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MODERN SURGERY: TECHNICAL INNOVATION

Advances in Circular Stapling Technique for Gastric Bypass: Transoral Placement of the Anvil

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Abstract In Roux-en-Y gastric bypass, construction of the gastrojejunostomy is commonly performed using a circular stapler. The initial description for placement of the anvil was via the transoral approach. Although the concept was ingenious, technical difficulty was encountered during passage resulting in complications such as hypopharyngeal perforation and esophageal mucosal injury. As a result, most surgeons subsequently changed their route of anvil placement to the transabdominal approach. Advances in stapler technology now allow the head of the anvil to be pre-tilted, permitting transoral introduction with greater ease and safety. This paper describes this improved method for transoral placement of the anvil during laparoscopic gastric bypass and reoperative bariatric surgery.

Keywords Morbid obesity · Roux-en-Y gastric bypass · Gastrojejunostomy · Circular stapler · Laparoscopy · Surgical technique

Introduction

The circular stapler is an essential tool for construction of gastrointestinal anastomoses. This stapling instrument has facilitated the construction of minimally invasive operations such as Roux-en-Y gastric bypass, gastrectomy, and esophagectomy. Laparoscopic gastric bypass was first described in 1994 by Wittgrove and Clark [1]. In their original technique, a 21-mm circular stapler was used with the anvil placed transorally. Their technique was similar to that used for percutaneous endoscopic gastrostomy in which a guide wire is retrieved transorally. The guide wire is then attached to the tip of the anvil, and the anvil is then pulled transorally and positioned within the small gastric pouch [1]. One of the concerns with regard to transoral placement of the anvil has been esophageal or hypopharyngeal injury. For example, in 2000, Nguyen et al. [2] reported a hypopharyngeal perforation using the transoral technique during construction of a gastrojejunostomy for laparoscopic gastric bypass. The major difficulty in the transoral technique is passage of the round anvil head through the upper esophageal sphincter. Multiple mechanical maneuvers have been used to facilitate the transoral delivery of the anvil including neck extension, use of an intubation blade to facilitate widening of the oral pharynx, and even deflation of the endotracheal tube balloon. With the technical difficulties of the transoral method, most bariatric surgeons subsequently changed to the transabdominal technique for placement of the anvil [3]. In this technique, the anvil is placed transabdominally through an enlarged port site, passed through a gastrotomy on the anterior aspect of the stomach and positioned on the anterior gastric wall approximately 1 cm distal to the gastroesophageal junction. The gastric pouch is constructed around the anvil, and the gastrotomy is closed. This transabdominal approach has been adopted by many surgeons. However, some drawbacks include the need to enlarge the trocar site to accommodate the anvil and construction of the gastrotomy and its closure. Because of these encumbrances, some surgeons have changed their technique to use the linear stapler for construction of the gastrojejunotomy [4]. However, in certain operative situations, the use of the linear stapler may be technically challenging. For example, some

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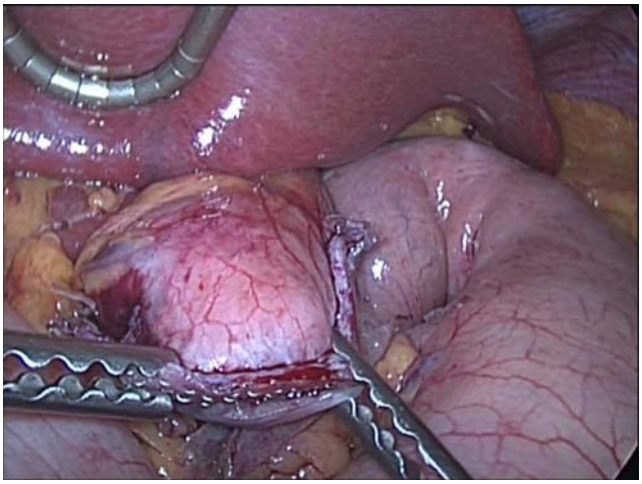

Fig. 1 A small gastric pouch is constructed

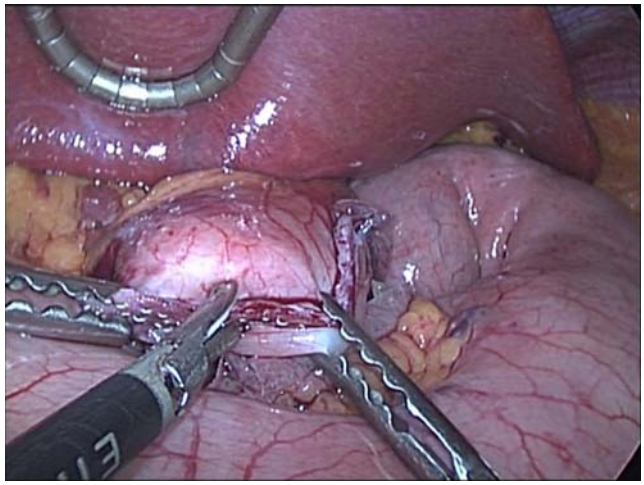

Fig. 3 A gastrotomy is performed along the staple-line at the tip of the gastric pouch

reoperative bariatric surgical procedures require construction of a very small gastric pouch, making the linear stapler technique difficult.

In an attempt to improve the transoral technique for placement of the anvil, Gagner and colleagues described (in video format) the technique of transoral placement of the anvil in which they manually tilted the head of the anvil to facilitate its passage through the hypopharynx and upper esophageal sphincter. The tilted anvil was then manually sutured to the end of an oral gastric tube in preparation for transoral passage. Upon passage, the oral gastric tube was laparoscopically withdrawn from the gastric pouch, and the anvil was pulled transorally and positioned within the gastric pouch. The oral gastric tube was separated from the anvil using the ultrasonic shear. Although the tilted configuration of the anvil improved the ease of transoral passage, it required manual alteration of the product. Recently, a pre-tilted anvil (Orvil™, Autosuture, Norwalk, CT, USA) was developed specifically for the purpose of transoral delivery. In this report, we describe our initial clinical experience using the Orvil™ for transoral placement of the anvil in preparation for construction of a circularly stapled gastrojejunostomy during laparoscopic gastric bypass and revisional bariatric surgery.

Surgical Technique

The gastric pouch is constructed laparoscopically using three applications of the linear stapler (Fig. 1). In preparation for transoral placement of the anvil, the anesthesiologist is given the Orvil™ package, which consists of a 25-mm anvil with the head pre-tilted and the tip attached to an oral gastric tube (Fig. 2). The anesthesiologist must first make sure that there are no other tubes within the esophagus (i.e., esophageal stethoscope). The oral gastric

Fig. 2 The anvil comes pre-tilted and attached to an oral gastric tube

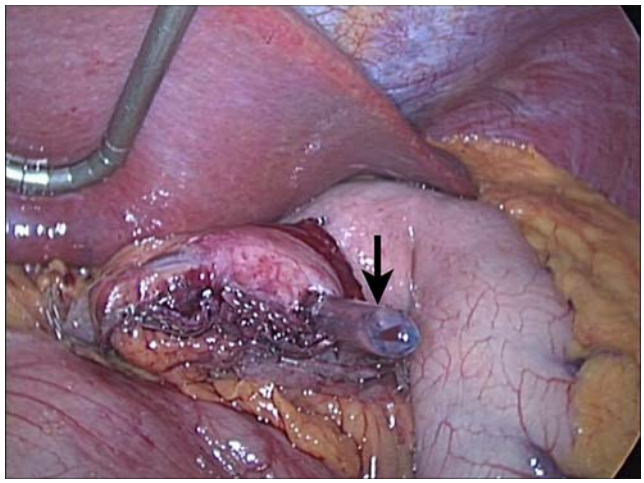

Fig. 4 The oral gastric tube (*arrow*) is advanced through the gastrotomy of the gastric pouch

Fig. 5 The transoral anvil is being passed through the mouth

tube with the attached anvil is then passed transorally in the typical fashion. Once the tip of the oral gastric tube is observed within the gastric pouch, a small gastrotomy is performed along the staple-line at the tip of the gastric pouch (Fig. 3). The oral gastric tube is advanced through the gastrotomy and grasped by the surgeon who pulls it out through a 12-mm trocar (Fig. 4). During the oral passage, it is important for the anesthesiologist to ensure that the anvil does not get caught on the teeth or the endotracheal tube (Fig. 5). The anvil is then positioned within the gastric pouch (Fig. 6). The suture attaching the anvil to the oral gastric tube is then cut and removed. The oral gastric tube is separated from the anvil and passed off the operative

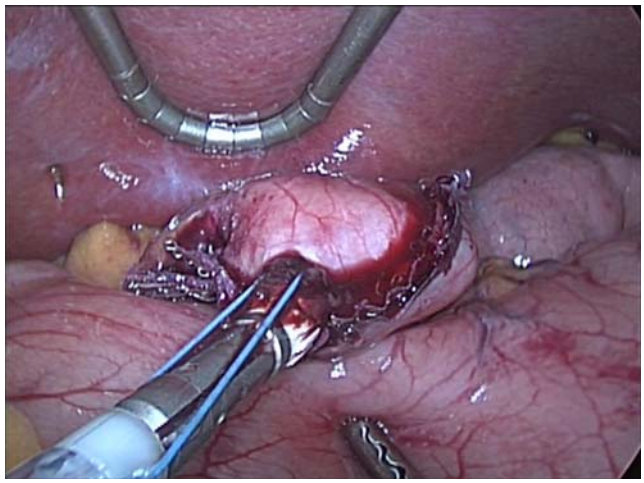

Fig. 6 The anvil is positioned within the gastric pouch

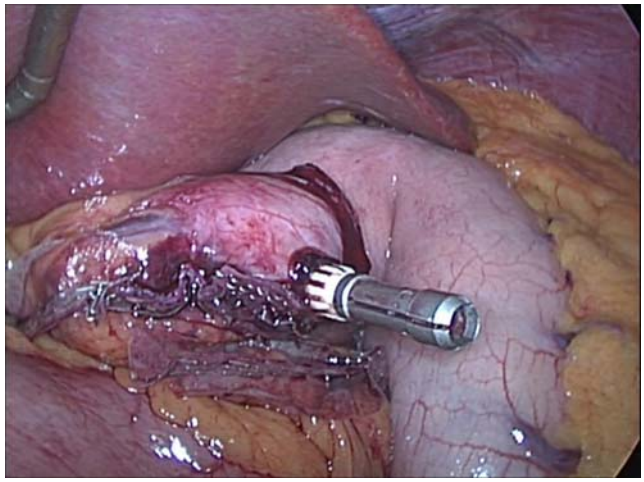

Fig. 7 The complete positioning of the transoral anvil after removal of the oral gastric tube

field. The anvil is now ready for connection to the 25-mm circular stapler (Fig. 7). The tilted anvil head will automatically tilt back into the flat position when the spike of the circular stapler is attached to the anvil in preparation for firing.

Thus far, the transoral technique for placement of the 25-mm anvil has been used on 18 patients who underwent laparoscopic gastric bypass and 5 patients who underwent reoperative bariatric surgery. The passage was technically easy and successful in all 23 cases. The oral gastric tube was easily separated from the anvil in all cases. In 5 of 23 cases, the site where the anvil exited the gastric pouch was considered too “loose" and a modified purse-string suture was placed to obtain a tight seal of gastric tissue around the anvil. The tissue doughnuts were complete in 21 of 23 cases. In cases with incomplete doughnuts, the anastomosis was secured with additional interrupted sutures. Endoscopy performed at the conclusion of the procedure did not show any evidence of esophageal lacerations or abrasions. There were no intra-operative or postoperative leaks.

Discussion

For laparoscopic gastric bypass, the transoral technique for placement of the anvil is an innovative and convenient approach. This technique is particularly important for reoperative bariatric surgery patients in whom construction of a smaller gastric pouch would make the linear stapler technique challenging. Unfortunately, the fixed-type anvil head is difficult to pass through the oropharynx because of its mushroom-like shape and may cause injury to the pharynx and esophagus. In an effort to improve the geometry of the anvil to facilitate transoral passage previously, Gagner and colleagues mechanically tilted the

head of the anvil and attached it to an oral gastric tube [5]. This technique worked well but required the surgeon's manipulation of the anvil by removing its spring mechanism. Additionally, the head of the anvil may fail to tilt back into the flat position during the stapling procedure. Design of the circular stapler has improved so that the anvil is now available pre-tilted and already attached to an oral gastric tube, thus eliminating manipulation of the mechanics of the anvil while ensuring consistent function.

We have utilized the transoral placement of the anvil during conventional laparoscopic gastric bypass cases as well as during reoperative bariatric cases. In our experience, we find the transoral placement of the anvil technique simplifies this portion of the operation and reduces operative time. For certain reoperative bariatric surgical cases, the gastric pouch may be very small, and the transoral placement of the anvil facilitates construction of a difficult gastrojejunostomy. For primary gastric bypass cases, the transoral technique eliminates the need for construction of a gastrotomy and its closure that can be time consuming. One disadvantage of the transoral technique is the slightly larger opening required where the anvil exits the gastric pouch, occasionally resulting in an incomplete gastric tissue doughnut. In such cases, oversewing of the anastomosis with interrupted sutures is advisable. This drawback can be rectified by placement of a modified purse-string suture around the anvil.

In summary, the transoral placement of the pre-tilted anvil head is technically feasible and safe for passage through the oropharynx and esophagus. This new device may allow surgeons to revert from the transabdominal approach back to the transoral technique that was originally described for placement of the anvil. The transoral method will likely reduce operative times for most surgeons and also facilitate the construction of a difficult gastrojejunostomy during revisional bariatric surgery.

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