Esophageal Endoprosthesis in Malignant Stricture

G N J TYTGAT, C J HOEKSTRA, CH B A MOLENAAR

Academic Medical Centre, Department of Gastroenterology, Hepatology, Meibergdreef 9,
1185 AZ Amsterdam, The Netherlands

Dysphagia, regurgitation and hypersalivation caused by loc al obstruction or incessant coughing due to a tracheobronchoesophageal fistula are the most important complications of end-stage esophageal carcinoma. The principal goal of palliative therapy is to achieve and maintain a patent esophageal lumen. This survey will discuss the current possibilities with insertion of an esophageal prosthesis.

Indications and Contraindications

Insertion of an endoprosthesis is indicated when dilation proves ineffective or difficult, or when the dilations are needed too frequently. Another major indication is malignant respiratory-esophageal fistula.

Relative contraindications include presence of a tumor within 2 cm of the upper esophageal sphincter and short life expectancy (except in case of a fistula or when the insertion will not contribute to improvement in the quality of life). Other contra-indications are multiple bleeding lesions with poor anchoring qualities or total luminal obstruction prohibiting the passage of a guidewire.

Equipment

Prosthesis

Custom-made polyvinyl prosthesis: Polyvinyl tubing (Tygon) with an outside diameter (OD) of 15.7 mm, inside diameter (ID) of 12.5 mm, and wall thickness of 1.6 mm is used. The prosthesis should be 4 cm to 6 cm longer than the endoscopically measured stenotic segment. The proximal end of the stent is widened by heating a 2.5 cm segment at one end in mineral oil at 105°C for 30 to 60 seconds. A bevel is cut on the distal end of the tube and the rough edges are smoothed. Retained rings may be glued onto the prosthesis to prevent its migration.

A section of polyvinyl tubing of about 50 cm in length is prepared as pusher tube by funneling one end.

Commercially available non-expansible endoprostheses: Several types of endoprosthesis are commercially available. The following are the most commonly used in Western countries:

i. Wilson-Cook prosthesis (Wilson-Cook Medical, Winston Salem NC, USA) is made of silicone and reinforced with a metal spiral; it has an OD of 16 mm and ID of 12 mm. They are available in lengths from 4.4 cm to 15.4 cm.

ii. KeyMed-Atkinson prosthesis (KeyMed, Southend, UK) is made of radio-opaque silicone rubber tube of 14 mm to 16 mm OD and 11 mm to 11.7 mm bore, with a nylon spiral attached to the distal end to prevent migration. Prostheses are available in lengths ranging from 14 cm to 19 cm.

iii. ESKA-Buess esophageal tube (ESCA, Lubeck, Germany) is made of silicone and has an oval-shaped proximal funnel to avoid compression of the trachea. The distal funnel collapses when passed through a stenosis. A metal spiral embedded within the wall provides stability to the tube.

iv. Medico-Ceterin tube: (Medico, Tetbury, UK) is made of latex, containing a nylon spiral. The OD is 15 mm and the ID 12 mm. A collapsible flange is added distally to maintain position. This tube fits snugly against the wall because of its tulip-shaped end. Tubes are available in lengths of 12.5 cm and 21 cm. Latex may show structural deterioration when exposed to hydrochloric acid, bile and radiation.

Fistula prostheses:

i. Wilson-Cook prosthesis carries circumferentially a foam rubber or sponge contained in a silicone sheath which expands and closed the fistula. After insertion, the vacuum in the covering balloon is released and the cuff fills with air, allowing the foam rubber to expand from 2.6 cm to 4 cm.

ii. ESKA-Buess fistula funnel is supplied as a separate part. This funnel is wider in diameter and the point of luminal sealing lies more proximal to the stenosis, allowing fistula closing.

Metal expandable stents

i. Self expanding wallstent (MetaVent SA, Lausanne Switzerland) is braided in the form of a tubular mesh configuration from surgical-grade, stainless super alloy monofilament wires. The stent is pliable, self-expanding and flexible in the longitudinal axis; when fully expanded it is 6 cm to 10 cm long and 20 mm in diameter. The stent is constrained in a compressed
form in an invaginated rolling membrane of 18 mm diameter. The rolling membrane can be retracted with hydraulic assistance through instillation of fluid or contrast medium at a pressure between 3.5 and 4.0 atm, thus permitting the stent to expand progressively. On expansion, the diameter is 60 mm and the length varies (53 mm to 88 mm to 106 mm). Prototype models have a silicone membrane covering the stent to prevent tumor ingrowth through the meshes.

ii. A modified self-expanding metallic Gianturco stent or Z-stent covered with a silicone membrane has also recently been described. They are made of 0.5 mm stainless steel wire, constructed in a cylindrical zigzag configuration, which gives them significant force. Individual stent bodies can be interconnected, depending on the length of the stricture. By modifying the stent with 3 mm long hooks on the exterior or by outward splayed wire skirts at each end, the stent can be anchored within the tumor. A nylon mesh may be wrapped around the outside of the stent. The mesh is sometimes coated with a 0.1 mm layer of silicone rubber.

iii. Self-expanding Eustalloy stents (Ultraflex stent, Boston Scientific, USA) are made of a single strand of elastic alloy wire; the stent forms a tubular shape, 18 mm in diameter. The proximal end is flared up to 20 mm diameter to enhance anchoring to the esophageal wall. The stent is available in three different lengths: 7 cm, 10 cm and 16 cm. The stent, which is encased in gelatin, will expand when released into contact with body moisture, which dissolves the gelatin. The stent delivery system, on which the compressed stent is mounted, has a diameter of 24.

Introducing devices

A prosthesis may be inserted over a small-caliber endoscope, over an Eder-Puestow dilator shaft or over a Savary-Gilliard type bougie. A Wilson-Cook or KeyMed introducing device, Celestin endoprosthesis introducer, Dumen-Gilliard endoprosthesis delivery system or Amsterdam metal introducer (Fujinon) can also be used. These introducers are inserted over a guidewire and have the capability of gradually increasing the stiffness and straightness of the stent. This facilitates the insertion of a stent through angulated lesions.

Insertion procedure

The first step in the insertion of a non-expandable stent is dilation of the malignant stricture to an appropriate diameter. The number of dilators of increasing diameter passed over a guidewire depends on the degree of narrowing, the longitudinal extent, and the tortuosity of the lesion. A luminal diameter of about 15 mm is usually required to allow prosthesis placement. In general, soft, necrotic lesions require less dilation. Some times require dilation to 16 mm to 20 mm. For easily expandable lesions, one dilatation procedure may suffice. For inelastic and tortuous lesions, usually not more than 3 or 4 sequential dilators are passed with each session. After dilation, the proximal and distal margins as well as exact distances from the teeth to the proximal and distal tumor margins are determined.

The distance from the incisor teeth, the proximal funnel edge of the prosthesis, measurement is marked on the pusher tube. It measures from its forward end backward. The pusher tube and the prosthesis are lubricated well and positioned on the selected introducing device.

The introducing device, carrying an endoprosthesis, is passed over a guidewire under fluoroscopic control. After the tip of the introducing device has been advanced well past the distal part of the tumor, the pusher tube is advanced to the predetermined point marked on the pusher; the prosthesis should now be seated properly with its funnel located above the proximal margin of the tumor. With the prosthesis in the correct position, the operator holds the tube steady as the introducing device is withdrawn. When using the KeyMed Atkinson system it is particularly important to ascertain that the endoprosthesis is not displaced during withdrawal of the introducer. With a rotation movement, the pusher tube is disengaged from the prosthesis, whereupon the pusher is withdrawn. If the lesion has been dilated adequately, stent placement should only require a few minutes. The endoscope may be reinserted to check the position of the prosthesis. Care must be taken to avoid dislodgement of the prosthesis upon withdrawal of the endoscope. To avoid this, the pusher tube may be kept in place to stabilize the prosthesis during this maneuver.

When an expandable stent is used, no prior dilation is usually necessary. Under endoscopic and fluoroscopic control a guidewire is passed through the tumor and positioned along the greater curve of the stomach. Over the guidewire the catheter bearing the constrained stent is advanced. After removal of the restraining catheter, the metal stent gradually expands up to its full diameter.

It is wise to examine the patient for cervical or precrural air crepitsus and to perform a chest radiograph couple of hours after the procedure to exclude a perforation. Luminal patency and tube functioning can be checked radiologically, starting with an iso-osmolar water-soluble contrast material. Radiograph from all directions should be taken. If no leakage is visible, more adequate documentation of tube position and function may be obtained with barium. Only after meticulous exclusion of leakage is the patient allowed to eat and drink.
When it has been established that displacement has not occurred and the passage is adequate, the patient is ready to eat and can be discharged. Detailed instructions regarding management of the prosthesis and diet should be given. In general, a regular diet is tolerated, provided dentition is adequate, the patient must be instructed to eat only in an upright position, to chew food carefully and to take copious drafts of fluid during and after meals. Obstruction of the prosthesis of a minor degree may be relieved by taking carbonated beverages. When the prosthesis is very long, it is appropriate to advise the patient to eat finely chopped food.

Complications

Perforation is the most important life-threatening complication. Predisposing factors are previous radiotherapy, sharp angulation especially in case of extensive tumor, involvement of stomach or cardia, and previous surgery. The vast majority of perforations should be suspected and recognized immediately, either endoscopically or clinically because of rapid development of subcutaneous emphysema with air crepitation, or radiologically because of pneumomediastinum or free air below the diaphragm. Occasionally, the first evidence of perforation is the appearance of a small amount of pleural fluid on the chest radiograph.

The appropriate treatment for perforation depends on the time of detection. If perforation occurs during the dilation or insertion phase of the procedure, one may complete the insertion procedure provided the narrowed segment has been sufficiently dilated. Its aim is sealing of the largely uncontaminated perforation site with the prosthesis serving to prevent mediastinal contamination. Otherwise one may prefer conservative treatment for 7-10 days and resume the insertion procedure after the tear has sealed. A perforation rate of around 60% seems to be an unavoidable feature of incubation. However, with more precise selection of patients, a perforation rate of less than 5% may be achieved. Adequate management results in more than 80%, if not 90%, survival from the event.9 The key to successful conservative management is early diagnosis and prevention of mediastinal contamination.10,11

Dislocation: Migration or dislocation may occur with any prosthesis. A tube with a distal and/or proximal retainer ring may prevent recurring dislocation.

Tumor overgrowth: Obstruction may be caused by tumor growth, cranial or caudal from the tube. This may be corrected by insertion of a longer prosthesis after destruction of the tumor with Nd:Yag laser. Growing tumor through the metal meshes is a major limitation of the uncoated expandable stents. Nd:YAG laser should not be used to reopen the lumen. A plastic prosthesis may readily be inserted in the partially occluded metal expandable stent.

Strictures due to reflux esophagitis: Despite anti-reflux measures, these occur rarely and may require dilation.

Pressure necrosis. Pressure necrosis caused by the funnel edge of the prosthesis usually arises in an area invaded by tumor, or previously irradiated, or both. The chance of pressure necrosis is higher when there is marked angulation between the esophagus and the prosthesis. Pressure necrosis causes pain and may lead to formation of mediastinal fistula. Deep pressure necrosis may extend to the aorta, with resultant exsanguination.

Food blockage: This is a common complication after prosthesis insertion, and usually results from inadequate mastication or dietary indiscretion. If clearing of the stent fails, the prosthesis should be exchanged.

Results of prosthesis insertion

The insertion of an endoprosthesis through a carcinoma of the esophagus and cardia provides acceptable relief of dysphagia and usually allows a patient to remain at home during the terminal phase.

Intubation difficulties can, however, be expected in the following situations:

1. Complete luminal obstruction
2. Sharp angulation of the esophageal lumen (which may occur in cancer of the distal esophagus and cardia or after surgical resection)
3. Concomitant sliding or para-esophageal hernia
4. Unusually necrotic or excessively serous tumor
5. Fistula without appreciable luminal narrowing
6. Origin of a fistula at the upper or lower end of the malignancy
7. Primary pulmonary cancer
8. Tumor involvement approaching the upper esophageal sphincter
9. Unfavorable anatomy predisposing to dislocation
10. Multiple strictures.

A non-expandable or expandable prosthesis can be placed anywhere in the esophagus, except near the upper sphincter. The insertion of a prosthesis in a short, straight malignant stenosis is usually not difficult. The proximal tumor shelf must be adequate to anchor the device. Therefore, the preferential tumor configuration is concentric rather than a longitudinal growth which occupies only a portion of the circumference of the wall. If the malignancy involves less than half the circumference, the stenosis is usually not adequate to hold the prosthesis.

The combination of cancer and hiatus hernia is

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common. In most cases it is possible to insert a prosthesis correctly. Depending upon the extent of the tumor and the size of the hernia, either a short prosthesis can be introduced which just enters the hernia, or a long tube can be used bypassing the hernia with the distal end of the tube ending in the stomach. The latter is usually preferred.

Insertion of a prosthesis is the only method to palliate a malignant esophageo-bronchial fistula. A satisfactory occlusion of the fistulous tract can be achieved in most such patients.

A large fistula without sufficient narrowing to anchor the prosthesis is exceedingly difficult to manage. One may try to use a wider funnel and a proximal wide shoulder may block Wilson-Cook Fistula prosthesis, with the soft self-inflating foam cuff for complete sealing of the fistulous tract. Occasionally this may fail. Presumably fluid and exudate block the air inlet channel after removing the insufflation wick. Full insufflation with air should be documented fluoroscopically prior to removing the insufflation wick.

When a stricture is 2 cm or less from the upper sphincter a regular prosthesis results in a foreign body sensation or strider due to laryngeal compression. To prevent this, a prosthesis with a small, short funnel or one without a funnel section can be inserted. The operator must be prepared to remove the prosthetic device immediately if acute strider occurs. Placing a prosthesis within 2 cm of or even proximal to the ericopharyngeal muscle should not be considered an absolute contraindication.

Frequent instrumentation, surgical manipulation and marked tumor involvement of the upper region decrease the likelihood that the patient will develop a severe foreign-body sensation. In addition, an appropriately sized, usually smaller caliber (12 cm), tailor-made prosthesis with a pliable proximal tunnel may decrease the severity of a foreign-body sensation.

Conclusion

Esophageal intubation with a plastic prosthesis or expandable prosthesis is a well-established palliative treatment for esophageal cancer and provides rapid and long-lasting relief of dysphagia in most patients. The maximum relief of dysphagia is immediate and improved quality of swallowing is quite consistent. Repeated procedures are usually not required. Insertion of a prosthesis is the treatment of choice for esophageo-bronchial fistulas. The cost of prosthesis placement is significantly less than of other modalities such as laser therapy, and only one treatment session is needed to place the stent. Laser therapy requires 2 to 4 sessions to achieve luminal patency.

Self-expanding metal stents may have distinct advantages over conventional esophageal prosthesis because their insertion is less traumatic and have fewer side effects. The risk of perforation with the expandable stents is lower because of the smaller external diameter of the stent. Blockage by food appears to be less frequent because the internal diameter is larger.

Disadvantages of prosthesis insertion include a high complication rate and risk of mortality. Another disadvantage is the problem with the passage of food through a rigid tube. In most studies, commercially available tubes with internal diameter of 10 mm to 11 mm have been used. This means that only 15% of the patients can eat a normal diet. A handicap of the Wallstent and the Ultraflex stent may be the short duration of palliation because of ingrowth of tumor or granulation tissue through the mesh of the stent. Gianturco stents are covered with a silicone layer which prevents tumor ingrowth. Some authors speak of the self-expandable metal stents as the promise for the future; this is still in the experimental stage. Long-term follow-up is needed before these stents are made commercially available.

References

NEWS AND NOTICES

Health Media Centre-India is a body which is attempting to bring together health and media professionals to undertake activities for dissemination of health information. Those interested, may please contact:

Secretary General
Health Media Centre-India
B-15, Swasthya Vihar, Vikas Marg, Delhi 110 092

The 2nd International Conference on Gallstones: Causes and Management will be held in Tel Aviv Hilton, Israel, March 19-22, 1995. The conference will consist of Plenary Sessions: Epidemiology and Natural History; Pathogenesis; Clinical Aspects; Treatment of Gallbladder Stones; Treatment of Biliary Tract Stones; Future Prospects, Research Workshops: Modulation of biliary lipid composition, Cholesterol complexes in bile, Nucleation and crystallization of cholesterol, Bimolecularization and stone formation, Lithogenic events in the gallbladder and Poster Sessions.

Presidents: T. Gilat (Israel), H. Fromm (USA). For details contact:

Gallstone Conference Secretariat,
Peltours Te'um Congress Organisers, PO Box 8388,
Jerusalem 91082, Israel
Fax: (972 2) 637572, Tel: (972 2) 617402.

The Golden Jubilee Annual Conference of Association of Physicians of India (APICON-1995) will be held in Madras, January 18-22, 1995. For details contact:

Conference Secretariat,
APICON-95,
No 31, Ormes Road, Kilpark
Mardas 600 010

The Endoscopic and Laparoscopic Surgeons of Asia (ELSA) together with the Endosurgery Group of the Royal Australasian College of Surgeons is holding a Meeting on 'The Current Status of Endosurgery' in Perth, Australia from October 20-22, 1994. For details contact:

Dr Eric Tan,
Chairman, Organising Committee,
The Secretariat, Petrie International, ELSA-Australia Endosurgery Congress, PO Box 568, Kalamunda WA 6076, Western Australia.

The XVIII National Congress of the Indian Association of Medical Microbiologists will be held in Pune, November 12-14, 1994. CME (Vaccines: The state of the art & perspectives for India) will be on 11th November, 1994. For details contact:

Col V C Ohri
Organising Secretary
Prof and Head
Department of Microbiology
Armed Forces Medical College, Pune 411 040.

Fourth World Congress of the International Society of Trace Elements Research in Humans (ISTERH) will be held in Taormina (Italy), September 25-28, 1995. For details contact:

Prof. Giacomo Carlo Stumia
Department of Medicina Interna- Gastroenterologia Policlinico
98100 MESSINA (Italy)
Fax 090 2935162 (RTel 090 2212361

Meeting of Editorial Board of Indian Journal of Gastroenterology will be held on 14th November at 1 PM during Annual Meeting of Indian Society of Gastroenterology at Varanasi 1994.