Chapter 3: Endoscopy

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Since the afternoon in Paris in September 1854 when Manuel Garcia, a professor of singing, saw his own vocal cords with the aid of two mirrors, physicians have been fascinated by the art of endoscopy. At about the same time, Desormeaux, a Frenchman, pioneered the first practical endoscope for examining the urethra, bladder, vagina and rectum, but it was not until 1868 in Freiburg, Germany, that Kussmaul, using a modified Desormeaux instrument, carried out the first oesophagoscopy. His patient was a professional sword swallow! The remainder of the nineteenth century was a time of great interest and advance in oesophagoscopy and laryngoscopy and it is pleasant to record that Garcia lived to the age of 102 and was recognized as the 'Father of laryngology'.

Killian, also working in Freiburg, became known as the 'Father of bronchoscopy', while in the USA in 1907 Chevalier Jackson published the first major text book on endoscopy entitled, *Tracheobronchoscopy, Esophagoscopy and Gastroscopy*. Endoscopes have been modified and greatly improved by modern lighting and telescopic systems, but the two major contributions to endoscopic techniques, in recent years, have been the use of the operating microscope and the introduction and development of flexible fibreoptic endoscopes.

**Outpatient endoscopy**

*Flexible nasopharyngolaryngoscopy*

Early fibreoptic laryngoscopes suffered from poor optical systems, and otolaryngologists were often reluctant to use them. However, as experience was gained both by the manufacturers and users, early problems were overcome and fibreoptic endoscopes became increasingly sophisticated. Present day instruments give excellent images and, with practice, are easy to handle.

The major advantage of the flexible laryngoscope is that it may be used immediately, even in a busy outpatient session, without disruption to the clinic. In the great majority of patients in whom the larynx and pharynx must be seen, and in whom indirect (mirror) laryngoscopy is unsatisfactory, admission for direct examination under general anaesthesia and its attendant expense is obviated. The economic advantages can be readily demonstrated and there should be no difficulty in persuading those who hold the purse strings that these instruments will rapidly pay for themselves (Welch, 1982).

**Indications**

Outpatient fibreoptic laryngoscopy is reserved for inspection only and therefore the indications do not differ significantly from those for indirect laryngoscopy (Chapter 1). Any patient, including cooperative children, with symptoms referable to the upper air and food passages, may be examined. These symptoms include hoarseness or other voice disorder, the feeling of a lump or discomfort in the throat, and problems associated with swallowing solids or liquids. An advantage over indirect laryngoscopy is that the nose and nasopharynx may be inspected during the passage of the endoscope. This is obviously relevant where symptoms
in the larynx or pharynx may be due to nasal pathology. An important advantage over direct laryngoscopy under general anaesthesia is that the dynamic function of the larynx can be more readily assessed.

Failed mirror examination is not the sole indication for flexible endoscopy. As the procedure is non-invasive, it is often useful for teaching or documentation purposes. Excellent still or video pictures can be taken with the wide range of cameras now available. While it is not proposed that the technique is a 'psychological' weapon it is often a valuable reassurance to patients with non-organic disease. They clearly see it as a 'better' investigation than indirect laryngoscopy. An additional bonus is that patients may view their own larynx and pharynx and thus be reassured that nothing has been concealed.

The flexible nasolaryngoscope is also a valuable instrument in assessing patients with neck lumps referred by general surgeons before excision or biopsy of the lump.

**Equipment**

The design of fibreoptic endoscopes and the various accessories, of which there is a wide range, are constantly being updated and refined. At the time of writing the smallest diameter nasolaryngoscope is the Olympus ENF-P2, outside diameter 3.4 mm. A heavier duty model, with biopsy/suction channel, is the same manufacturer's ENF-IT10, outside diameter 5.0 mm. The former costs approximately £3.500 ($5.250) and the latter £7.900 ($11.850) (prices early 1986), but the economic advantages have been mentioned. With regular but careful use and maintenance these instruments should last at least 5 years. When considering purchase of flexible endoscopes it is sensible to take into account other instruments, light sources and camera units already available within the department or hospital. This is probably more important than minor variations in price and specifications between the instruments of different manufacturers. If still or video records are to be made it is strongly recommended that advice is sought from the medial illustration department. Without such advice many inappropriate and expensive purchases have been made.

**Anaesthesia**

Many people can tolerate a fibreoptic laryngoscope passed through the nose and into the pharynx without topical anaesthesia provided that the instrument is carefully manipulated. However, many patients undergoing fibreoptic examination will have failed indirect laryngoscopy and are therefore likely to gag easily. Various methods of obtaining adequate topical anaesthesia have been described: the author's technique is as follows.

The nose is first inspected and the wider side chosen if there is a significant difference. This is sprayed with up to 1 mL of 10% cocaine solution and the oropharynx and back of the tongue are sprayed with 10% lignocaine solution. Five to six sprays (50-60 mg) of Xylocaine spray are a suitable dose. This side of the nose is then packed with a pledget of cotton wool soaked in a further 1 mL of 10% cocaine to anaesthetize further and constrict the nasal mucosa. It is helpful, but not essential, if the patient then sucks a benzocaine lozenge (10 mg) for 10 minutes. Adequate time should be allowed to obtain good anaesthesia as this results in a very low failure rate. This is not time wasted as other patients may be seen in the meanwhile.
Technique

The patient sits upright in a chair with a tilt facility in case of vasovagal attacks or vomiting due to excessive manipulation in the pharynx or cocaine reaction. Similarly, suction and resuscitation equipment must be available even though complications are extremely rare. The nasal pack and any residual lozenge are removed. Normally the examiner stands to the right of the patient and, after lubricating the endoscope suitably, according to the manufacturer's instruction, and applying a demister to the objective lens, passes the endoscope along the floor of the nose, under vision, through the posterior choana and into the nasopharynx. Using the thumb control the tip is gently flexed downwards at the posterior border of the soft palate. Early attempts from this stage onward may not be entirely successful and, as in all things, expertise comes only with practice. The basic movements are advancement and retraction of the cable of the endoscope with the leading (left) hand, combined with rotation of the lens housing by the right hand, the thumb of which controls the lever flexing the tip of the cable (this assumes a right-handed operator). After general inspection of the region the patient should say 'Eee', or just speak. A close view of the cords can be obtained, but in simple outpatient fibreoptic laryngoscopy, the instrument should not be inserted through the vocal cords.

If the objective lens mists over it need not be withdrawn as it may be cleared by asking the patient to swallow. On completion, the endoscope is gently withdrawn and, as with all endoscopy, inspection is maintained on the way out. If topical anaesthesia has been used the patient must not swallow until full sensation has returned, usually in 1.5-2 hours.

Problems and difficulties

Failed examination

In a large personal series (unpublished data) of several hundred patients, examination has failed on three occasions only. In one patient, extreme anxiety prevented introduction of the laryngoscope and a second patient gagged severely whenever the tip of the laryngoscope was advanced beyond the soft palate, despite apparent adequate topical anaesthesia. On the third occasion, the objective lens misted so persistently that no view was obtained. a large overhanging epiglottis may prevent full exposure of the anterior commissure and this may necessitate direct laryngoscopy.

Occasionally, a posterior deviation of the septum, not apparent on anterior rhinoscopy, may impede passage of the endoscope. If so, the other nostril should be anaesthetized, but it is too rare an occurrence to merit bilateral preparation routinely.

Misinterpretation of findings

It should almost always be possible to say whether the larynx and hypopharynx are normal or abnormal. Correct interpretation of abnormality is gained with experience, when correlation between findings at fibreoptic laryngoscopy and direct laryngoscopy should be high. Misdiagnoses at fibreoptic laryngoscopy should not result in harm to the patient, but only deflated pride and education for the examiner when direct laryngoscopy reveals the true diagnosis (see below).
Lack of biopsy channel

This is in fact less of a problem than it appears. Anaesthesia and biopsy of the larynx in a busy outpatient clinic are time consuming, potentially hazardous because of bleeding or airway obstruction and, as biopsy forceps in fibreoptic laryngoscopes with such a channel are very small, the histological interpretation of tiny fragments of tissue may be difficult or misleading. If abnormalities are noted at fibreoptic laryngoscopy the patient should be examined later by direct laryngoscopy under general anaesthesia.

Telescope pharyngolaryngoscopy

Some laryngologists favour the use of a rigid telescope to examine the pharynx and larynx as a primary means or to attempt to obtain a view when mirror examination has failed. Advantages of rigid telescopes include an excellent view, especially with camera and video, speed of examination and relative economy compared with flexible endoscopes. But their main disadvantage is that they must be passed through the mouth and they may not be tolerated by patients who have failed indirect laryngoscopy.

Stroboscopy

Even greater appreciation of vocal cord action may be obtained by examination with a stroboscopic light source. By synchronizing an intermittent flash of light with the vibrations of the cords on phonation their movement can be effectively 'frozen' or reduced to slow motion. Both the fibreoptic endoscope and telescope may be used but, while this is an outpatient procedure, it is too time consuming for a routine clinic. The investigation of voice disorders is discussed fully in Chapter 7.

Day patient endoscopy

Flexible bronchoscopy and oesophagogastroscoopy

The term 'day patient' is used for these procedures as they take considerably longer than simple fibreoptic nasolaryngoscopy and therefore cannot be fitted into a busy outpatient clinic on an ad hoc basis. Specific outpatient sessions can be designated for fibreoptic procedures in this area, whereas rigid system endoscopies necessarily entail general anaesthesia with access to an operating theatre and recovery area. An ideal solution is a day ward on a half-session basis, with the morning patients being discharged by 1300 h to allow afternoon admissions. This maximizes the use of beds and caters both for patients requiring topical anaesthesia, with or without sedation, and for those who need general anaesthesia. It is important, particularly for the latter, that the general state of health of the patient is assessed beforehand and that the patients are warned that they will not be able to drive themselves home.

A further important difference compared to fibreoptic laryngoscopy is that a trained assistant is essential. Flexible bronchoscopes and oesophagogastroscopecopes require the operator to use both hands on the control housing simultaneously during long periods of the procedure as both these instruments incorporate suction and biopsy channels.
In addition to the tip control, as found on the flexible laryngoscope, channels for the passage of instruments, suction and insufflation are also present. The assistant is therefore needed to advance and retract the endoscopes as instructed and also helps with the introduction and removal of instruments from the biopsy channel.

Flexible system bronchoscopy and gastroscopy are normally undertaken by cardiothoracic surgeons or chest physicians and gastroenterologists respectively, rather than by otolaryngologists, and therefore it is not intended to give any great detail as to technique in this chapter. Batch (1985) has suggested that otolaryngologists could usefully employ the gastro-oesophagoscope to examine the gastrointestinal tract, even as far as duodenum, but it seems unlikely that a practising otolaryngologist, even if he correctly diagnosed pathology that far from his own area, would want to trespass on the territory of the gastroenterological physicians or general surgeons so far as treatment was concerned. However, there are patients with symptoms referable to our own area in whom it is impossible to obtain an adequate view by the traditional rigid system pharyngo-oesophagoscopy in whom fibreoptic examination provides the diagnosis. Even so it is the author's practice to refer such patients to a colleague who is undertaking many such procedures each week. Correct interpretation of visual findings lies in the experience of the observer (Batch, 1985).

If oesophagogastroscopy is of little practical application for otolaryngologists it is well worth our while learning to use a fibreoptic bronchoscope. Possibly the commonest reason for otolaryngologists to use a bronchoscope is for patients with a hoarse voice due to a paralysed vocal cord. If this is caused by a carcinoma of the bronchus, the thoracic surgeon usually cannot offer a surgical cure and, thus if confirmation of the diagnosis can be obtained at the time of laryngoscopy the patient is spared a second procedure. Significant advantages of the fibreoptic bronchoscope over the rigid instrument are its smaller diameter and its innate flexibility thus giving much greater access within the tracheobronchial tree for inspection and biopsy.

The other ways in which the otolaryngologist will appreciate its value are in the removal of foreign bodies or secretions from the chest. Few departments are equipped with the full range of grasping forceps which have been designed over the years to remove the wide variety of foreign bodies which may be inhaled, and it is a reassurance to have a flexible bronchoscope available to remove small foreign bodies, particularly from the periphery of the bronchial tree. Inspissated and impacted secretions may act in the same way as foreign bodies and cause segmental collapse. The fibreoptic bronchoscope may prove vital if they cannot be moved by conventional suction and physiotherapy.

**Instruments and techniques**

There is now a wide range of instruments available from several different manufacturers most of whom are prepared to put together a 'package' tailored to the user's requirements. No advice will be given here on particular instruments except to recommend very strongly that individuals or departments hoping to buy flexible endoscopes should, if appropriate, talk to others within their hospital already using these. Interdepartmental compatibility is not only sensible but may also have considerable economic advantages. as with nasolaryngoscopes it is also essential to discuss the purchase of any photographic or video equipment with the department of medical illustration.
The actual techniques are not difficult to learn, but should be acquired from someone already experienced in the procedures. As mentioned, the skill often lies in the interpretation of the visual findings and this only comes from practice. Briefly and for completeness, gastro-oesophagoscopy is normally carried out with sedation - oral or intravenous diazepam is commonly used - and topical anaesthesia of the pharynx by lignocaine spray or benzocaine lozenges. It can, of course, also be performed under general anaesthesia. The endoscope is passed through the mouth, but no anaesthesia of the oesophagus and beyond is needed.

Fibreoptic bronchoscopy is best carried out on the conscious patient. Individual techniques obviously vary, but an acceptable method is to begin as for fibreoptic laryngoscopy and supplement the topical anaesthesia by spraying 10% lignocaine, via the bronchoscope, into the larynx when seen and similarly, after the cords have been passed, into the tracheobronchial tree as the endoscopy progresses.

**Rigid system endoscopy**

Provided there is no risk of airway obstruction or perforation of the pharynx or oesophagus there is no reason why rigid system endoscopies cannot be carried out in a day case operating theatre. However, as patients undergoing these procedures have traditionally been admitted, partly for administrative reasons and also as many need thorough medical and anaesthetic assessment, this subject will be covered in the next section.

**Inpatient endoscopy**

**Indications**

Rigid system endoscopy has been a standard method of diagnosing disease of the pharynx, oesophagus and laryngotracheobronchial complex throughout this century. Despite the recent increase in the use of flexible endoscopy, the place of rigid system endoscopy has not decreased, perhaps with the exception of exclusion endoscopy where flexible endoscopy may provide the answer in a less invasive manner. There is no likelihood, in the foreseeable future, that rigid endoscopic techniques will become obsolete or of less use and it is therefore most important that all trainees should have a thorough grounding in them. As with the fibreoptic endoscope this can only be learned with practice, initially under close supervision, and is even more important with rigid endoscopes as it is much easier to do damage with them. Serious complications with flexible endoscopes are rare, but many patients have had their oesophagus perforated with a rigid endoscope.

The following three indications are suitable for rigid system endoscopy.

**Diagnosis**

Rigid system endoscopy is suitable for obtaining tissue for histological examination from patients with symptoms referable to the upper air and food passages. (It is worth mentioning here that if lymphoma is a possible diagnosis many pathologists now prefer tissue dry, rather than in formalin or other fixative, to facilitate immunological typing.)
Treatment

The human race will certainly never cease to insert different foreign objects into its various orifices. For a century now, rigid system endoscopy has been the method of choice for removing foreign bodies from the pharynx, oesophagus, larynx or tracheobronchial tree. Endoscopic dilatation of benign or malignant stricture of the oesophagus is another traditional way in which rigid system endoscopy has been used for treatment and benign lesions such as polyps or nodules are readily removed endoscopically from the larynx. More recently, the laser has been employed in this manner and now, particularly in some conditions such as juvenile papillomatosis and premalignant lesions of the larynx, it is probably more efficient than the older methods of ultrasound, suction diathermy or removal with forceps. The endoscopic diathermy of pharyngeal pouches is described in Chapter 14, and a further example of the use of rigid system endoscopy for the purpose of treatment is submucosal injection of Teflon into paralysed vocal cords to improve the voice.

As part of other procedures

An essential step in the treatment of a pharyngeal pouch is to pack it with ribbon gauze endoscopically to give bulk to the pouch and thus facilitate its location and dissection.

'Pan'-endoscopy

Pan-endoscopy here refers to a full examination of the upper air and food passages when, for example, a search is being made for a primary cancer in a patient presenting with a neck lump which is possibly malignant. It should include careful examination of the mouth, oro- and hypopharynx, oesophagus, larynx, tracheobronchial tree and nasopharynx. The latter is covered in Volume 4, Chapter 3 and will not be referred to further in this chapter despite its importance. Furthermore, it may not be necessary to carry out a full examination on every patient, but it is more convenient to present pan-endoscopy here as one entity and the author's preferred technique will be described.

Preoperative assessment

Except in an emergency the following routine is carried out:

Clinical examination

The pure anatomy of the region will not be repeated as this is covered in Volume 1 and standard anatomy textbooks. However, clinical examination of the mouth, indirect laryngoscopy and palpation of the neck allow the surgeon to appreciate the shape of each patient. Factors which may influence the endoscopy such as capped or loose teeth, unusual configuration or stiffness of the jaw and neck should be noticed. Severe trismus may affect surgeon or anaesthetist and the latter will wish to be warned of any suspected or significant narrowing of the airway. A general medical history is also taken and the patient's chest, heart and abdomen are examined in the routine manner. If there is any doubt about the general health then electrocardiography is arranged, blood is taken for haemoglobin, urea and electrolytes and other investigations as appropriate.
Radiology

X-rays of the chest and a lateral view of the neck are carried out. Aortic aneurysms were once a significant worry to endoscopists. It is certainly helpful to be forewarned of any pathology within the mediastinum.

General measures

The patient is starved for a minimum of 4 hours and suitable premedication is ordered by the anaesthetist.

Instruments

Many hospitals still use the standard Negus instruments and these are normally quite adequate, with modern fibreoptic lighting, for pan-endoscopy. However, as systems for cleaning, sterilizing and storing instruments and then presenting them to the surgeon vary widely it is essential that these are checked carefully on each occasion before the induction of anaesthesia. It is annoying for the surgeon and dangerous for the patient to suspend the endoscopy in mid-procedure while someone is sent to hunt for a suction tube or biopsy forceps of the correct length. Similarly light sources and suction apparatus must be checked before starting.

Anaesthesia

This is clearly the province of the anaesthetist and each technique will vary to some extent. However, it is essential to understand clearly that the anaesthetist has overall control and the right to the airway. Where a surgeon and anaesthetist are used to working together there will normally be no problems of communication, but where the pair do not know each other's habits well, the surgeon must be prepared to demur immediately to his colleague. In a full pan-endoscopy the present author carries out the laryngoscopy and bronchoscopy using an 'apnoeic' technique with no tube, thus maximizing the view of the larynx. Intravenous thiopentone and suxamethonium are used to keep the patient asleep and paralysed. Oxygenation is maintained by intermittent manual ventilation via face mask during the laryngoscopy and by Venturi injection down the bronchoscope during this part of the procedure. When these are completed a standard endotracheal tube is passed and anaesthesia then maintained by appropriate concentrations of halothane, oxygen, and nitrous oxide while the pharyngoscopy and oesophagoscopy are performed.

A small tube does allow a more leisurely examination of the larynx, but this is normally reserved for patients with potential airway obstruction as the anaesthetic technique described above still allows ample time for diagnosis, assessment of lesions, biopsy and teaching.

Surgical techniques

It is pointless to pretend that pan-endoscopy is a sterile technique and therefore to scrub up, put on gown and gloves and towel the patient is a waste of time and money. Indeed, covering up all but the patient's mouth with green towels can be positively dangerous as
important danger signs such as cyanosis or poor chest movements may be missed. Except in small children in whom a long procedure is expected, when cooling may become an important factor, it is better to leave the head and neck completely exposed and nothing more than a thin gown covering the chest. The lower half may be blanket ed as appropriate. It is sensible to wear a pair of clean, but not necessarily sterile, gloves to prevent acquiring any infection from the patient.

When anaesthetized the patient's head and neck are extended. This can be achieved most simply by pushing the patient's ordinary pillow under the shoulders and allowing gentle extension. Great care should be taken to prevent the head from 'hanging' and particular gentleness must be exercised in manipulating the head and neck of patients with cervical osteoarthritis. Even if no long-term damage is caused it is unkind to inflict a stiff neck, even temporarily, on a patient.

Specially designed pieces are available to fit the ends of tables for endoscopy but seem less fashionable nowadays. It is certainly worthwhile learning to endoscope patients without these to be prepared for endoscopy in another operating theatre.

When the patient is adequately oxygenated the face mask is removed, a swab or silastic gum shield used to protect the upper gum or teeth and a lubricated Negus laryngoscope inserted. The epiglottis is identified and the laryngoscope passed posterior to this and on to view the larynx. If the patient's configuration prevents a good view, an assistant, with direction if necessary, can apply pressure externally on the laryngeal complex. The surgeon must never rotate the endoscope on the fulcrum of the upper teeth and the instrument must only be lifted (upwards as the patient lies on the operating table). The Negus laryngoscope gives a good general view of the larynx and, being broader at its distal end, is often the best endoscope through which to take biopsies. However, to examine the larynx fully it is also necessary to use what is conventionally known as the 'anterior commissure' laryngoscope as, with its narrower distal end, a more precise view is obtained of the less accessible parts of the larynx, and in particular, the anterior commissure, subglottic region, ventricles and posterior surface of the epiglottis which must be carefully inspected. For the removal of polyps or nodules and the taking of biopsies, an upward cutting pair of punch forceps is usually ideal. These small biopsies must be handled very carefully to prevent the histology report returning as 'crush artefact' and should therefore be transferred directly from the jaws of the punch forceps to a histology pot using only a hypodermic needle.

After completion of laryngoscopy a suitable size of bronchoscope is passed through the larynx turning the instrument through 90° to facilitate passage of the tip of the instrument past the vocal cords and then returning it to its normal orientation once it is in the trachea. The anaesthetist is informed, and the Venturi injector attached and used as necessary to maintain oxygenation. It is wise to keep a thumb on the connector if one's eye is anywhere near the proximal end of the bronchoscope. It can fly off at dramatic velocity despite the normal screw lock attachment. The bronchial tree is then inspected systematically beginning with the normal side if disease is thought to be unilateral. As each main bronchus is entered the patient's head must be turned gently to the opposite side. Telescopes to alter the angle of vision may be used as necessary, and biopsies are taken of any suspicious lesions. Straight forceps are usually more effective in the bronchial tree unlike in the larynx. If appropriate, bronchial washings using 20 mL of normal saline and collecting the aspirate in a suction trap
may be carried out. Up to this point in the endoscopy the patient has remained paralysed and therefore if vocal cord movement is to be assessed the anaesthetist should be informed so that the effect of the muscle relaxant can wear off. A MacIntosh anaesthetic-type laryngoscope is then inserted with the tip in the vallecula and the vocal cords are observed. This is more accurate than using the heavier Negus laryngoscope behind the epiglottis as this may in itself cause distortion of the larynx and impairment of the vocal cord movements.

The patient is now intubated and examination of the pharynx and oesophagus carried out. The Negus oesophageal speculum, approximately 22 cm in length, will give a view of the oropharynx, hypopharynx and the upper oesophagus. The upper teeth or gum are protected and a full inspection carried out. It does not really matter in what order the inspection is carried out, but it is important to develop a system early in training so that no area is overlooked. The exception to this is when a lesion is noted or when it is suspected bleeding may occur from one part. Then the remainder of the area should be examined first and the biopsy, or close inspection of a particular site, left until last. Again, no rotational force must be used on the upper gum or teeth. Occasionally these are so prominent that examination with the endoscope in the midline is impossible. Often only the incisor teeth remain and it is perfectly in order to examine the hypopharynx from either side.

After examination of the hypopharynx the tip of the speculum is passed behind the larynx and advanced as far as the cricopharyngeal sphincter, approximately 15 cm from the incisor teeth in adults. If this is open, or opens easily, the endoscope is introduced into the upper oesophagus. An aid to easy passage through the sphincter is to slip the left thumb behind the lower teeth or gums and lift, that is protrude, the mandible. If the cricopharyngeus is in spasm, further intravenous suxamethonium may be helpful but, as in all endoscopic work it is essential that no undue force is used. It is normally possible to see approximately 5 cm of the upper oesophagus with this instrument and, particularly when looking for small foreign bodies, it is essential to keep looking as the instrument is withdrawn.

To examine the mid or lower oesophagus longer instruments are needed depending on the size of the patient and it is important to remember that though these instruments are rigid and straight the oesophagus is not! In order to examine the whole length safely, the help of an assistant to hold and move the patient's head is normally necessary. Initially, to pass the longer instruments through the cricopharyngeus the head is gently flexed. Once the instrument is in the cervical oesophagus the head can be extended and, as the oesophagus curves to the left in the upper chest the head is turned to the right.

As the cardia is reached and the oesophagus swings back to the midline the head can be straightened. These movements should obviously be reversed as the endoscope is removed, again carefully observing the oesophageal lumen during removal of the endoscope. The treatment of pathology within the oesophagus, such as dilatation of strictures, is discussed in Chapter 22. As stated earlier these procedures need not all necessarily be carried out each time on each patient and can all be carried out independently.

There seems general reluctance to palpate the mouth of patients either awake or asleep. It is surprising how much information may be obtained by careful palpation within the mouth and neck at the time of endoscopy. For example, if one patient in whom jaw shape and very prominent teeth prevented any view of the pharynx with a rigid instrument, but in whom there
was a high level of suspicion of a carcinoma of the pyriform fossa because of an overlying neck lump, the present author made the diagnosis by sliding a finger down the corner of the mouth, feeling the tumour and obtaining a truly 'blind' biopsy. The neck should also be repalpated as it is not unusual to feel enlarged cervical nodes under anaesthesia which have not been felt previously, particularly in people with short necks who may be somewhat nervous before surgery.

**Postoperative care**

Many patients undergoing endoscopic procedures will do so once only, for example to remove a foreign body, but many will also return for further procedures. It is therefore most important to write an accurate account of the findings immediately. Many surgeons prefer to draw their own diagram of the larynx and pharynx, but rubber stamps and printed diagrams are available and are particularly helpful for accuracy in the bronchial tree. Any lesion, particularly if it is possibly malignant, should be assessed meticulously as to its extent and this then drawn into the notes with an accurate description. 'Fair-sized ?SCC right larynx', is far from helpful without a good diagram. The notes should also contain postoperative instructions to the nursing staff and likely dispersal of the patient on discharge.

Postoperative instructions should always state when the patient may eat or drink. Something should be written in the notes, even if it is only 'See standard instruction for "X" procedure on ward'. Such a list of standard instructions for each endoscopic procedure on the ward is a useful device provided that people read it. In uncomplicated endoscopies it is now the author's practice to allow clear fluids when the patient is fully recovered from the anaesthetic - usually 2-3 hours - and, if tolerated well, a light meal a further 2-3 hours later. However, where there has been any difficulty, particularly if there is a possibility of a perforation or tear in the pharyngeal or oesophageal mucosa nothing is given by mouth for 6-12 hours, while the temperature, pulse and blood pressure are carefully monitored. Again, unless there has been any cause for concern during surgery or in the postoperative period, a routine postoperative chest X-ray is not obtained, although some surgeons still prefer to do so.

**Complications of surgery**

**Laryngospasm**

This is fairly common immediately after operation and is due to blood or other secretions in the larynx or irritation of the larynx by passage of endoscopes or tubes. Most anaesthetists prefer not to use local anaesthetic on the vocal cords as it is important that the patient's cough reflex should recover immediately in view of the possibility of blood in the larynx or pharynx. Patients should therefore be kept in the recovery area with full facilities for resuscitation and reintubation until the danger of laryngospasm is past.

**Missing teeth**

Even if great care has been taken with loose teeth during the endoscopy, the use of a sucker in the postoperative period or the patient biting on an airway may break or dislodge teeth. If there is a possibility of a tooth, or fragments of one, having been inhaled, then a
chest X-ray must be obtained. If any such fragment has entered the bronchial tree the patient must be returned to theatre to have it removed by bronchoscopy.

Perforation of the pharynx or oesophagus

If care is taken with the endoscopy this should be rare. If there is a possibility that it has occurred the patient should be starved and observed carefully until its presence or absence is proved. Suggestive symptoms and signs of perforation include pain in the neck or in the chest radiating to the back, a rising temperature and pulse, air emphysema in the neck and widening of the mediastinum or pneumothorax on chest X-ray. A nasogastric tube should not be used initially as this may be passed through the perforation. A thoracic surgeon should be consulted. The perforation can be treated surgically or medically by intravenous fluids with broad-spectrum antibiotics via the same route; nothing should be allowed by mouth. Most perforations heal rapidly on this regimen, but it is wise to confirm this with a contrast swallow before letting the patient resume a normal diet. However, if the perforation has occurred through a carcinoma then emergency arrangements must be made to carry out the surgical procedure appropriate to the particular tumour in order to minimize the risk of seeding tumour into the neck or mediastinum. Instances are related, some doubtless apocryphal, of perforation into an aortic aneurysm, the great vessels or even the heart. The operator is hardly likely to fail to notice such an event, but the patient is unlikely to remember it.

Microlaryngoscopy

Kleinsasser introduced and helped to popularize the use of a new design of laryngoscope to be used in conjunction with the operating microscope in the early 1960s. These instruments are now familiar and have three particular features, namely, the matt black finish to prevent glare and reflection from the microscope, the broader lumen, and their ability to be stabilized allowing the operator both hands free for manipulation with the larynx. Kleinsasser’s design has since been modified by several surgeons, but the basic features persist. Other advantages stem from the magnification and excellent light provided by the microscope which, in turn, also allows more lucid teaching of students and trainees, either via the side arm or through closed-circuit colour television with a camera in place of the side arm. Permanent records in the form of video tapes, which have now largely replaced colour cine film, and still photographs add to the teaching value. Furthermore, accurate laser therapy is now available by linking an appropriate machine to the microscope.

Compared to conventional laryngoscopy there are two major disadvantages. The first is the cost: although most otolaryngology departments possess a microscope it may not be possible to modify it for laser work. The second is that procedures inevitably take very much longer, particularly if photography is undertaken. Many otolaryngologists still feel that they have adequate vision, lighting and instrumentation with the conventional instruments to remove small laryngeal polyps and nodules without resorting to the microscope for procedures which take a matter of 5 minutes or less, including induction of an recovery from the anaesthetic. Certainly, assessment of tumours should still be carried out with the traditional instruments as the laryngoscope is dynamic in this role whereas in microlaryngoscopy it is static.
Procedures particularly suited to microlaryngoscopy include laser excisions of laryngeal lesions and microdissection, as in stripping of polypoid or premalignant vocal cords where it is necessary to grip mucosa with one instrument and dissect simultaneously with a second. In neonates or small infants magnification is often helpful.

**Anaesthesia and surgical technique**

Preoperative preparation is as for conventional laryngoscopy. A small endotracheal tube (5-6 mm) rarely obstructs the surgeon's view within the larynx, thus most anaesthetists prefer to intubate for microlaryngoscopy as the procedures last considerably longer than conventional laryngoscopy. However, a recent innovation of high pressure, rapid pulsed oxygen via a small needle for oxygenation while maintaining anaesthesia intravenously gives a completely unobstructed view (Smith, 1982).

When the patient is anaesthetized he is positioned as described previously. Again there is no advantage in scrubbing and towelling up just because the procedure may appear more 'sophisticated'; bacteriologically it is no different. Unless the patient is well known to the surgeon a diagnostic endoscopy with Negus instruments should be carried out first to alert the surgeon to any likely difficulties resulting from unusual anatomy or pathology. A suitably sized microlaryngoscope is then inserted using, initially, a conventional lighting system. The patient's chest is then padded or, alternatively, a rigid bar fixed to the side of the operating table. When the larynx is clearly seen the laryngoscope is fixed with a Lewy, or other suitable holding device. The microscope with a 400 mm objective lens is swung into place and it is often helpful at this stage to have some head-up tilt on the operating table to make the operating position as comfortable as possible. Another advantage is to have an experienced assistant who puts the right instrument in the endoscopist's hand at the right time, thus minimizing the length of the procedure and strain on the eyes from constant looking up and down with its attendant necessity to refocus.