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MODERN SURGERY: TECHNICAL INNOVATION

Advances in Circular Stapling Techniques for Gastric Bypass: The Circular Stapler Introducer

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Abstract
Background Modern laparoscopic bariatric surgery relies strongly on stapling devices and the perfection of the anastomotic technique is at the core of the patient's safety.
Methods Circular stapler anastomosis is a common technique for performing gastro-jejunostomy in gastric bypass surgery. In obese patients, transabdominal circular stapler introduction can be challenging and associated with morbidity. To overcome these technical obstacles, we have developed a new device, circular stapler introducer (CSI) to assist both the abdominal wall passage of the circular staplers and its introduction into the jejunum.
Results The CSI facilitates the insertion of the circular stapler not only into the abdomen but also into the jejunum enhancing safety and swiftness of laparoscopic Roux-en-Y gastric bypass.
Conclusions Our innovative CSI device facilitates this part of the operation significantly and makes the performance of bariatric surgery more convenient.

Keywords Circular stapler introducer · Gastric bypass surgery · Bariatric surgery

Abbreviations
CSI circular stapler introducer

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Introduction

Modern laparoscopic bariatric surgery relies strongly on stapling devices and the perfection of the anastomotic technique is at the core of the patient's safety.

Circular stapler devices have the advantage of creating a well-defined size of the anastomosis and are an essential tool for construction of gastrointestinal anastomoses. Circular stapler anastomosis is a common technique for performing gastro-jejunostomy in gastric bypass surgery or esophagogastrectomy for non-bariatric indications.

Laparoscopic gastric bypass procedure was originally performed by Wittgrove et al. in late 1993 [1]. Their technique involves the use of circular staplers with the transoral anvil placement. Since then, several groups throughout the world have preformed the gastric bypass laparoscopically, with various modifications [2–4].

In obese patients, transabdominal circular stapler introduction and anvil placement can be challenging and associated with morbidity at both levels [5].

Recently, Nguyen has reported transoral placement of the anvil to avoid encumbrances with transabdominal, transgastric anvil placement. Loss of pneumoperitoneum through an enlarged port site at an early stage of the operation is an undesired effect that can be overcome with the proposed technique [6].

Furthermore, passage of the blunt circular stapling device through the typically bulky abdominal wall of the obese patients and the introduction into the jejunum for the end-to-side anastomosis could be time-consuming and technically demanding.

To overcome these technical obstacles, we have developed a new device, circular stapler introducer (CSI) to assist both the abdominal wall passage of the circular staplers and its introduction into the jejunum. The main function of the novel

CSI device is to ascertain a sliding introduction of the CS head and to enable the introduction and advancing of the circular stapler head into the jejunum yet, without interfering with the application of the circular stapler and the safety of the anastomosis.

In this report we present this technical innovation and our initial experience.

Surgical Technique

Laparoscopic gastric bypass was performed using an antecolic, antegastric technique with a tubular 10–15 ccl gastric pouch along the lesser curvature. The anvil was placed transabdominally through an epigastric port whose site was dilated to 25 mm using standard reusable metal Hegar's dilators. To prevent loss of pneumoperitoneum a towel clamp was applied to the skin around the port shaft when necessary. Generally a seven-port technique was used and suitable patients were operated through four ports in the upper abdomen.

The Roux-limb (generally 100 cm) was created and the jejunojejonostomy was performed using linear staplers with suture closure of the introduction site. The Roux-limb was prepared for the end-to-side gastro-jejunostomy with the limb left-oriented in 65 patients and right-oriented in 12. The jejunum was opened for the introduction of the circular stapler. The same epigastric port was further dilated to 29 mm using rectal bougies (Ethicon Endosurgery) and the circular stapler with the well-lubricated CSI applied brought into the abdomen and then into the jejunum without changing instruments or camera position. Only when the circular stapler was placed ideally within the jejunum the CSI was retracted using the plastic threads (Figs. 1 and 2). The anastomosis was then completed as usual. Both the stapler and the introducer were removed from the abdomen. Pulling the CSI backwards over the stapler head was accomplished without sudden counter-movement and never interfered with the anastomosis. Also the removal of the CSI in one piece still on the shaft of the stapler never caused difficulties.

Routine intravenous single shot antibiotic prophylaxis using second generation Cephalosporin was administered. Before closure, the stapler entry port was carefully rinsed with ample saline solution. No local antibiotics were applied. No subcutaneous stitches were made and the skin carefully closed with intracutaneous stitches using absorbable material. There were no incisional abscesses.

We have used the CSI in 77 patients successfully and introduction through the abdominal wall as well as into the jejunum was greatly facilitated and no adverse events occurred. On the contrary: the openings both into the abdominal wall and the intestine could be kept smaller and the introduction into the jejunum was smooth and protective in all applications.

The stapling devices used were either Tyco/Covidien (n=15) or Ethicon EndoSurgery (n=62).

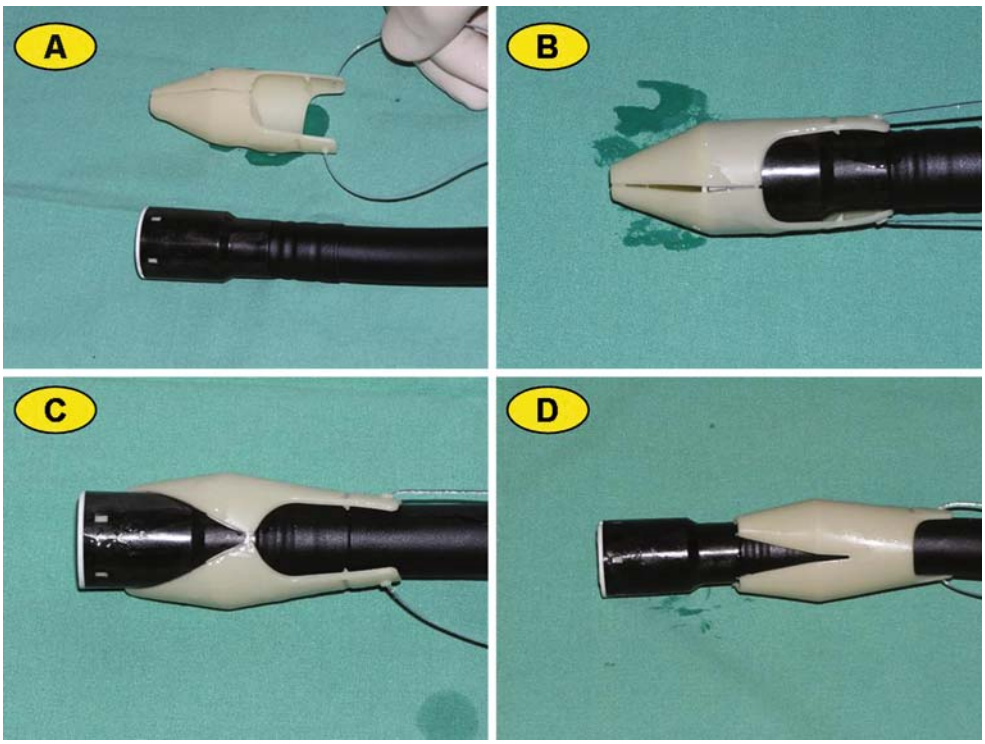


Fig. 1 Circular stapler head with well lubricated CSI (**a**) CSI is applied on the head of the circular stapler (**b**). CSI is retracted using the plastic threads (**c**). Pulling the CSI backwards over the stapler shaft (**d**)

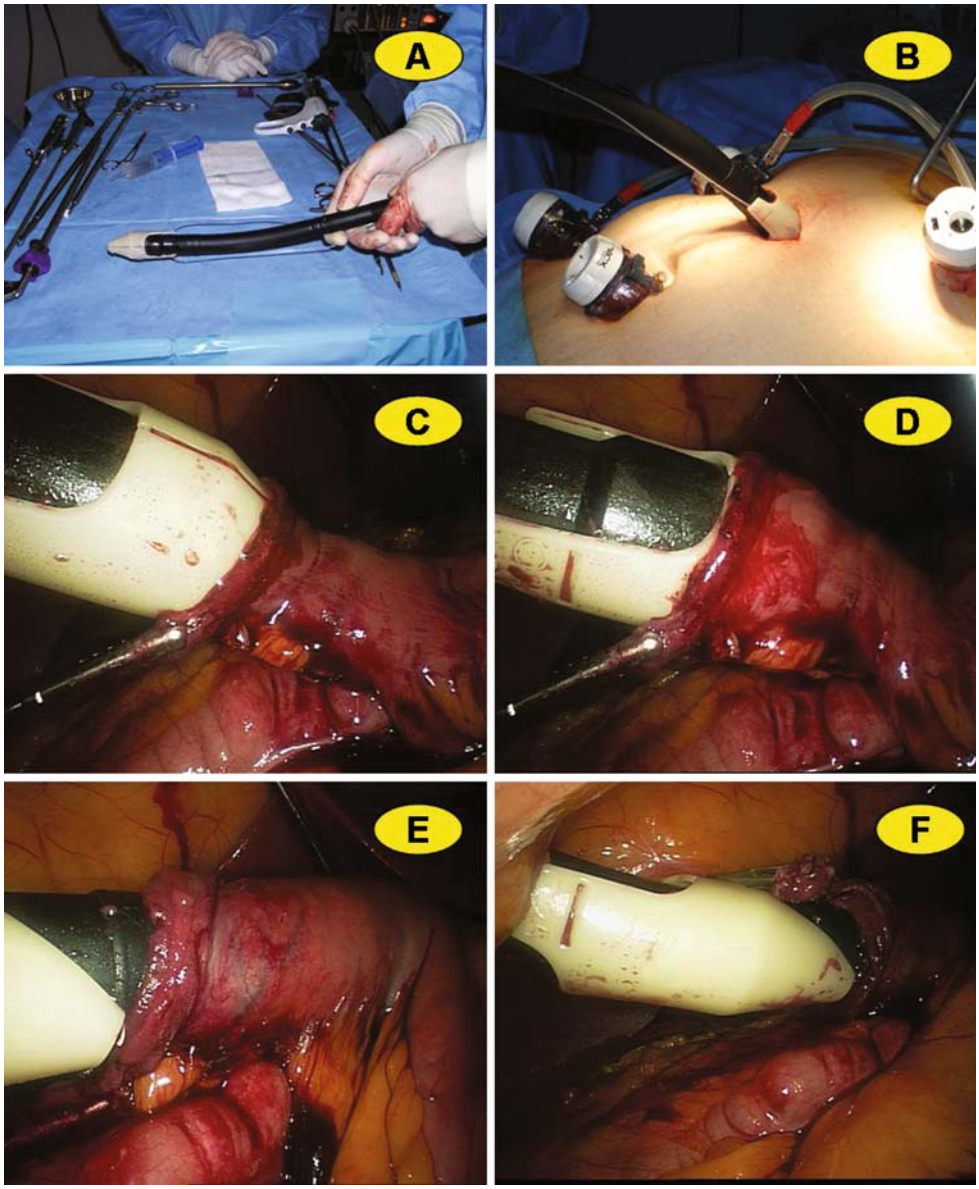


Fig. 2 Application and use of the A CSI/circular stapler combination. **a** Native CSI, **b** Trans-abdominal insertion, **c**, **d** trans-jejunal insertion and advancement, **e**, **f** the CSI after retraction and before firing of the anastomosis

The material of the CSI is TPE Santoprene 283-40 MED and its tip is pronounced to overcome gastric wall resistance. One long plastic thread is fixed on both ends to the CSI for pulling back. Threads are used to prevent loss of air (Fig. 1).

Discussion

The introduction of stapling devices and laparoscopic techniques were key innovations in surgery over the last decades. The widespread use of advanced laparoscopic techniques particularly in bariatric surgery is unthinkable without staplers. Over the last few years, laparoscopic approach to the surgical treatment of morbid obesity has been developed and increasingly accepted.

In bariatric surgery, difficulties such as thick abdominal walls and limited intra-abdominal working space are common and any help in these aspects enhances safety for the patient and speeds up the procedures.

Circular stapler passage through the abdominal wall could be tricky especially in obese patients and its introduction into the jejunum for the end-to-side anastomosis could be technically demanding which involve the risk of a leaking pneumoperitoneum, impairing exposure and visibility.

To solve these obstacles, various techniques were suggested including the use of the sophisticated transorally introduced circular stapler, SurgASSIST [7].

We developed a small and non-complicated device, the CSI, which covers the head of the stapler and provides a sliding effect during transabdominal insertion of the circular

stapler. Furthermore, the CSI facilitates the insertion and the advancement of the circular stapler head into the jejunum without interfering with the application and the safety of the anastomosis. The use of our CSI device is simple and requires no special training or skills.

Another device has been proposed by other group which has the shape of a trocar tip and its posterior part has the shape of a connection pole to fit the Tyco stapler [8].

Once the device is connected, the stapler is used like a trocar and introduced through the abdominal wall. That facilitates abdominal wall passage but it has to be taken off the stapler before its placement into the jejunum and remains in the abdominal cavity until the anastomosis is performed. After removal of the stapler, the device is extracted using a thread attached to the device tip.

Our CSI device remains on the shaft of the stapler until the anastomosis is completed. Hence, the device does not occupy any additional intra-abdominal space and no extra work required to extract the device.

Recently, a randomized prospective blinded study found that the incidence of stenosis is significantly higher in the 21-mm as compared to and 25-mm circular stapled anastomoses in laparoscopic Roux-en-Y gastric bypass [9].

Therefore, our new CSI was designed for use with the preferred 25-mm circular stapler. However; it could also be used for the 21-mm circular staplers.

In our series of 77 patients with RY gastric bypass using the CSI, wound infection was not registered in any patients. This low incidence is comparable to our infection rate of 1.1% (three wound infections) in another series of 260 patients with RY gastric bypass without using the CSI (unpublished data), which means that the CSI device material has no particular resistance to germs and bacteria of the small bowel. Alternatively, a small vi-drape (Medical Concepts Development, St. Paul, MN, USA) could be used for wound protection; however we saw no need for it.

A similar CSI device with slight adaptation was developed by our group for the transanal introduction of the circular stapler devices to accomplish left-sided colorectal anastomoses. It facilitates the introduction and advancement of the circular stapler without interfering with the application and the safety of the anastomosis [10].

In conclusion, the CSI facilitates the insertion of the circular stapler not only into the abdomen but also into the jejunum enhancing safety and swiftness of laparoscopic Roux-en-Y gastric bypass. Our innovative CSI device facilitates this part of the operation significantly and makes the performance of bariatric surgery more convenient.

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