

Reconstruction after LATG: technical tips and pitfalls

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Abstract: Since the launching of laparoscopic radical gastrectomy in 1990s, the technique of laparoscopy has become more mature, and it has gradually been applied from distal gastrectomy to total gastrectomy. Laparoscopic distal gastrectomy is an accepted option for gastric cancer surgery; however, laparoscopic total gastrectomy is not widely performed, because of the difficulty of reconstruction of the digestive tract. Efforts have been made to establish an intracorporeal anatomic technique for esophagojejunostomy. There have been several techniques for esophagojejunostomy reported using either circular or lineal staplers. This article is to introduce these techniques and try to analysis the technical tips and pitfalls of them.

Keywords: Laparoscopic surgery; total gastrectomy; esophagojejunostomy

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Since the first case of laparoscopic assisted distal gastrectomy for gastric cancer was reported by Kitano *et al.* (1) in 1994, the laparoscopic technique has been made great progress in gastric cancer radical operation. Early laparoscopic technique is mainly used in early gastric cancer, and a lot of researches (2-4) have revealed several advantages of the procedure, including less bleeding in operation, shorter hospital stay, faster recovery of bowel function and fewer complications compared with the open surgery. Therefore, laparoscopic techniques have been widely accepted, and gradually applied to the proximal and total gastrectomy. However, the technique difficulty of Roux-en-Y reconstruction is the major reason for surgeons' hesitancy to perform the totally laparoscopic total gastrectomy. The reconstruction related complications like leakage, bleeding, stricture must be concerned. Okabe *et al.* (5) analyzed 16 retrospective studies. The results showed that the frequency of leakage is similar with open surgery (6-8) and stricture occurred rates are lower than open surgery (9), and the incidence of anastomotic bleeding is very rare, which suggests that LTG is a safe and feasible option.

So far, the techniques of esophagojejunostomy include circular staplers, linear staplers and hand-sewn esophagojejunal anastomosis. This article is aimed to review the current techniques of esophagojejunostomy and analysis their advantages/disadvantages and pitfalls of each method.

Techniques using circular staplers

Circular stapler is the most frequent used technique in open surgery and the most obvious advantage using in the laparoscopic procedure is that surgeons are already familiar with the device and know the detailed technical tips on how to best to use them. Nowadays, there are several methods of circular staplers. The common difficulty of them is the insertion of the anvil head into the esophagus.

Purse-string suture

Laparoscopic purse-string suture was first used in the laparoscopic assisted total gastrectomy. The extracorporeal methods recommended a mini-laparotomy. The tip of this method is to select the best location of the mini-laparotomy

to access the esophagus with the shortest distance. We often make an upper midline incision of 4–6 cm. The pitfall of this procedure is that the purse-string instrument is too large to be handled in a narrow space, and placing sutures through a small wound in the deep surgical field is challenging.

Facing the disadvantages, an intracorporeal method was first used in 2008 by Usui (10). The purse-string instrument can be inserted through the 12-mm port, then finish the anastomosis under the laparoscopic vision. The advantage of this method is that with the help of laparoscopy, the surgeons can have a clear visualization.

Anti-puncture technique

The anti-puncture technique was first reported for laparoscopic anastomosis after total gastrectomy esophagus jejunum by Omori (11) in 2009. The procedure is using a 2-0 suture with a needle and thread on the tail of the anvil which has a small hole and then tie tightly, then inserting the anvil into the abdomen through the 12-mm port and clamp the esophagus using the intestinal clamp. Cutting the esophagus with 2 cm half ring above the intestinal clamp, then send the anvil into the lower esophageal segment bottom-up and then pierce reversely from the anterior esophageal wall 1 cm above the incision. Clamping the esophagus using a linear stapler and do not fire temporarily. Pulling the suture of the tail of the anvil, the anvil can be completely out of the interior esophageal wall and clamp the esophagus with the linear stapler. Finally, complete the anastomosis with the circular stapler center rod.

The advantage of the anti-puncture technique is that the anvil is easily inserted because the esophagus is not cut completely and it doesn't need the purse-string instrument which make the operation more simple, however, the insertion of the anvil into the esophagus bottom-up increases the difficulty of the surgery and prolong the operation time. Another potential pitfall of such a method would be that the incision is made closer to the tumor. The possibility of the intraluminal spread of cancer cells by anvil insertion would be a concern, especially in cases with tumors near the gastroesophageal junction.

Orvil

Orvil was first reported by Nguyen (12) in thoracoscopic surgery, and the application in laparoscopic gastrectomy was in 2009 by Korean scholars Jeong and Park (13). The

technique tips is: (I) laparoscopic radical operation of total gastrectomy and D2 lymph node dissection; (II) free the abdominal segment of esophagus and cut off the esophagus; (III) PLACE the Orvil stomach tube with the help of the anesthesiologist. When the Orvil stomach tube arrive the end of the esophagus, cut a small hole by the end of the esophagus, and let the Orvil stomach tube pass through the hole until the anvil head arrived at the end of the esophagus and then tightening the tube and cut it off; (IV) make a 4-cm incision and put the center rod of the anvil to connect the anvil and complete the anastomosis. The pitfall of the operation is the hypopharyngeal or esophageal mucosal injury.

Techniques using linear staplers

Linear staplers is another choice for surgeons when undergo a LTG. And they seems to prefer these ways cause the easier handling in the limited space, better view during anastomosis and accessibility through a 12-mm port.

Functional end to end anastomosis (FEEA)

The application of the way was first reported by the scholar Uyama (14). First of all, cut off the jejunum 20 cm away from the Treitz ligament, then pull the distal jejunum to the right site of the esophagus with no tension, open a small hole on the jejunum wall with the ultrasonic scalpel, using the same way open a small hole on the right wall of the esophagus and the linear stapler is inserted into the esophagus and jejunum through holes on their edges. Finally, the entry hole is closed with a linear stapler.

The advantage of the method is that neither anvil insertion nor purse-string instrument is needed, so the surgery is relatively simple, and because the linear stapler can adjust the length of the anastomosis which makes the frequency of anastomotic stenosis rare. However, when the esophageal length is shorter then it will retract the chest easily, resulting in poor vision and increasing the operation difficulty, this may limit the width of the anastomosis, and because of the shrinking of the esophagus and the twisting folding of the jejunum arm that tread to the increasing of the tension of anastomosis, thereby increasing the risk of anastomotic leakage.

Overlap

The so called overlap method was introduced by Inaba (15)

in 2010. Two forks of a linear stapler are inserted into the jejunum through a small hole made 5 cm from the edge and another hole on the esophageal stump. A side to side isoperistaltic anastomosis is constructed, and then the common entry hole is closed using a hand-sewn technique.

Overlap requires more time than FEEA, but because without the twisting folding of the jejunum arm, the tension of anastomosis is low and the risk of anastomotic leakage is rare.

Hand-sewn esophagojejunal anastomosis

This method has been also reported (16,17). It is similar to the open surgery; the difference is that all the sutures are done under the laparoscopy. Since either circular staplers or linear staplers needs suture under the laparoscopy, we are trying to share the laparoscopic hand-sewn technique tips.

Training the control ability of laparoscopic suture: different from open surgery, laparoscopic suture needs a long suture holder, it should use the trocar as the fulcrum, so it requires repeated practice.

The choice of the suture and the suture needle: larger or smaller needle, longer or shorter of the suture both increase the difficulty, so the size of the needle and the length of the suture is important. We suggest that you can choose the 3-0 absorbable line and the length can be 10 cm.

The choice of anastomotic size: a larger anastomotic stoma will prolong the operation time, while the anastomotic stoma too small is likely to lead to anastomotic stenosis, so we often choose the anastomotic stoma for 3 cm.

Suture of anterior and posterior edge of anastomosis: the first several sutures of the posterior of the anastomosis is often deep in the position, you should cooperate with your assistants and expose the anastomosis fully. The anterior wall of the anastomotic stoma is usually clear and easy to sew.

Conclusions

Several different techniques can be used for esophagojejunostomy after LTG, all of them has its advantages and disadvantages. No apparent superiority of any particular method was confirmed. You can use any of them according to your own preferences and technology.

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Footnote

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