Diagnostic Upper Endoscopy

4

Indications

Full assessment of the clinical role of upper gastrointestinal (GI) endoscopy is outside the scope of this book. It varies with local circumstances, and with the available radiological and endoscopic expertise. Endoscopy is appropriate when a patient's symptoms are persistent and unresponsive to simple conservative management, since a precise diagnosis is needed to apply cost-effective focused therapy—whether medical, endoscopic or surgical.

Endoscopy was used initially to examine patients who had undergone barium X-ray studies which had not completely answered the clinical question, or had raised other questions. The endoscopic task was then straightforward, for the precise target and question were defined. Barium studies are now used only for investigation of motility and outlet problems, and to provide roadmaps of strictures or gross morphology prior to complex surgery. Endoscopy has taken over the primary role in most clinical situations, which makes the task more difficult and the endoscopist's responsibility greater in achieving both accuracy and a high level of safety and patient acceptability. The examiner must be capable of doing a complete and reliable survey of the oesophagus, stomach and proximal duodenum. It is relatively easy to see, describe and sample a lesion, but much more experience and skill are needed to say with certainty that no lesion is present.

The need for cancer screening, and repeated endoscopic surveillance in patients with pre-malignant conditions (e.g. Barrett's oesophagus and the operated stomach) remains controversial.

Although endoscopy appears to be an example of expensive Western high tech medicine, the technique is cost-effective and has become popular in developing countries—where X-ray facilities are more expensive and radiologists are rare.

Patient preparation, position and medication

Details of explanation, consent and safety issues are discussed in Chapter 3. Patients are instructed not to eat or drink for 4–6 h before endoscopy (although small sips of water are permissible for comfort). It is kinder to perform examinations during the morning so that most patients need only fast overnight. Patients with oesophageal or gastric outlet obstruction should be fasted

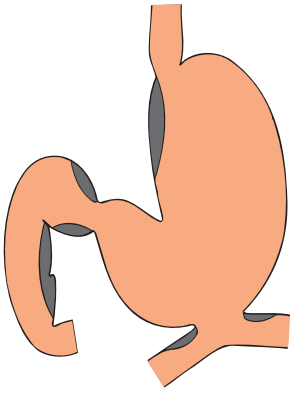

Fig. 4.1 Some areas (grey shading) are more difficult to see with a forward-viewing endoscope.

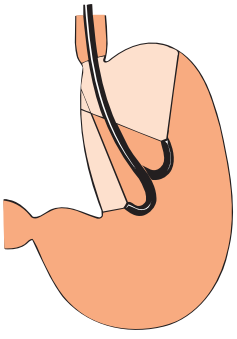

Fig. 4.2 Tip retroversion visualizes the gastric fundus.

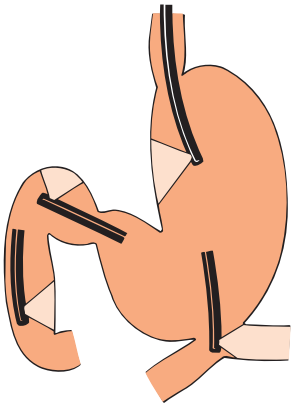

Fig. 4.3 The blind areas are well seen with a side-viewer.

for longer periods; aspiration of the oesophagus or formal gastric lavage may be necessary in these circumstances. The patient should partly undress and put on a gown or protective bib. Dentures and spectacles (including contact lenses) should normally be removed and stored safely.

The patient lies on the examination trolley/stretcher on the *left* side with the intravenous access line in the *right* arm. The head is supported on a small but firm pillow, with a disposable towel to collect secretions. Monitoring sensors are applied as appropriate (see Chapter 3), and a mouthguard is inserted. We prefer a type which can be strapped into place, and which also includes an oxygen feed.

Medication practices vary widely between different centres and cultures. Pharyngeal anaesthesia is used almost universally, and most units give sedation. We use a combination of pethidine (Demerol) and diazepam (Valium), or midazolam (Versed, Dormicum) in the majority of patients. Details of these and other drugs (e.g. antibiotics) are given in Chapter 3. Selected patients are managed without sedation, relying on good technique, rapport and speed. This is tolerated better by older patients than by younger ones and in procedures using small endoscopes (and lateral-viewing instruments which have a rounded tip); it may be safer in patients with pulmonary problems. Endoscopy is also easier to organize when sedation is avoided; there is no need for formal recovery, and fit patients can drive or return immediately to work or play.

Choice of endoscope

Routine upper endoscopy is done with a long forward-viewing instrument. With the modern degree of tip deflection and wide-angle lenses available, it is usually possible to perform a complete survey of the stomach and duodenum. Some areas are slightly more difficult to see face-on (Fig. 4.1), as is necessary for optimal tissue sampling (e.g. high lesser curve gastric ulcers), although a skilled endoscopist can usually achieve this by suitable manoeuvres, including tip retroversion (Fig. 4.2). These areas are well seen with side-viewing instruments (Fig. 4.3), which are essential for examination (and cannulation) of the papilla of Vater. Only very rarely is it necessary nowadays to withdraw a forward-viewing instrument and replace it with a side-viewing endoscope. There is a trend towards smaller 'paediatric' endoscopes. These are essential for small children and are useful in patients with strictures. Surprisingly, very small endoscopes (5–6 mm diameter) can be more difficult to pass than standard instruments, as the bending section is more floppy; it is easy to get lost in the pharynx unless insertion is done under direct vision.

The proliferation of therapeutic techniques has lead to the

development of larger 'therapeutic' endoscopes, with bigger channels (4 mm or greater, compared with the standard 2.8 mm). These channels allow the passage of larger and more robust probes and more effective suction (e.g. of blood clots).

A unit offering a comprehensive service for upper endoscopy should have a variety of different instrument types, and a sufficient total number to allow for rapid patient turnover with complete disinfection schedules. A single procedure room unit would need four endoscopes (two standard, one paediatric and one therapeutic). Busy rooms will alternate three endoscopes in a session of upper GI endoscopy. The more specialized instruments can be shared when there are several procedure rooms. Backup instruments are necessary to cover breakages. Each room must have appropriate light sources and sufficient accessories (water bottles, biopsy forceps, etc.) to ensure that sterile replacements are always available.

When video-endoscopes are used (or a video convertor onto a fibrescope), it is important to site the monitor in a place convenient for the endoscopist and main assistant — which means across the patient (Fig. 4.4). The patient and other assistants may appreciate a second monitor at a site convenient for them. If television systems are not in use, a side-arm 'teaching attachment' should be available.

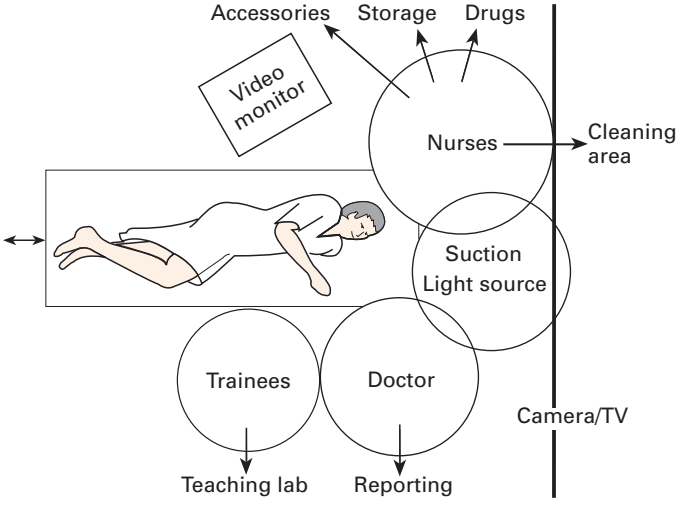

Fig. 4.4 Functional planning is important in the endoscopy room.

Stance and instrument handling

The endoscopist should stand comfortably and hold the instrument in such a way that it runs in a gentle curve directly to the patient's mouth (rather than drooping below the examination table, which reduces torque control). Inexperienced endoscopists often stand too close to the patient in a cramped and uncomfortable position (Fig. 4.5). Video-endoscopes, not requiring the endoscopist to hold the control body to the eye, are particularly easy to handle in this respect (Fig. 4.6).

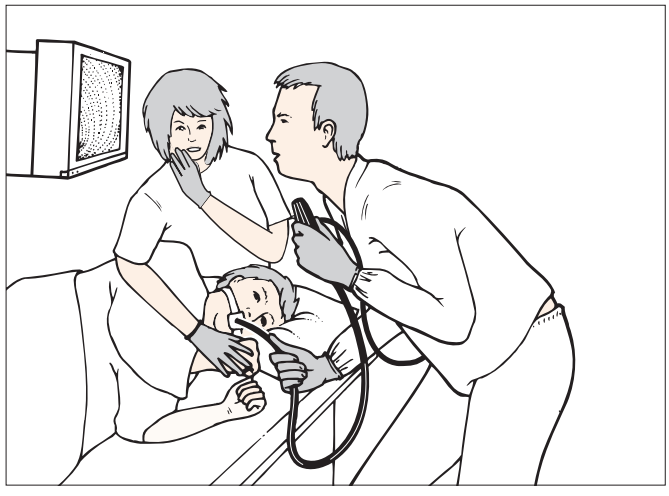

Fig. 4.5 Wrong: an obviously incompetent endoscopist with clumsy stance and handling.

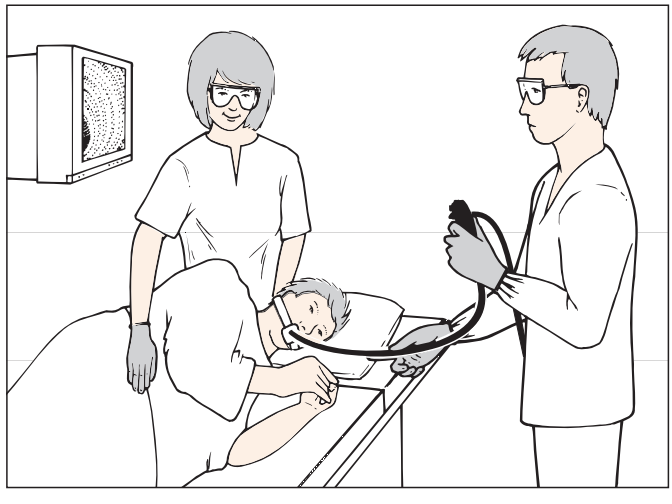

Fig. 4.6 Right: confident and balanced stance with a straight instrument, gently handled.

The endoscope should be held delicately in the fingers, avoiding sudden or aggressive shaft movements which tend to provoke gagging. Twisting (torqueing) movements of the control body and a straightened shaft can add to the fluency of the examination.

The grip. Like a golf club or violin, the endoscope has to be held correctly to produce good results. Its head should be placed in the palm of the left hand, and gripped between the fourth and little fingers and the base of the thumb, with the tip of the thumb resting on the up/down control (Fig. 4.7). This grip leaves the first finger (forefinger) free to activate the air/water and suction buttons. The second (middle) finger assists the thumb as a 'ratchet' during major movements of the up/down control. With practice, the left/right control can also be managed with the left thumb (Fig. 4.8). The left thumb is used to control the lever for the forceps elevator, where present. The right hand thus remains free to push, pull and torque the instrument and also to control accessories such as the biopsy forceps and cameras. The right hand may be used intermittently to manage the left/right tip control and the brakes, but for fluent 'single-handed' endoscopy this is avoided as much as possible.

The basic left-hand grip should be maintained throughout the examination. Acute rotation of the instrument should be effected by rotating the hand, not by rotating the instrument in the hand. Some endoscopists find it convenient to ask the nurse to push and pull the instrument, leaving both hands free to manage the controls. This method may be easier for beginners, but is not generally recommended.

Orientation conventions. When referring to tip deflection, it is convenient to use 'up/down' and 'left/right' in relation to the instrument view and the neutral position of the instrument head (i.e. buttons up), rather than to the ceiling or floor. Thus, turning the up/down control anticlockwise as seen from the right (pushing the bottom of the wheel away from the endoscopist with the thumb) always moves the tip 'up' relative to the field of view (Fig. 4.9). This applies whatever the shaft rotation; if the hand and the (straight) scope are rotated so that the buttons face the floor, 'up' deflection of the tip now points it towards the floor (Fig. 4.10). Fibreoptic instruments have a small mark at 12 o'clock in the field of view (Fig. 4.11) to facilitate orientation for photography (and the endoscopist viewing down a teaching side-arm), and 'up' deflection always deviates the tip towards that mark; video-endoscopes do not need this facility since the monitor does not rotate. Remember that tip movements cause the view to move in the opposite direction (Fig. 4.12). The lens in side-viewing instruments always faces upwards towards the buttons, and the same conventions apply.

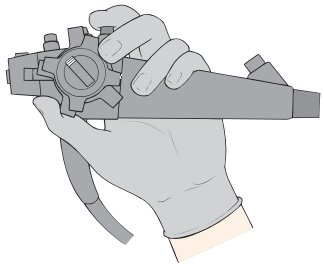

Fig. 4.7 The thumb rests on the up/down control wheel, the forefinger on the air/water button and the middle finger can also assist.

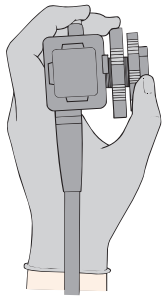

Fig. 4.8 The thumb can reach across to the left/right control.

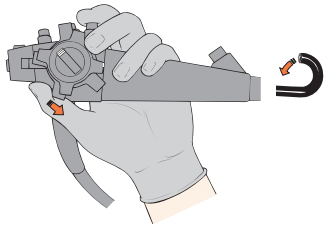

Fig. 4.9 The thumb pushes away from the endoscopist to angle the tip 'up'.

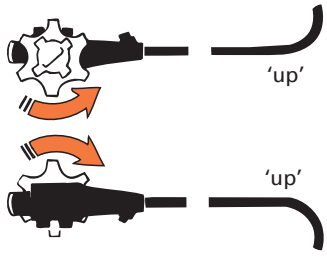

Fig. 4.10 Inversion of the endoscope and the 'up/down' convention.

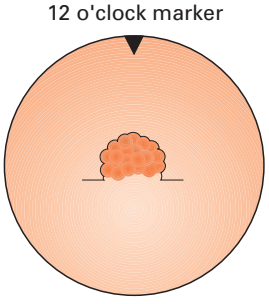

Fig. 4.11 Fibrescopes have a marker for photography.

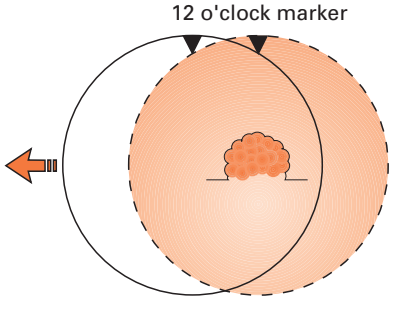

Fig. 4.12 Tip movements move the view in the opposite direction.

Passing the instrument

Pre-check the endoscope for proper functioning and lubricate the distal 20 cm of the shaft (lightly) with jelly. Avoid waving the instrument around in front of a nervous patient; a little subtlety, sleight of hand and smooth talking are appropriate at this moment. Just before inserting the endoscope through the tooth-guard, pre-rehearse up/down movements of the controls to ensure that the tip moves in the correct longitudinal axis to follow the pharynx (Fig. 4.13). If necessary, adjust the lateral knob or twist the shaft appropriately so that it does so, and will track automatically down the midline, rather than impacting laterally into a piriform fossa.

There are three basic methods for passing an endoscope.

Method 1 Steering down under direct vision

This is the safest, most exact and (with a little practice) the quickest method of inserting a forward-viewing instrument. With the mouthguard in position, hold the endoscope shaft at the 30 cm mark (so that changes of hand position are not needed during insertion), pre-rehearse up-angling to check the axis and then pass the tip into the mouthguard. Look for a rough, pale surface of the tongue horizontally in the upper (anterior) part of the view (Fig. 4.14a) and keep the interface between it and the red

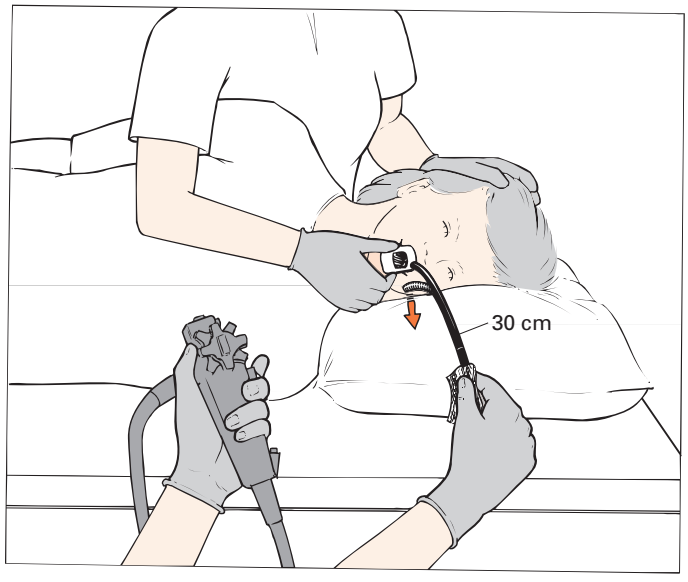

Fig. 4.13 The endoscopist pre-rehearses tip angulation in the correct axis before insertion.

surface of the palate in the centre of view by angling up appropriately, whilst advancing inwards over the curve of the tongue. Simultaneously, take care to stay in the midline by watching for the linear 'median raphe' of the tongue or the convexity of its midpart, correcting if necessary by twisting the shaft; if the view is lost, or the teeth are seen, withdraw and start again. The uvula is often seen transiently, projected upwards in the lower part of the view (Fig. 4.14b). Then, as the tip advances, the epiglottis and, finally, the cricoarytenoid cartilage with the 'false' vocal cords above it are visible in the upper part of the view (Fig. 4.14c; Plate 4.1). In a few patients with forcefully bulging tongues the view may be poor; in others gagging movements can be reduced by asking for deep breathing which automatically reduces retching. The normal tonic contraction of the cricopharyngeal sphincter means that the entrance to the first, or pharyngeal, part of the oesophagus is poorly seen except transiently during swallowing. To reach it, angle down (posteriorly) so that the tip passes inferior to the curve of the cricoarytenoid cartilage, preferably passing to one or other side of the midline since the midline bulge of the cartilage against the cervical spine makes central passage difficult (Fig. 4.14d). At this point there will often be a 'red-out' as the tip impacts into the cricopharyngeal sphincter; insufflate air, maintain *gentle* inward pressure, and the instrument should slip into the oesophagus within a few seconds. If necessary, ask the patient to swallow, and push in quickly as the sphincter opens. Keep watching carefully to ensure smooth mucosal 'slide-by' as the instrument passes semiblind into the upper oesophagus, for it is here that there is the occasional danger of entering a diverticulum.

After insertion to the cricopharyngeal region under direct vision the instrument will be in the midline, with no possibility of impaction into one of the piriform fossae. The endoscopist can therefore have confidence that the instrument will pass correctly, safely and rapidly into the oesophagus, even when a less than perfect view is obtained. The adequate views of the region normally obtained, including the vocal cords, are a bonus denied to those using the old-fashioned 'blind' insertion technique.

Method 2 Blind tip manipulation

This is an alternative insertion method. Standing facing the patient, the operator holds the instrument control head and tip close to each other. The nurse places the mouthguard, and holds the patient's head slightly flexed (see Fig. 4.13). With the right hand, the endoscopist passes the instrument tip through the mouthguard and over the tongue to the back of the mouth; using the left thumb on the control knob, the tip is then actively deflected upwards so that it curls in the midline over the back of the tongue and into the midline of the pharynx. The tip is

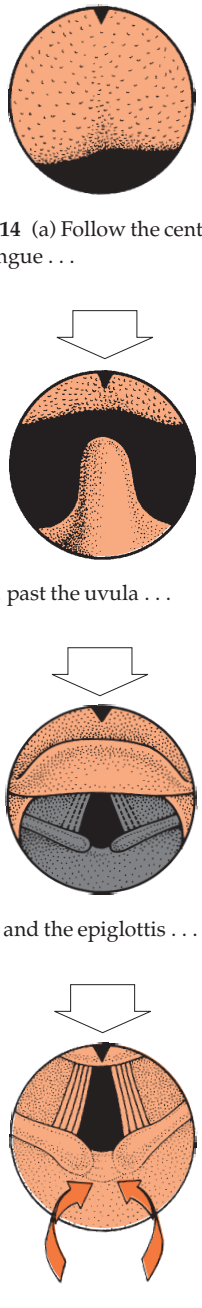

Fig. 4.14 (a) Follow the centre of the tongue . . .

(b) . . . past the uvula . . .

(c) . . . and the epiglottis . . .

(d) . . . to pass below the cricoarytenoid on either side.

advanced slightly and the thumb is removed from the tip control. While slight forward pressure is maintained, the patient is asked to swallow when the 20 cm mark on the endoscope shaft is just visible outside the mouthguard. This relaxs the cricopharyngeal sphincter, which lies at 15–18 cm from the incisor teeth. As in the direct insertion method, constant reassurance and encouragement should accompany this phase ('swallow please, this is the worst part, you've nearly done it, swallow please, well done, almost finished', etc.).

Passage of the tip through the cricopharyngeal sphincter is easily felt by the right hand as resistance is lost. If the tip does not pass after two or three good swallows, it is probably not in the midline. This can be checked by view or finger (see method 3 below), but it is often better to remove the instrument and to re-insert it after re-orientation and further reassurance.

Method 3 Finger guidance

Finger insertion is not recommended as a routine. The head of the instrument is held by an assistant (avoiding contact with the control knobs) or can be draped over the endoscopist's shoulder. The mouthguard is fitted over the shaft. The endoscopist puts the second and third fingers of his gloved left hand over the back of the tongue. With the right hand he then passes the tip of the instrument over the tongue and uses the inserted fingers of the left hand to guide it into the midline of the pharynx (Fig. 4.15).

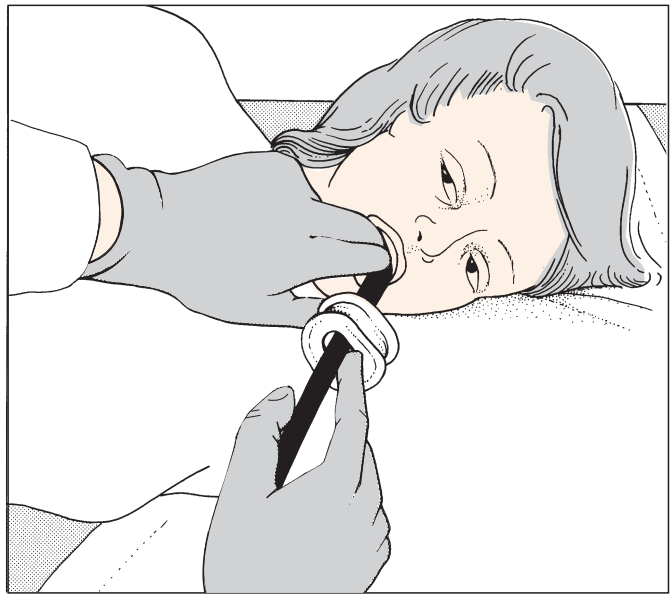

Fig. 4.15 Sometimes 'blind' insertion is helped by guiding the instrument between two fingers.

The patient is asked to swallow after the fingers are withdrawn and the mouthguard is slid into place. If swallowing is not effective, the tip of the instrument has probably fallen into the left pyriform fossa; it may be necessary to reinsert a finger to lift the tip back into the midline.

We strongly recommend passing the instrument under direct vision (method 1). Method 2 is applicable for lateral-viewing endoscopes which have smooth rounded tips. Method 3 may be necessary on occasions, but is risky. Bites to the fingers and the instrument can be dangerous and expensive.

Passage of an endoscope is a co-operative venture between patient and endoscopist; rapport and safety should never be compromised by persisting when the patient is distressed. If in doubt, remove the instrument, and only try again when the patient is ready. The addition of pethidine (Demerol) 20–50 mg i.v. is helpful if anxiety or retching are problematic.

Endotracheal tubes present no problem for the endoscopist inserting under direct vision. Deflating the balloon of the tube may be necessary occasionally to allow easier passage, especially with larger instruments.

Nasogastric tube position can be maintained during endoscope insertion by the simple means of inserting a stiff guidewire down the tube beforehand.

The routine survey

Whatever the precise indication, it is usually appropriate to examine the entire oesophagus, stomach and proximal duodenum. A complete survey may sometimes be prevented by stricturing from disease or previous surgery, or can be curtailed for other reasons. It is important to develop a systematic routine to reduce the possibility of missing any area. The instrument is always advanced under direct vision, using air insufflation and suction as required, and delaying occasionally during active peristalsis (if antispasmotics have not been used). Mucosal views are often better during instrument withdrawal, when the organs are fully distended with air, but inspection during insertion is also important since minor trauma by the instrument tip (or excessive suction) may produce small mucosal lesions with consequent diagnostic confusion. Lesions noted during insertion are best examined in detail (and sampled for histology or cytology) following a complete routine survey of other areas. As well as being systematic in survey, be precise in movements and decisive in making a 'mental map' of what is being seen. A careful, unhurried gastroscopy can be achieved in less than 5 min by avoiding unnecessary movements and repeated examinations of the same area.

Remember two golden rules for endoscopic safety:

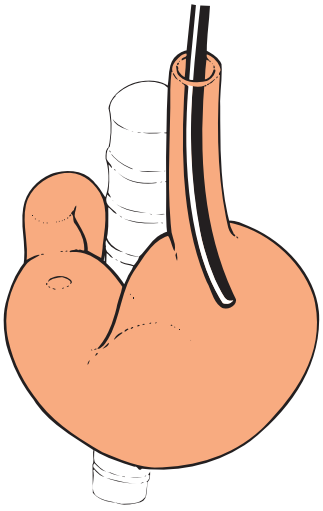

Fig. 4.16 The distal oesophagus angles the scope into the posterior wall of the lesser curve.

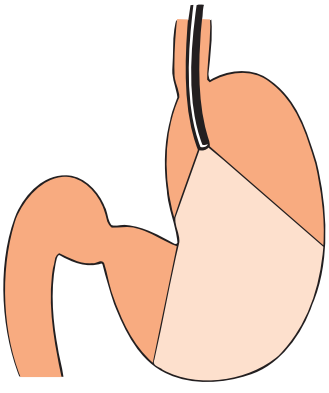

Fig. 4.17 With the gastroscope high on the lesser curve . . .

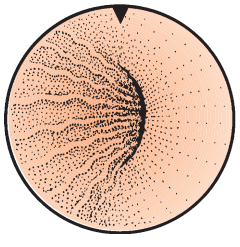

Fig. 4.18 . . . the view is of the angulus in the distance, with the greater curve longitudinal folds on the left.

1 do not push if you cannot see;
2 if in doubt, inflate and pull back.

Oesophagus

After the cricopharyngeal sphincter, other landmarks seen during oesophagoscopy may include indentation from the left main bronchus, and pulsation of the left atrium and aorta. The oesophagogastric mucosal junction is clearly seen (at 38–40 cm from the incisor teeth in adults) where pale pink squamous oesophageal mucosa abuts darker red gastric mucosa; this junction is often irregular and therefore called the 'Z-line'. The diaphragm normally clasps at or just below the oesophagogastric mucosal junction. The position of the diaphragmatic hiatus can be highlighted by asking the patient to sniff or to take deep breaths, and is recorded as the distance from the incisors. In any patient, the precise relationship of the Z-line to the diaphragmatic hiatus varies during an endoscopy (depending on the patient position, respiration, gastric distension, etc.). In normal patients, the gastric mucosa is often seen at least 1 cm above the diaphragm; hiatus herniation is diagnosed if the Z-line remains more than 2 cm above the hiatus. From the clinical point of view, however, the presence or degree of herniation may be less important than any resulting oesophageal lesions (e.g. oesophagitis or columnar transformation).

Stomach

Endoscopes are easy to pass through the cardia unless there is stenosis; the tip is simply advanced gently under direct vision. The distal oesophagus usually angles to the patient's left as it passes through the diaphragm, so it may be necessary to turn the instrument tip slightly to remain in the correct axis (Fig. 4.16). Unless the cardia is unduly lax, the mucosal view is lost momentarily as the tip passes through, passage being felt by the advancing hand as a slight 'give'. If the tip is further advanced in the same plane, it will abut on the posterior wall of the lesser curvature of the stomach so that pushing in blindly risks retroflexing towards the cardia. Thus, as soon as the tip has passed through the cardia, the instrument should be rotated somewhat to the 'left' (counterclockwise), further air inflated and the tip withdrawn slightly to disimpact from the wall of the fundus or the pool of gastric juice on the greater curve.

With the patient in the left lateral position and the instrument held correctly (buttons up), the disimpacted endoscopic view is predictable (Figs 4.17 & 4.18). The smooth lesser curvature is on the endoscopist's right with the angulus distally, the longitudinal folds of the greater curve are to the left and its posterior aspect is below (Plate 4.2). The pool of gastric juice should be

aspirated to avoid reflux or aspiration during the procedure and the stomach then inflated sufficiently to obtain a reasonable view during insertion. When the mucosal view is obscured by foaming or bubbles, it is helpful to inject a suspension of silicone (simethicone) down the biopsy channel. The four walls of the stomach are examined sequentially by a combination of tip deflection, instrument rotation and advance/withdrawal. The field of view during the advance of a four-way angling endoscope can be represented as a cylinder angulated over the vertebral bodies; the distended stomach takes up an exaggerated J-shape with the axis of the advancing instrument corkscrewing clockwise up and over the spine, following the greater curvature (Fig. 4.19). Thus, the endoscopist, after first turning the tip to his left and somewhat down on entering the stomach, must increasingly angle it up, and rotate the shaft clockwise, following the longitudinal folds as the instrument is advanced down over the vertebral column and into the antrum (Fig. 4.19).

This clockwise corkscrew rotation through approximately 90° during insertion brings the angulus and antrum into end-on view (Fig. 4.20); downward deflection of the tip brings it into the axis of the antrum (Fig. 4.21). The antrum and pylorus should first be examined from a distance, waiting as necessary for any peristaltic waves to pass.

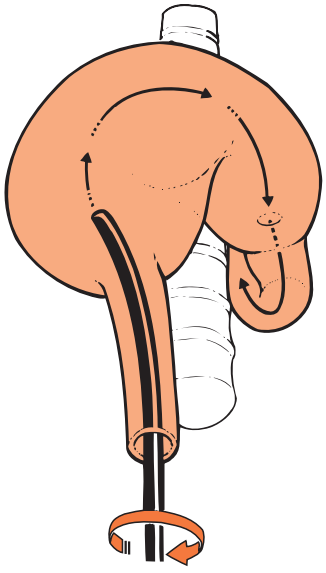

Fig. 4.19 The route to the pylorus and down the duodenum is a clockwise spiral around the vertebral column.

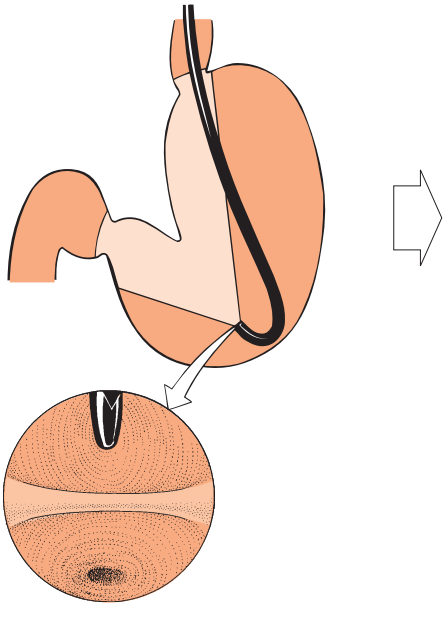

Fig. 4.20 The angulus and antrum come into view . . .

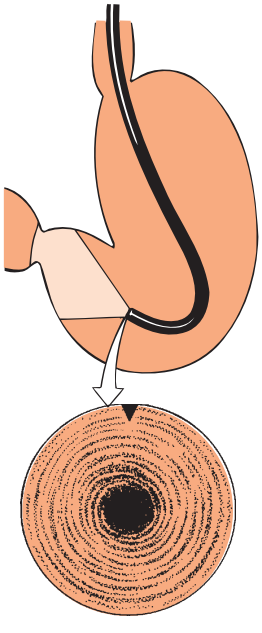

Fig. 4.21 . . . then angle down to see the pylorus in the axis of the antrum.

The tip is then again advanced past the angulus into the antrum (Fig. 4.22). The motor activity of the antrum, pyloric canal and pyloric ring should be carefully observed. Any asymmetry during a peristaltic wave is a useful indicator of present or previous disease.

Through the pylorus into the duodenum

The pyloric ring is approached directly for passage into the duodenum. During the manoeuvre it is particularly convenient to use only the left hand to maintain the instrument tip in the correct axis. When the pyloric ring fills the field of view, the tip is advanced and is seen or felt to pass into the duodenal cap (Figs 4.23 & 4.24) which is recognized by its more granular and paler surface. Some patience may be needed to pass the pylorus, especially if there is spasm or deformity; downward angulation of the tip or deflation may help its passage.

As the instrument tip passes the resistance of the pylorus, the loop which has inevitably developed in the stomach straightens out and accelerates the tip to the distal bulb (Fig. 4.24). This makes it necessary to withdraw the shaft considerably to disimpact the tip (and insufflate some air) before a view is obtained (Fig. 4.25). Like the stomach, the bulb is scanned by circumferential manipulation of the tip during advance and withdrawal. The area immediately beyond the pyloric ring, especially the inferior part of the bulb, may be missed by the inexperienced, who fail to withdraw sufficiently for fear of falling back into the stomach. Buscopan (or Glucagon) can be given intravenously if visualization is impaired by duodenal motility — but avoid excessive air insufflation, which will leave the patient uncomfortably distended.

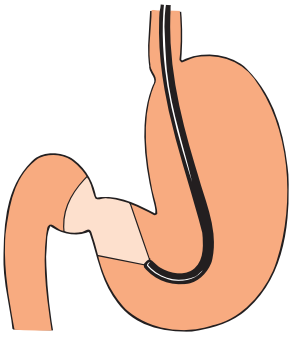

Fig. 4.22 The scope passes from the antrum . . .

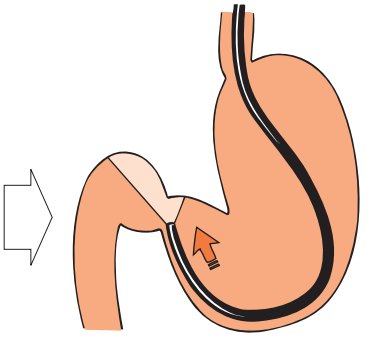

Fig. 4.23 . . . to the pylorus and duodenal cap . . .

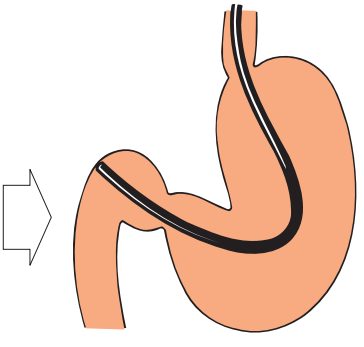

Fig. 4.24 . . . and tends to impact in the duodenum.

Passage into the descending duodenum

This must be effected with care. The superior duodenal angle is the important landmark (Fig. 4.25). The instrument is advanced into the angle, so that the tip lies at the junction of the first and second parts of the duodenum. The shaft is rotated about 90° to the right, and the tip is then angled to the right and acutely up to corkscrew round the bend (Fig. 4.26), and provide a tunnel view of the descending duodenum. Paradoxically, the tip is best advanced beyond the flexure by *withdrawing* the shaft, since straightening the loop in the stomach presses the tip inwards, and the straightening shaft also corkscrews more efficiently round the superior duodenal angle (Figs 4.27 & 4.28). Inexperienced endoscopists mistakenly push to attempt passage into the descending duodenum. Using the correct 'pull and twist' method, the tip slides in to reach the ampullary region with only 55–60 cm of instrument inserted. Duodenoscopy with more than 70 cm of shaft inserted is inelegant and uncomfortable.

A forward-viewing instrument gives tangential and often restricted views of the convex medial wall of the descending duodenum and the papilla of Vater. With small acute-angling instruments, it is sometimes possible to view this area more directly in a partly retroflexed manner (Fig. 4.29), but care should be taken.

Be gentle when trying to pass standard instruments further into the third part of the duodenum. Attempts at pushing may simply form a loop in the stomach (Fig. 4.30). Further pressure may advance the tip but often at the cost of considerable discom-

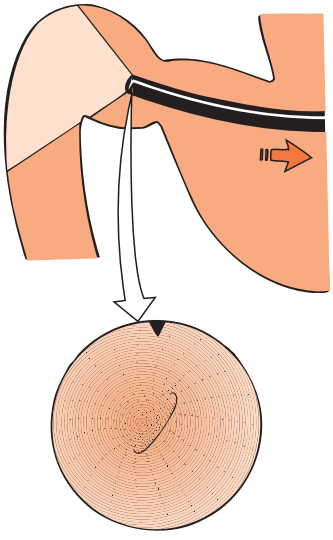

Fig. 4.25 Withdraw the scope to disimpact the tip and see the superior duodenal angle — an important landmark.

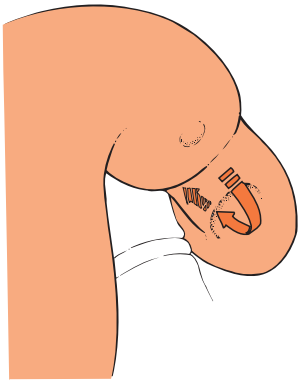

Fig. 4.26 Corkscrew the tip clockwise around the superior duodenal angle, using twist, right- and up-angulation simultaneously.

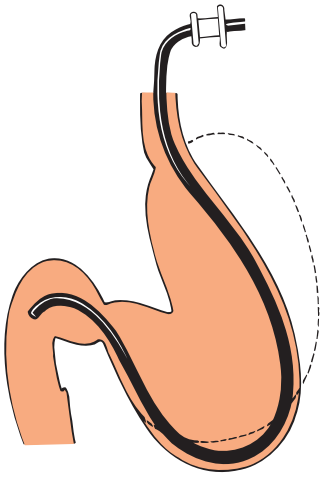

Fig. 4.27 Because of the loop in the greater curve . . .

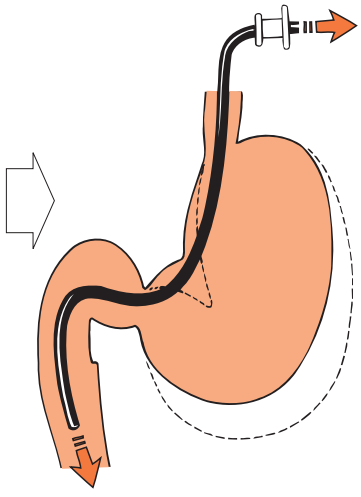

Fig. 4.28 . . . withdrawal helps to advance the scope into the second part of the duodenum.

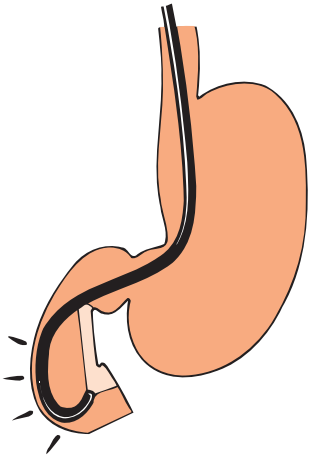

Fig. 4.29 Forceful partial retroflexion may give a view of the papilla, but take care.

fort to the patient; pulling back, deflating or even applying pressure on the patient's upper abdomen may be more effective.

Retroflexion

Retroflexion of the tip of the instrument is achieved by complete 180° upward angulation (combining both angling controls) with simultaneous inward pressure if the tip of the instrument is in the antrum, and the stomach distended. This manoeuvre should demonstrate the angulus, the entire lesser curve and the fundus as the instrument is withdrawn (Fig. 4.31). The retroversion (or 'J') manoeuvre is probably best performed after examining the duodenum so as to avoid overinflation on the way in. Some patients (particularly those with a lax cardia) find it difficult to hold enough air to permit an adequate view. If retroversion proves difficult, it may be made easier by rotating the patient slightly onto the back to give the stomach more room to expand. Having examined the lesser curvature from below, the retroflexed shaft is rotated through 180° in either direction to swing the tip around and provide views of the greater curvature and fundus (Fig. 4.32). Close-up cardia views are obtained by withdrawing further still, again rotating the retroverted instrument as necessary.

During all of these manoeuvres, it is particularly important to keep the shaft of the instrument relatively straight from the patient's teeth to your hands. This reduces the strain on the endoscope, helps orientation and ensures that rotatory movements are precisely transmitted to the tip.

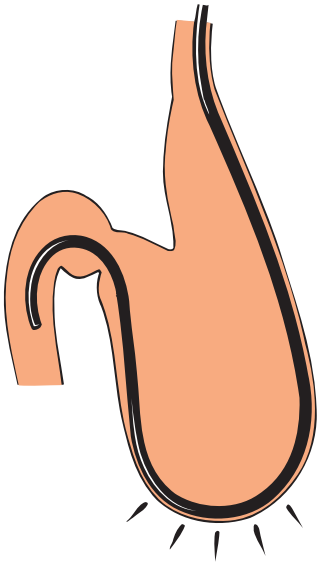

Fig. 4.30 Trying to reach the third part by force simply forms a loop in the stomach.

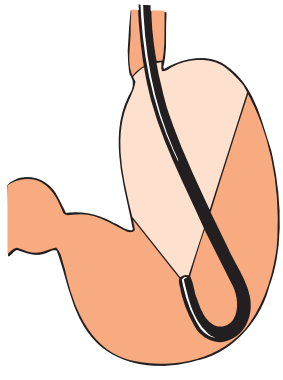

Fig. 4.31 Angulation of 180° retroflexes the tip to see the lesser curve . . .

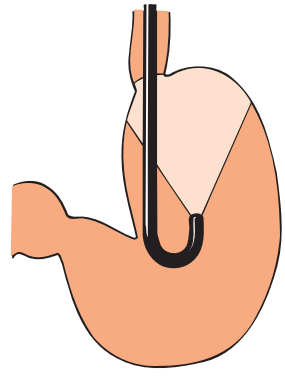

Fig. 4.32 . . . and swinging the retroflexed tip around gives a view of the fundus and cardia.

Having examined the proximal stomach and cardia, the instrument tip is straightened back to the neutral position by de-angling the controls and pulling back.

Removing the instrument

The duodenum, stomach and oesophagus should be surveyed carefully once again during withdrawal. Under the different motility conditions and organ shapes produced by distension and instrument position, areas previously seen only tangentially on insertion may be brought into direct view on the way out. Remember to aspirate air (and fluid) from the stomach completely on withdrawal, and to take the brakes off from the control knobs.

The instrument should be wiped and its channel flushed immediately after it is removed from the patient, before proteinaceous secretions and blood can dry in the channels. The endoscopist or assistant should place the tip of the instrument into water and press down on both control buttons; this flushes both the suction/biopsy and the air/water channels. Details of formal cleaning and disinfection methods are given in Chapter 3.

Problems during endoscopy

Patient distress

Endoscopy should be terminated quickly if any patient shows distress, the cause of which is not immediately obvious and remediable. Many patients have an understandable anxiety about choking. The airway should be checked and any residual oral sections aspirated. If reassurance does not calm the patient, remove the instrument and consider giving additional sedation or analgesia (especially pethidine). Inadvertent bronchoscopy is not rare if insertion is done by the 'blind' method. It is obvious from the unusual view and impressive coughing. Discomfort may arise from inappropriate pressure during intubation, or from distension due to excessive air insufflation. Most sedated patients are able to belch; when performing endoscopy under general anaesthesia, it may be wise to keep the abdomen exposed so that overinflation can be detected, especially in children. Remember to keep inflation to a minimum, and to aspirate all the air at the end of the procedure. Severe pain during endoscopy is very rare, and indicates a complication such as perforation or a cardiac incident. It is extremely dangerous to ignore warning signs.

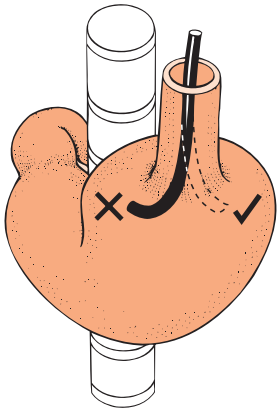

Fig. 4.33 Angling right (rather than left) on entering the fundus can cause retroflexion and can result in getting lost.

Getting lost

The endoscopist may become disorientated, and the instrument looped, in patients with congenital malrotations, major pathology (e.g. achalasia, large diverticula and hernias, 'cup and spill' deformities) and after complex surgery. Careful study of any available radiographs should help. The commonest reason for disorientation in patients with normal anatomy is inadequate air insufflation due to a defect in the instrument or air pump (which should have been detected before starting the examination). Inexperienced endoscopists often get lost in the fundus, especially when the stomach is angled acutely over the vertebral column. Having passed the cardia, the instrument tip should be deflected to the endoscopist's *left* and slightly downwards (Fig. 4.33). A wrong turn to the right will bring the tip back up into the fundus. When in doubt, withdraw, insufflate and turn sharply left to find the true lumen.

A curious endoscopic view may indicate perforation (which is not always immediately painful). If in any doubt, abandon the examination and obtain radiological studies.

Inadequate mucosal view

Lack of a clear view means that the lens is lying against the mucosa or is obscured by fluid or food debris. Withdraw slightly and insufflate air; double check that the air pump is working and that all connections are firm. Try washing the lens with the normal finger-controlled water jet. This may not be effective if the instrument lens is covered by debris (or mucosa which has been sucked onto the orifice of the biopsy channel). Pressure can be released by brief removal of the rubber cap of the biopsy port, but it may be necessary to flush the channel with water or air, using a syringe. Small quantities of food or mucus obscuring an area of interest can be washed away with a jet of water. Foaming can be suppressed by adding a few drops of silicone suspension. Since most patients obey instructions to fast beforehand, the presence of excessive residue is an important sign of outlet obstruction. Standard endoscope channels are too small for aspiration of food; prolonged attempts simply result in blocked channels. The instrument can usually be guided along the lesser curvature over the top of the food to allow a search for a distal obstructing lesion. The greater curvature can also be examined if necessary by rotating the patient into the right lateral position. However, any examination in the presence of excess fluid or food carries a significant risk of regurgitation and pulmonary aspiration. The endoscopist should only persist if the immediate benefits are thought to justify the risk. It is usually wiser to stop and to repeat the examination only after proper lavage.

Recognition of lesions

This book is concerned mainly with techniques rather than lesions. We recommend that beginners should study several of the excellent atlases which are now available. Certain points, however, are worth emphasizing here.

Oesophagus

Oesophagitis normally follows acid reflux and is most apparent distally, close to the mucosal junction. There is no clear macroscopic dividing line from normality; the earliest visible changes consist of mucosal congestion and oedema, which obscure the normal fine vascular pattern. At a more advanced stage, the mucosa becomes friable and bleeds easily on touching; there are patches of exudate and areas of reddening or ulceration, usually in the long axis of the oesophagus. The process culminates in a symmetrical stricture above which the mucosa (now protected from reflux) may appear almost normal. Columnar lining of the oesophagus (Barrett's oesophagus) is easily recognized (Plates 4.3 and 4.4). Red gastric-type mucosa extends more than 2 cm above the diaphragmatic hiatus; initially in longitudinal stripes or plaques, it can coalesce to involve the entire circumference. Monilial oesphagitis is characterized by white spots or plaques (Plate 4.5).

Oesophageal carcinoma usually causes asymmetrical stenosis, with areas of exuberant abnormal mucosa, and sometimes an irregular ulcer with raised edges. Carcinoma of the gastric fundus may also infiltrate upwards submucosally to involve the oesophagus. The correct diagnosis is then easily made if the endoscope can be passed through the stricture to allow retroverted views of the cardia.

Diverticula in the mid- or distal oesophagus are easily recognized, but the instrument may enter a pulsion diverticulum or pouch in the upper oesophagus without the true lumen being seen at all. Lack of view and resistance to inward movement are (as always) an indication to pull back and reassess. Webs or rings (Plate 4.6), such as the Schatski ring at or just proximal to the oesophagogastric junction, may not be obvious to the endoscopist due to a combination of 'flat' bright endoscope illumination and distortion from the wide-angled lens view. If in doubt, skilled radiology (with video taping) should be used to define the situation before therapeutic endoscopy.

Varices lie in the long axis of the oesophagus as tortuous bluish mounds covered with relatively normal mucosa. They resemble varicose veins elsewhere in the body.

Mallory–Weiss tears are 5–20 mm longitudinal mucosal splits lying either side of or across the oesophagogastric mucosal junction. In the acute phase the tear is covered with exudate or clot and may sometimes be seen best in a retroverted view.

Motility disturbances of the oesophagus should be diagnosed by radiology and manometry, but their consequences — such as dilatation, pseudodiverticula, food retention and oesophagitis — are well seen at endoscopy, which is always needed to rule out obstructing pathology. Hypermotility is probable when recurrent oesophageal contractions are seen in spite of antispasmodics and sedation; the inco-ordinate non-propulsive contractions of oesophageal dysfunction being known as 'tertiary' contractions.

Achalasia allows the endoscope to pass easily through the cardia, in contrast to the fixed narrowing of pathological strictures due to reflux oesophagitis or malignancy (Plates 4.7 and 4.8).

Stomach

The appearance of the normal gastric mucosa varies considerably. Reddening (hyperaemia) may be generalized (e.g. with bile reflux into the operated stomach) or localized; sometimes it occurs in long streaks along the ridges of mucosal folds. Localized (traumatic) reddening with or without petechiae or oedematous changes is often seen on the posterior upper lesser curve in patients who habitually retch. Macroscopic congestion does not correlate well with underlying histological gastritis, and care should be taken when considering clinical relevance. Biopsy samples should be taken from any odd-looking mucosa.

Gastric folds vary in size, but the endoscopic assessment also depends upon the degree of gastric distension (Plate 4.2). Very prominent fleshy folds are seen in Ménétrièr's disease and are best diagnosed by a snare-loop biopsy. Patients with aggressive duodenal ulceration often have large gastric folds with spotty areas of congestion within the areae gastricae and excess quantities of clear resting juice. With gastric atrophy, there are no mucosal folds (when the stomach is distended) and blood vessels are easily seen through the pale atrophic mucosa. Atrophy is often associated with intestinal metaplasia which appears as small grey-white plaques.

Erosions and ulcers are the most common localized gastric lesions. A lesion is usually called an erosion if it is small (<5 mm diameter) and shallow with no sign of scarring. Acute ulcers and erosions are often seen in the antrum and may be capped with, and partially obscured by, clots. Oedematous erosions appear as small, smooth umbilicated raised areas, often in chains along the folds of the gastric body. When these are multiple, the condition has been called 'chronic erosive gastritis'. However, gastritis is a term best reserved for histological use.

The classic chronic benign gastric ulcer is usually single and is most frequently seen on the lesser curvature at, or above, the angulus. It is typically symmetrical with smooth margins and

a clean base (unless eroding adjacent structures). Multiple and punched-out ulcers (sometimes odd-shaped and very large), occur in patients on non-steroidal anti-inflammatory drug (NSAID) therapy.

Malignancy may be suspected if an ulcer has raised irregular margins (or different heights around the circumference), a lumpy haemorrhagic base or a mucosal abnormality surrounding the ulcer. Mucosal folds around a benign ulcer usually radiate towards it and reach the margin. Inexperienced endoscopists cannot hope to separate benign from malignant ulcers on macroscopic appearance alone; tissue specimens must always be taken. Unfortunately, gastric cancer is usually diagnosed at an advanced stage in Western countries, when it is all too obvious at endoscopy. Diffusely infiltrating carcinoma (linitis plastica) may be missed unless motility is carefully studied. Early gastric cancer may mimic a small benign ulcer, chronic erosion or flat polyp. Polypoid lesions under 1 cm in diameter are usually inflammatory in origin. However, since all malignant lesions start small and are curable if detected at an early stage, odd mucosal lumps and bumps should not be ignored; a tissue diagnosis must be made. Submucosal tumours are characterized by normal overlying mucosa and bridging folds; leiomyomas and plaques of aberrant pancreatic tissue (characteristically found in the floor of the antrum) usually have a central dimple or crater (Plate 4.9).

Duodenum

Duodenal ulcers, either current or previous, often cause persistent deformity of the pyloric ring. The ulcers occur most commonly on the anterior and posterior walls of the bulb and are frequently multiple. When active they are surrounded by oedema and acute congestion. Scarring often results in a characteristic shelf-like deformity which partially divides the bulb and may produce a pseudodiverticulum; a small linear ulcer or scar is seen running along the apex of this fold. The mucosa of the bulb often reveals small mucosal changes of dubious clinical significance. Areas of mucosal congestion with spotty white exudate ('pepper and salt' ulceration) merge into even less definite macroscopic appearances labelled as 'duodenitis'. Small mucosal lumps in the proximal duodenum usually reflect underlying Brunner's gland hyperplasia or gastric metaplasia (ectopic islands of gastric mucosa). Primary duodenal tumours are rare; papillary lesions are described in Chapter 6.

Ulceration and duodenitis in the second part of the duodenum suggests Zollinger–Ellison syndrome or underlying pancreatic disease. Crohn's disease may be suspected by the presence of small aphthous ulcers in the second part; there are typical granulomas on histology.

Coeliac disease can be recognized microscopically (in the second part of the duodenum and beyond), especially when viewed close up. The fine villus pattern is lost and the mucosa appears knobbly and oedematous.

Dye-enhancement techniques

These may assist the recognition of inconspicuous lesions—such as coeliac disease. Dye coating is best achieved by spraying with a tube and fine nozzle applied close to the mucosa. The dye fills the interstices, highlighting irregularities in architecture. Indigo carmine is used most frequently, but simple pen ink (1 : 5 dilution of washable blue) is also effective. Intravital staining is an alternative approach to lesion enhancement. Dyes such as methylene blue, Lugol's solution and toluidine blue may be taken up preferentially in diseased mucosa (such as intestinal metaplasia). Fluorescent stains (given intravenously) may highlight lesions under special conditions such as ultraviolet illumination.

Specimen collection

It is important to emphasize the need for close collaboration between endoscopy and laboratory staff. The diagnostic yield from endoscopic specimens will be maximized if laboratory staff are involved in defining the policy for specimen handling and transmission. Specimens should reach the laboratory with precise details of their origin, and the specific clinical question which needs to be answered. Pathologists who routinely receive a copy of the endoscopy findings (and later follow-up) are more likely to give timely and relevant reports. Regular review sessions should be part of the quality improvement process.

Biopsy specimens

Biopsy specimens are taken with cupped forceps. The lesion should be approached face-on, so that firm and direct pressure can be applied to it with the widely opened cups; the forceps are then gently closed by an assistant and withdrawn. At least six good specimens should be taken from any lesion—perfectionists would ask for many more. Forceps with a central spike make it easier to take specimens from lesions which have to be approached tangentially (e.g. in the oesophagus). Some experts prefer not to use spiked forceps because of the risk of accidental skin puncture.

Ulcer biopsies should include samples from the base and from the ulcer rim in all four quadrants; basal specimens are sometimes diagnostic, but usually yield only slough. When sampling

proliferative tumours, it is wise to take several specimens from the same place to penetrate the outer necrotic layer. A larger final tumour biopsy may be obtained by grabbing a protuberant area and deliberately *not* pulling the forceps through the channel; the instrument is withdrawn with the specimen still outside the tip.

The methods for handling and fixing specimens should be established after discussion with the relevant pathologist; some prefer samples to be gently flattened on paper or other surfaces such as cellulose filter (Millipore, etc.). The cellulose filter method of biopsy mounting has considerable advantages for the management of multiple small endoscopic biopsies. They adhere well to the filter and are rarely lost, they are mounted in sequence so that errors of location are impossible, and they allow the histopathologist to view serial sections of six to eight biopsies at a time in a row across a single microscope slide. A 15 mm strip of cellulose filter (just less than the width of a glass slide) has a pencil-ruled or printed central line and a notch or mark made at one end (Fig. 4.34a). Each biopsy is eased out of the forceps cup with the tip of a micropipette or toothpick (Fig. 4.34b) (to avoid needle-stick injuries), placed exactly onto the line and patted flat (Fig. 4.34c). The strip with its line of biopsies is placed into fixative (Fig. 4.34d). In the laboratory it is processed, wax-mounted in the correct orientation (Fig. 4.34e),

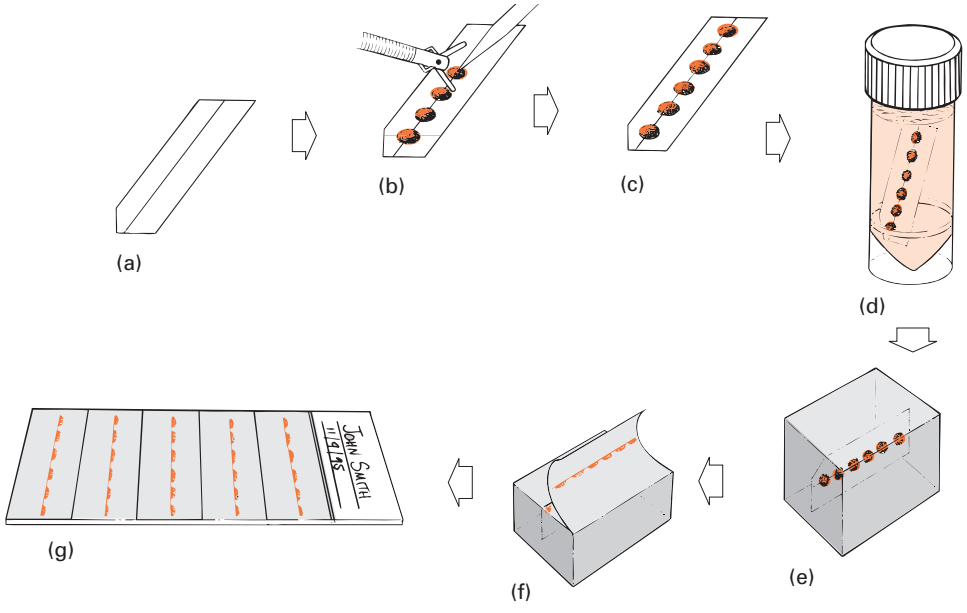

Fig. 4.34 (a–g) Stages in placing biopsies onto the filter, then fixing, sectioning and mounting the specimens.

sectioned through the line of biopsies on the filter (Fig. 4.34f), positioned on the microscope slide (Fig. 4.34g), and then stained and examined without handling the biopsies individually at any stage.

A dissecting microscope or hand lens can be used to orientate mucosal specimens before fixation if information is required about the mucosal architecture (e.g. duodenal biopsies in malabsorption).

Detection of *Helicobacter pylori* infection has become important recently. A biopsy specimen should be taken from the gastric antrum and placed in a rapid urease test; a formalin-fixed specimen is sent to the laboratory only if the urease test is negative.

Biopsy sites often bleed trivially, but sometimes sufficiently to obscure the lesion before adequate samples have been taken; if so, the area should be washed with a jet of water or adrenaline (epinephrine) solution (1 : 100 000). Bleeding of clinical significance is exceptionally rare.

Cytology specimens

Cytology specimens are taken under direct vision with a sleeved brush (Fig. 4.35) which is passed through the instrument channel. The head of the brush is advanced out of its sleeve and rubbed and rolled repeatedly across the surface of the lesion; a circumferential sweep of the margin and base of an ulcer is desirable. The brush is then pulled back into the sleeve, and both are withdrawn together. The brush is protruded, wiped over two to three glass slides and then rapidly fixed before drying damages the cells. The precise method of preparation (in the unit or laboratory) is determined by the cytologist. Brushes should not be re-used. Bleeding of clinical significance is exceptionally rare. A trap (Fig. 4.36) can be used to collect cytology specimens. Suction through the channel after a biopsy procedure also produces useful cellular material ('salvage cytology').

Fig. 4.35 Cytology brush with outer sleeve.

The value of brush cytology depends largely on the skill and enthusiasm of the cytopathologist. Many studies indicate that the combination of brush cytology and biopsy provides a higher yield than biopsy alone. In practice, most endoscopists reserve cytology for lesions from which good biopsy specimens are difficult to obtain (e.g. tight oesophageal strictures) and when resampling a suspicious lesion.

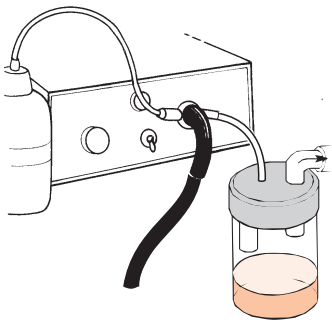

Fig. 4.36 A suction trap to collect fluid specimens.

Sampling submucosal lesions

Histology reports are usually normal in patients with submucosal lesions (such as benign tumours), since standard biopsy forceps do not traverse the muscularis mucosa. Larger and deeper specimens can be taken with a diathermy snare loop; the technique is described with polypectomy in Chapter 10. Larger

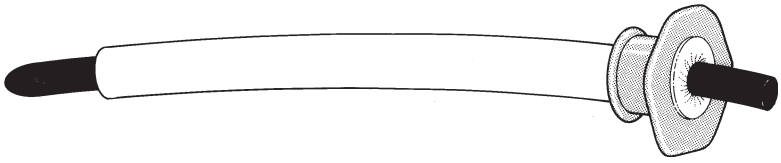

Fig. 4.37 An overtube with toothguard over a rubber lavage tube.

specimens can also be taken with 'jumbo' forceps or even larger experimental forceps which have to be 'muzzle loaded', i.e. the forceps are threaded backwards up the biopsy channel before the instrument is passed into the patient — with an overtube (Fig. 4.37) to protect the pharynx and oesophagus during intubation. An alternative method for obtaining deeper tissue samples is to use a needle to obtain aspiration samples for cytology. Good results have been reported for this technique, but it has not become popular.

Patient recovery and discharge

With standard sedation regimens, most patients rest after the procedure for about 15–30 min on a trolley (stretcher) or in a reclining chair in view of the nursing staff. The accompanying relative or friend can sit with the patient if space permits. Drinking is usually delayed for 20 min if pharyngeal anaesthesia has been used. However, the effect of pharyngeal anaesthesia can be displaced in a few seconds if the patient is able to gargle (and spit out) two mouthfulls of water. Most patients who have been sedated are fit to leave in the care of a relative or friend 30–60 min after a routine examination. They are again instructed to go home, and not to drive or take any responsible action on the same day; these instructions should also be given in writing.

Every patient should leave the unit with an idea of what has been discovered and what should happen next. Consultation should take place in the presence of an accompanying relative because of the potential for significant amnesia after sedation. Staff must ensure that the patient has further appropriate appointments. All of this process is simpler if patients are managed without sedation.

Diagnostic endoscopy under special circumstances

Operated patients

Unless prevented by postoperative stenosis, endoscopy is the best method for diagnosis and exclusion of mucosal inflammation, recurrent ulcers and tumours after upper GI surgery. The

endoscopist can document the size and arrangement of any outlet or anastomosis, but standard barium radiology and nuclear medicine techniques may be needed to give more information about motility and emptying disorders.

Experience is needed to appreciate the wide range of 'normal' endoscopic appearance in the operated patient. Partial gastrectomy, gastroenterostomy and pyloroplasty result in reflux of bile and intestinal juice; resultant foaming in the stomach may obscure the endoscopic view and should be suppressed by flushing with a silicone suspension. Gastric distension is difficult to maintain in patients with a large gastric outlet; avoid pumping too much air and overdistending the intestine. Most patients who have undergone partial gastrectomy or gastroenterostomy have impressively hyperaemic mucosae. Initially this is most marked close to the stoma, but atrophic gastritis is progressive and plaques of greyish-white intestinal metaplasia may been seen. There is an increased risk of cancer in the gastric remnant, particularly close to the stoma. Many cancers in this site are not recognized endoscopically, so during endoscopy of an operated stomach the opportunity should be taken to obtain multiple biopsy (and cytology) specimens from within 3 cm of the stoma—in every case, whatever the level of suspicion.

Ulcers following partial gastrectomy or gastroenterostomy usually occur at, or just beyond, the anastomosis. Endoscopic diagnosis is usually simple, but the area just beneath the stoma may sometimes be difficult to survey completely using a forward-viewing instrument. A lateral-viewing endoscope may also sometimes allow a more complete survey in a scarred and tortuous pyloroplasty. Many surgeons use non-absorbable sutures when performing an intestinal anastomosis; these can ulcerate through the mucosa and appear as black or green threads and loops. Their clinical significance remains controversial; when sutures are associated with ulcers, it is justifiable to attempt their removal with biopsy forceps or with a diathermy snare loop. Endoscopy is occasionally performed (for bleeding or stomal obstruction) within a few days of upper GI tract surgery; if so, air insufflation should be kept to a minimum.

Acute upper gastrointestinal bleeding

Bleeding provides special challenges for the endoscopist and details are given in Chapter 5.

Endoscopy in children

Paediatric endoscopy is simple with appropriate instruments and preparation; examination techniques are similar to those

used in adults. The standard adult forward- and lateral-viewing instruments (10–12 mm diameter) can be used down to the age of about 2 years. Smaller paediatric instruments (5 mm diameter) may be needed in infants.

Endoscopy can be performed with little or no sedation in the first year of life. Fasted babies usually swallow the instrument avidly. A few endoscopists prefer to use general anaesthesia beyond this age and into the mid-teens (especially for complex procedures) but most are satisfied with heavy sedation alone. This usually consists of a small dose of a benzodiazepine and generous doses of pethidine (Demerol). Even an apparently calm or well-sedated child may suddenly become briefly uncontrollable during intubation and it is essential to swaddle the upper body and arms completely within a blanket before beginning, and to have an experienced nurse in charge of the mouthguard (and suction). There is a risk of excessive air insufflation when using heavy sedation or anaesthesia; it is wise to keep the abdomen exposed during examination and to palpate it regularly. Careful monitoring of oxygenation and the pulse is essential. Impending shock in a neonate is indicated by the baby suddenly becoming still and floppy; this is an indication to abort the procedure rapidly.

Complications

Upper GI endoscopy should be very safe, but there are many potential hazards. Large surveys suggest that simple diagnostic endoscopy carries a risk of significant complications in about one in 1000 procedures, and of death in about one in 10 000. Problems are more likely to be encountered in the elderly and acutely ill, and during emergency and therapeutic procedures. Definitions, risk factors and general precautions are discussed in Chapter 3. The most important factors are inexperience, incompetence, overconfidence and oversedation.

Medication reactions

Medication reactions may result from idiosyncrasy or overdosage. Allergy to local anaesthetics is not unusual and should always be checked prior to examination. Small doses of sedatives may produce coma in patients with respiratory or hepatic insufficiency. Medication problems may occur after patients leave the unit. Prolonged effects of various sedatives may affect co-ordination and judgement, and patients must not drive or operate machinery on the same day. Anticholinergics will not affect treated glaucoma but may precipitate an acute painful attack in occult chronic glaucoma, which is a good thing since it leads to diagnosis and appropriate treatment; there is therefore

no ocular contraindication to the use of anticholinergics. Superficial thrombosis occasionally occurs at injection sites; the glycol carrier medium used for diazepam is particularly irritating and should not be given into small veins. The risk is reduced with diazepam in lipid emulsion form (Diazemuls) or water-soluble midazolam (Versed).

Pulmonary problems

These are not unusual, and hypoxia has been shown to be a common event with standard medication regimens. Significant hypoxia is best prevented by careful oximeter monitoring with appropriate responses to any drop in saturation (stimulation, oxygen or antidotes to narcotics). Aspiration pneumonia can also occur, especially in patients with oesophagogastric retention (e.g. achalasia, pyloric stenosis) or in those with active bleeding. Aspiration is more likely to occur in elderly patients, and when the gag reflex has been suppressed by pharyngeal anaesthesia and excessive sedation.

Cardiac dysrhythmias

Cardiac dysrhythmias can be induced by endoscopy, especially in the presence of hypoxia. Electrocardiographic monitoring, used routinely in many units, is certainly advisable when endoscopy is performed in patients with cardiac problems. Full resuscitation equipment must always be available.

Perforation

Peroration can occur at all levels of the upper gut. It is more common in the pharynx and cervical oesophagus where the endoscope is passed blindly, but can occur also at the cardia and superior duodenal angle, especially when these areas are distorted or diseased. Perforation is more likely to occur during therapeutic dilatations, either when passing a stiff guidewire blindly or during the dilatation itself. Imprudent force is usually responsible, but excessive air insufflation alone may occasionally result in perforation of an existing lesion. Perforation is immediately painful in the neck and mediastinum, but more distal perforation may not be apparent for some hours. Perforation may be obvious (by the bizarre view), or recognized only later by subsequent development of subcutaneous emphysema, and by the characteristic appearances on abdominal radiographs. The management of evident or suspected perforation is discussed in Chapter 5.

Instrument impaction

This can occur in a hiatus hernia or the distal oesophagus during the retroversion manoeuvre. Blind and forceful withdrawal should not be attempted if impaction has occurred. Disimpaction is best achieved by *advancing* the instrument, preferably under fluoroscopic guidance. Rarely, a mechanical failure in a diagnostic device (cytology brush, biopsy forceps or snare loop) may prevent its withdrawal through the instrument tip; the instrument and device must be carefully withdrawn together.

Bleeding

Bleeding can be induced by forceps biopsy, especially in patients with impaired coagulation and portal hypertension. Aggravation of bleeding during urgent endoscopy is difficult to detect or disprove. Bleeding is more common after therapeutic procedures.

Transmission of infection

This is discussed in Chapter 3.

Further reading

See further reading list in Chapter 5.