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Endoscopic Management of Transmural Defects, Including Leaks, Perforations, and Fistulae


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Transmural defects of the gastrointestinal tract can be classified into 3 distinct entities—leak, perforation, and fistula. Each arises from different mechanisms and is managed accordingly. Leaks occur most often after surgery, while perforations occur most often after flexible endoscopic maneuvers. Fistulae arise from a variety of mechanisms, such as an evolution from surgical leaks, as well as from specific disease states. Endoscopic management plays a vital role in the treatment of transmural defects as long as the region of interest can be accessed with the appropriate endoscopic accessories. Endoscopic approaches can be broadly classified into those that provide closure and those that provide diversion of luminal contents. With advances in technology, a myriad of devices and accessories are available that allow a tailored approach. Endoscopic approaches to leaks, perforations, and fistulae are discussed in this review.

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Transmural defects are a heterogeneous group of lesions that involve a disruption in the wall of the gastrointestinal (GI) lumen. They are broadly classified as leaks, perforations, or fistulae. It is important to recognize that there are many etiologies and presentations, and many treatment approaches, depending on patient status and whether the surrounding tissue is otherwise healthy. A GI leak usually occurs after surgery and is defined as a communication between the intra- and extraluminal compartments as a result of a defect of the integrity of the intestinal wall, most commonly at the level of the anastomosis. A GI fistula is an abnormal connection between the gut and hollow organs, such as the bladder, urethra, vagina, skin, or between the gut and an abscess cavity. Fistulae can develop as a result of a prolonged anastomotic leak, especially when the leak results in extraluminal fluid (such as an abscess) that is managed percutaneously. A perforation is an acute rupture of the GI wall, which can occur after endoscopic instrumentation or due to underlying pathology, such as peptic ulcer or diverticular disease.

In this review, the presentation and management of leaks, perforations, and fistulae vary and will be discussed separately.

Assessment of Transmural Defects

GI leaks are identified in the postoperative course clinically by persistent output from surgical drains or presentation with infection because of contaminated extraluminal fluid (abscess). The leak can be assessed by computed tomography scan, which allows identification of fluid that requires intervention (usually percutaneous or surgical). Orally (upper GI leaks) or rectally administered water-soluble contrast (lower leaks) at the time of computed tomography or luminal radiographic studies (esophagram, upper GI series, or enema) can define precise location and extent of leakage. Endoscopic examination can also provide details concerning size of leakage and presence of ischemia, which may offer prognostic information and change management.

Perforations recognized at the time of endoscopic procedures are assessed and closed, when possible. Delayed recognition of perforations usually occurs after presentation of fever and pain, and imaging as for GI leaks is appropriate, with computed tomography scan preferred to assess need for drainage of extraluminal fluid. Fistulae are usually well-defined before endoscopic assessment, but can be assessed radiographically by contrast injection through the fistula tract irrespective of indwelling drain(s).

Abbreviations used in this paper: **EVT, endoscopic vacuum therapy; GI, gastrointestinal; RYGB, Roux-en-Y gastric bypass; SEMS, self-expandable medal stents; TTS, through-the-scope.**

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Endoscopic Closure Modalities

Endoscopic closure of transmural defects can be achieved using a variety of modalities,[1] as outlined in Supplementary Table 1. In some cases, more than one approach is used concomitantly, while in other cases therapies are applied sequentially, depending on the initial clinical response.

It is important to note that each closure modality has a different mechanism of action and potential for the need for procedures to evacuate extraluminal fluid. Stent placement acts by covering the defect, but external drainage is required for evacuation of extraluminal fluid. Any method that brings tissue together, to include clip placement, application of endoscopic sutures act by closure and adaptation of wound edges, and also may require external drainage.

Endoscopic vacuum therapy (EVT), introduced by surgeon Gunnar Loske, works by intraluminal and intracavitary apposition of wound edges and provides simultaneous internal drainage, obviating external drainage.

When self-expandable stents are used, covered metal stents (SEMS) are usually used. This is an off-label use of these devices, and in the United States, the only large-bore luminal covered stents are designed for esophageal use. Most of these have non–through-the-scope (TTS) delivery systems, although one TTS stent is available. Fully covered SEMS have a high migration rate, which can be reduced by endoscopic placement of sutures or over-the-scope clipping devices to anchor the proximal flange to the surrounding GI wall.[2–6] Partially covered SEMS have a lower rate of migration, but can be difficult to remove,[7] often requiring the use of the stent-in-stent technique.[8] Outside of the United States, dedicated, specially designed SEMS are available for the treatment of gastric sleeve leaks.[9,10]

Newer approaches worth mentioning that will be discussed later include placement of double-pigtail plastic stents through the leak or fistula to provide internal drainage and divert contents, the use of large-diameter dilation to relieve downstream obstruction, the use of EVT, and electro-incision of fistulae. In Europe, there are dedicated, commercially available open-pore drainage devices for use in the rectum (Endo-SPONGE; Braun Medical, Hessen, Germany) and the esophagus (Eso-SPONGE; Braun Medical). These devices are not available in the United States. Their use in the esophagus began approximately 10 years ago with self-constructed drainage devices and off-label use of electronic vacuum pumps. Retrospective studies of esophageal leaks have derived data using vacuum therapy using self-constructed open-pore drains. The modality chosen is often based upon personal preference, accessibility of devices (both within an endoscopy unit and by location within the GI tract). It is also important to note that defined nomenclature has been used in few studies, and comparative studies among modalities for the treatment of transmural defects are lacking, leading to an inability to provide evidenced-based recommendations.

Gastrointestinal Leaks

As mentioned previously, GI leaks are usually due to defects at surgical anastomotic sites. The Achilles heel of GI surgery is anastomotic leakage. For example, esophagogastrostomy is associated with leak rates up to 26%. These leaks often result in septic mediastinitis, respiratory insufficiency, long intensive care unit stays and prolonged recovery, and are responsible for the majority of surgical mortality. If the patient recovers, leaks are responsible for the development of anastomotic strictures compromising quality of life due to the resultant dysphagia.[11,12] Additionally, delayed closure of leaks can result in fistula formation, which is much more difficult to manage endoscopically.

The most common surgical leak sites treated endoscopically are listed in Supplementary Table 2. The clinical presentation depends on whether a surgical drain is in place to collect spilled GI contents. If so, the leak is identified early in the postoperative course as excessive drainage output. In the absence of a drain, the presentation is nearly always infectious due to accumulation of fluid in otherwise sterile spaces, such as the peritoneum. In these cases, the first principle of management is drainage of extraluminal fluid, which can be surgical, percutaneous, or endoscopic.

Endoscopic closure of postsurgical leaks can be achieved using some of the modalities[13] outlined in Supplementary Table 1. In the upper GI tract, the most commonly used endoscopic therapies are placement of covered SEMS and over-the-scope clipping devices. In general, TTS clips are not large or robust enough to allow closure of leaks. For lower GI tract leaks, stents are not a good option because of their near-uniform migration rate and difficulty with suturing or applying over-the-scope clips to the proximal flange.

Esophagogastric Anastomotic Leaks

Esophagogastric anastomotic leaks occur after distal esophagectomy (Ivor-Lewis procedure), performed most often for resection of cancer. Covered SEMS placement is effective for leak closure (Figure 1).[14,15] Patients tolerability to SEMS is dependent on the proximity of the anastomosis to the upper esophageal sphincter. Earlier placement after diagnosis of a leak is associated with improved outcomes after SEMS placement.[15] Over-the scope clipping devices have been used alone or in combination with SEMS to close these leaks.[16] When used alone, over-the-scope clips are best reserved for small defects that occur early. Their limitations are the need for an en face view and pliable tissue for successful deployment, and the theoretical concern for a permanent foreign body.

It is important to recognize that adverse events of SEMS placement can occur and include proximal or distal migration, bleeding and/or stricture formation due to ulceration at the stent ends, and iatrogenic trachea-esophageal fistula formation when placed for extended periods.

EVT has been used for the management of esophagogastric anastomotic leaks in patients who have failed to respond to stent placement (Figure 2).[17] Sponges can either be advanced or pulled with a grasping forceps and placed intracavitary and/or intraluminal, depending on the size of the defect and presence of an extraluminal cavity. Advantages of EVT are that it can be uses in any region of esophagus and when there is lack of luminal continuity, and