in the satisfactory nature and permanence of its results. The word "radical" is used advisedly, for gastric resection may mean anything from pyloric circumcision to a planned and effective removal. The requirements of radical gastrectomy are threefold. Firstly it must remove the whole of the high convoluted mucous membrane of the body and leave only the thin low-secreting layer of the fundus, that is it must take three-quarters of the stomach.

FIG. 6

Secondly it must remove the whole of the antrum or antral mucous membrane as far as the pylorus, so that no further acid shall be secreted when the food has left the small stomach, as it will do in about twenty minutes. Thirdly it must divide the soft tissues on the lesser curve as far as the cardia, and so cut off more than half the vagal supply.

A gastrectomy so performed reduces the acid secretion profoundly and permanently and limits its outflow to the time that food is in the stomach. It gives results that are uniformly excellent, and still remains the standard by which other operations are judged.

I should like to express my grateful thanks for the help I have been given in writing this review by Colonel W. Connell, Mr. Charles Nicholas, Miss Margaret Loudon and Miss Muriel Waterfall.

W. H. O.

REFERENCES

- ABERCROMBIE, JOHN : (1828) *Pathological and practical researches on diseases of the stomach, the intestinal canal, the liver and other viscera of the abdomen*. Edinburgh, Waugh and Innes.
- BELL, JOSEPH : (1866) *A manual of the operations of surgery*. Edinburgh, Maclachan and Stewart.
- CRUVEILHIER, J. : (1856) Mémoire sur l'ulcère simple de l'estomac. *C. R. Acad. Sci. Paris* 42, 81-85 : 421-425.

SIR HENEAGE OGILVIE

- DONATUS, MARCELLUS : (1586) *De medica historia mirabili libri 6*. Mantua, F. Osana.
- EUSTERMAN, G. B. and BALFOUR, D. C. : (1936) The stomach and duodenum. Philadelphia, Saunders.
- FORSTER, J. C. : (1858) Description of the operation of gastrotomy. *Guy's Hosp. Rep.* 3.s, 4, 13-18.
- FORSTER, J. C. : (1859) Contraction of oesophagus from corrosive poison—gastrotomy. *Guy's Hosp. Rep.* 3.s, 5, 1-8.
- HURST, SIR A. and STEWART, M. J. : (1929) Gastric and duodenal ulcer. Oxford University Press.
- MAES, U., BOYCE, F. F. and MCFETRIDGE, E. M. : (1936) The story of gastric surgery. *Am. J. Surg.* 31, 378-394.
- SMITH, STEPHEN : (1881) *Manual of the principles and practice of operative surgery*. Boston, Houghton Osgood.
- STIMSON, LEWIS A. : (1878) *A manual of operative surgery*. Philadelphia, Lea.
- THOREK, M. : (1945) Gastrostomy: History of its development, indications and contra-indications. *Rev. Gastroenterology* 12, 347-352.
- ZUCKERKANDL, OTTO : (1901) *Atlas and Grundriss der chirurgischen Operationslehre*. 2te Aufl., München, Lehmann.