5 Therapeutic Upper Endoscopy

Over the last two decades, gastroenterologists have taken an increasing role in the interventional treatment of many upper gastrointestinal problems. This chapter discusses the techniques and applications in dysphagia, benign and malignant oesophageal stenoses, achalasia, gastric polyps, gastric and duodenal stenoses, instrument perforation, foreign bodies, acute bleeding and nutritional support.

Dysphagia

There are specific techniques used in managing different causes of dysphagia, but some important common principles. The nature, site and extent of the causative lesion must be evaluated carefully before a management strategy is determined (Plates 4.7 and 4.8). Many endoscopists rely almost exclusively on endoscopy, but a radiological roadmap is helpful with tight and tortuous strictures, and functional data (e.g. manometry and 24-h pH monitoring) may be needed. It is essential to have 'control' of the stricture, i.e. with a guidewire. Hurrying is dangerous and invites perforation. Objective outcome measures should be used (e.g. swallowing scores and quality of life indices). Good dietary advice and appropriate medications may be as important as aggressive therapeutic interventions.

Benign oesophageal stenosis

Most benign strictures are due to longstanding gastro-oesophageal acid reflux. Dilatation is used only as part of an overall treatment plan, with due attention to diet, medication and the possible need for surgical intervention. The patient must understand the treatment plan and recognize the risks and alternatives. Instrumental dilatation can provoke bacteraemia; antibiotic prophylaxis against endocarditis should be given to patients with significant cardiac lesions (see Chapter 3).

Dilatation techniques

Many techniques and variations of equipment are available. Mild strictures can be treated simply with mercury-weighted dilators (such as Maloney's bougie) without sedation. Other techniques are necessary when the stenosis is tight or tortuous, along with endoscopic and/or fluoroscopic control (over a guidewire), to ensure correct placement.

When the narrowing is not suitable for Maloney dilatation, the main question is whether to use dilating balloons or tapered bougies. Both methods are effective and their relative merits are debated. It has been suggested that the *radial* force applied by distending a balloon is likely to be more effective and safer than the tangential *shearing* force of a bougie, but these claims have not been proven. Bougie techniques give a better 'feel' of the stricture, which may be an important safety factor.

Through the scope (TTS) balloon dilatation. Balloons designed to be passed via the endoscope channel are 3–8 cm in length and of various diameters. We use 10, 15 and 18 mm diameter balloons, and usually prefer the 5 cm length (Fig. 5.1). These are easier to pass than longer balloons, but less likely to 'pop out' of the stricture than shorter ones. Passage is easier if the balloons are well maintained and 'furled' in the same direction on each occasion. Lubrication should be applied, either directly to the balloon with a silicone spray or by injecting 1–2 ml of silicone oil down the endoscope channel followed by 10 ml of air. Suction should be maintained on the balloon whilst it is passed through the channel. The stricture is examined endoscopically, and the soft tip of an appropriately sized balloon is passed gently through the stricture under direct vision. The balloons are fairly translucent, so that it is usually possible to observe the 'waist' of the balloon endoscopically during the procedure and to note the extent of dilatation. Most manufacturers recommend inflation to a fixed pressure, but, in the oesophagus, many experts dilate by feel. It is helpful to use a smaller syringe (15–20 ml) for easy inflation, changing to a larger one (50 ml) for more rapid evacuation. For tight strictures or maximal dilatation, the efficiency of balloon inflation is improved by using water (or contrast medium) rather than air, since fluids cannot be compressed. To do this, the balloon must be fluid-filled and all air extracted before insertion down the endoscope.

TTS balloon dilatation has become popular for several reasons. It can be performed as part of the initial endoscopy, and does not normally require fluoroscopic monitoring. The results of dilatation should be obvious immediately; the endoscope can be passed through the stricture (if this was not possible previously) to complete the endoscopic examination, including a retroverted view of the cardia in low lesions. However, balloons must be handled with care and are relatively expensive.

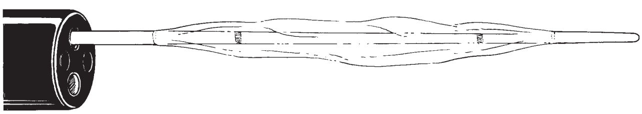


Fig. 5.1 A deflated TTS balloon dilator.

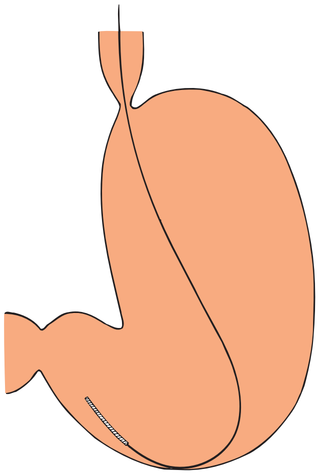


Fig. 5.2 A dilator guidewire positioned in the gastric antrum.

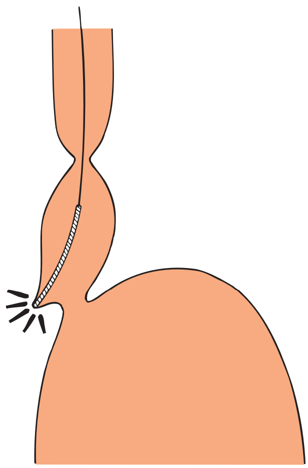


Fig. 5.3 Take care not to impact the guidewire.

Wire-guided bougie dilatation. This depends on endoscopic passage of a guidewire through the stricture into the stomach (Fig. 5.2) Standard guidewires are rigid 'piano' wires with floppy tips. Biliary-type guidewires, which are more flexible (see Chapter 6), may help find the lumen in tight and tortuous strictures. Endoscopic injection of contrast may also be instructive. The presence of the guidewire provides the security of knowing that the dilator will pass correctly through the stricture (and not into a diverticulum or necrotic tumour, or through the wall of a hiatus hernia) (Fig. 5.3). This security exists only if fluoroscopy is being used during the dilatation process — which can be a problem since many endoscopists do not have immediate X-ray access. However this is essential when tight and complex strictures are being treated.

Savary–Guilliard bougies are popular throughout the world. These are simple plastic wands with a long taper (Fig. 5.4), a distal metal marker and a radio-opaque band at the 'neck'. Variants of this design are available from other manufacturers. Diameters range from 3 to 20 mm. Eder–Puestow bougies were initially more popular in Europe; these are a series of metal olives (21–53 French gauge) which attach to a shaft and leader (Fig. 5.5). They give good 'feel', but the dilatation is relatively abrupt.

The following steps should be performed when dilating.

1 Choose a bougie which will pass relatively easily through the stricture and slide it over the guidewire down close to the mouth; lubricate the tip of the bougie.

2 Hold the bougie shaft in the left hand and push in, simultaneously applying countertraction on the guidewire with the right hand. Keep the left elbow extended (Fig. 5.6) so that the dilator cannot travel too far when resistance 'gives' (with the potential for distal perforation or a punch in the face for the patient).

3 Increase the size of the bougies progressively, but do not use more than three sizes above that at which significant resistance is felt.

4 Check the guidewire position repeatedly by fluoroscopy or by placing its end against a fixed external object.

5 After dilatation check the effect endoscopically; take biopsy and cytology samples if necessary.

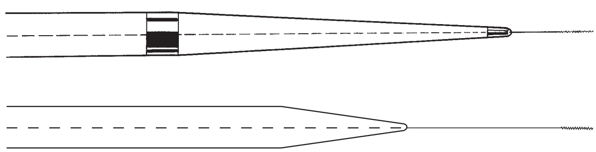


Fig. 5.4 Tips of Savary–Guilliard (above) and American Endoscopy (below) dilators for use over a guidewire.

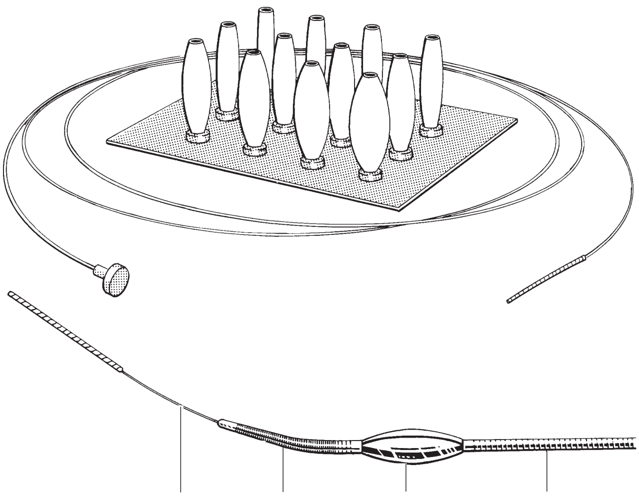


Fig. 5.5 Eder–Puestow dilator set with guidewire and olives.

Certain strictures, particularly those due to irradiation or corrosive ingestion are particularly difficult to dilate. The process may take many procedures (which should start early after corrosive ingestion) and too rapid an increase in dilator size will result in perforation.

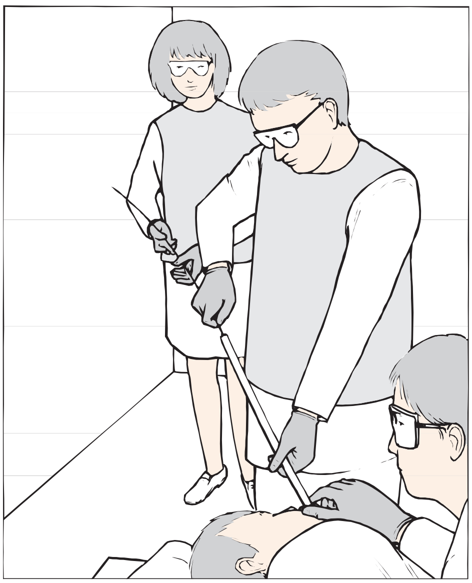


Fig. 5.6 Advance the dilator with the left hand and the elbow extended to avoid sudden overinsertion. Keep traction on the wire with the right hand.

Post-dilatation management

The patient should be kept under observation for at least 1 h, and considerably longer if the stricture is complex and the dilatation has been difficult. Patients are kept 'nil by mouth' during this first period and observed in the recovery area for any sign of perforation. The patient should always be reviewed by the endoscopist concerned (or his designated deputy), who should personally give the patient a trial drink of water if progress has been satisfactory. The patient is then discharged with instructions to keep to a soft diet overnight, plus appropriate medication and a follow-up plan. Dilatation can be repeated within a few days in severe cases, and then subsequently every few weeks until swallowing has been restored fully.

Achalasia

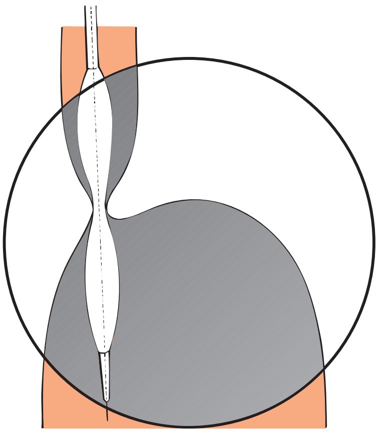
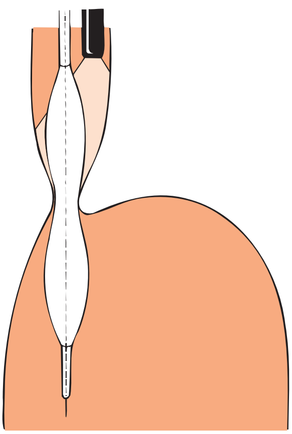


Fig. 5.7 Achalasia dilating balloons (before full inflation). (a) Checked fluoroscopically.



(b) Visualized endoscopically.

Manometry provides the gold standard for the diagnosis of achalasia, but endoscopy is also important, to demonstrate the absence of any local lesions such as a submucosal malignancy (Plates 4.7 and 4.8). The optimal treatment for achalasia is currently under review. To the longstanding techniques of 'brusque' balloon dilatation and open surgery, have recently been added two new methods of considerable promise — laparoscopic myotomy and endoscopic injection of botulinus toxin.

Balloon dilatation techniques are still widely used. The patient should be on a clear liquid diet for several days before the procedure. When, despite this, the endoscopist finds significant residue, he should remove the endoscope and perform lavage with a large-bore tube. Many different techniques and balloons have been used for achalasia dilatation. The position can be checked radiologically, or under direct vision with the endoscope alongside the balloon shaft, or even by a retroversion manoeuvre with the balloon fitted on the endoscope shaft. We prefer to place a guidewire endoscopically, and then dilate with a balloon under fluoroscopic control (Fig. 5.7). Achalasia balloons are available with diameters of 30, 35 and 40 mm. We start with the smallest balloon, warning the patient that repeat treatments may be necessary if symptoms persist or recur quickly. Inflation is maintained at the recommended pressure for 1–2 min if tolerated. There is usually some blood on the balloon after the procedure.

Close observation is mandatory for at least 4 h to detect any sign of perforation. Overnight admission is usually not necessary, but may be appropriate in selected cases. A chest X-ray and water-soluble contrast swallow should be done once the patient has recovered from sedation. Nothing should be given by mouth until the patient and the X-rays have been examined by the endoscopist personally. A trial drink of water is given under supervision. The uncomplicated patient can return to a normal diet on the next day. A formal follow-up review is arranged.

Malignant oesophageal stenosis

Barium studies and endoscopy have complementary roles in assessing the site and nature of oesophageal neoplasms. Endoscopic ultrasonography is the most accurate staging tool. Endoscopic management can help to improve swallowing in the majority of patients who are unsuitable for surgery because of intercurrent disease or tumour extent.

The abrupt onset of severe dysphagia may be due to the impaction of a food bolus which can be removed endoscopically (see below). The bulk of an exophytic tumour can be reduced by diathermy, lasers or an injection of toxic agents such as alcohol. Malignant strictures can be dilated using balloons or wire-guided bougies, but improvement is brief. Recurrence of dysphagia after dilatation can be prevented by inserting an oesophageal stent.

Oesophageal stents

The best candidates for stents are patients with mid-oesophageal tumours who are not expected to survive for more than a few months. Stents cannot be used when the tumour extends to within 2 cm of the cricopharyngeus, and stent function is less predictable with lesions at the cardia because of the angulation (Fig. 5.8). Appropriate stents provide good palliation for patients with malignant tracheo-oesophageal fistulae.

There are two main types of oesophageal stents: plastic and expandable metal mesh stents.

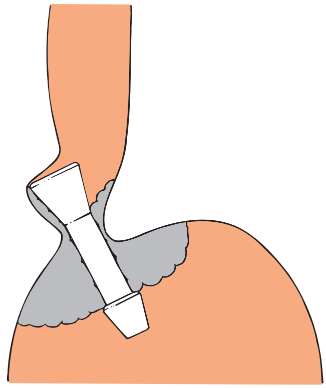


Fig. 5.8 Plastic stents through angulated tumours at the cardia may not function well.

Plastic stents

Some experts make their own stents, since they wish to be able to tailor the length and shape precisely to the individual patient. However, a variety of stents are available commercially. Designs are broadly similar, with lumens of at least 10 mm, upper and lower flanges to prevent migration and radio-opaque markings (Fig. 5.9). They are flexible enough for ease of insertion and comfortable 'seating', but strong enough not to collapse. There are several lengths, and narrower tubes are available for special circumstances. A stent with a self-inflating cuff is available for use in patients with fistulae (Fig. 5.10).

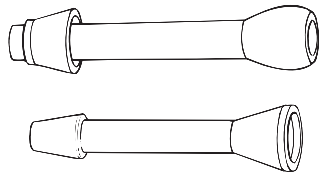


Fig. 5.9 Typical plastic oesophageal stents.

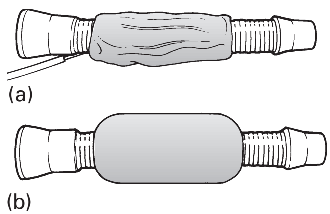


Fig. 5.10 Plastic-sleeved stent for fistulae. (a) Collapsed. (b) Sleeve expanded.

Stent insertion

The lesion is assessed carefully by radiology and endoscopy, and the patient fully informed about the aims and risks of the procedure and the (usually few) available alternatives. Antibiotic prophylaxis should be considered. The stricture is then dilated by standard methods using wire-guided dilators, up to 50 French gauge (16 mm). The process must not be hurried since there is a significant risk of perforation by splitting the tumour; several sessions may be required. Dilatation may be more difficult and perhaps more hazardous after radiation therapy.

Placing a plastic stent is simple in principle. However, the procedure is technically demanding, and requires a fine blend of dexterity, caution and force; it is not for the inexperienced.

The Dumon–Guillard introducer consists of a long 10.5 mm diameter Savary bougie, a range of stents and a semirigid polyvinyl pusher tube (Fig. 5.11). The stiff guidewire is left in

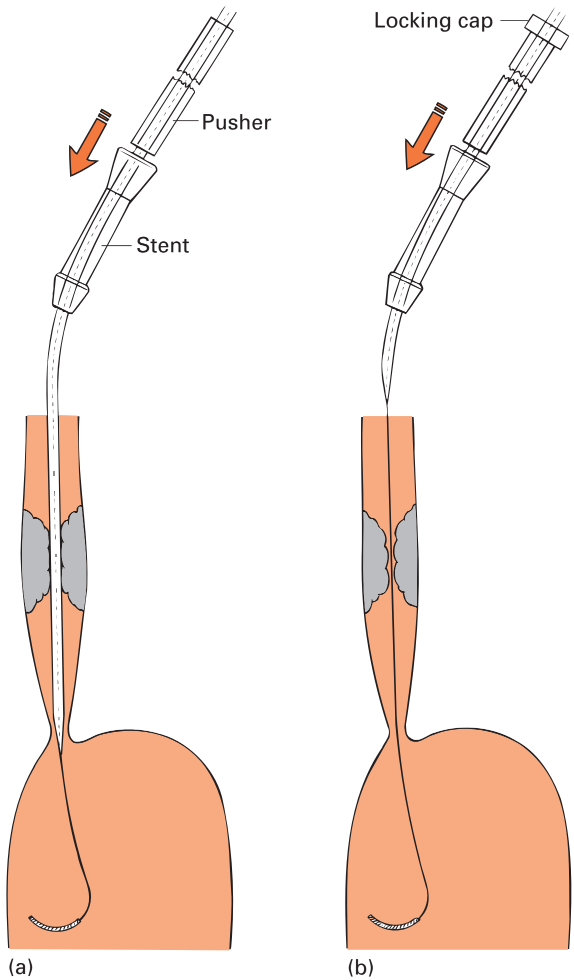


Fig. 5.11 'Over the dilator' methods for dilatation. (a) The stent is pushed over the static dilator. (b) The stent and pusher tube are locked onto the dilator and move in together over the guidewire.

place after bougie dilatation to 50 French gauge (16 mm) and its position checked fluoroscopically. A suitable stent of appropriate length is selected, and mounted on the long dilator with the pushing tube behind it. The assembly is lubricated and passed over the guidewire like a dilator—with backward traction of the guidewire. It is often necessary for the endoscopist to 'help' the stent around the pharynx using his fingers. Correct positioning is monitored fluoroscopically. Usually it is easy to feel when the stent enters the stricture and when the proximal funnel abuts its upper end. Rather than relying solely on feel, it is wise to place distance markers on the pusher tube shaft, having made the appropriate measurements (to the top and bottom of the tumour from the incisor teeth) during endoscopy after the final dilatation. Correct placement of the stent is also facilitated by prior endoscopic injection of contrast (lipiodol) at the upper and lower limits of the tumour, using a sclerotherapy needle.

When the stent appears to be correctly placed, the dilator and guidewire are removed, leaving the pusher tube in place. Endoscopy is then performed through the pusher, after it has been withdrawn 1–2 cm to separate it from the stent (Fig. 5.12). With the scope in place as a guide, the stent position can be adjusted forwards with the pusher or withdrawn somewhat if the tip is in the stomach, by pulling back with sharp retroversion (Fig. 5.13).

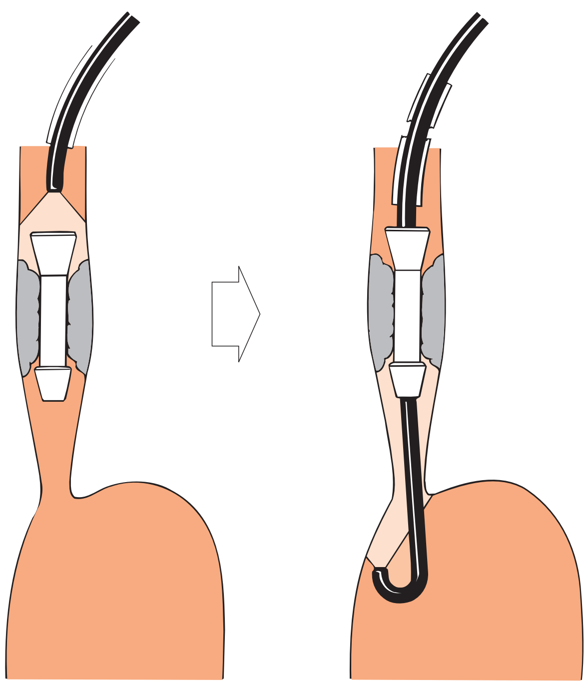


Fig. 5.12 Pass the scope through the pusher to check the final position of the stent.

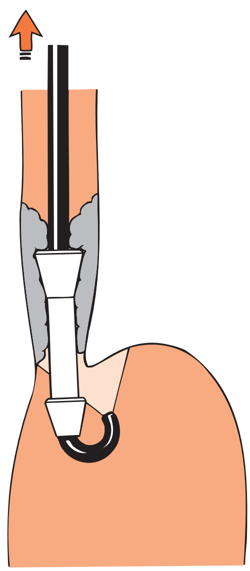


Fig. 5.13 Use the hooked scope to pull back the stent—providing the tip is in the stomach.

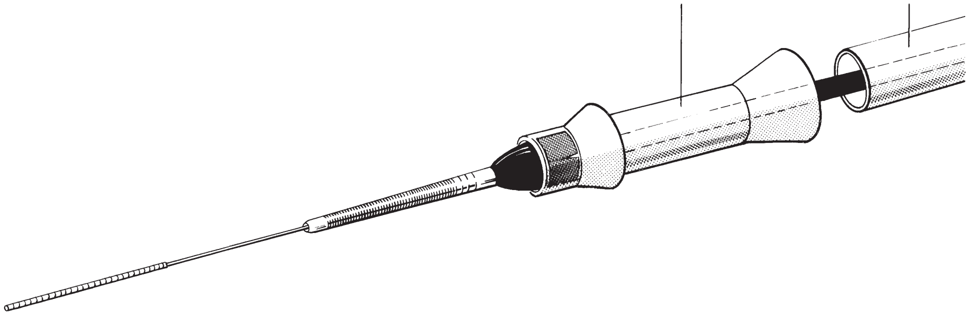


Fig. 5.14 The 'Nottingham introducer' system—the black expanding leader grips the stent tip firmly.

A variant method employs a flexible metal shaft with a device which can be expanded to grasp the inside of the stent (the Nottingham system) (Fig. 5.14). The system is passed over a standard guidewire after appropriate dilatation (Fig. 5.15). The stent is deposited by releasing the lock and removing the inserting assembly and guidewire. A pushing tube can also be used with this system, to hold the stent in place and to facilitate check endoscopy.

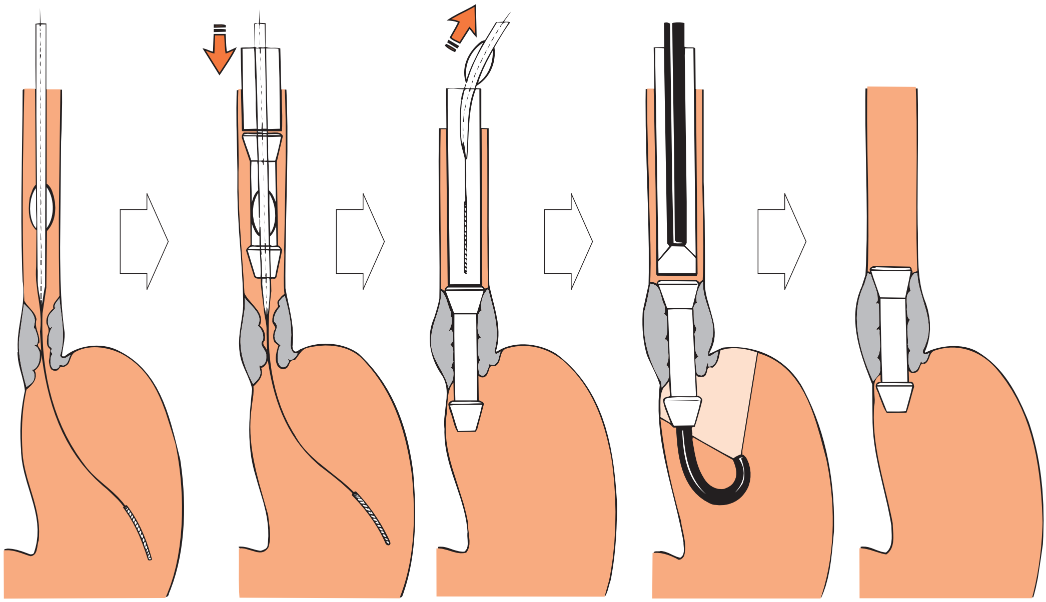


Fig. 5.15 The sequence of events for stent insertion using the 'Nottingham introducer' system.

Post-stent management

Patients with large tumours in the upper oesophagus may develop respiratory distress due to tracheal compression as the stent is placed. Always be prepared to remove a stent rapidly should this occur.

Stent insertion carries a perforation risk of 5–10%. Patients are kept in the hospital overnight under observation. Chest X-ray and water-soluble contrast swallow examinations are performed after about 2 h. Clear fluids can be given after 4 h if there have been no adverse developments.

Patients must understand the limitations of the stent, and the need to maintain a soft diet with plenty of fluids during and after meals. Written instruction should be provided and relatives counselled. Overambitious eating or inadequate chewing may result in obstruction. When this occurs, the food bolus can usually be removed or fragmented at endoscopy using snares or biopsy forceps. Sometimes the stent must be removed and replaced.

Stent dysfunction due to tumour overgrowth can be managed by endoscopic diathermy, laser photocoagulation or placement of another (smaller) stent inside the first. Gastro-oesophageal reflux can be a problem with stents crossing the cardia. Stents can deteriorate with time and may eventually disintegrate. Occasionally, a good result from chemotherapy or radiotherapy may make it possible to remove a stent entirely.

Stent extraction

Complete removal of a stent can be difficult, especially if there has been tumour overgrowth. Reversing the 'Nottingham introducer' technique (see Fig. 5.14) is effective. Alternatively, sufficient purchase can usually be provided with a large (unlubricated) TTS balloon inflated within the stent. When a stent has migrated downwards, removal is easier if it is first pushed into the stomach, rotated and withdrawn with the distal tip leading. If the stent cannot be gripped by inflating a large TTS balloon within its lumen, a polypectomy snare may be employed (Fig. 5.16). Fortunately, plastic stents which have migrated into the stomach rarely cause problems if left *in situ*.

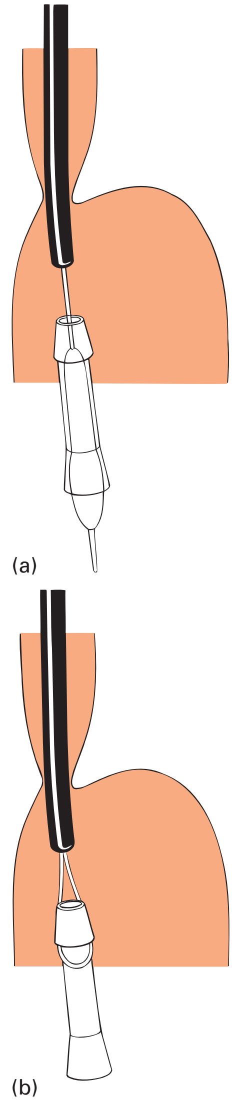


Fig. 5.16 Removing a stent, after rotation, using (a) a TTS balloon or (b) polypectomy snare.

Expandable metal mesh stents

There are several varieties of metal mesh stents and the technology is developing rapidly. The principle is simple. The nitinol (memory metal) or stainless steel device is compressed inside an introducing tube of 8–10 mm diameter (20–25 French gauge). This is inserted over a guidewire under fluoroscopic control after some initial dilatation (less than that required for a plastic

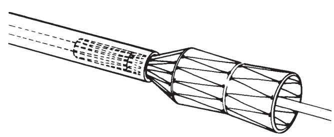


Fig. 5.17 Metal mesh oesophageal stent (partially expanded).

stent). The stent is released by gradual withdrawal of the covering sleeve (Fig. 5.17). The overall maximal luminal diameter of these stents is 15–18 mm. However, they vary considerably in expansile force. Most expand gradually over a period of days, and become fully incorporated in the oesophageal wall so that they cannot be removed. Less powerful stents—although easy to place and well tolerated—may not expand sufficiently to relieve the patient's symptoms, even with balloon dilatation.

The main problem with metal mesh stents (apart from their cost) is the tendency for tumour ingrowth through the mesh. This can be managed by endoscopic debulking (see below) or by placement of a second stent. The problem of ingrowth is being addressed by the development of metal mesh stents with plastic covering sleeves (Plate 5.1).

Tracheo-oesophageal fistulae are best managed with sleeved metal stents. A plastic stent with a self-expanding cuff is also available (see Fig. 5.10).

Tumour debulking

Obstructing tumour tissue can be destroyed endoscopically by several techniques. Scanning (especially endoscopic ultrasonography) may be helpful beforehand to assess the depth and size of tumours, and their relationships to important local structures (such as the aorta). It is pertinent to inform patients that dysphagia may worsen temporarily, for a few days, after some of these treatments, before the oedema subsides and the tumour sloughs.

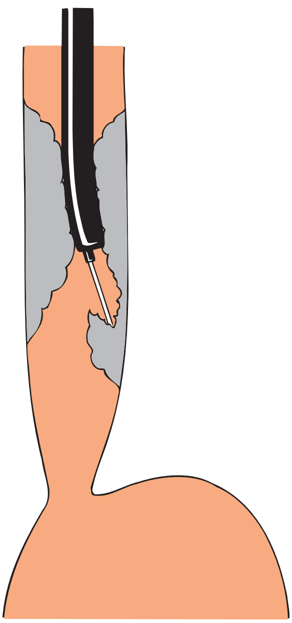


Fig. 5.18 Laser treatment is best performed from below upwards.

Snare-loop diathermy. This is a simple method for debulking polypoid and exophytic tumours.

Local injection. Local injection of toxic agents will produce similar debulking results. Absolute alcohol is applied in aliquots of 0.2–0.5 ml using a sclerotherapy needle; it is rarely necessary or wise to exceed a total of 10 ml as extensive necrosis and mediastinitis have resulted. The effect is best judged after about 7 days and repeated as necessary. Other methods are preferred for longer and less exophytic lesions.

Laser photocoagulation. This vaporizes tumour tissue, so that the result can be assessed immediately if the smoke is aspirated continuously. The principle is simple, but the practice can be tedious and difficult for both endoscopist and patient. Repeated treatments are usually required. Lasers are expensive; safety goggles and venting systems are needed. The neodymium-yttrium aluminium garnet (YAG) laser has been used most commonly, at settings of 80–100 W, applied with a 300 μm fibre in a catheter with a coaxial gas jet. Laser energy can also be applied at low power using contact (sapphire tip) techniques, and the argon beam coagulator is becoming popular in this context.

Laser treatments should be applied from below upwards (Fig. 5.18), since starting from the top may cause oedema, and obscure the view completely. Starting from below may require prior dilatation, which carries its own risks. It is preferable to use an endoscope with a large operating channel (or two channels) to be able to aspirate smoke and vent excessive insufflated gas; often there is not room for anything other than a small instrument. The probe should be activated about 1 cm away from the lesion. Treatment from a greater distance reduces the effect, whereas treating too close (which is often difficult to avoid) causes 'drilling' and splatter of charred debris onto the endoscope lens. The tip of the instrument itself can be damaged if the laser fibre is withdrawn inadvertently too far into the channel, or by reflected light energy.

The BICAP tumour probe. This is a cylindrical bipolar coagulator which can be passed over a guidewire (Fig. 5.19). Several sizes are available. Treatment is applied from below upwards after initial dilatation. The process is monitored fluoroscopically, and with an endoscope passed alongside the probe. This method is applicable only with circumferential tumours and has not been widely used.

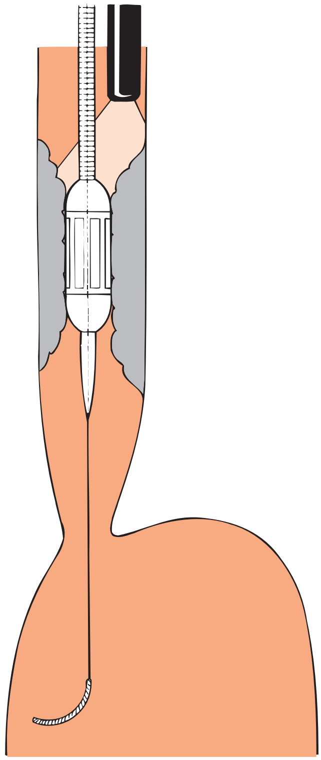


Fig. 5.19 The BICAP tumour probe over a guidewire — the procedure is monitored endoscopically.

Stents or tumour ablation?

Stenting is (theoretically) a once-only treatment performed after the initial dilatation. Stents are particularly useful in patients with straight mid-oesophageal lesions. The tumour probe is suited to long circumferential tumours. It is easiest to apply snare diathermy and injection to short exophytic lesions and to local recurrences after surgery or stenting. Laser therapy can be used in all of these contexts, but is becoming less popular because of its complexity and cost.

Endoscopists should be aware of their limitations, and be able to balance technological enthusiasm with full consideration of the patient's quality of life. These treatments are palliative, risky and only partially effective at best. They often need to be repeated. Even achieving a large lumen will not restore normal swallowing. The goal must be to restore 'adequate but not perfect' swallowing, at the lowest risk, cost and inconvenience to the patient.

Photodynamic therapy

Photodynamic therapy utilizes the fact that certain light-sensitive drugs (photosensitizers) concentrate selectively in malignant tissue when injected intravenously. Endoscopic laser light is used to produce toxic singlet oxygen from the photosensitizer, with destruction of the malignant tissue. The potential of this 'targeted' tumour therapy is considerable, and may have application in other conditions (e.g. Barrett's oesophagus). This treatment method is being studied actively in several centres using different photosensitizers and lasers. Its ultimate clinical role cannot be predicted.

Gastric and duodenal polyps

The principles and techniques of endoscopic polypectomy are described in Chapter 10 in relation to colonic polyps. Gastric and duodenal polyps are seen much less frequently; oesophageal polyps are rare. Endoscopic treatment of early oesophageal and gastric cancers (mucosectomy) is under investigation in Japan.

Upper GI polyps rarely have the long, thin stalks which make most colonoscopic polypectomies easy and safe. Many upper GI polyps are sessile, and some are largely submucosal. The possibility of a transmural lesion should be considered, in which case endoscopic ultrasonography may be helpful in making a treatment decision; surgical (or laparoscopic) resection may be safer. Because of the risk of bleeding, we usually inject the base of gastric and duodenal polyps with adrenaline (1 : 10 000) prior to snare diathermy; using saline (rather than aqueous) adrenaline solution slows the bleb dispersal.

Snare diathermy techniques can also be used to obtain large biopsy specimens when the gastric mucosa appears thickened, and standard biopsy techniques have failed to provide a diagnosis.

Gastric polypectomy and snare-loop biopsy techniques leave an ulcer; it is probably wise to prescribe appropriate medication for a few weeks.

Gastric and duodenal stenoses

Functionally significant stenoses may occur in the stomach or duodenum as a result of disease (tumours and ulcer healing) and following surgical intervention (e.g. hiatus hernia repair, gastroenterostomy, pyloroplasty, gastroplasty). Dilatation techniques as applied in the oesophagus (see above) can be used in these contexts, albeit often with less satisfactory results. Balloon dilatation of surgical stomas is usually effective (except in the case of banded gastroplasty with a rigid silicone ring). Pyloroduodenal stenosis caused by ulceration can be relieved by balloon dilatation, but recurrence is common. Plastic and expandable metal mesh stents have been used to palliate malignant obstruction of the stomach and duodenum, with only marginal benefit.

Instrument perforation

Oesophageal dilatation is relatively safe using optimal techniques. However, perforations do occur, especially with complex and malignant strictures approached by inexperienced or overconfident endoscopists. The rate is approximately 0.1% in benign oesophageal strictures, 1% in achalasia dilatation and 5–10% in malignant lesions. Never try to dilate to the largest balloon or bougie simply because it is available. The risk is minimized by taking the process step by step — gradually and deliberately.

Early suspicion and recognition of perforation is the key to successful management, and no complaint should be ignored. The problem is usually obvious clinically; the patient is distressed and in pain. Signs of subcutaneous emphysema may not develop for several hours. Electrocardiograph (ECG), chest X-ray and water-soluble X-ray contrast swallow examinations should be performed. Surgical consultation is mandatory when perforation is seriously suspected or confirmed. Many confined perforations have been managed conservatively, with no oral intake, intravenous fluids or antibiotics — with or without placement of a sump tube across the perforation (with the suction holes above and below it). The choice between surgical and conservative management (and the timing of surgical intervention if conservative management appears to be failing) are difficult decisions; review of the literature shows varied and strong opinions. Conservative management is more likely to be appropriate when the perforation is in the neck; since the mediastinum is not contaminated, local surgical drainage can be performed simply when necessary. Perforation through a malignancy can be treated with a sleeved stent if the lumen can be found.

Foreign bodies

Foreign bodies are mainly found in children, in elderly patients with poor teeth and in the drunk and deranged. The problem is obvious if the patient is distressed and cannot swallow, and especially if a missing object is visible on a radiograph. However, many instances are less straightforward. Patients may not know that they have swallowed a bone or a drink-can pull and these items are not radio-opaque. It is therefore necessary to maintain a high index of suspicion.

Chest and abdominal radiographs (with lateral views) are appropriate. A water-soluble contrast swallow examination is helpful in patients with oesophageal symptoms, but is not necessary and potentially hazardous if dysphagia is complete.

Treatment should be initiated within hours in the following circumstances.

1 Patients who cannot swallow saliva.
2 Impacted sharp objects.
3 Ingestion of button batteries (which can disintegrate and cause local damage).

Other situations are usually less urgent. Indeed many foreign bodies should be managed conservatively, at least initially; food

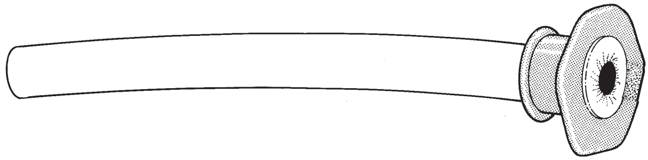


Fig. 5.20 An overtube with toothguard.

boluses and coins often pass spontaneously. An intravenous injection of Glucagon (0.5–1 mg) may help release oesophageal impactions.

Extraction techniques

Objects impacted at, or above, the cricopharyngeus, are usually removed by surgeons with rigid instruments. Foreign bodies in the oesophagus have also been approached traditionally with a rigid oesophagoscope. This allows good suction and the use of large grasping tools; however, general anaesthesia is required and the technique carries risks. Flexible endoscopy now takes precedence in most (but not all) situations. This procedure is easier for patients and does not usually require general anaesthesia. The use of an overtube increases the therapeutic options (Fig. 5.20).

Food impaction

If endoscopy is performed soon after the food has been ingested, meat can be removed as a single piece using a polypectomy snare, triprong grasper or retrieval basket. An increasingly popular approach is to use strong suction on the end of an overtube or a banding sleeve (Fig. 5.21). The biggest risk is losing the bolus in the region of the larynx. Food that has been impacted for several hours can usually be broken up (e.g. with a snare), and the pieces pushed into the stomach. This must be done carefully, especially if there is any question of a bone being present. Sometimes it is possible to manoeuvre a small endoscope past the food bolus and to use the tip to dilate the distal structure; the food can then be pushed through the narrowed area.

Most patients with impacted food have some oesophageal narrowing (benign reflux stricture or Schatski's ring). The endoscopist's task is not complete until this has been checked and treated. Usually, dilatation can be performed at the time of food extraction, but should be delayed if there is substantial oedema or ulceration.

Enzyme preparations (meat tenderizer) should not be used since severe pulmonary complications have been reported.

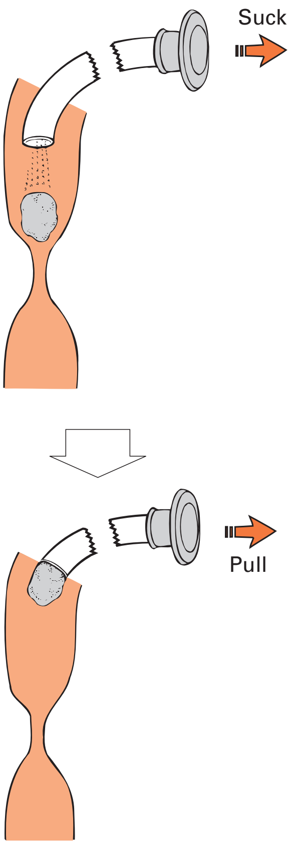


Fig. 5.21 Use an endoscopic overtube (after removing the scope) with suction to remove a food bolus.

True foreign bodies

Foreign bodies should always be removed if they are trapped in the oesophagus (Plate 5.2). Sharp objects (such as open safety pins) should be withdrawn into the tip of an overtube (Fig. 5.22); sometimes it is safer to use a rigid oesophagoscope.

Most objects entering the stomach will pass spontaneously, but there are a few indications for early removal. Sharp and pointed objects have a 15–20% chance of causing perforation (usually at the ileocaecal valve), and should be extracted whilst still in the stomach or proximal duodenum. Foreign bodies wider than 2 cm and longer than 5 cm are unlikely to pass from the stomach spontaneously and should be removed if possible. Once they have reached the stomach, button batteries usually pass spontaneously; a purgative should be given to accelerate the process. Endoscopists should resist the temptation to attempt removal of condoms containing cocaine or other hard drugs since rupturing the containers can lead to a massive overdose; surgical removal is the safest option.

The golden rules for foreign body removal are:

1 be sure that your extraction procedure is really necessary;
2 think before you start, and rehearse outside the patient;
3 do not make the situation worse;
4 do not be slow to get surgical or anaesthesia assistance;
5 protect the oesophagus, pharynx and bronchial tree during withdrawal with an overtube or endotracheal anaesthesia.

The endoscopist should have several specialized tools available, in addition to the overtube. There are forceps with claws or flat blades designed to grasp coins (Fig. 5.23), and a triprong extractor is useful for meat (Fig. 5.24). Many objects can be grasped with a polypectomy snare or stone-retrieval basket. Any object with a hole (such as a key or ring) can be withdrawn by passing a thread through the hole. The endoscope is passed into the stomach with biopsy forceps or a snare closed within its tip, grasping a thread which passes down the outside of the instrument (Fig. 5.25). It is then simple to pass the thread through the hole in the object by advancing the forceps, dropping the end and picking it up on the other side.

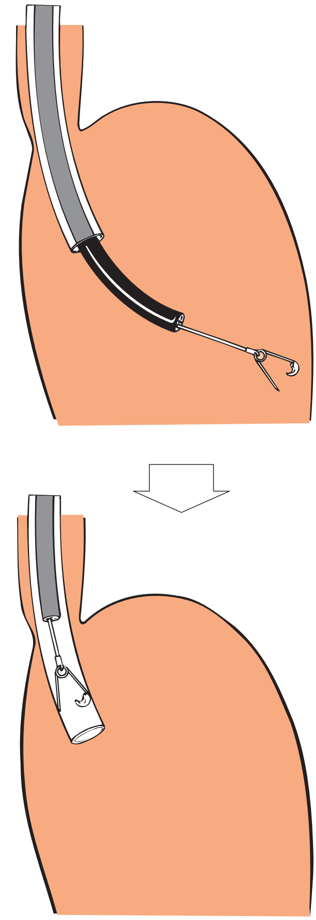


Fig. 5.22 Remove sharp foreign bodies with a protecting overtube.

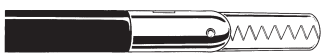


Fig. 5.23 Foreign-body extraction forceps.

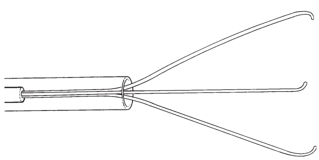


Fig. 5.24 A triprong grasping device.

Gastric bezoars

Gastric bezoars are aggregations of fibrous animal or vegetable material. They are usually found in association with delayed gastric emptying (e.g. postoperative stenosis or dysfunction). Most masses can be fragmented with biopsy forceps or a polypectomy snare, but more distal bolus obstruction may result if fragmentation is inadequate. Various enzyme preparations have been recommended to facilitate disruption, but these are rarely necessary or effective. Large gastric bezoars are best disrupted and removed by inserting a large-bore (36 French gauge,

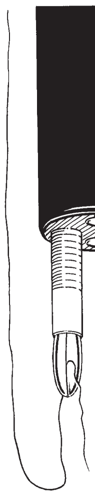


Fig. 5.25 Take a thread down with the forceps to pass through any object with a hole in it, e.g. a ring or key.

12 mm) lavage tube, and instilling and removing 2–3 litres of tap water with a large syringe. The cause of gastric-emptying dysfunction should be evaluated.

Upper gastrointestinal bleeding

Acute upper GI bleeding (haematemesis and/or melaena) is a common medical problem, for which endoscopy has become the primary diagnostic and therapeutic technique. Barium radiology is obsolete in this context and surgical intervention has been markedly reduced in recent years.

The timing of endoscopy is important and somewhat controversial. Examination can be delayed to a convenient time (e.g. the next morning) in most patients who appear to be stable, but the endoscopic team must be prepared to go into action within hours (after immediate resuscitation) in certain circumstances.

Emergency endoscopy

Indications for emergency endoscopy include the following:
1 Continued active bleeding requiring intervention.
2 Suspicion of variceal bleeding.
3 When the patient has an aortic graft.
4 To check the upper tract before severe rectal bleeding is attributed to a colonic source.

Emergency endoscopy is a challenging task. There is considerable potential for benefit — but there are also risks. These techniques require experience, nerve and judgement. The endoscopist should be expert, must know the equipment and should be assisted by an experienced GI nurse. Unstable patients should be under supervision in an intensive care environment. Safety considerations are paramount. Sedation should be given cautiously in unstable patients, and every precaution must be taken to minimize the risk of pulmonary aspiration. Patients with massive bleeding are often best examined under general anaesthesia, with the airway protected by a cuffed endotracheal tube. Even in less acute situations, blood clots may obscure the view in the stomach and duodenum. Standard gastric lavage is rarely effective, even when performed personally with a large-bore tube. Endoscopes with a large channel (or two channels) allow better flushing and suction. An alternative approach is to start the procedure with an overtube over the endoscope (see Fig. 5.20). If blood is encountered, the endoscope can be removed; blood clots can be sucked directly through the overtube or after flushing with a lavage tube. A diagnosis can usually be made even if the stomach cannot be emptied completely. Lesions are rare on the greater curvature, where the blood pools in the standard left lateral position. Changing the patient's position somewhat should improve the survey, but turning completely on the right side is hazardous unless the airway is protected.

Lesions which cause acute bleeding are well known. Endoscopy has highlighted the fact that many patients are found to have more than one mucosal lesion (e.g. oesophageal varices *and* acute gastric erosions). A complete examination of the oesophagus, stomach and duodenum should be performed in every bleeding patient, no matter what is seen *en route*. A lesion should be incriminated as the bleeding source only if it is actually bleeding at the time of examination, or is covered with clot which cannot be washed off with a jet of water. An ulcer whose base is haemorrhagic, or contains a visible vessel, can be assumed to have bled recently (Plate 5.3). If the patient has presented with haematemesis, and endoscopy shows only a single lesion (even without any of these features), it is likely to be the bleeding source. This is not necessarily the case if the presentation has been with melaena, or if the examination takes place more than 48 h after bleeding since acute lesions such as mucosal tears and erosions may already have healed.

Treatment modalities

Many different endoscopic techniques have been developed. These include injection sclerosis, rubber banding, thermal probes (heat probe, bipolar or monopolar electrocoagulation and lasers), clipping and simple adrenaline (epinephrine) injection. Many randomized trials have compared different techniques, but the experience of the endoscopist — and his familiarity with a particular technique — is probably the most important determinant of success. Laser photocoagulation initially became popular because it was assumed that it was safer not to *touch* the lesion. However, it has become clear that direct pressure with some probes (and injection treatment) provides an additional important tamponade effect. Standard laser photocoagulation is now rarely used because of its complexity and cost, but the argon beam coagulator is useful for certain lesions.

Variceal treatments

Endoscopic treatment of oesophageal (and gastric) varices can be helpful in patients who are bleeding, or have recently bled. Prophylactic treatment is controversial. Techniques include injection sclerosis, banding and combination techniques. Clips and loops have also been used recently. Endoscopic management should be seen as only a part of a patient's overall care.

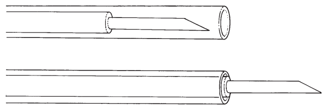


Fig. 5.26 A retractable sclerotherapy needle.

Injection sclerotherapy

This has been used for decades, originally with rigid oesophagoscopes; flexible instruments are now used routinely. Many adjuvant devices have been described, including overtubes with a lateral window and the use of balloons—either in the stomach to compress distal varices or on the scope itself to permit tamponade if bleeding occurs. However, most experts use a simple 'freehand' method, with a standard large-channel endoscope and a flexible, retractable needle (Fig. 5.26). Injections are given directly into the varices, starting close to the cardia (and below any bleeding site) and working spirally upwards for about 5 cm. Each injection consists of 1–2 ml of sclerosant, to a total of 20–30 ml.

Precise placement of the needle within the varix (as guided by co-injection of a dye such as methylene blue or by simultaneous manometric or radiographic techniques) may improve the results and reduce the complications. However, some experts believe that paravariceal injections are also effective, and it is often difficult to tell which has been achieved. If bleeding occurs on removal of the needle, it is usually helpful to tamponade the area simply by passing the endoscope into the stomach.

Several sclerosants are available. Sodium morrhuate (5%) and sodium tetradecylsulphate (STD) (1–1.5%) are popular in the USA. Polidocanol (1%), ethanolamine oleate (5%) and STD are widely used in Europe. Various experts use mixed sclerosant 'cocktails' (some containing alcohol). Efficacy, ulcerogenicity and the risk of complications run together, since it is the process of damage and healing by fibrosis which eradicates or buries the communicating veins, but may equally result in stricture. In general, excessive volumes, especially if given paravariceally, increase the risk of ulceration or stricture, whereas higher concentration of stronger agents (e.g. 3% STD) increases the likelihood of perforation.

Endoscopic polymer injection is another alternative. The two agents most commonly used (*n*-butyl-2-cyanoacrylate and isobutyl-2-cyanoacrylate) are not available in the USA. These polymers solidify almost immediately on contact with proteinaceous material. The endoscopist and nurse must be very aware of how to use these polymers in order to provide an effective injection without gluing up the endoscope. Preliminary results appear to be excellent, especially in gastric varices (which do not respond well to standard sclerotherapy).

Variceal ligation (banding)

Variceal ligation is a method originally used for the treatment of haemorrhoids which has become popular for the management of oesophageal (and gastric) varices. The device consists of a friction-fit sleeve on the endoscope tip, an inner cylinder preloaded with an elastic band and a trip wire (passing up the endoscope channel) to move the inner cylinder and release the band (Fig. 5.27). The varix is sucked into the sleeve, and the band fired by pulling on the nylon trip wire (Plate 5.4). Early devices contained only one band which meant that the endoscope had to be passed repeatedly. This was facilitated by using an overtube, but there were concerns about safety. The need for repeated passage has been greatly reduced by the development recently of devices which contain five or more bands. Banding can also be applied to gastric varices and to small ulcers (e.g. Dieulafoy lesions).

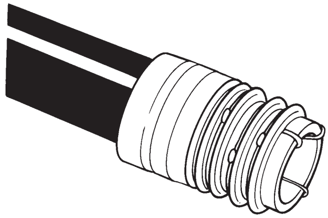


Fig. 5.27 An oesophageal banding device.

Repeated treatments are necessary (initially at 5–7 days, then every 2–3 weeks) until the varices are obliterated, whichever method is used.

Actively bleeding varices are more difficult to treat. It may be helpful to tilt the patient slightly head up, or to apply traction on a gastric balloon. Sometimes it is wiser to defer endoscopy for several hours and temporize with a pharmacological agent (vasopressin or somatostatin) or a Sengstaken–Blakemore tube. The TIPS (transvenous interventional porto-systemic shunt) procedure provides a useful alternative when these treatments fail.

Risks of variceal treatment include all of the complications of emergency endoscopy (especially pulmonary aspiration). Severe ulceration and stricturing are more common after sclerotherapy than after banding. Medications to lower gastric acid and/or protect the mucosa are given until the treatment sequence is complete.

Treatment of bleeding ulcers

Duodenal and gastric ulcers are the commonest cause of acute bleeding. About 80% will stop spontaneously, but it is now possible to predict those patients likely to rebleed and select them for endoscopic treatment. Certain clinical features (e.g. size of the bleed and type of presentation) give some predictive information. We pay most attention to the appearance of the lesion itself. Active 'spurters' continue to bleed (or rebleed soon) in 70–80% of cases. Ulcers with a 'visible vessel' have about a 50% chance of rebleeding. Clean ulcers do not rebleed. An important question is whether it is appropriate to wash clots off the base of an ulcer simply to check for these stigmas. Most endoscopists will do so in high-risk patients provided they are poised for treatment. Endoscopic Doppler devices can be used to 'listen' for feeding vessels.

The most popular haemostatic methods now are injection, heat probe and bipolar probe.

Fig. 5.28 Teflon-coated tip of a heat probe with a water-jet opening.

Fig. 5.29 The tip of a multipolar BICAP probe with a central water jet.

1 *Injection treatment*. Adrenaline (epinephrine) in 1 : 10 000 to 1 : 20 000 dilution, is applied with a standard sclerotherapy needle in 0.5–1.0 ml aliquots around the base of the bleeding site, up to a total of 10 ml; diluting it in saline solution (0.9–1.8%) gives a more localized bleb. Some experts use absolute alcohol in much smaller volumes (1–2 ml in 0.1 ml aliquots) or combinations of adrenaline with alcohol or with the sclerosants used for the treatment of varices.
2 *The heat probe* (Fig. 5.28) provides a constant high temperature; the setting (usually 30 J) reflects the duration of application.
3 *The bipolar probe* (Fig. 5.29) provides bipolar electrocoagulation, which is assumed to be safer than monopolar diathermy (which produces an unpredictable depth of damage). Use the larger 10 French gauge probe at 30–40 W for 10 s.

These treatment devices share some common principles. All can be applied tangentially, but (apart from injection) are better used face-on if possible. When the vessel is actively spurting, direct probe pressure on the vessel or feeding vessel will reduce the flow and increase the effectiveness of treatment. The bipolar and heat probes incorporate a flushing water jet which helps prevent sticking.

Know when to stop treatment and when not to start

Treatment attempts should not be protracted if major difficulties are encountered; the risks rise as time passes. There are some patients and lesions in which endoscopic intervention may be foolhardy, and surgery is more appropriate, e.g. a large posterior wall duodenal ulcer which may involve the gastroduodenal artery.

Follow-through

A single endoscopic treatment is not an all-or-nothing event. It is necessary to continue other medical measures, to maintain close monitoring and to plan ahead for further intervention (endoscopic, radiological or surgical) if bleeding continues or recurs. The job is not complete until the lesion is fully healed. Eradication of *Helicobacter pylori* reduces the risk of late rebleeding.

Complications of ulcer haemostasis

The two most important hazards of ulcer haemostasis are pulmonary aspiration and provocation of further bleeding. It is difficult to know how often endoscopy causes rebleeding which would not have occurred spontaneously, but major immediate bleeding is unusual and can usually be stopped. The risk of pulmonary aspiration is minimized by protecting the airway using pharyngeal suction and a head-down position, or a cuffed endotracheal tube. Perforation can be induced with any of the treatment methods if they are used too aggressively, especially in acute ulcers which have little protecting fibrosis.

Treatment of mucosal lesions

All of the modalities described above can be used to treat vascular malformations such as angiomas and telangiectasia. The risk of full-thickness damage and perforation is greater in organs with thinner walls (e.g. the oesophagus and small bowel) than in the stomach and duodenum. Lesions with a diameter of more than 1 cm should be approached with caution, and treated from the periphery inwards to avoid provoking haemorrhage. Laser photocoagulation and the argon beam coagulator provide the best control.

Nutrition

Feeding and decompression tubes

Tubes for short-term feeding (and gastric decompression) are normally placed blindly, but can also be passed under fluoroscopic guidance or after endoscopic placement of a guidewire. Two direct endoscopic methods can be used when necessary, for example to advance tubes through the pylorus or a surgical stoma.

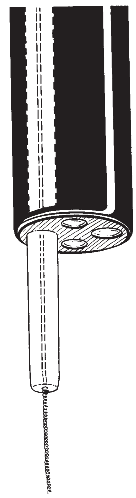


Fig. 5.30 The feeding tube and guidewire are passed through a large-channel scope.

Through-the-channel method. The simplest technique is to advance a 7 French gauge plastic tube through a large-channel endoscope, over a standard (400 cm long) 0.035-inch diameter guidewire (Fig. 5.30). The tube and guidewire are advanced through the pylorus under direct vision, and subsequent passage is checked by fluoroscopy. When the tip is in the correct position, the endoscope is withdrawn whilst further advancing the tube (and guidewire) through it. Finally, the guidewire is removed and the tube is rerouted through the nose (see Chapter 7).

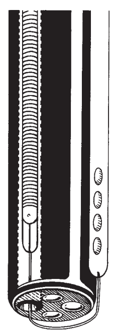


Fig. 5.31 A tube is carried alongside the scope by a thread grasped with a biopsy forceps.

Alongside-the-scope method. This technique allows the placement of a tube larger than the endoscope channel, and is appropriate when a therapeutic instrument is not available—or when there is a need to pass a large decompression tube. A short length of suture material is attached to the end of the tube and is grasped within the instrument channel with a biopsy forceps or snare (Fig. 5.31). The endoscope is passed into the stomach and the tube is then pushed through the pylorus (or stoma) under direct vision. Once in position (checked by fluoroscopy), the thread is released and the endoscope is removed. It is helpful to make the tube stiffer with a large-gauge guidewire to avoid dislodgement while withdrawing the endoscope. The final position should be checked by fluoroscopy.

Percutaneous endoscopic gastrostomy (PEG)

Nasoenteric feeding can be used for several weeks but is inconvenient and unstable, and it is probably often responsible for pulmonary aspiration and pneumonia. PEG is now a popular method for long-term feeding, particularly to permit the transfer of patients with chronic neurological disability from acute care hospitals into nursing homes. The technique can be extended into a feeding jejunostomy by the use of appropriate tubes. Studies comparing PEG with operative gastrostomy have shown some advantages for the endoscopic method, but surgical (and laparoscopic) options should always be considered, especially in circumstances (e.g. ascites) where the endoscopic approach may be more difficult or hazardous.

Although many variants have been described, there are two major methods for PEG — the 'pull' and the 'push' methods. The risk of skin sepsis may be reduced by using antibiotics prophylactically; some experts also recommend disinfectant mouthwashes.

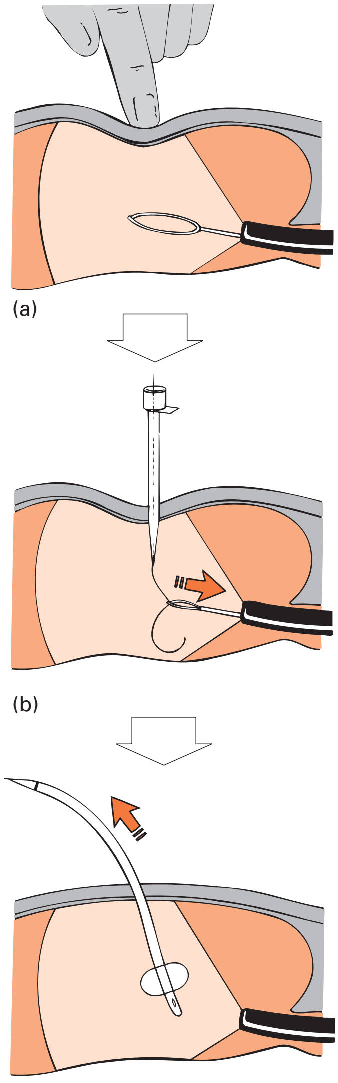


Fig. 5.32 (a–c) Stages in PEG tube placement—the 'pull' technique (see text).

Methods of insertion

The 'pull' technique. A standard endoscope is passed into the stomach and the gastric outlet is checked. The patient is rotated onto the back, the stomach distended with air and the room darkened. Darkening is particularly important with video-endoscopes which provide less illumination.

1 The tip of the endoscope is directed towards the anterior wall of the stomach.

2 The abdominal wall is observed for transillumination and the assistant indents the site with a finger.

3 The endoscopist checks that the indentation can be seen and that it is in an appropriate part of the body of the stomach.

4 The assistant marks this spot on the anterior abdominal wall, applies disinfectant and infiltrates local anaesthetic into the skin, subcutaneous tissues and fascia.

5 A short (about 5 mm) skin incision is made with a pointed blade, extending into the subcutaneous fat.

6 An 18 gauge needle catheter is pushed through the anterior abdominal wall and its entrance into the stomach is observed by the endoscopist, who has meanwhile placed a polyp snare under the area of indentation and maintained gastric distension (Fig. 5.32a).

7 A guidewire (or silk suture) at least 150 cm long is passed

through the needle and grasped with the snare (Fig. 5.32b).
8 The endoscope and snare are withdrawn through the mouth, carrying the guidewire, ensuring that the free end of the wire remains outside the abdominal wall.
9 The wire at the mouth is then tied to the PEG catheter, which is pulled down the oesophagus and through the anterior abdominal wall (Fig. 5.32c). It should not be pulled tight, since compression necrosis of the gastric wall has been described. This position is checked after the endoscope is replaced (Fig. 5.32c).
10 The tube is anchored at the skin by various disc devices.
11 Feeding can be commenced on the day after the procedure if there are no complications.

A simplified 'pull' technique. A variation of the 'pull' technique eliminates the necessity to pass the endoscope twice.
1 Pass the endoscope, pulling the guidewire or long suture down *alongside* it (holding the tip with forceps in the channel) (see Fig. 5.25).
2 Grasp the guidewire with a polyp snare (without the sheath) which has been passed by the assistant through the needle traversing the abdominal wall.
3 Withdraw the snare loop and guidewire.
4 Pull the PEG tube down through the mouth (alongside the endoscope) and into the correct position.

The 'push' technique. This method is inherently simpler. The feeding tube is pushed through the abdominal wall (rather than pulling it down from the mouth). The stomach is distended and an appropriate position chosen by transillumination and finger indentation, as with the other methods. The skin and subcutaneous tissues are infiltrated with local anaesthetic to allow a wider and deeper skin incision.
1 Insert a needle through this incision into the stomach, and pass a guidewire through it (Fig. 5.33a).
2 Withdraw the needle and pass a larger trochar with a plastic 'peel-away' catheter over the guidewire with pressure and rotation.
3 Withdraw the trochar once the catheter enters the stomach (Fig. 5.33b).
4 Pass the feeding tube through the catheter.
5 Remove the outer 'peel-away' catheter and fix the tube to the abdominal wall (Fig. 5.33c).

This 'push' method eliminates contamination of the feeding tube by passage through the mouth, and requires only one insertion of the endoscope. It can be performed under fluoroscopy without endoscopy. However, it is sometimes difficult to push the trochar and catheter through the abdominal and gastric walls.

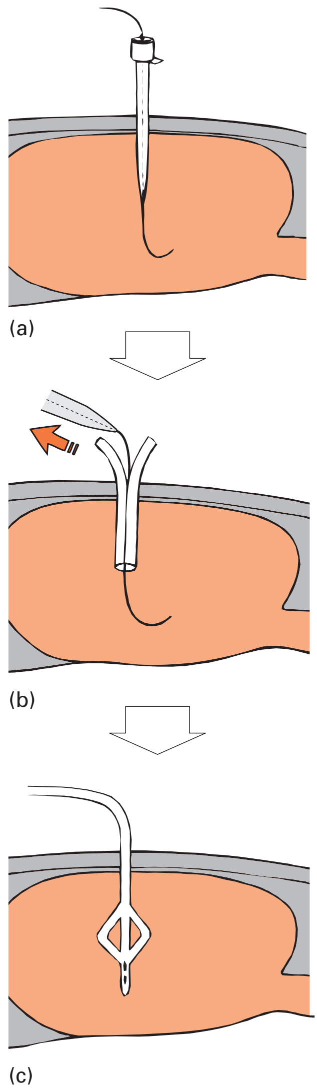


Fig. 5.33 (a–c) Stages in PEG tube placement—the 'push' technique (see text).

Problems and risks

PEG placement cannot be performed in patients with oesophageal strictures too tight to permit the passage of an endoscope. Technical difficulties and risks are higher in patients who have previously undergone abdominal surgery, particularly with partial gastric resection, and in patients with ascites or obesity. Local infection can occur (even spreading fasciitis), particularly if the skin incision is too small or if the tube has been pulled too tight against the gastric wall. A small pneumoperitoneum is not uncommon, and usually benign, but major and persisting leakage requires operative correction. Injury to the transverse colon may result in a gastrocolic fistula.

Tube dislodgement was distressingly frequent with original Foley catheter-type tubes, but should occur only rarely with other commercial devices unless the patient pulls on them. Early dislodgement usually results in peritonitis requiring surgical repair. A blocked or displaced tube can be replaced once a fibrous tract has formed (after a few weeks) by the simple insertion of a Malecot-type catheter, or one of the 'buttons' that are available commercially.

Percutaneous endoscopic jejunostomy (PEJ)

Jejunal feeding is often recommended in patients with gastro-oesophageal reflux to reduce the risk of pulmonary aspiration. Current evidence suggests that this hope may not always be realized. The jejunostomy tube may be inserted (under endoscopic guidance) through an established gastrostomy tract or using special commercial kits at the time of the original PEG puncture.

Further reading

General

Blades EW, Chak A, eds. *Upper Gastrointestinal Endoscopy*. Gastrointestinal Endoscopy Clinics of North America, Vol. 4(3) (series ed. Sivak MV). Philadelphia: WB Saunders, 1994.

Greene FL, Ponsky JL. *Endoscopic Surgery*. Philadelphia: WB Saunders, 1994.

Hawes RH, ed. *Experimental and Investigational Endoscopy*. Gastrointestinal Endoscopy Clinics of North America, Vol. 4(2) (series ed. Sivak MV). Philadelphia: WB Saunders, 1994.

VanDam J, ed. *The Oesophagus*. Gastrointestinal Endoscopy Clinics of North America, Vol. 4(4) (series ed. Sivak MV). Philadelphia: WB Saunders, 1994.

Wyllie R, ed. *Pediatric Endoscopy*. Gastrointestinal Endoscopy Clinics of North America, Vol. 4(1) (series ed. Sivak MV). Philadelphia: WB Saunders, 1994.

Dysphagia

Boyce GA, Boyce HW. *Endoscopic Management of Gastrointestinal Tumors*. Gastrointestinal Endoscopy Clinics of North America, Vol. 2(3) (series ed. Sivak MV). Philadelphia: WB Saunders, 1992.

Earlam R, Cunha-Melo J. Benign oesophageal strictures: historical and technical aspects of dilatation. *Br J Surg* 1981;**68**:829–36.

Earlam R, Cunha-Melo J. Malignant oesophageal strictures: a review of techniques for palliative intubation. *Br J Surg* 1982;**69**:61–8.

Lightdale CJ. Staging of esophageal cancer I: endoscopic ultrasonography. *Semin Oncol* 1994;**21**:438–46.

Pasricha PJ, Fleischer DE, Kalloo AN. Endoscopic perforations of the upper digestive tract; a review of their pathogenesis, prevention and management. *Gastroenterology* 1994;**106**:787–802.

Pass HI. Photodynamic therapy in oncology: mechanisms and clinical use. *J Natl Cancer Inst* 1993;**85**:443–56.

Payne-James JJ, Spiller RC, Misiewicz JJ, Silk DBA. Use of ethanol-induced tumor necrosis to palliate dysphagia in patients with esophagogastric cancer. *Gastrointest Endosc* 1990;**36**:43–6.

Vermeijden JR, Bartelsman JFWM, Fockens P *et al.* Self-expanding metal stents for palliation of esophagocardial malignancies. *Gastrointest Endosc* 1995;**41**:58–63.

Foreign bodies

American Society for Gastrointestinal Endoscopy. *Guideline for Management of Ingested Foreign Bodies*. ASGE Publication 1026. Manchester: American Society for Gastrointestinal Endoscopy, 1995.

Greene FL. Endoscopic management of gastrointestinal tract foreign bodies. In: Greene FL, Ponsky JL, eds. *Endoscopic Surgery*. Philadelphia: WB Saunders, 1994.

Webb W. Management of foreign bodies of the upper gastrointestinal tract. *Gastroenterology* 1988;**94**:204–16.

Upper gastrointestinal bleeding

Binmoeller KF, Soehendra N. 'Super glue'; the answer to variceal bleeding and fundal varices? *Endoscopy* 1995;**27**:392–6.

Chung SCS, Leung JWC, Sung JY, Lo KK, Li AKC. Injection or heat probe for bleeding ulcer. *Gastroenterology* 1991;**100**:33–7.

Cook DJ, Guyatt GH, Salena BJ, Laine LA. Endoscopic therapy for acute nonvariceal upper gastrointestinal hemorrhage; a meta-analysis. *Gastroenterology* 1992;**102**:139–48.

Fardy JM, Laupacis A. A meta-analysis of prophylactic endoscopic sclerotherapy for esophageal varices. *Am J Gastroenterol* 1994;**89:**1938–48.

Freeman ML, Cass OW, Peine CJ, Onstad GR. The non-bleeding visible vessel versus the sentinel clot: natural history and risk of rebleeding. *Gastrointest Endosc* 1993;**39**:359–66.

Goff JS. Gastroesophageal varices: pathogenesis and therapy of acute bleeding. *Gastroenterol Clin North Am* 1993;**22**:779–800.

Infante-Rivard C, Esnaola S, Villeneuve JP. Role of endoscopic variceal sclerotherapy in the long-term management of variceal bleeding: a meta-analysis. *Gastroenterology* 1989;**96**:1087–92.

Laine L, Peterson WL. Bleeding peptic ulcer. *N Engl J Med* 1994; **331**:717–27.

Laine L, El-Newihi HM, Migikovsky B *et al.* Endoscopic ligation com-

pared with sclerotherapy for treatment of bleeding esophageal varices. *Ann Intern Med* 1993;**119**:1–7.
National Institutes of Health Consensus Conference. Therapeutic endoscopy and bleeding ulcers. *Gastrointest Endosc* 1990;**36**:S1–S65.
Steele RJC, Chung SCS, Leung JWC. *Practical Management of Acute Gastrointestinal Bleeding*. Oxford: Butterworth-Heinemann, 1993.
Swain P. What should be done when initial endoscopic therapy for bleeding peptic ulcer fails? *Endoscopy* 1995;**27**:321–8.
Westaby D, ed. *Variceal Bleeding*. Gastrointestinal Endoscopy Clinics of North America, Vol. 2(1) (series ed. Sivak MV). Philadelphia: WB Saunders, 1992
Endoscopic band ligation of varices. *Gastrointest Endosc* 1993;**39**:877–8.

Nutrition/percutaneous endoscopic gastrostomy

Ponsky JL. *Percutaneous Endoscopic Gastrostomy*. Gastrointestinal Endoscopy Clinics of North America, Vol. 2(2) (series ed. Sivak MV). Philadelphia: WB Saunders, 1992.

ASGE guidelines and technology assessments

Therapeutic Gastrointestinal Endoscopy. Manchester: American Society for Gastrointestinal Endoscopy, 1990.
Appropriate Use of Gastrointestinal Endoscopy. Manchester: American Society for Gastrointestinal Endoscopy, 1992.
The Role of Endoscopy in the Management of Non-variceal Acute Gastrointestinal Bleeding. Manchester: American Society for Gastrointestinal Endoscopy, 1992.
Endoscopic Feeding Tubes. Manchester: American Society for Gastrointestinal Endoscopy, 1994.
Balloon Dilatation of Gastrointestinal Tract Strictures. Manchester: American Society for Gastrointestinal Endoscopy, 1994.