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Review article

Enteral stents in the management of post–bariatric surgery leaks

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Abstract A post–bariatric surgery leak is a rare but grave condition and remains every bariatric surgeon's nightmare. Endoscopic therapy with the insertion of self-expandable stents provides an effective minimally invasive approach for the management of leaks. Self-expandable stents, however, are still hampered by their tendency for migration and are not always well tolerated. Recently, double-pigtail stents have been proposed as an alternative endoscopic therapeutic modality. Both types of stents have been shown to be very effective in the management of leaks; however, most studies have pooled gastrointestinal leaks due to different etiologies together. In this article, we review the current status and foreseen innovations in gastrointestinal stenting for post–bariatric surgery leaks. (Surg Obes Relat Dis 2018;▮:00–00.)

Proven to be the most effective weight loss interventions, bariatric surgeries have witnessed a surge in the number of yearly procedures over the last 2 decades, providing effective and sustained weight loss in a large number of patients [1]. However, this has also been accompanied by a surge in the related complications, the most serious of which is a staple-line leak. Leaks remain a catastrophic complication associated with significant morbidity and mortality, occurring in approximately 1% to 5% of primary surgeries and up to 13% of revisional surgeries [2–5]. Conventionally, leaks have been managed by either by an aggressive surgical approach or conservative expectant management reliant on total parenteral nutrition and prolonged use of antibiotics. Surgery for leaks—whether by radical resections or simple attempts at repair—is a perilous endeavor that frequently fails, with morbidity up to 50% and mortality in 2% to 10% [6–8]. Conservative management entails prolonged hospitalization, frequent infections, and numerous complications of prolonged total parenteral nutrition and frequently fails to heal the leak [9].

Peroral endoscopy provides minimally invasive access to the site of leakage, allowing therapeutic procedures to be performed with minimal anesthesia and minimal stress to an already critical patient. Of all the endoscopic techniques described, stents have been the most studied and most popular to this date [10]. Self-expandable stents isolate the site of leakage from contents of the alimentary tract, allowing the leaks to heal while simultaneously allowing enteral feeding to resume. Double-pigtail plastic stents work by a different concept: the maintenance of an open fistulous tract allowing constant drainage of the leak cavities internally [11]. Numerous studies have addressed the use of stents in leaks; however, the vast majority has pooled the results of leaks due to different etiologies, including endoscopic perforations [12]. Post–bariatric surgery leaks have their particular characteristics with regard to the surgical anatomy and the morbid nature of the patient. In this article, we review the current status of the use of stents in the management of post–bariatric surgery leaks and the foreseen innovations in this field.

Self-Expandable Stents

Types

Numerous self-expandable stents are commercially available, and the endoscopist must be knowledgeable of the

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features and pros and cons of each. Although each endoscopist may have a tendency to prefer one stent over another, an experienced endoscopist knows that there is no "one-size-fits all" stent for postsurgical leaks.

Self-expandable stents are made of different materials but can be broadly classified into plastic and metallic stents. The Polyflex plastic stent (Boston Scientific, Marlborough, MA) was initially popular in the management of esophageal strictures and leaks, having the advantage of easy extraction and a strong radial force. However, their very high axial force renders them more traumatic and painful, less conformable to any angulated anatomy, and much more liable to migration [10]. Other disadvantages of plastic stents are a large caliber insertion system and the need for preloading. Their use in post–bariatric leaks is thus now limited to very few indications. The vast majority of self-expandable metal stents (SEMS) are now made of nitinol, an inert metal alloy of nickel and titanium. Nitinol has the great advantage of high flexibility and the ability to retain its shape; this comes with a slight drawback of a lower radial force. Apart from the stent material, the way the mesh is woven strongly contributes to the physical characteristics of the stent. For example, knitted stents have a lower axial force (more flexible, less traumatic) compared with braided stents, at the expense of a lower radial force (less compression against the walls, liability to collapse/kink). To date, no studies have clearly confirmed superiority of one stent material or mesh design over another, yet the physical characteristics should be taken in consideration when selecting a stent for a particular patient.

Perhaps the larger ongoing debate is whether to use fully or partially covered stents. Fully covered SEMS (FCSEMS) have silicone or polyurethane covering the entire length of the stent. This covering helps isolate the site of leakage from any of the luminal contents, and it also prevents the metal mesh from being embedded within the mucosa and avoids tissue ingrowth, allowing easy and safe stent extraction. Being fully covered, however, renders the stent much more liable to migration as there is no anchoring to the walls. Partially covered stents (PCSEMS) are similarly covered but have exposed segments of 1 to 2 cm at each end where the metal mesh is not covered. Once inserted, tissue hyperplasia occurs at the exposed segments; as early as within a week, the metal mesh becomes completely embedded in this hyperplastic tissue. This gives rise to 2 main advantages: (1) the stent is fixed to the wall and will not migrate, and (2) as the upper edge is adherent circumferentially to the walls, there is no risk of liquids seeping around the stent and reaching the site of leakage. Partially covered stents, however, are very difficult to extract as they are embedded in the mucosa, and the risk of failing to extract these stents still deters many endoscopists from their use. A "stent-in-stent" technique has proven effective to facilitate the removal of PCSEMS (described below) [13].

Bariatrics-specific stents

Until recently, all available stents were relatively primitive in design because they were simply esophageal stents designed for the management of malignant dysphagia, not specifically adapted to the postsurgical anatomy or the indication of leaks [14]. Their short lengths, small calibers, and lack of flexibility hamper these conventional stents. Only recently have a few designs been proposed to be more suited to the bariatric anatomy. All so far are fully covered nitinol stents (Fig. 1) [15–17]. The MEGA stent (Taewoong Medical, Gimpo, South Korea) is a fully covered ultra-large stent with a shaft diameter of 28 mm and both ends are 36 mm [15]. It is made of braided nitinol with a relatively low axial force, which gives more flexibility and allows the stent to better conform to the tight angulations frequently observed after sleeve gastrectomy. The BETA stent

Fig. 1. Examples of Bariatrics-specific Stents. Left: the MEGA stent (Taewoong; www.stent.net with permission). Middle: BETA stent (Taewoong; www.stent.net with permission). Right: GASTROSEAL stent (MITECH; www.mitech.co.kr with permission).