EARLAM’S OESOPHAGOSCOPE
Produced by Seward Surgical in 1978; Based on Lloyd-Davies Stainless Steel Sigmoidoscope

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Earlam’s Oesophagoscope

A range of instruments for Inspection, Biopsy, Stricture Dilatation of the Oesophagus and introduction of Palliative Intubation Tubes.
Seward Surgical have worked closely with Mr Richard Earlham, Consultant Surgeon, to develop a new range of instruments for the investigation and intubation of the oesophagus. As with the Lloyd-Davies Sigmodoscope from Seward, the oesophagoscopy is made of stainless steel with interchangeable parts. The scope has a safe, non-slip handle, specially contoured beak for easy introduction, graduated outer surface and fitted with distal fibre light illumination, proximal magnifying telescope and inflation bellows. Available in sets or individual components, there are two basic sizes: 15 mm diameter for inspection and dilatation and 20 mm diameter for dilatation and insertion of palliative tubes.

### Oesophagoscopes

<table>
<thead>
<tr>
<th>Cat. no.</th>
<th>Description</th>
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<tbody>
<tr>
<td>17.8501</td>
<td>Earlham's Oesophagoscope, Combination Set comprising: 450 mm × 20 mm dia. tube with fibre light stem. 450 mm × 15 mm dia. tube with fibre light stem. Telescope with connection for inflation bellows. Double inflation bellows. Tube cleaning rod with two size brushes. Complete in carrying case.</td>
</tr>
<tr>
<td>17.8503</td>
<td>Earlham's Oesophagoscope, Large Set comprising: 450 mm × 20 mm dia. tube with fibre light stem. Telescope with connection for inflation bellows. Double inflation bellows. Tube cleaning rod with one brush. Complete in carrying case.</td>
</tr>
<tr>
<td>17.8510</td>
<td>450 mm × 20 mm dia. Oesophagoscope only.</td>
</tr>
<tr>
<td>17.8512</td>
<td>450 mm × 15 mm dia. Oesophagoscope only.</td>
</tr>
<tr>
<td>17.8514</td>
<td>Fibre light stem with B24REM removable mount.</td>
</tr>
<tr>
<td>17.8515</td>
<td>Fibre light stem with STORTZ removable mount.</td>
</tr>
<tr>
<td>17.8516</td>
<td>Fibre light stem with WOLF removable mount.</td>
</tr>
<tr>
<td>17.8518</td>
<td>854824 removable mount only.</td>
</tr>
<tr>
<td>17.8519</td>
<td>STORTZ removable mount only.</td>
</tr>
<tr>
<td>17.8520</td>
<td>WOLF removable mount only.</td>
</tr>
<tr>
<td>17.8522</td>
<td>Telescope with connection for inflation bellows.</td>
</tr>
<tr>
<td>19.4022</td>
<td>Double inflation bellows.</td>
</tr>
<tr>
<td>17.8524</td>
<td>Tube cleaning rod in two sections.</td>
</tr>
<tr>
<td>17.8526</td>
<td>Brush for cleaning rod — 20 mm tube size.</td>
</tr>
<tr>
<td>17.8527</td>
<td>Brush for cleaning rod — 15 mm tube size.</td>
</tr>
<tr>
<td>17.8529</td>
<td>Plastic suction tube.</td>
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### Dilators and Intubation Sets

<table>
<thead>
<tr>
<th>Cat. no.</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>17.8532</td>
<td>Earlham's Oesophageal stricture dilators, complete set of 30 fitted into slotted then roll (Autoclavable).</td>
</tr>
<tr>
<td>17.8534</td>
<td>Earlham's Oesophageal Dilators. (See illustration for ACTUAL SIZES) Sizes: 9 FG (3 mm dia.) 16 FG (6 mm dia.) 33 FG (11 mm dia.) 10 FG (3½ mm dia.) 19 FG (6½ mm dia.) 36 FG (12 mm dia.) 11 FG (3¾ mm dia.) 20 FG (6¾ mm dia.) 39 FG (13 mm dia.) 12 FG (4 mm dia.) 21 FG (7 mm dia.) 42 FG (14 mm dia.) 13 FG (4¼ mm dia.) 22 FG (7½ mm dia.) 45 FG (15 mm dia.) 14 FG (4½ mm dia.) 23 FG (7¾ mm dia.) 48 FG (16 mm dia.) 15 FG (5 mm dia.) 24 FG (8 mm dia.) 51 FG (17 mm dia.) 16 FG (5½ mm dia.) 25 FG (8½ mm dia.) 54 FG (18 mm dia.) 17 FG (5¾ mm dia.) 26 FG (9 mm dia.) 57 FG (19 mm dia.) One set of 4 malleable, tapered, figure-of-eight dilators without handles.</td>
</tr>
<tr>
<td>17.8535</td>
<td>Linen Roll, slotted to hold 30 oesophageal dilators.</td>
</tr>
<tr>
<td>17.8537</td>
<td>Palliative oesophageal intubation tubes, made of stainless steel with 1 mm thick. 70 mm × 12 mm dia. 150 mm × 12 mm dia.</td>
</tr>
<tr>
<td>17.8538</td>
<td>70 mm × 14 mm dia. 150 mm × 14 mm dia.</td>
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<tr>
<td>17.8539</td>
<td>70 mm × 16 mm dia. 150 mm × 16 mm dia. (Other sizes made to order, minimum quantity of six.)</td>
</tr>
<tr>
<td>17.8545</td>
<td>Introducing tube for palliative tubes.</td>
</tr>
<tr>
<td>17.8546</td>
<td>Introducing rod for palliative tubes.</td>
</tr>
</tbody>
</table>
There are 30 dilators from which to choose. Each has a smooth tellon end, malleable in the smaller sizes, ranging from 3 mm to 18 mm in diameter. The handles are clearly marked with the size (French gauge). The complete set, or part set can be fitted into a pocketed linen wrap which is ideal for protection during autoclaving and storage. The 6 sizes of stainless steel intubation tubes can now be easily fitted using the new flexible tellon introducer tube and rod. Extra long accessories are available and include cleaning rod and brushes for the oesophoscopes, suction tube and a range of forceps which are shown overleaf.
Four Seward stainless steel instruments for use with Earlam’s oesophagoscope.

17.8550 Chevalier Jackson’s Biopsy Forceps, 650 mm long with cutting jaws and basket.

17.8551 Paterson’s Biopsy Forceps, 650 mm long with oval cutting jaws.

17.8552 Chevalier Jackson’s Foreign Body Forceps, 650 mm long with set back grasping jaws.

17.8553 Chevalier Jackson’s Nodule Forceps, 650 mm long with angular cup shape cutting jaws.

seward surgical

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INTRODUCTION

1.01 A NEW STAINLESS STEEL RIGID OESOPHAGOSCOPE

The author spent two years from 1966-1967 at the Mayo Clinic in Rochester, Minnesota, USA, working on oesophageal motility with the physiologist, Professor Charles Code and the cardio-thoracic surgeon F Henry Ellis Jr. The subjects were the repair of hiatus hernia in dogs after making first a hiatus hernia and weakening the gastro-oesophageal sphincter with a Heller’s myotomy, before doing various repairs which was the subject of my M.Chir Thesis in Cambridge in 1968. Having also done experimental work on the effect of ischaemia on ganglion cells and the disease caused by trypanosomes in Brazil – Chagas Disease, the author wrote an essay for the Isobella Forshall Essay Prize in Liverpool “Ischaemia: a hypothesis for the genesis of aganglionic bowel” in 1968. Both of these works were written while the author was an Alexander Von Humboldt scholar in 1968 in the cardio-thoracic unit of Professor Rudolf Zenker in Munich and formed the basis of a surgical interest in the oesophagus and oesophageal manometry which culminated in a book “Clinical Tests of Oesophageal Function” in 1976 after having returned to England in 1969. As a lecturer in surgery at The London Hospital the author first lived in a rented house between Montpelier Square and Harrods in London. But after marriage in September 1969 he and his wife Roswitha from Munich moved into a house with an incredible view over the Thames Valley viewed from the hills above Dulwich. From there the history of London combined with history of the hospitals and the development oesophagoscopes.

1.02 From this vantage point in Crescent Wood Road on the hills above Dulwich south of the river, where I lived in 1975, the Thames valley can be seen together with the Houses of Parliament and the block of Big Ben. The River Thames itself is hidden but the main buildings of the city and St Paul’s cathedral are clear. On the right over to the East is the site of the old London Bridge. This was the lowest bridge crossing the Thames estuary and river in the olden days. Almost all imports arrived by ship and were landed in these docks still tidal at this level. The main use of the bridge was to bring in food from the market gardens of Kent. In medieval times this was also the route for monks and ordinary people going on their annual pilgrimage southwards to Canterbury clearly described by Geoffrey Chaucer. Two hospices run by monks were developed as hospitals: one North of the bridge, St Bartholomew’s, and the other South, St Thomas. Subsequently the latter moved opposite the Houses of Parliament near to the Bishop of Lambeth and was replaced by a hospital founded by a surgeon call Mr Guy. These were the three earliest London teaching hospitals. But in two of the hospitals founded later, namely King’s College Hospital and The London Hospital, modern oesophagoscopy in England was developed by Sir Victor Negus and Sir Henry Souttar respectively.
2. CHEVALIER JACKSON (1865-1958)

2.01 However, the true father of the modern rigid oesophagoscope is Chevalier Jackson who did metal lathe work himself so his instrument was circular round. No one nowadays can match his experience with extraction of foreign bodies from the oesophagus. Chevalier Jackson was a self made man with two outstanding abilities, hard work and attention to practical details, which enabled him to develop instruments and obtain the maximum use out of them. He always had a workshop and one of his great joys was to work at his lathe. The power was obtained from water since it was in a converted corn mill that he used as his weekend house. He was responsible for legislation to mark bottles containing lye for making soap as poison in an attempt to reduce the number of children who had accidentally drunk the clear liquid and developed lye strictures. To his clinic in Philadelphia came Victor Negus in 1924, and on return home to King’s College Hospital he developed the rigid oval brass oesophagoscope which bears his name. But the advantages of a round circular tube are that it is better optically, the maximum size of a round circular bougie can be passed, it is easier for cleaning and can be machined on a lathe. The outside diameter of the beak which is expanded to make its introduction safe is measured accurately because this passes through the cricopharyngeal sphincter and, after dilatation with bougies, can be passed through a peptic lower oesophageal stricture to dilate it to a circumference larger than the largest bougie which measures 54 French Gauge (18 mm diameter). Negus having done anatomical research on the larynx and cricopharyngeal region found the opening of the upper oesophageal sphincter as a transverse slit which widened to an oval so he made his instrument oval in shape. Lighting was from the proximal end. Basically the brass Negus oval instrument has been unchanged since its introduction 50 years ago. Modern fibreoptic lighting has replaced the proximal twin bulbs and has improved the amount and reliability of the proximal light source, but can never be as efficient as distal illumination. We all owe a great debt to Professor Harold Hopkins, FRS for his invention and developments of fibreoptics, but there is still a place for rigid instruments.
3. **STAINLESS STEEL VERSUS BRASS: MEASUREMENTS ARE ESSENTIAL**

3.01 The oesophagus has not changed its shape, its length or its diameter in the last fifty years, so oesophagoscopes have not altered greatly, but the material they are made from has changed. It is, however, essential to know the diameters, both internal and external, and to measure them accurately. The easiest metal to work with is brass and prototypes are usually made of this material. The beak must be wedge shaped for safe introduction through the transverse slit of the upper sphincter, it must be well smoothed for safety, but small enough for introduction. Since the entrance to the upper oesophagus is its narrowest portion, it is very susceptible to damage.

3.02 Brass is an alloy of copper and zinc, which is not as strong as bronze, an alloy of copper and tin, used for large gun barrels. Stainless steel is a mixture of iron and chromium (20%) which is even stronger and not so malleable like iron or brass which is the easiest to knock into shape. This should be irrelevant today considering the technological advances of modern surgical instrument manufacturing.

3.03 The barrel of the Earlam oesophagoscope is made from standardised stainless steel tubing which because of its strength has a thin wall and a larger internal diameter than a comparable brass tube. The advantage of a round tube over an oval one is that it is easily manufactured, better optically, is cleaned more easily and can take a larger size of round dilator for any given circumference.

3.04 Another advantage of stainless steel over brass is that the surface does not become dull. The special shaped handle which does not actually enter the oesophagus can be made of brass and it has the additional advantage of giving a better weighted instrument. The chromium plating is reliable nowadays and tough enough to withstand constant use and autoclaving. Bronchoscopes made of brass were never chromium plated in the past because in the early days this was unreliable and nobody wanted to risk leaving chips of chromium down a bronchus.

3.05 The majority of theatres possess no bottle brush large enough and capable of cleaning a sigmoidoscope let alone an even longer oesophagoscope so a special cleaning rod is provided, to which can be attached two different sizes of brush for the small and large oesophagoscope. These brushes and long handles were copied with their help from designs used by James Purdey and Sons, famous Royal gunsmiths in the West End of London, for use in their excellent 12 bore shot guns (12 bore measures 18.5 mm internal diameter just over 54 FG) with a length of 24-28 inches (61-71 cm). It is essential to keep the inside of the lumen shiny and there seems to be no good reason why society should wish to keep the inside of a gun barrel cleaner than the lumen of an oesophagoscope, so a similar technique is used for both. After use this oesophagoscope can be autoclaved without losing any of its brightness, it is, of course, made of polished stainless steel.
3.06 **MEASUREMENTS ARE ESSENTIAL**

French Gauge (FG) equals circumference in mm \((2\pi r)\) where \(\pi = 3\) and \(r = \) radius in mm.

**EARLAM OESOPHAGOSCOPE** both large and small is 450 mm long and its overall length with handle 558 mm long.

It comes in two sizes of barrel like the Lloyd-Davies sigmoidoscopes –

- Small 15 mm in diameter
- Large 20 mm in diameter

The outside diameter/circumference of the oesophagoscope is larger than the Lloyd-Davies sigmoidoscope because of the beak.

Earlam oesophagoscope – small outside diameter OD 60 FG

large outside diameter OD 72 FG

The internal diameters of the Earlam oesophagoscope and the Lloyd-Davies sigmoidoscope are the same.

- Small internal diameter ID maximum 39 FG equivalent 13 mm d
- Large internal diameter ID maximum 54 FG equivalent 18 mm d.

Forceps for biopsy/foreign body FB removal must be long enough; the best are Chevalier Jackson, length 650 mm, also made by Sewards.

James Purdey and Sons: 12 bore shot gun (NOT for use in theatre) length 610-710 mm (24-28 inches). Internal diameter ID 54 FG equivalent to 18.5 mm.

**Bougies Teflon (PTFE)** 26 sizes from 8-54 FG.

- Increments in 1 x FG circumference in mm 9-24 FG 3-8 mm diameter
- Increments in 3 x FG circumference in mm 24-54 FG 8-18 mm diameter
- Maximum for small oesophagoscope 39 FG 13 mm diameter (12.5 mm = \(\frac{1}{2}\) inch)
- Maximum for large oesophagoscope 54 FG 18 mm diameter

Negus Bag maximum diameter 35 mm (25 mm = 1 inch)

  Circumference 105 FG
Souttar Tubes only for large oesophagoscopes
   Made from 1 mm stainless steel wire
   Deduct 2 mm for internal diameter size
   Add 3-4 mm for lip at top end.

Short tubes 70 mm 12, 14, 16 mm outside diameter OD
   36, 42,48 mm circumference FG
Long tubes 150 mm same three choices in size
4. EARLAM NEW OESOPHAGOSCOPE

4.01 PLANS FOR A FUTURE NEW OESOPHAGOSCOPE (1975) BECAUSE OF DISSATISFACTION WITH THE PRESENT NEGUS OESOPHAGOSCOPE WHICH IS USED IN MOST HOSPITALS IN ENGLAND.

The Negus instrument is based on technology which is about 50 years old, even though some of the modern instruments have had fibreoptic lighting added, it was originally designed for simple bulbs and the total optics is based on a facile concept of light reflecting from the inside lumen. Since the inside is almost never properly cleaned in any hospital and has a thick crust like layer that presents on the inside, the lighting is so poor that nobody can really see properly to the distal end. In addition there is an extremely dangerous beak which is far too sharp. The instrument is usually not long enough for very tall people who have strictures at the lower end of the oesophagus. It is oval shaped which is inefficient because most of the instrumentation that one has to perform is based on round objects rather than oval shaped objects and therefore it won’t take a large enough dilator, nor will it take a very large Souttar tube. I understand that the brass finish was because plating was not reliable enough in the early days and for a bronchoscope it was felt dangerous that some of the chrome would peel off and be left in the bronchus. This reason was applied similarly to the oesophagus.

4.02 A prototype of both the small and the large oesophagoscope has been made and this has been tested out over the last six weeks in my routine operating lists. After some modifications I would now consider that it was a wise procedure to go ahead and make the scope in stainless steel. If at least three of the small and of the large scopes are made I would suggest that they be tested out by myself, Mr Flavell and Mr Leigh-Collis, all of whom are surgeons who believe in the rigid scope. Some slight modifications of the lighting might then ensue since the reflection and the optics of the stainless steel are somewhat different from the brass. I think it is essential to go to this next step rather than straight into production so that we get the benefit of expert testing (this was written in 1975).

4.03 It was suggested in 1975 that a completely new oesophagoscope should be developed using at least some modern technologies such as the use of stainless steel tubing and a fibreoptic source.

4.04 Dealing with oesophageal strictures of a benign nature and also carcinoma is the essential use for this instrument and it will of course be the most useful instrument for extracting foreign bodies.

4.05 The round body should be of stainless steel so it would seem convenient to use the same two sizes as found in the Lloyd-Davies sigmoidoscopes. With an external diameter of 15 mm and 20 mm. With stainless steel there is a larger internal diameter and because the body is round the oesophagoscope can take larger dilators. For instance the small scope takes a 39 FG and the large takes a 54 FG bougie.
which is the largest available. The additional size of the large oesophagoscope will also enable larger Souttar tubes than are now used to be passed down the lumen. A further advantage is that all fittings used on the Lloyd-Davies sigmoidoscope also fit the Earlam oesophagoscope.

4.06 On the barrel the cm markings have been made in a clear style similar to that which is already done on the Lloyd-Davies sigmoidoscope.

4.07 The non-slip handle is considered to be a very safe innovation. Knurling is usually too fine for rubber gloves so this particular rough surface has been developed from a simple extruded tubing and there is almost no loss of adhesion when rubber gloves are worn.

4.08 The beak is thick and rounded and with the prototype has been found to be extremely safe on introduction. The maximum outside circumference of a small scope is 60 FG and for the large 72 FG. The small scope with a circumference of 60 FG due to the beak has a larger circumference than the largest bougie 54 FG. This means that when a stricture is dilated by passing the small scope completely through there is a definite knowledge of what dilatation (in FG) has been reached so that standardization of treatment can be effected. Dilatation to 72 FG is not necessary for treatment of a benign peptic lower oesophageal stricture.

4.09 The light source is a fibreoptic bundle similar to that used on the bronchoscope but obviously longer. The light is carried in a separate tube on the outside of the scope so that the internal diameter is kept clear for good optics, passing bougies and easy cleaning. The pin which attaches the light to a small bar on the handle can easily be tamped out if it gets blocked and it is in fact easily extractible. Any type of fitting can easily be put on this fibreoptic source and naturally people can be persuaded to buy the Seward one or two light source.

4.10 The length overall is 558 cm. The barrel and the beak is only 450 mm and the remainder of the length is formed by a handle which can in very tall patients actually be passed into the mouth so that large, long people with oesophageal problems can be dealt with.

4.11 The Lloyd-Davies sigmoidoscope telescopic end has been slightly modified by taking 4 mm off the barrel so that it can fit into the proximal end and be used both for the pneumatic dilatation and the magnification. Pneumatic dilatation of the oesophagus is useful in assessing carcinoma and the magnification enables the epithelium to be visualized so that the correct biopsy can be taken. The fitting will connect with both the large and the small oesophagoscope so there is complete standardization with the sigmoidoscope and the only alteration necessary is the trimming of the barrel.
4.12 OESOPHAGOSCOPE: STORAGE

The new stainless steel oesophagoscopes come in a convenient carrying case. The larger size is for the introduction of palliative intubation tubes and the smaller one for routine inspection, dilatation and biopsy. Both have interchangeable fibre light bundles of the same length which are passed down a separate tube on the outside of the barrel lighting up the distal beak. The case contains a special cleaning rod made of delrin, a flexible nylon material, onto which can be screwed two different sizes of cleaning brush for the two barrels. This is similar to a ramrod used for cleaning gun barrels and is essential to maintain the shiny interior of the tube which can not be reached by conventional bottle brushes. At the lower end of the case are the telescope and bellows attachment in red rubber. The outside diameter of the barrel of the small scope is 15 mm and of the large one 20 mm.

4.13 The instrument consists of a non-slip handle, a stainless steel barrel and introducing beak. On the proximal end the telescope is attached to which is fitted the red rubber tubing and bellows for insufflation of the oesophagus.

4.14 The handle is made of fluted brass, turned and shaped to provide a very safe grip, which can be held in two fingers or the whole hand if necessary, but it must be emphasized that no force at all should be used for any oesophagoscopy. The small protruding pillar serves two purposes, firstly it stops the instrument rolling off the table and secondly it fixes the fibre light bundle contained in a small external steel tube. The proximal part of the fibre light source can be unscrewed to provide a fitting for British Standard, ACMI Wolf or Stortz cables whichever is in use in that particular theatre.

4.15 A separate unit fits on to the proximal end of the oesophagoscope providing magnification which can be simply adjusted for each doctor to give an accurate focus. The bellows are useful during the introduction of the instrument which should never be forceful and also help in the assessment of any strictures or narrowing due to tumours. If a biopsy has to be taken the telescope and bellows are removed and the biopsy forceps inserted after the exact site has been identified. This fitting is exactly the same for both sizes of oesophagoscope and is also identical with that of the Lloyd-Davies sigmoidoscopes.

4.16 The beak is slightly expanded and thickened so that it can act as a wedge shaped spade to lift the epiglottis forward. Rotation from side to side enables a safe gradual dilatation of the transverse slit of the cricopharyngeal sphincter to be performed before the round barrel passes through. The fibre light bundle ends in the beak, a short distance above the end so that it does not become occluded by secretions. If it becomes covered with blood the fibre light source can be quickly removed, washed and re-inserted.
4.17 TROLLEY – Total view of all instruments prepared in theatre

The instruments are laid out on a trolley, autoclaved prior to use, but normal cleanliness rather than sterility is used during the procedure. Both sizes of oesophagoscope are available. The telescope and bellows fit both if required. Suction and biopsy forceps must be long enough for this instrument, 650 mm see Seward’s brochure. A needle for removing specimens out of the biopsy forceps jaws and a specimen jar filled with formol saline complete the available instruments. The fibreoptic lead and the rigid fibre bundle fitting both oesophagoscopes provide the light.

4.18 THEATRE UNDER GENERAL ANAESTHESIA

It is safest to pass a rigid instrument in theatre under general anaesthesia. The use of a Negus head rest which can be fitted to the routine operating table makes adjustment of the neck in relationship to the thorax easier and avoids having to use an assistant holding the head in the Chevalier Jackson grip. The large wheel on the left adjusts the head piece up and down.

4.19 Obviously flexion and extension of the head on the neck at the occipito-atlantal joint cannot be achieved nor can there be such an accurate control of movements of the neck as with an assistant. But help which can be relied on to appear at each and every operating session now seems to be a luxury of the past, whereas machinery is less easily lost, and therefore becomes more reliable and safer.

4.20 After the oesophagoscope has been passed through the cricopharyngeal sphincter into the upper oesophagus it is useful to use the air bellows to puff the mucosa away and make introduction easier. Changes in rigidity of the oesophageal wall can be noted and there will be far less danger of perforating the oesophagus. The safe beak, the graduated markings on the barrel and the roughened handle which can be gripped easily even when wearing rubber gloves can be seen. Suction is used to clear secretions but there is usually not enough saliva nor refluxed gastric contents to obscure the distal illumination. Blood following a biopsy can be sucked out and if there is excess, saline flushed down the lumen and aspirated will soon clear the view.
5. **THE NEW BOUGIES: TEFON NOT GUM ELASTIC**

5.01 The original Chevalier Jackson bougies were made out of gum elastic with a bulbous end and a tapered body leading up to the largest diameter. They had a wire steel shaft allowing a certain amount of bending. The other type of straight gum elastic bougies are also made of gum elastic over a woven interior, they are elastic and withstand bending, but they cannot be sterilised by autoclaving or boiling; both techniques destroy them. Their manufacture is complicated and requires numerous applications of a vegetable gum in a manner similar to French polishing, using linseed oil, up to five applications each day for three weeks, applied cold in layers, dried in an oven to oxidise the linseed oil and finally sand papered.

5.02 PTFE, Polytetrafluoroethylene or Teflon, discovered in 1938 on the other hand is a modern polymer with properties ideal for dilators. In the smaller diameters it bends, holds its position and can then be bent back to its original shape. The substance can be machined on a lathe to an accurate diameter. It is easy to work with and can be shaped at low cutting speeds with a high polish. The non-slip properties of this material, used to prevent sticking of food on frying pans, is ideal for dilatation of strictures, and there is the additional advantage that no lubricating jelly is needed. An additional advantage is that Teflon can be autoclaved without losing any of its properties.

5.03 A new set of bougies has been developed. The word bougie derives from the French word for a waxed taper first used by Fabricius ab Acquapendente in the 16th Century named after the town of Bougie in Algeria on the north coast of Africa. However, the new ones are made of stainless steel rods, Teflon ends and chromium plated brass handles. The sizes vary from 3 mm (9 FG) in diameter to 18 mm (54 FG). They are kept in order in a linen bag. All the ends are seven cm in length with a uniform diameter and no tapering.

5.04 Two fingers (index and thumb) are recommended as the strength for dilatation – not a fist of four fingers and a thumb. Apart from trying to unify Europe by force after the French Revolution, Napoleon introduced the metric system. Remember that during the French Revolution the decimal system was also proposed for a new length of the old seven day week to ten days (like ten fingers), but this was successfully resisted by the workers who would have worked longer with less holidays and less frequent Sunday holidays. Charrière was an instrument maker at this time and his bougies were measured by the circumference in mm \((2\pi r)\). French gauge figures must be divided by \(\pi\), which is roughly 3, to give the diameter in mm, \(\frac{1}{2}\) an inch (12.5 mm) is approximately 39 French gauge or 13 mm in diameter. If French gauge is accepted as the unit of circumference measurement for dilatation everything else should be defined in mm or cm to avoid confusion.
5.05 In the smaller sizes from 9-24 FG the increase in size proceeds as individual units of French gauge size but in the larger sizes above 8 mm (24 FG) diameter each increase is by 1 mm (3 FG) in diameter. For convenience the bougies are placed in a bag which keeps them in numerical order. The numbers can be seen easily on the handle even in the semi-darkness of an operating theatre during oesophagoscopy and are of a size to be seen even by presbyopic surgeons.

5.06 It is difficult to swallow a bougie with a diameter more than 39 FG without a general anaesthetic and most thoracic surgeons prefer to pass the oesophagoscope itself through a stricture under a general anaesthetic. The maximum external size of the small oesophagoscope is 60 FG and of the large is 72 FG due to the dilated beak at the distal end which makes introduction easier.
6. **NEGUS BAG** (Sir Victor Negus 1887-1974, King’s College, London)

6.01 The Negus bag consists of a dilatable rubber balloon which can be filled with water to a diameter of 3.5 cm or 105 FG. When collapsed it is thin enough to be passed through the lumen of the smaller of the two oesophagoscopes. There are two layers of rubber and a woven mesh to maintain uniform distension. Considerable pressure is required to push in the 40 ml required for full dilatation so a Gabriel syringe and a Luer type lock which enables the thumb to contract against two fingers are necessary. Since the cricopharyngeal sphincter is the narrowest part of the gastrointestinal tract this is the limiting factor for the size of bougies passed to dilate lower oesophageal strictures. 72 French gauge (the outer diameter of the large scope) is the largest that can pass through the upper sphincter so if further dilatation is required distally, the Negus bag, Plummer pneumatic dilator or mechanical dilators such as Starcks have to be used. The main use for this bag is for stretching the gastrooesophageal sphincter in achalasia of the oesophagus.
7. **SOUTTAR TUBES (Sir Henry Souttar 1875-1964, Surgeon The London Hospital)**

7.01 Souttar tubes are used for permanent dilatation of a non-resectable oesophageal tumour, and very rarely for benign strictures which can usually be managed by repeated dilatations. The coiled wire type was first introduced by Sir Henry Souttar from the London Hospital in 1924. Before studying medicine he had taken an engineering degree at Oxford. Palliative oesophageal intubation tubes are either of the push or the pull type. To push a tube in it has to be rigid and the ideal shape is a coiled spring, which is easily made by winding wire on a lathe. The alternative method of pulling a tube through a mid-oesophageal tumour necessitates an abdominal operation with opening of the stomach and the two main types, both of which have a flexible thin introducing end, are the plastic Mousseau-Barbin and the latex rubber Celestin tubes. The advantage of pushing a tube through is that it avoids an operation, but it does require skill and special instruments.

7.02 The modern Souttar tube is made of 1 mm thick stainless steel wire, 7 to 15 cm in length, with a proximal lip. The outside diameter is either 12, 14 or 16 mm and the inside diameter is 2 mm smaller. Its great property is that it cannot be compressed, it can elongate and bend in any direction. Originally Souttar tubes were made in gold plated German silver wire, with an additional spiral. With the minimal internal diameter at 10 mm (30 FG), normal food can be swallowed. It is always wise for patients to chew their food well, but not necessarily the 32 times purported to have been suggested for Victorian children by the Prime Minister William Gladstone.

7.03 The larger oesophagoscope is essential for introducing these tubes because of the size of the upper rim or lip. The tumour is dilated either on one or repeated occasions to the optimum size to allow the largest possible Souttar tube to be inserted; usually the shorter of the two available tubes is best.

7.04 The large flexible 9 mm introducer rod is then passed through the growth. A Souttar tube is pushed down with the introducer, which fits snugly into the lip, until the grooved handle reaches the proximal end of the oesophagoscope. The black ring indicates that the introducer has just appeared through the beak and the first groove on the handle marks the distal end of the beak. If the oesophagoscope has been placed carefully at the upper margin of the tumour then the lip of the Souttar tube will rest exactly in its final position.

7.05 The marks are essential since the introduction is done blindly and there is only one chance to drive the tube firmly into its final place to keep the lumen of the oesophagus open. Once in place they can stay there for the rest of the patient’s life. It is always wise to obtain an X-ray immediately after inserting a Souttar tube to confirm its position.
8. **FURTHER READING**

8.01 The author has a website [www.richardearlam.com](http://www.richardearlam.com) as a source for further information with many references to his published works using pdf for easy access. In the introduction to the website is mention of Tim Berners-Lee and his work on the web, hoping for transmission of data without hindrance or charge. To this is now added the famous quotation from Bernard of Chartres in the 12th Century. “We are like dwarfs on the shoulders of giants, so that we can see more . . .” These words have also been cited by Isaac Newton as well as GOOGLE.

8.02 From my website under 150 “medical publications” will be found a pdf of the following:-

57 Earlam, R J (1978)
   New stainless steel rigid oesophagoscope (Cine Film – unfortunately lost).
   Includes Seward’s brochures on the Earlam oesophagoscope and also Lloyd-Davies sigmoidoscope.

61 Earlam, R J (1979)
   Souttar tubes for oesophageal carcinoma
   Chirurgia Gastroenterologica 13:15-20

   Benign oesophageal strictures: historical and technical aspect of dilatation.
   Brit J Surg, 68:829-36 (89 references)

   Malignant oesophageal strictures: a review of techniques for palliative intubation.

8.03 The following predecessors in the field of oesophagoscopes and gastroenterology are of extreme importance and are the basis of any advances made by the author. In chronological order they are (all to be found via Google and Wikipedia).

   Sir Morell MacKenzie 1837-1892, The London Hospital
   Chevalier Jackson 1865-1958, Philadelphia, USA
   Sir Henry Souttar FRCS 1875-1964, The London Hospital
   Sir Victor Negus FRCS 1887-1974, King’s College Hospital
   James Purdey and Sons, Gunsmith in London, West End. 12 bore shot gun.
   Oswald Vaughan Lloyd-Davies FRCS, 1905-1987 St Mark’s Hospital
   Prof Harold Hopkins, FRS 1918-1994, Reading University
9. **CLOSING WORDS**

9.01 Some people spend four to five thousand pounds on flexible fibreoptic instruments to view the upper gastrointestinal tract and then have to replace them as the bundles break. It is a lot of money to spend for a good view. This stainless steel oesophagoscope only costs about £100 and is built to last a lifetime. It is an instrument for action, for biopsy, dilatation, removing foreign bodies and inserting palliative intubation tubes. It so happens also that the view with the telescope is as good as that with a flexible fibreoptic endoscope. The manufacturing technology is relatively simple because the majority of the work is done on a lathe and the tubing is standard, but that has the advantage that the instrument is cheaper, more robust and lasts longer than a flexible endoscope.

9.02 One theatre technician once told me that it was by far and away the best and strongest instrument for cleaning out blocked drains in theatre. I hope he was never caught. But remember that all stainless steel oesophagoscopes are autoclaved/sterile before use.

9.03 When the new Earlam oesophagoscope had been completed in 1977 I went to visit the famous Lloyd-Davies to show him my prototype and thank him for his wonderful success in designing the sigmoidoscope whose technology had been so important to me. We both agreed on the excellent help we had received from Seward’s Surgical Team and I casually asked him how much he had been paid for his efforts. “You are looking at it” he replied, holding up his sigmoidoscope. “That’s funny.” I said, “that is exactly what I received – the prototype of the oesophagoscope.” But we agreed that we were both happy, Seward’s was equally happy and all the patients had benefit from both our inventions.

9.04 In memory of Lloyd-Davies 1905-1987, an original Seward’s catalogue description of his sigmoidoscope is enclosed.
This is the first Lloyd-Davies' Sigmoidoscope to be made entirely of stainless steel.

It is also the first time a Lloyd-Davies' Sigmoidoscope has been produced with all the component parts interchangeable between instruments.

This superior version of the widely used Lloyd-Davies' Sigmoidoscope has been developed by Seward and is the result of intensive research. Precision-made, it will introduce important benefits to both the surgeon and hospital—and, equally, ensure maximum comfort for the patient.

**Stainless steel construction throughout**

The advantages of instruments made entirely of stainless steel are widely recognised. All these practical advantages will be found in the Lloyd-Davies' Sigmoidoscope from Seward.

With stainless steel, individual components can be machined to finer tolerances than with plated sigmoidoscopes, so that a higher degree of precision becomes possible. There is also considerably greater resistance to physical and thermal shocks.

The Lloyd-Davies' Interchangeable Sigmoidoscope may be regarded as virtually everlasting and no maintenance should ever be necessary. A benefit of particular value is that the risk of metallic flaking, with its serious attendant problems, is permanently eliminated with stainless steel.

**Every part is interchangeable**

Because all the component parts are interchangeable between any number of Seward Lloyd-Davies' Sigmoidoscopes, there is no need for labelling in preparation for the cleansing and sterilisation process.

Should any part ever become lost, it can be rapidly replaced by Seward with the assurance that the new part will fit perfectly.

**Immediate availability**

As with all the instruments Seward make, the policy is to maintain adequate stocks and avoid delivery delays. The Lloyd-Davies' Interchangeable Sigmoidoscope is available from stock and either small or bulk orders can be supplied promptly. Manufacturing in quantity has the additional advantage of lowering production costs—the Seward instrument compares extremely favourably in price with ordinary Lloyd-Davies' Sigmoidoscopes.
Lloyd-Davies' Interchangeable Sigmoidoscope

- Stainless steel construction throughout
  - precision made, precision fitting
  - finer tolerances than with other metals
  - increased resistance to physical and thermal shocks
  - virtually everlasting
  - no metallic flaking
  - no maintenance normally required

- All components interchangeable
  - no labelling needed for cleansing and sterilisation (CSSD)
  - lost parts rapidly replaced
  - replacement parts fit perfectly

- Maximum comfort for the patient
- Competitively priced
- Ample stocks to fill orders promptly
## Sigmoidoscope Sets

### Electric

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<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.5521</td>
<td>250 mm Sigmoidoscope comprising: tube, obturator, 3.5 volt lighting chamber, inflation window, connecting cable and two 3.5 volt lamps. (without case)</td>
</tr>
<tr>
<td>19.5531</td>
<td>Identical to set 19.5521 above, complete in leatherette case</td>
</tr>
<tr>
<td>19.5522</td>
<td>300 mm Sigmoidoscope comprising: tube, obturator, 3.5 volt lighting chamber, inflation window, connecting cable and two 3.5 volt lamps. (without case)</td>
</tr>
<tr>
<td>19.5532</td>
<td>Identical to set 19.5522 above, complete in leatherette case</td>
</tr>
<tr>
<td>19.5523</td>
<td>Combined Sigmoidoscope comprising: 250 mm tube and obturator, 300 mm tube and obturator, 3.5 volt lighting chamber, inflation window, connecting cable and two 3.5 volt lamps. (without case)</td>
</tr>
<tr>
<td>19.5533</td>
<td>Identical to set 19.5523 above, complete in leatherette case</td>
</tr>
</tbody>
</table>

### Fibre light illuminated

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<tr>
<th>Code</th>
<th>Description</th>
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<tbody>
<tr>
<td>19.5541</td>
<td>250 mm Sigmoidoscope comprising: tube, obturator, A.C.M.I. fibre glass fitting lighting chamber and inflation window. (without case)</td>
</tr>
<tr>
<td>19.5551</td>
<td>Identical to set 19.5541 above, complete in leatherette case</td>
</tr>
<tr>
<td>19.5542</td>
<td>300 mm Sigmoidoscope comprising: tube, obturator, A.C.M.I. fibre glass fitting lighting chamber and inflation window. (without case)</td>
</tr>
<tr>
<td>19.5552</td>
<td>Identical to set 19.5542 above, complete in leatherette case</td>
</tr>
<tr>
<td>19.5543</td>
<td>Combined Sigmoidoscope comprising: 250 mm tube and obturator, 300 mm tube and obturator, A.C.M.I. fibre glass fitting lighting chamber and inflation window. (without case)</td>
</tr>
<tr>
<td>19.5553</td>
<td>Identical to set 19.5543 above, complete in leatherette case</td>
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