Laparoscopic Parastomal Hernia Repair

Isaac Seow-En, Yuan-Yao Tsai, and William Tzu-Liang Chen

Introduction

Parastomal hernia is an incisional hernia resulting from an abdominal wall stoma creation [1]. The published incidence of parastomal hernia varies widely, with 2–28% and 4–48% affecting end ileostomies and end colostomies, respectively, depending on the severity of the hernia, method of diagnosis, and the duration of follow-up [2]. Loop stomas have a much lower incidence of parastomal herniation, as these tend to be reversed before a hernia can develop. The risk of herniation is cumulative with time but appears to be highest within 2 years of ostomy formation. Most patients are asymptomatic or have mild complaints such as intermittent discomfort or sporadic obstructive symptoms, but many eventually have symptoms significant enough to warrant surgical intervention, including incarceration, strangulation, and perforation. The bulging around the stoma can also cause result in difficulty applying the stoma appliance, resulting in leakage and skin irritation [2].

As with other types of incisional hernia, risk factors associated with parastomal hernia development can be categorized into patient- or technique-related. Patient factors include underlying comorbid conditions which raise intra-abdominal pressure, adversely affect wound healing and nutrition, or predispose to wound infection. Obesity with a BMI $\geq$ 25 kg/m^2 has also been found to be an independent risk factor [3].

Surgery-related or technical factors include the site of stoma creation, the size of the trephine, intraperitoneal versus extraperitoneal route, and the prophylactic use of a mesh. It is a common belief that stomas formed through the rectus abdominis muscle have lower hernia rates than those formed lateral to the muscle. However, a 2003 review [2] observed that only one study [4] out of six comparing the two approaches found any significant benefit in the transrectus positioning. A 2019 Cochrane review similarly could not demonstrate a lower rate of hernia if the stoma were placed through versus lateral to the rectus muscle [5]. It is noteworthy that another recent meta-analysis showed a significantly reduced incidence of

I. Seow-En
Department of Colorectal Surgery, Singapore General Hospital, Singapore, Singapore

Division of Colorectal Surgery, China Medical University Hospital, Taichung, Taiwan

Y.-Y. Tsai
Division of Colorectal Surgery, China Medical University Hospital, Taichung, Taiwan

W. T.-L. Chen (✉)
Division of Colorectal Surgery, Department of Surgery, China Medical University Hsinchu Hospital, Zhubei City, Hsinchu County, Taiwan
e-mail: wtchen@mail.cmuh.org.tw

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parastomal herniation with preoperative stoma site marking, which the authors suggested was a result of transrectus ostomy creation [6]. The ideal trephine size is not yet established, although an increased risk of herniation has been associated with a defect of 3 cm and above [7, 8].

The extraperitoneal technique of end stoma creation, described by Goligher in 1958, was devised to reduce small bowel internal herniation into the lateral peritoneal space [9]. This method was also found in a 2016 meta-analysis to have a significantly lower rate of parastomal herniation compared to the transperitoneal approach (6% vs 18%) as well as stomal prolapse rate (1% vs 7%) [10]. Similar benefits were reported with the "Goligher method" following a laparoscopic approach to bowel resection and stoma formation [11]. Many recent studies have also evaluated the utility of prophylactic mesh placement, either biologic or synthetic, at the time of permanent ostomy creation. A 2018 Cochrane meta-analysis of 10 randomized controlled trials with 944 patients looked at mesh placement for prevention of parastomal herniation [12]. Seven of these trials described an open sublay and three a laparoscopic intraperitoneal onlay method, of which the most recent [13] employed a laparoscopic modified Sugarbaker technique. The authors found that using a prophylactic mesh halved the incidence of hernia (41% vs. 22%) without increasing stoma-related infection rates, although the overall quality of evidence was low due to a high degree of clinical heterogeneity [12]. The 2018 European Hernia Society guidelines strongly recommend the use of a prophylactic nonabsorbable mesh upon the construction of an end colostomy [14].

The transrectus, transperitoneal route without the use of mesh prophylaxis is still a popular approach for end ostomy creation, and parastomal herniation remains a common complication. There are several different approaches to surgical repair of parastomal hernias. In this chapter, we evaluate the various methods with a focus on laparoscopic repair.

Indications

The best remedy for parastomal hernia is to reverse the stoma and restore intestinal continuity. This option may not be always possible, as in the case of an abdominoperineal resection. In our practice, end colostomies following abdominoperineal resections complicated by symptomatic parastomal hernias is the most common indication for surgery. Patients with bothersome symptoms, cosmetic concerns, or emergency indications should undergo surgical intervention. Based on current evidence no recommendation can be made for operative repair over regular observation for asymptomatic patients or those with mild complaints [14]. Support garments may improve some symptoms.

Surgical Approach

Options for surgical repair of parastomal hernias include local suture repair, stoma relocation, and various forms of mesh repair. Suture repair is the easiest method and avoids a repeat laparotomy or laparoscopy. After parastomal incision and hernia sac reduction, the fascial opening is narrowed using absorbable or nonabsorbable sutures. Of all methods, direct suture repair has the highest rate of hernia recurrence ranging from 46 to 100% [2], with an overall morbidity and infection rate of 23% and 12%, respectively [15]. Despite this, direct repair may have a role in selected emergency cases or frail patients who are unable to tolerate more major surgery. Stoma relocation involves resiting the stoma to a new position on the abdominal wall. While this has a lower recurrence rate (0–76%) than direct tissue repair [2], it is inferior to mesh repair and should only be used if the existing stoma site is unsatisfactory.

Mesh repair can be onlay (fixation onto the fascia of the anterior rectus sheath and aponeurosis of the external oblique muscle), retromuscular sublay (dorsal to the rectus muscle and anterior to the posterior rectus sheath), or intraperitoneal (intra-abdominal fixation onto the peritoneum) [14]. Two common methods are used for intra-

peritoneal prosthesis placement, the Sugarbaker technique, first described in 1985 [16], and the keyhole technique. A third method, the sandwich technique, involves a combination of both methods and uses two meshes. In a 2012 review, recurrence rates for mesh repair ranged from 7 to 17% and did not differ significantly between the different methods when open surgery was performed [15]. Overall morbidity and mesh infection rates were low and comparable for each type of mesh repair.

Perhaps the success of laparoscopy for ventral hernia repair has led to an increased uptake of the laparoscopic modality for parastomal hernia repair [17], with both having similar short-term outcomes [18]. A 2013 retrospective review of more than 2000 patients, of which 10% were performed by laparoscopy, showed that the minimally invasive approach was associated with a shorter operating time, decreased length of hospital stay, lower risk of morbidity, and lower risk of surgical site infection, following adjustment for all potential confounders including age, gender, ASA score, emergency or elective surgery, hernia type, and wound class [19]. Interestingly, while the intraperitoneal mesh techniques have similar recurrence rates when performed via open surgery, using laparoscopy the same meta-analysis reported the modified Sugarbaker approach having a significantly lower recurrence rate than the keyhole method [15]. Moreover, the laparoscopic sandwich method showed promising initial results [20] but requires further evaluation before routine use can be recommended [14].

OT Setup

Schematic of the operating setup and port positioning for repair of parastomal herniation of an end colostomy following abdominoperineal resection is shown in Fig. 1. The patient is placed supine. A 12 mm camera trocar is placed under direct vision at the right flank to avoid adhesions from previous midline surgery. Two 5 mm working trocars are placed at the right abdomen. Prophylactic intravenous antibiotics are given at anesthetic induction.

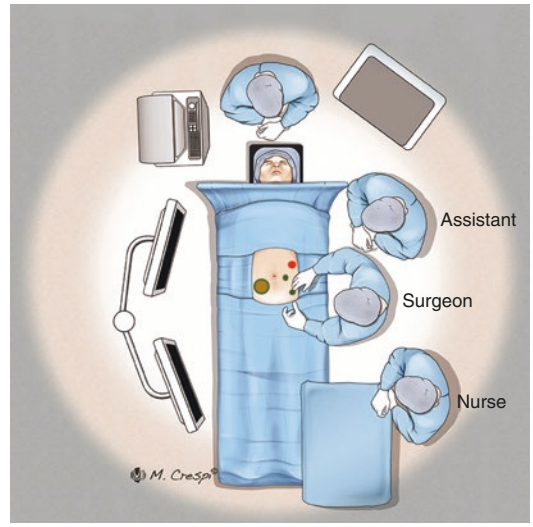

Fig. 1 Schematic of the operating setup and port placement for repair of a right lower quadrant parastomal hernia. The 12 mm camera port can be placed at either of the two superior "x" markings with 5 mm ports placed at the other two

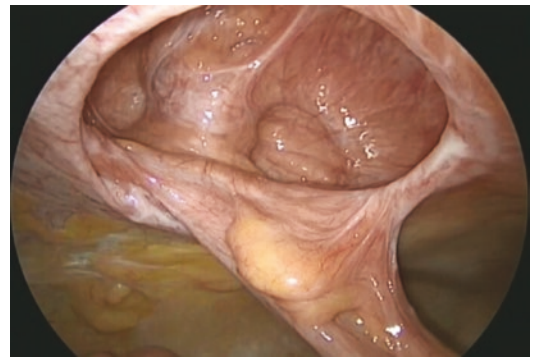

Fig. 2 Fascial defect and proximal bowel limb clearly seen following reduction of hernia sac and adequate adhesiolysis

Surgical Technique

Essential steps and technique

1. Adhesiolysis
2. Reduction of the hernia sac contents
3. Placement and fixation of the prosthesis

Following laparoscopic entry, adequate adhesiolysis and careful reduction of hernia sac contents are performed as per usual. The fascial defect should be clearly seen by the end of this process (Fig. 2). The keyhole technique uses a slit mesh

with a 2–3 cm "keyhole" cut-out to allow passage of the bowel while covering the entire fascial defect. There is a risk of bowel obstruction if too small a keyhole is made and risk of hernia recurrence if the keyhole is too large. The Sugarbaker technique is more easily accomplished by securing a piece of non-slit mesh over the entire fascial defect. We favor the latter technique, for its relative simplicity and lower recurrence rates.

In the Modified Sugarbaker method, the proximal bowel is anchored using Ethibond 2–0 to the peritoneum lateral to the hernial defect at two points (Fig. 3). The fascial defect can be accurately measured using a ruler (Fig. 4) to assist in preparation of the mesh. We use a Bard™ Composix™ E/X mesh, which is comprised of a synthetic layer of polypropylene, combined with a permanent barrier layer of expanded polytetrafluoroethylene (ePTFE) [21]. The mesh is first prepared externally. Appropriate mesh size is selected such that the fascial defect can be overlapped by 4–5 cm circumferentially after fixation [22]. A larger mesh can be chosen and trimmed if necessary. A length of Prolene 2–0 suture with a straight needle is anchored to the anticipated cranial end and another similar length anchored to the lateral aspect of the mesh, both on the synthetic side. The mesh is then tightly rolled up along with the attached straight needles and introduced into the abdomen through the 12 mm trocar.

Within the peritoneal cavity, the mesh can be unfurled and positioned with the synthetic surface facing up. The straight needles are passed through the anterior abdominal wall at the corresponding superior and lateral positions adjacent to the hernia defect (Fig. 5). The sutures are held with clamps and held taut; this two-point temporary fixation to the abdominal wall spreads the

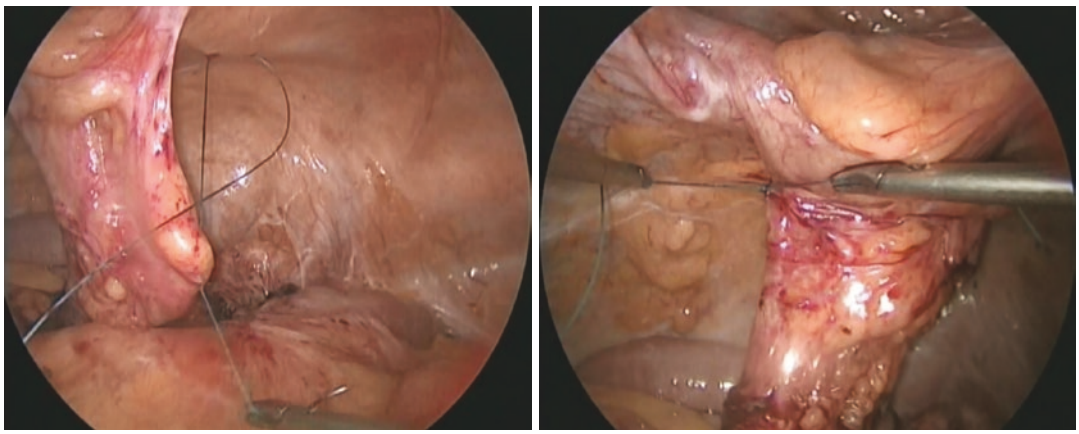

Fig. 3 The bowel limb is secured on either side to the peritoneum just lateral to the fascia defect

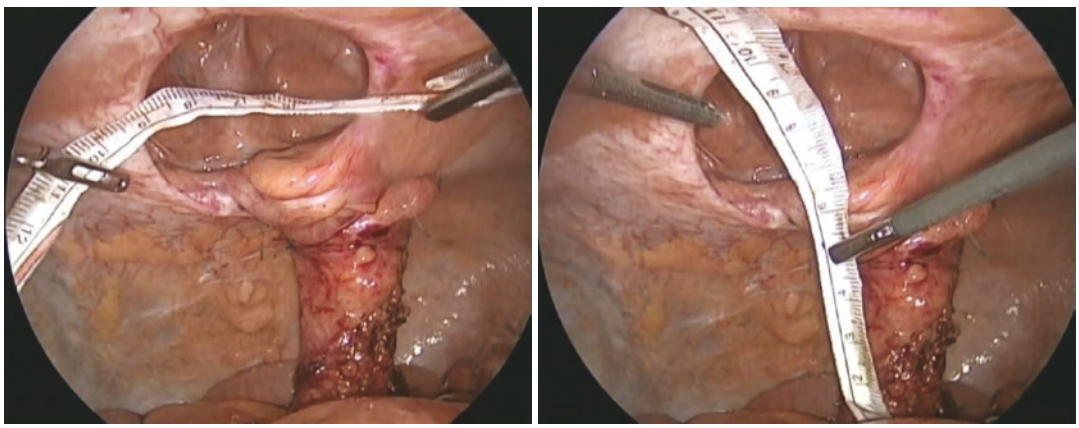

Fig. 4 The fascia defect is accurately measured to assist in mesh preparation

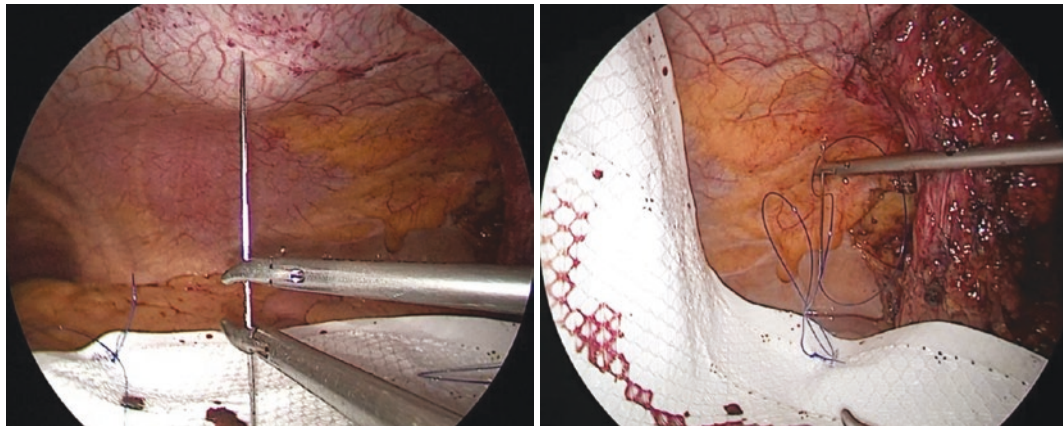

Fig. 5 Prolene 2/0 with straight needles are anchored to the mesh and passed through the anterior abdominal wall at the 12 and 3 o'clock positions

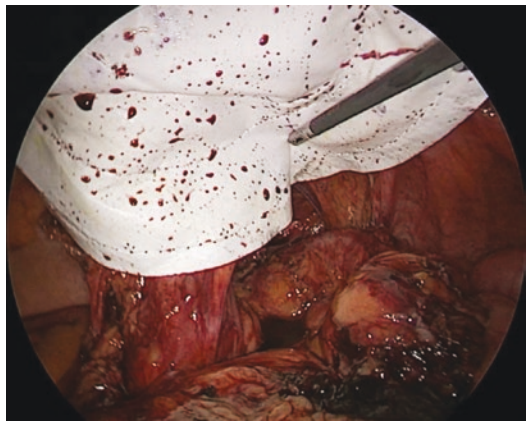

Fig. 6 Once the trans-fascial sutures are held taut, the mesh can be appropriately positioned to facilitate subsequent fixation

mesh out over its intended position to facilitate tacking (Fig. 6). Next, the mesh is secured using a ProTack™ Fixation Device in a double crown fashion (Fig. 7) just beyond the fascial defect and a second layer at the outer periphery of the mesh. While applying the tacks laterally it is important not to injure the bowel. A reasonable amount of space is left to accommodate passage of stool through the lateralized bowel "mesh flap valve." The trans-fascial Prolene 2–0 sutures can be cut externally, and the surgery is concluded.

The choice of mesh is an important consideration. Synthetic uncoated meshes, such as polypropylene, should not be used for intraperitoneal repair as they are associated with a significant risk of adhesions and mesh erosion [15, 23]. Biologic meshes have been shown to have high recurrence rates of 16–90% [24]. Composite prostheses are the ideal design for intraperitoneal hernia repair as these meshes comprise of a permanent synthetic material for the parietal side to encourage adhesion formation and an adhesion barrier layer for contact with the visceral side [21]. The adhesion barriers can either be absorbable or permanent. Thus far, ePTFE mesh has been the popular choice for laparoscopic Sugarbaker repair [17]. The advantage of ePTFE is the microporous structure which prevents tissue ingrowth into the prosthesis, with a low tendency for developing adhesions [25].

Surgeons should also be aware of mesh shrinkage over time. Shrinkage of the mesh and enlargement of the central hole is likely the greatest contributing factor to the higher reported recurrence rate of the keyhole method compared to the Sugarbaker technique [15]. It is therefore essential to achieve good mesh positioning and adequate fascial overlap of the mesh circumferentially.

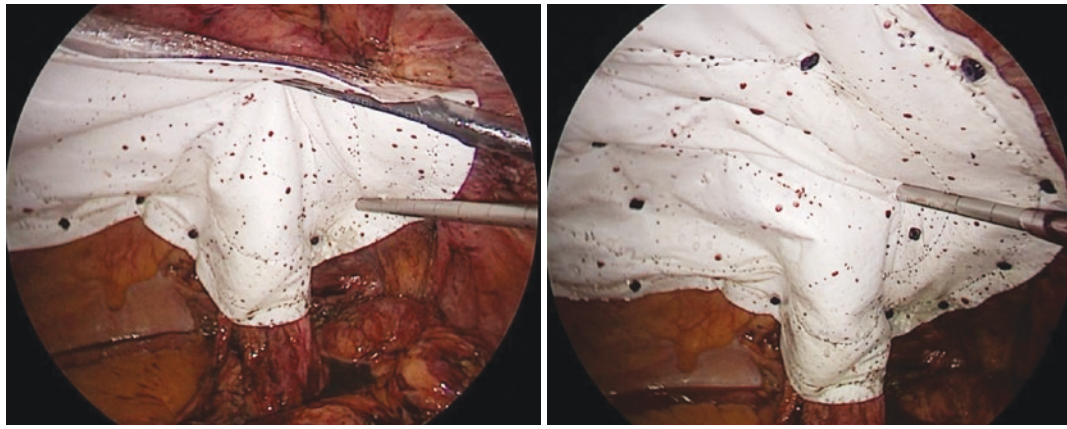

Fig. 7 The mesh is secured using the double crown method. (*left*) The outer layer of tacks is applied leaving adequate space for the lateralized bowel. (*right*) The inner layer of tacks applied just beyond the fascial defect

Complications and Management

A 2015 meta-analysis of laparoscopic parastomal hernia repair studied 15 articles with 469 patients [17]. The overall postoperative morbidity rate was 1.8%, with no differences between techniques. The most common complication was surgical site infection in 3.8%, with mesh infection occurring in 1.7% and obstruction requiring reoperation in 1.7%. The overall recurrence rate using laparoscopy for hernia repair was 17%, with the laparoscopic modified Sugarbaker technique showing superior recurrence rates at almost one-third that of the keyhole approach (10% vs. 28%).

Postoperative Care

The postoperative management of patients following parastomal hernia repair is similar to that of any incisional hernia repair. In general, no further antibiotics are given beyond the induction dose unless significant bowel manipulation and adhesiolysis were performed. The patient is advised to avoid heavy lifting and strenuous activity for 4–6 weeks and modifiable risk factors which can contribute to hernia recurrences are controlled.

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