

The history of British oesophageal surgery

General developments

Only since the mid-1930s has oesophageal surgery been a routine part of surgical practice. The reasons for this are partly the actual difficulties of the subject and partly an attitude of mind that magnified the problem. Operations that avoided opening the pleural cavity, however, did not arouse this fear, so that procedures in the neck and on the lower oesophagus through the abdomen, and also instrumentation of the oesophageal lumen, had been performed at a much earlier date.

Armstrong Davison in *The Evolution of Anaesthesia*¹ makes reference to a whole variety of world events and historical happenings, quite unconnected with our profession, that have had an important influence on medical progress; and here too we must consider, at least in outline, some of the general developments that had to occur before progress would be made in the treatment of individual oesophageal disorders. The main problems that delayed a surgical approach to the oesophagus were maintenance of pulmonary function; the need for anaesthetic control and for an understanding of the anatomy and physiology of the organ; and development of the necessary techniques for investigation, the operation itself and the care of the patient throughout the operative period.

PULMONARY FUNCTION

From prehistoric times it must have been obvious that if a wound was made in the chest of an animal or a man breathing became impossible and death occurred. As far back as 1667 Robert Hooke, the curator of the Royal Society, gave scientific demonstrations on the intrathoracic state of dogs while maintaining life by inflating the lungs with a bellows. In 1775 John Hunter was engaged in similar activities and was even using a two-way flow so that air was both inflating and deflating the lung. About the same time Alexander Monro the Second, of Edinburgh, was doing the same thing; but the clinical application of such work was directed mainly towards resuscitation, which had the unfortunate effect of concentrating attention on keeping the lungs expanded rather than on keeping them ventilated. Insufflation anaesthesia did make it possible to deal with a patient with the chest open for short periods, but the resulting carbon dioxide retention was a stumbling block for many years.

In Berlin Sauerbruch was commissioned by his chief, von Mickulicz, to look into this problem. His plan was to have the patient (all except the head) in a chamber

together with the surgical team. The negative pressure in the chamber was alternated in degree, so that the lungs were expanded via the patient's mouth since this was outside the chamber. The technical requirements were enormously complicated, however, and his fine efforts had the unfortunate effect of inhibiting advance.

The problems were being tackled more realistically in other parts of the world before the first world war and in 1909 Green and Janeway were using rhythmic inflation of the patient's lungs in the United States. The vital change was that instead of being kept expanded the lungs should be ventilated, with both an inspiratory and an expiratory phase, which was achieved with positive pressure via the trachea, rather than with a negative-pressure chamber as advocated by Sauerbruch. Great strides in the development of this endotracheal inhalational anaesthesia were made in Britain by Rowbotham² and Magill,³ who were working on non-thoracic surgical cases soon after the first world war. Later Magill became associated with Tudor Edwards at the Brompton Hospital, a relationship that put anaesthetic practices firmly on the right footing.

ANAESTHETIC CONTROL

The provision of satisfactory facilities for anaesthesia¹ evolved in much the same way as methods for maintaining pulmonary function. Davison tells us that as long ago as AD 220 the Chinese surgeon Hua To claimed to be able to produce what he described as surgical anaesthesia.¹ In 1526 Paracelsus stated that ether (which he knew as *oleum vitreoli dulce*) could quieten chickens and relieve pain. In Birmingham in 1772 Priestley, a Unitarian minister, discovered nitrous oxide and in 1825 Charles Waterton published the story of his wanderings in South America and gave an extensive and reasonably accurate account of curare.

Early in the nineteenth century the drugs were available and their use was sufficiently understood for a good attempt to have been made at clinical anaesthesia, but it was 1846 before Morton at the Massachusetts General Hospital first administered ether successfully. This was followed the next year by the first use of chloroform by James Young Simpson in Edinburgh; chloroform was also given to Queen Victoria in 1853 for the birth of Prince Leopold. In fact, the main concern at this stage appears to have been the relief of the pains of labour. Later, anaesthesia was used widely in general surgical procedures and in Sauerbruch's patients in the negative-pressure chamber, but its use in oesophageal surgery developed alongside its use in pulmonary work and was

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dependent on the development of satisfactory endotracheal inhalational methods. As already mentioned, the turning point was the period after the first world war; and Magill and Rowbotham again played an important part, along with others, in establishing safe methods for maintaining pulmonary function and anaesthesia with the chest open. Since then many other important developments have occurred, but the critical breakthrough had been made and the general body of knowledge had grown so that full use could be made of previous discoveries.

ANATOMY AND PHYSIOLOGY

As with many other parts of the body, the requirements of surgery of the oesophagus have stimulated investigations into the anatomy and function of the area. The macroscopic anatomy of the oesophagus itself had been well described but its attachments and surrounding structures had received scant attention. This particularly applied to the diaphragm. Side by side with the development of operations for hiatal hernia the anatomy of the diaphragm, the phreno-oesophageal ligament,⁴ the distribution of the fibres of the phrenic nerves, and the structure and enervation of the right crus of the diaphragm^{5,6} were all being studied. Much of the development was British – for example, the idea that symptoms were related to reflux.^{4,7,8} The radiographic visualisation of oesophageal movement and gastric reflux was probably widespread but the Leeds school⁹ here played an especially important part.

When studies were extended to oesophageal manometry the pioneer steps were taken in the United States,¹⁰ but in some cases British doctors were co-operating in the early American work and in others the techniques were quickly taken up and further developed on this side of the Atlantic.¹¹⁻¹³ In the use of these techniques for routine care of patients Britain again played an important part.¹⁴ Routine studies included not only manometry but also overnight tests for reflux and investigations for bile reflux, both at the hiatus and at the pylorus.¹⁵⁻¹⁸

INVESTIGATIONS

Before these physiological methods came along other techniques had become available. Oesophagoscopy was developed both in America and in Britain between the wars and we were particularly fortunate at that time to have Mr Robert Schranz at the Genito-Urinary Manufacturing Company making such beautiful instruments – in particular a series of oesophagoscopes to the design of Negus, as well as laryngoscopes and a whole range of thoracic surgical tools.

The prominent part played by Britain in producing fiberoptic instruments is not generally realised. In 1870 John Tyndall, an English physicist, showed that a thin stream of water issuing from a tap conducts light along a

curved path. As a consequence John Logie Baird, the inventor of television, worked out a method of transmitting images through bundles of quartz or glass and of projecting the images so obtained by means of a lens. For this idea he took out a British patent (No 20,969/27 (1927)). It was further developed at Imperial College, London, and in 1954 a description was published of a flexible fiberoptic instrument four inches (10 cm) long with a resolution of a hundred lines to the inch.¹⁹ The name fibroscope was suggested for this instrument. The next steps, however, were not taken in Britain and it was the American Cystoscope Makers of New York that produced the first clinically usable fiberoptic endoscope in 1960.

Probably the most important of all investigative methods is radiography. The recording of studies by cineradiography is a useful addition, but there seems to be no real substitute for the oesophageal surgeon seeing for himself the barium swallow being carried out in collaboration with an expert radiological colleague.

OPERATIVE APPROACHES

In the main, surgical approaches to the oesophagus had to wait until surgery in general was sufficiently advanced. Isolated efforts had been made previously and as far back as 1633 Ambrose Paré²⁰ had stated that when the oesophagus was being sutured great care should be taken. By an approach to the oesophagus at its upper or lower end operations were possible without opening the chest and these naturally came first, but the big developments all came together from 1930 onwards, when operations could be planned with some hope of success (see below under individual clinical conditions).

PATIENT CARE

The care of patients includes management before, during, and after surgery. Enormous advances have been made here from the interwar years right up to the present day. Attention to fluid balance, the treatment of shock, and blood transfusion are all essential to oesophageal surgery, as to other surgical activities. Antibiotics, while they are similarly essential but non-specific adjuncts, deserve special mention because without them oesophageal anastomoses would have had a poor chance of success, and oesophageal surgeons owe much to Alexander Fleming as discoverer of penicillin,²¹ and to Florey in making it clinically available.²²

Specific conditions

ACHALASIA

One of the first references to achalasia was in 1675 by the English doctor Thomas Willis, who not only described the disability but also reported a successful treatment.²³ Using a sponge on the end of a piece of whalebone, he dilated the passage and gave material relief to his patient.

This action, however, started a controversy about treatment that has persisted ever since, as one school of thought favours treatment by dilatation while the other advocates treatment by open operation.

The main impetus for open operation came from Germany when Heller did the first myotomy at the cardia.²⁴ He took this action in the belief that the condition was due to spasm at the lower oesophageal sphincter, but this theory was altered by the work carried out at Guy's Hospital by Hurst,²⁵ who realised that the abnormality was due to a failure of relaxation rather than spasm and gave the condition its present name. He also brought dilatation back into favour by introducing and using his mercury-loaded bougies, but at the same time myotomy was having an ever-increasing vogue. Nevertheless, results were seen not to be perfect and a better means of relieving the obstruction was sought. This led to an operation for anastomosing the dilated oesophagus to the fundus of the stomach, but this produced most unsatisfactory results on account of the gross regurgitation that occurred. Those who used this method very properly and commendably reported their unfortunate results in full to warn others.²⁶

Even though the Heller procedure was well tolerated, with no operative mortality in many series, there remained some dissatisfaction with the results in about 20% of cases. This naturally encouraged the advocates of dilatation and stimulated the introduction of alternative methods of stretching the area through the oesophagoscope.²⁷

The advocates of myotomy were slow to counter this trend because it was not easy to find a reason for the unsatisfactory results. Several papers then appeared emphasising the importance of reflux and suggesting surgical steps to prevent it. The good results which finally resulted from this modification²⁸ might have been expected to swing opinion firmly in favour of myotomy, but this has not happened as dilatation can now be achieved with the aid of the fiberoptic oesophagoscope.²⁹

ATRESIA

To Britain goes the credit for an accurate description of atresia,³⁰ without which surgical treatment could not have been planned. Clearly there were many reasons why surgical treatment was delayed for more than 30 years, but among these were two misconceptions. These were, firstly, that the condition was very rare and, secondly, that it was universally associated with other serious congenital defects. Finally, after some attempts to deal with the condition by a multiple-stage procedure, a successful operation using excision and direct anastomosis was reported from the United States in 1943.³¹ The first success on this side of the Atlantic was recorded in 1947.³² Naturally the early efforts were associated with a high death rate but there was steady improvement.³³ ³⁴ It

also became evident that not all patients could be treated by direct anastomosis, so there is still a place for staged procedures.

CARCINOMA OF THE OESOPHAGUS AND CARDIA
In 1913 the American surgeon Torek reported the first successful removal of an oesophageal growth.³⁵ The gut was left with the upper end of the oesophagus brought to the surface and the patient fed by a gastrostomy. Many surgeons endeavoured to simulate this feat, but not until 1933 did the British surgeon Grey Turner record the second success.³⁶ In the same year Ohsawa in Japan described not only the removal of a cancer but also the restoration of alimentary continuity by a oesophagogastrostomy performed at the same operation.³⁷ This article, however, did not reach the attention of the Western world, with the result that the same procedure was reported in 1938 in the belief that it was an original success.³⁸ The first such success in Europe was in 1941 (reported in 1945)³⁹ and in Britain 1942.⁴⁰

The pattern of single-operation oesophageal resection was therefore established, but it remained for technical improvements to be made and the results assessed. One important modification was for the resection and anastomosis to be done from the right side after the stomach had been mobilised from the left.⁴¹ This was particularly useful for growths above the cardia but below the pharyngo-oesophageal junction. When these techniques were fully established a steady reduction in operative mortality was reported from the centres.⁴²⁻⁴⁴ As time passed two things became apparent: the quality of life after oesophagogastrostomy or oesophagojejunostomy was very good⁴⁵ but the long-term results were poor⁴⁶ despite all efforts to extend the dissection and remove more oesophagus.⁴⁷ With good relief of symptoms but poor long-term survival the value of resection in the individual case had to be carefully weighed against the operative upset to which the patient would be subjected.

Surgeons were therefore driven to reappraise the older technique of oesophageal intubation. This had been successfully performed in 1885,⁴⁸ with a useful modification reported by Souttar in 1924.⁴⁹ Both these methods required the tube to be pushed down from above. Clearly it was preferable to do this through the oesophagoscope so that laparotomy was avoided and the discomfort to the patient minimised. Despite this some surgeons preferred to pull the tube through from below,⁵⁰ although this has been shown to be less satisfactory from all points of view.⁵¹

CARCINOMA OF PHARYNGO-OESOPHAGEAL JUNCTION

Surgeons could remove growths at the pharyngo-oesophageal junction without opening the thoracic cage, so that surgical effort started early. Three approaches were tried – namely, intubation, resection,

and resection with reconstruction. Progress generally followed in that order. The Symonds tube,⁴⁸ which was a sound attempt to bring relief to the patient, was developed in Britain but efforts at resection seem to have started on the Continent.⁵² With successful resection accomplished the need arose to re-establish swallowing and the first efforts here were again made in Europe,⁵³ skin flaps from the neck being used for the reconstruction. A further impetus towards surgical treatment was provided by the work of Trotter in Britain.⁵⁴ He was concerned primarily with pharyngeal cancer, but five of the patients he described in his Hunterian lectures were women with growths in the postcricoid area. For the higher pharyngeal growths he used skin flap reconstruction, but this was not attempted in the patients with lower growths. Skin tube techniques, either to bridge a local gap⁵³ or to join the pharynx to the stomach,⁵⁵ were required for both malignant and non-malignant disease; but with the operation in several stages the patient often died from recurrence of the cancer before surgery was complete. Further work on the skin tube method, which really amounted to its last fling, came from the work of Wookey in Canada.⁵⁶

Increasingly it became apparent that a tube of gut must be used if excision and reconstruction were to be attempted. This was successfully performed with colon^{57,58} or jejunum,⁵⁹ the gut being brought up in front of the sternum. A further step in this direction was made by Goligher and Robin,⁶⁰ who produced a successful and practical technique using the left colon, placed in the antethoracic position. This appears to have replaced most other methods where anastomosis to the pharynx is required,⁶¹ though some surgeons still use the stomach.

Now the limitations of surgery for these cancers arise not from a high operative mortality rate but from the high recurrence rate of the growths. For this reason palliative methods that cause less upset to the patient still have an important place. Thus Stuart's operative reconstruction method using a plastic tube⁶² and also radiotherapeutic regimens with or without intubation deserve consideration.

UNCOMPLICATED HIATAL HERNIA

Before 1940 all hernias through the diaphragm were generally grouped together and regarded as examples of protrusions of abdominal contents through various orifices. Even the best-informed authorities viewed hiatal hernia in this way.⁶³ Allison,⁴ ⁶⁴ however, supported by Barrett,⁸ changed this attitude. They focused attention on the idea that symptoms were due mainly to an upset in the physiological function of the area causing reflux from the stomach. Once this was accepted tests were obviously necessary to investigate function and measure the degree of reflux. Screening examinations with a barium swallow immediately became important

and have remained so. Some attention was given to pH studies,⁷ but these remained only a research tool for many years.

The natural consequence of Allison's thinking was that he himself developed operations designed to improve reflux control at the oesophago-gastric junction. Both he and others⁵ ⁶ studied the anatomy of the area and reviewed previous anatomical descriptions.⁶⁵ This led to several surgical modifications designed to make the structures at the hiatus as near to normal as possible.⁶⁶ In all aspects of the subject, including hiatal herniae in infants and children,⁶⁷ surgeons in the United Kingdom played a leading part.

A physiological revolution occurred in the mid-1950s with the introduction and development of oesophageal manometry.¹⁰ ¹¹ These techniques, with measurements of transmucosal potential difference and oesophageal pH,¹⁴ provided much better methods for evaluating the need for surgery and assessing the results. These advances also raised the question of whether acid found in the oesophagus was important in itself or was merely an indicator of the presence of other irritant substances in the gastric juice. Furthermore, the difficulty of relating symptoms to the degree of reflux prompted the search for damaging factors other than acid and pepsin. The work of Capper and Gillison¹⁵ ⁶⁸ ⁶⁹ offered an answer to many of these questions and led to important new investigations on other substances in the stomach that might also be flowing back into the oesophagus.¹⁶ ¹⁷ The most obvious of these is bile and so research was directed to finding the conditions in which it was present in the stomach. At first the pylorus was regarded as a sphincter similar to the cardia, but it was soon realised that it was part of a complicated reciprocal mechanism in which various parts of the stomach and duodenum were concerned.⁷⁰ Here the idea that hormones play a major part in the control of the lower oesophageal sphincter⁷¹ was one of the most important pharmacological advances.

From the point of view of surgical technique the attitude of British surgeons continued to follow Allison in using techniques designed to strengthen the lower oesophageal sphincter and make the muscle action of the right crus more normal, but from about 1960 there was the alternative operation of fundoplication, which was introduced by Nissen.⁷² There is still controversy about whether the traditional British approach or the Nissen operation provides the better results.

REFLUX STRICTURE

In some patients with a hiatal hernia and reflux the oesophagus becomes shortened and the cardia is drawn up into the chest. In some cases gross stricture formation occurs at the oesophago-gastric junction, in others there is mild obstruction, while in a third group there is no narrowing at all. The difficulty of achieving reflux

control in all these patients is widely acknowledged,^{73,74} though the surgical approach has varied over the years.

In the group with really gross strictures the surgical options lie between excision of the narrowed area and special methods to effect reflux control despite the greater difficulties. Excision implies that the stricture is presumed to be irreversible, and after the narrowed area has been excised the continuity of the bowel is re-established by various means.⁷⁵ The contrary view is that there is no such thing as a reflux stricture that cannot be dilated with care and patience. This having been done, an operation that prevents reflux⁷⁶ will allow the condition to be controlled. In the intermediate group of patients, whose stricture can easily be dilated, some would still excise it while others would rely on surgical reflux control. Several operations are used for this, gastroplasty having been in longest use.⁷⁶ For the mildest group a standard reflux-controlling operation is accepted as satisfactory, with or without gastroplasty. Thus there are two opposing approaches to these conditions, both having originated in Britain. Surgeons in Britain tend to favour resection while support for the more conservative operation of gastroplasty has come from the United States and Canada.^{77,78}

OESOPHAGEAL REPLACEMENT

Replacement of the oesophagus may be needed because of disease, congenital defects, or trauma and the efforts to deal with this problem illustrate the general historical development of oesophageal surgery. Feeding the patient through a gastrostomy or connecting the exteriorised upper end of the oesophagus to a gastrostomy hardly amount to replacement. If we exclude these, the first methods to give hope that a patient could have his swallowing restored came from Germany. Bircher⁵⁵ attempted unsuccessfully in 1894 to form an anterior connection by a skin tube, but in 1907 he recorded a success and his method was fairly widely used around the world. A series of such operations was done in Birmingham⁷⁹ in the decade before the second world war. I assisted at some of these operations, which were all performed on women who had strictures from swallowing caustic, either accidentally or with suicidal intent. In women the operation was easier because of the extra skin and subcutaneous tissue on the front of the chest and the absence of hair. Not long after Bircher's report a successful operation bringing the jejunum up in front of the sternum was developed, also in Germany.⁸⁰ This technique continued to be popular in Eastern Europe, mainly because attempted suicide by swallowing caustic continued to be a common event there. Yudin's work in Moscow⁵⁹ was well known and had a big influence. Although he preferred to bring up the jejunum he also used skin tubes and transverse colon in the antethoracic position.

If the obstructing lesion is short and confined to the

neck continuity can be restored by ingeniously placed skin flaps. Here the best-known work was done in Canada.⁵⁶ The big disadvantage with all skin-tube techniques was that multiple-stage operations were required; while another disadvantage, which has only recently come to light, is the risk of carcinoma in the skin tube.⁸¹

The whole picture changed with the development of safe intrathoracic surgery and the successful introduction in Japan in the early 1930s of the operation bringing the stomach up into the chest.³⁷ For total replacement, however, the anterior route was still favoured by many on account of its general convenience, the easier handling of leaks from suture lines, and the fact that the patient could assist his swallowing manually. A major step in the successful use of the left colon for this purpose was reported by British surgeons in 1954.⁶⁰ Both intrathoracic and extrathoracic routes continue to be used, the choice depending partly on the height of the lesion and partly on the individual preference of the surgeon concerned.^{82,83}

SPONTANEOUS RUPTURE OF THE OESOPHAGUS

The first description of spontaneous rupture of the oesophagus was by the famous Netherlands doctor Hermann Boerhaave,⁸⁴ who in 1724 reported on the necropsy carried out on Baron de Wassenauer, a Grand Admiral of the Fleet of Holland. This colourful occurrence attracted Barrett when he was planning the first edition of *Thorax*. He found himself short of surgical material and was driven to the conclusion that this could be corrected only by writing a paper himself.⁸⁵ Spontaneous rupture was the subject he chose, although he had never at that time seen such a case. In reviewing the published reports he found that no patient had survived the operative closure of such a lesion. He did, however, give credit to my colleagues and myself, who two years previously had reported correctly diagnosing a case with subsequent treatment by surgical repair.⁸⁶ Unfortunately the patient died soon after operation. Barrett emphasised the fact that doctors fail to diagnose this condition because they are unaware of its existence. This is undoubtedly true, but we had no knowledge of the condition before we were confronted with our case. Barrett's point was well demonstrated in 1947, when he reported the closure of such a rupture with the first example of survival after the operation.⁸⁷ Since that time many cases have been reported, but a continuing feature is the high death rate, even with early diagnosis.

PHARYNGEAL POUCH

Ludlow described the pharyngeal pouch in 1769,⁸⁸ but as a result of a lucid German account over 100 years later the condition has become eponymously associated with Zenker.⁸⁹ In Britain Whitehead in 1891 appreciated the necessity for action, but could only suggest doing a

gastrostomy for his patient.⁹⁰ At the beginning of this century a series of cases in which excision had been used with considerable success was reported from Britain by Butlin.⁹¹ It was acknowledged, however, that this work was not original as von Bergmann had performed excision in a case some 10 years before. Even in 1891 the condition was called a pressure diverticulum and subsequent papers generally referred to a pulsion diverticulum, which seems to be close to the current understanding of the aetiology. Despite Butlin's successes there was a high incidence of wound breakdown and fistula formation, and Goldman in Freiburg therefore introduced a two-stage operation.⁹²

In 1950 Negus in Britain published a full and careful review of the evolution and treatment of the condition.⁹³ Consequently attention focused on the aetiological importance of the upper oesophageal sphincter and the question of whether a myotomy should be part of the operation was raised.⁹⁴ There was speculation about whether the pouch was secondary to upper sphincter spasm caused by gastro-oesophageal reflux, and the association of pharyngeal pouch and sliding hiatal hernia tended to support this view.⁹⁵

MISCELLANEOUS CONDITIONS

Before the days of endoscopy foreign bodies in the oesophagus presented a serious problem; but as long ago as 1879 a young house surgeon at the Queen's Hospital, Birmingham, reported successfully removing a half-penny from a child using a probang.⁹⁶ Endoscopic methods were developed by an American, Jackson,⁹⁷ who devised a wide range of techniques for the removal of awkwardly shaped foreign bodies with the rigid oesophagoscope. His skill in this direction was internationally respected, but now seems to have been almost forgotten. This is because it is now recognised that if a foreign body cannot be removed easily via an oesophagoscope it is best to proceed immediately to a thoracotomy.

Finally, a condition that just deserves a mention, though it is of minor surgical importance, is the oesophageal web. It was first described in Britain in 1919 by Kelly⁹⁸ and Paterson.⁹⁹ Though two American names are more usually associated with it, Vinson¹⁰⁰ makes it clear that Plummer, though he spoke of the syndrome at an early date, never published his observations. Thus the condition is more properly called the Paterson-Kelly syndrome.

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