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HOW TO DO IT

Laparoscopic extraperitoneal sigmoid colostomy using the totally extraperitoneal hernia repair technique after abdominoperineal resection for rectal cancer

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Abstract
Stoma creation through the extraperitoneal route reportedly reduces the risk of parastomal hernia and stomal prolapse after abdominoperineal resection (APR) for rectal cancer. We describe a new technique for laparoscopic extraperitoneal sigmoid colostomy following APR. After the rectus abdominis muscle is separated, Lap ProtectorTM and EZ AccessTM devices are placed. An extraperitoneal stoma tunnel is created laparoscopically as much as possible. Next, the peritoneum is separated from the inside of the abdominal cavity, and the extraperitoneal tunnel is opened. At the time of writing, we had performed laparoscopic extraperitoneal sigmoid colostomy in eight patients, without any complications or conversion to the conventional procedure. Thus, laparoscopic extraperitoneal sigmoid colostomy is a useful and safe technique for the laparoscopic creation of an extraperitoneal stoma tunnel after APR.

Keywords Laparoscopic surgery · Colostomy · Rectal cancer

Introduction

Creating a sigmoid colostomy through the extraperitoneal route is thought to reduce the risk of parastomal hernia and stomal prolapse after abdominoperineal resection (APR) for rectal cancer [1, 2]. To create this extraperitoneal tunnel, the peritoneum is separated using blunt dissection with Cooper scissors or laparoscopic graspers. However, complications such as bleeding or difficulty pulling out the proximal sigmoid colon are sometimes encountered because the tunnel is obscured from direct vision. Furthermore, it is difficult to create an extraperitoneal tunnel in obese patients.

To address these issues, we developed a new technique to create a laparoscopic extraperitoneal sigmoid colostomy (LEPS) after APR. We introduce the LEPS technique and evaluate the feasibility and short-term surgical outcomes of rectal cancer patients who underwent this procedure.

Materials and methods

Between January, 2013 and December, 2016, 29 patients with rectal cancer underwent laparoscopic APR at Nagoya City University Hospital in Japan. We analyzed retrospectively the records of 28 of these patients, who were followed up for over 6 months. Eight of the 28 patients were operated on using LEPS.

After the administration of general anesthesia, a 12-mm port was placed using the traditional open method, after which four additional ports were placed in the abdomen (Fig. 1a). The left colon was then mobilized using a medial-to-lateral approach, and the rectum was mobilized using the standard laparoscopic total mesorectal excision technique. After high ligation of the tumor-supplying vessels, the sigmoid colon mesentery and sigmoid colon were divided. The surgical specimen was then retrieved through a perineal incision, and the perineal wound and pelvic peritoneum were closed.

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The extraperitoneal sigmoid colostomy was constructed laparoscopically as follows. First, the proximal sigmoid colon was mobilized adequately to reduce traction. Then, a circular incision was made at the stoma site, which had been marked preoperatively. The subcutaneous fatty tissue was removed and the anterior rectus sheath was opened using a vertical incision. After separating the rectus abdominis muscle, the Lap Protector TM and EZ AccessTM devices (Hakko Co. Ltd., Tokyo, Japan) were placed with a single 12-mm trocar accommodating a 10-mm flexible laparoscope (Olympus Corporation, Tokyo, Japan) and a single 5-mm trocar designed for a laparoscopic instrument (Fig. 1b). We kept the pressure in the extraperitoneal space as 10 mm Hg and any intraperitoneal carbon dioxide was evacuated during extraperitoneal dissection.

The posterior rectus sheath was opened at the left edge of the rectus abdominis muscle (Fig. 2a), and the peritoneum was separated using laparoscopic scissors. After separating the peritoneum up to the level of the left upper port, this port was removed from the abdominal cavity and reintroduced into the separated extraperitoneal space, where peritoneal separation was continued to the greatest extent possible (Fig. 2b). Using an additional grasper from this left upper port makes it easy to dissect the peritoneum further. After separating the peritoneum from the inside of the abdominal cavity, the extraperitoneal tunnel was opened (Fig. 3).

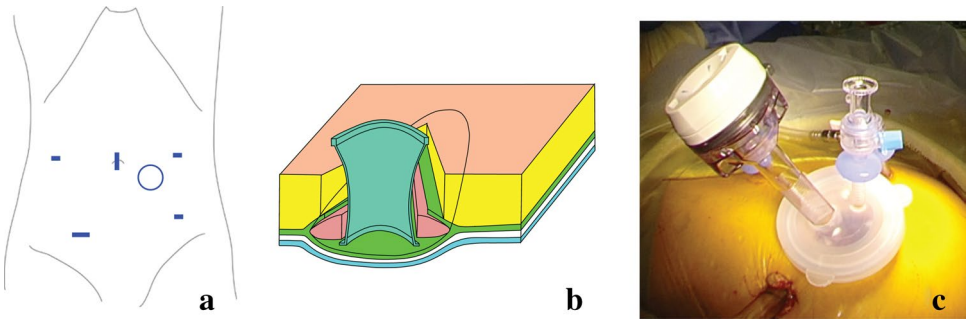

Fig. 1 Trocar placement for abdominoperineal resection and devices used for laparoscopic extraperitoneal sigmoid colostomy. (**a**) Schematic: a 12-mm port is placed using the traditional open method and four additional 5-mm ports are placed. Schema (**b**) and photograph (**c**): the Lap Protector TM and EZ ACCESSTM devices in situ, with a single 12-mm trocar for a 10-mm flexible laparoscope and a single 5-mm trocar for a laparoscopic instrument

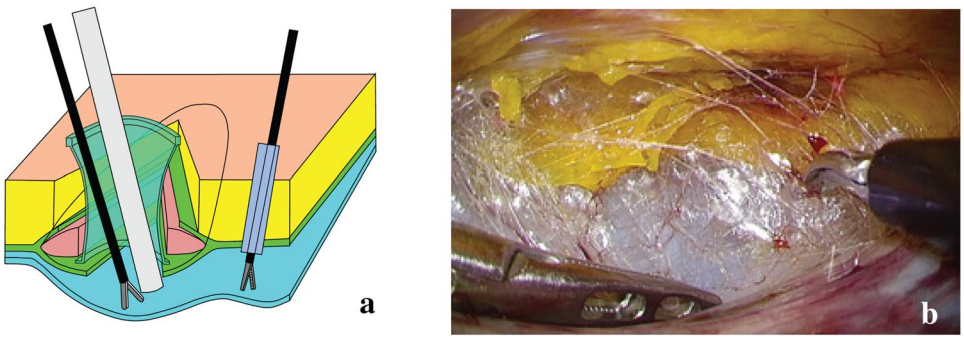

Fig. 2 Schema (**a**) and photograph (**b**): the posterior rectus sheath is opened, and the peritoneum is separated as much as possible using laparoscopic scissors and graspers

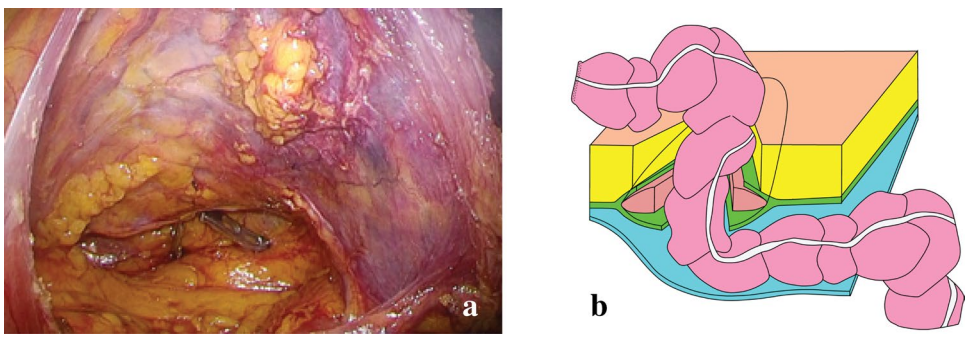

Fig. 3 **a** The peritoneum is separated from the inside of the abdominal cavity, and the extraperitoneal tunnel is opened. **b** The proximal sigmoid colon is then pulled out of the tunnel

Finally, the proximal sigmoid colon was pulled out of the tunnel, and the intestinal wall and skin were sutured using the standard technique.

We recorded operative time and blood loss, and postoperative short-term parameters, such as parastomal hernia formation and surgical complications. The incidence of parastomal hernia was confirmed by physical findings and follow-up CT scans, according to the European Hernia Society classification [3]. This study was approved by Nagoya City University Graduate School of Medical Sciences and Nagoya City University Hospital Institutional Review Board (60–18-0201).

Results

Eight patients underwent successful LEPS and the other 20 underwent the conventional procedure. Creating the extraperitoneal tunnel using the LEPS technique did not result in any additional bleeding compared with the conventional procedure. The time to create an extraperitoneal stoma tunnel using LEPS (mean 21.1 min) tended to be longer than the time required for the conventional procedure (mean 14.5 min).

Parastomal hernia, including asymptomatic radiological parastomal hernia, did not develop in any of the patients who underwent LEPS, and in only one patient who underwent the conventional procedure. However, the duration of follow-up after LEPS was brief (mean 24.1 months) and further follow-up is required. No patients experienced surgical complications greater than Clavien–Dindo grade III. The mortality rate was zero, and there was no case of conversion of LEPS to the conventional procedure.

Discussion

Laparoscopic APR has become a widely used surgical technique for patients with lower rectal cancer. The extraperitoneal stoma route is thought to be better than the intraperitoneal route, even in laparoscopic APR. The benefit of extraperitoneal stoma creation is a reduced risk of parastomal hernia and stomal prolapse; however, it is more difficult to create an extraperitoneal stoma tunnel.

In open APR, the extraperitoneal stoma route is dissected bluntly, typically with the surgeon's fingers. When we started performing laparoscopic APR, we separated the peritoneum by blunt dissection using Cooper scissors or laparoscopic graspers; however, this method of blunt dissection sometimes causes retroperitoneal bleeding. It is also difficult to separate the peritoneum in obese patients. A safer and easier technique is required to create an extraperitoneal stoma.

Totally extraperitoneal hernia repair is used for laparoscopic hernia surgery and its merit lies in the creation of extraperitoneal space under laparoscopic vision, avoiding damage to the peritoneum [4]. As totally extraperitoneal hernia repair is performed regularly in our department for the repair of inguinal hernias, we thought that we could apply this technique to create an extraperitoneal stoma after APR. This series demonstrates that this new technique could be performed successfully without any complications. We are able to control any bleeding easily under direct visualization with clear vision of the entire route of the extraperitoneal tunnel. Moreover, it is easy to pull out the proximal sigmoid colon using this technique. Due to its merits, we have never encountered a peritoneal tear when pulling the colon out of tunnel, even if the peritoneum was very thin. However, the operative time to create the extraperitoneal stoma tunnel by LEPS tends to be longer than that of the conventional procedure and extra instruments are required. From this viewpoint, LEPS might be particularly useful for operating on obese patients, when performing the conventional technique is challenging.

There are some limitations to this technique. First, the extraperitoneal stoma route sometimes needs to be verified laparoscopically from inside the peritoneum, as it can be difficult to verify the correct direction of dissection from the extraperitoneal space. Second, any intraperitoneal carbon dioxide should be evacuated during LEPS because intraperitoneal pressure inhibits visualization and limits the operating field for LEPS. Third, the extraperitoneal space must be separated very carefully. We have never experienced unintentional peritoneal injury in LEPS, but we have encountered air leakage from unintentional peritoneal injury in TEP. Once air leakage has occurred, completing the surgical procedure would be very difficult because of poor visualization.

To reduce the risk of parastomal hernia, intraperitoneal mesh reinforcement upon construction of an end colostomy is recommended [5]. The rate of parastomal hernia in this series was 7% and no mesh infection or complication requiring mesh removal were recorded, so we think it is also an effective technique. Both LEPS and intraperitoneal mesh reinforcement should be performed for very high-risk patients.

Conclusions

The new LEPS technique is useful and safe for the creation of an extraperitoneal stoma tunnel after laparoscopic APR, although the long-term surgical outcomes remain to be evaluated.

Compliance with ethical standards

Conflict of interest We have no conflicts of interest to declare.

Ethical approval All the procedures performed in this study were carried out in accordance with the ethical standards of the institutional research committee and with the 1964 Declaration of Helsinki and its later amendments.

Informed consent Written informed consent was obtained from all patients.

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