Parastomal Hernia

41

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Abbreviations

PH	Parastomal hernia
cm	Centimeter
CT	Computed tomography
BMI	Body mass index
APR	Abdominoperineal resection
RCT	Randomized control trial
CI	Confidence interval
mm	Millimeter
ePTFE	Expanded polytetrafluoroethylene

Overview

Stomas are created for a number of emergent and elective gastrointestinal disease processes including colorectal cancer, fecal incontinence, constipation, diverticulitis, bowel obstruction, bowel ischemia, inflammatory bowel disease, and anal fistula. This chapter will provide an overview of parastomal hernias and explore the diagnosis, management, and prevention of this difficult clinical entity.

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Definition and Classification

A parastomal hernia (PH) can be defined as a protrusion in the vicinity of a stoma or as the abnormal protrusion of abdominal cavity contents through the abdominal wall defect resulting from colostomy, ileostomy, or ileal conduit creation [1, 2]. This chapter will focus on PHs relating to colostomies and ileostomies. A number of classification systems for PH have been proposed based on clinical, radiographic, or intraoperative findings but none have been accepted universally (Table 41.1) [3–6]. The classification systems have been criticized for including types that do not fulfill the definition of a hernia and for not including the presence of a concomitant incisional hernia. More recently, the European Hernia Society met to review the existing classification systems and expanded upon the definitions proposed by Gil and Szczepkowski to include a size cutoff of 5 centimeters (cm), but this new system has not yet been validated clinically [2].

Incidence

The incidence of PH has a broad range of 0–80 % and can vary based on the definition used, the method of diagnosis, and the surgical approach at time of stoma creation [7–9]. Cingi et al. noted an incidence of 52 % on physical exam, which increased to 78 % with the addition of computed tomography (CT) scan [10]. The incidence for end and loop colostomies are 4–48.1 % and 0–38 %, respectively, and are 1.8–28.3 % and 0–6.2 % for end and loop ileostomies, respectively [11].

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Table 41.1 Classification of parastomal hernias

Author year	Classification basis	Types	Clinical validation
Rubin [3]	Intraoperative findings	I: true PH	
		Ia: interstitial	No
		Ib: subcutaneous	
		II: intrastomal hernia	
		III: subcutaneous prolapse	
		IV: pseudohernia	
Devlin [4]	Intraoperative findings	I: interstitial hernia	Yes
		II: subcutaneous hernia	
		III: intrastomal hernia	
		IV: peristomal hernia (stoma prolapse)	
Moreno-Matias [5]	CT findings	0: peritoneum follows the wall of the bowel forming the stoma, with no formation of a sac	Yes
		Ia: bowel forming the colostomy with a sac < 5 cm	
		Ib: bowel forming the colostomy with a sac > 5 cm	
		II: sac containing omentum	
		III: intestinal loop other than bowel forming the stoma	
Gil and Szczepkowski [6]	Physical exam	I: isolated small PH	Yes
		II: small PH with cIH (without significant abdominal wall deformity)	
		III: isolated large PH (with significant abdominal wall deformity)	
		IV: large PH with cIH (with significant abdominal wall deformity	
Smietanski [2]	Intraoperative findings	I: PH < 5 cm without cIH	No
		II: PH 5 cm with cIH	
		III: PH > 5 cm without cIH	
		IV: PH > 5 cm with cIH	
		P: primary PH	
		R: recurrent PH	

PH parastomal hernia, *cIH* concomitant incisional hernia

Laparoscopic stomas with less than 1-year follow-up had a PH incidence of 0–6.7%, and the incidence was 6.7–12% for trephine stomas with 1-year follow-up [12]. The incidence reported from retrospective studies likely only captures those patients with symptomatic PHs, thus underestimating the true incidence. One series detected an 18% rate of asymptomatic PH [5]. Most PHs develop within the first 2 years after stoma creation with one series reporting development within 8 months of surgery [5, 13].

Pathophysiology

The true pathogenesis of hernia formation is not understood but there has been speculation relating to loss of tensile strength due to alterations in the type of collagen production. Junge et al. studied the ratio of type I to type III collagen in explanted meshes from inguinal and incisional hernias and found a significantly lower ratio in those meshes explanted for recurrence as compared to those explanted for chronic pain or infection [14]. A

similar lower ratio of type I to type III procollagen mRNA was seen in skin fibroblasts of hernia patients as compared to control groups [15]. Type I collagen is characteristically found in mature scar or fascia whereas type III collagen represents a less mechanically stable form found in the early phases of wound healing [16]. It has been hypothesized that alterations in collagen synthesis due to mutations within regulatory elements could be responsible for the "hernia disease phenotype" [17].

Risk Factors

Given the above hypothesis on collagen abnormalities, the presence of other hernias is a known risk factor for PH development [18, 19]. Increasing patient age, with some studies citing age > 60 years, is also a risk factor [18–23]. Female sex has also been shown to increase the risk of PH development [22, 23]. Conceivably, stoma aperture size, if created too large, can lead to PH formation [20, 23]. Comorbidities including obesity, chronic obstructive pulmonary disease, hypertension, and ascites were independent risk factors for PH development [12, 22]. PH prevalence more than doubled in one cohort study comparing those patients with a body mass index (BMI) ≥30 versus <30 and was also higher in another study when patients' waist circumference exceeded 100 cm [24, 25]. On the other hand, another study showed no significant risk between PH development and BMI or waist circumference [23]. Stomas are often created in patients with inflammatory bowel disease, and there has been a higher risk of PH noted in patients with Crohn's disease versus ulcerative colitis [26]. Risk factors for surgical site infections and wound dehiscence in general include smoking, diabetes mellitus, cardiovascular or pulmonary comorbidities, amount of blood loss, and type of surgery performed with the highest odds ratio (OR) for colorectal surgery [27]. The type of stoma created can also impact the rate of PH development with the highest rates occurring in colostomies compared to ileostomies with loop ileostomies having the lowest rates of PH [11, 28].

Complications

Complications associated with PH can be mild or severe ranging from abdominal discomfort to intestinal perforation requiring emergent laparotomy [10]. Approximately 30% of patients require repeat surgical intervention for PH related to bleeding, difficulty with appliance fit, fecal leakage, obstruction, and/or strangulation [29, 30]. Accordingly, recommended indications for repair include ileus, incarceration, or problems with appliance fit [31]. There have also been rare case reports of incarcerated stomach and gall bladder within PHs [32–35].

Prevention

Preoperative Considerations

Preoperative risk factor modification to reduce the likelihood of PH can be a challenge. The majority of patient characteristics associated with increased risk of PH including sex, age, presence of other hernias, or certain comorbidities are nonmodifiable. Tobacco cessation can be encouraged and efforts can be made to lose weight or optimize diabetes control preoperatively; however, these strategies cannot be employed for emergent procedures warranting ostomy creation.

Operative Considerations

In an early study, there was a significantly lower rate of PH when the stoma was brought out through the rectus abdominus muscle versus lateral to it [36], but more recent studies have concluded that stoma site, fascial fixation, or closure of the lateral space have no effect on PH formation [10, 12, 18, 19, 37]. A meta-analysis of 1071 colostomy patients showed a lower rate of PH with extraperitoneal colostomy creation compared to intraperitoneal colostomy [38]. The main interest in PH prevention is investigating the role of prosthetic mesh. The use of prophylactic mesh to prevent PH was reported as early as 1986

by Bayer et al. who had no PHs over a 4-year follow-up period in 43 patients who underwent placement of Marlex mesh (Phillips Petroleum Company, Bartlesville, OK) during colostomy creation [39]. Following Bayer's success, there have since been many observational studies that have evaluated the efficacy and safety of prophylactic mesh placement. Figel et al. demonstrated no mesh complications and no PH recurrences in 16 patients who underwent placement of a bioprosthetic mesh with a median follow-up of 38 months [40]. Gogenur et al. demonstrated no infectious complications, an 8% rate of minor complications, and an 8% rate of PH recurrence in 25 patients who had polypropylene mesh placed in the onlay position with a median follow-up of 12 months [41]. A small series of intraperitoneal onlay of polyvinylidene mesh during laparoscopic abdominoperineal resection (APR) showed no mesh-related complications, infections, or PH recurrence at a mean follow-up of 6 months [42]. A study by Nagy et al. evaluated the polypropylene hernia system large device in 14 cases after APR with sigmoid colostomy and noted no PH recurrence in the first postoperative year [43]. Marimuthu et al. studied a polypropylene monofilament mesh with a circle cut in it for the stoma placed preperitoneally without stitches in 18 patients and found no PH at a mean follow-up of 16–17 months. One patient required revision for stoma necrosis on postoperative day one and subsequently developed a wound infection, but no other complications were noted [44]. A prospective study of preperitoneal polypropylene mesh placed in 42 patients with a mean follow-up of 31 months demonstrated a PH incidence of 9.52% (4/42) [45]. Cost-effectiveness of mesh prophylaxis has also been studied by Lee et al. who looked at mesh prophylaxis in 60-year-olds who underwent APR with end colostomy for rectal cancer and found mesh prophylaxis to be less costly and more effective compared to no mesh for those patients with stage I–III rectal cancer [46]. A multicenter randomized control trial (RCT) by Hauters et al. evaluated 20 patients who underwent laparoscopic and open APR and had an intraperitoneal onlay mesh placed. One patient presented with mild stoma stenosis and one patient (5%) had a stoma bulge that was confirmed as a PH on CT scan [47]. Another RCT found decreased presence of radiographic PH in patients who had a lightweight intraperitoneal/onlay mesh placed during laparoscopic APR compared to those without mesh (50 versus 93.8%, $p=0.008$) [48]. The three RCTs by Hammond, Janes, and Serra-Aracil have been the most cited papers on the topic of PH prevention. In 2008, Hammond et al. published a RCT of 20 patients undergoing defunctioning stomas with a porcine-derived collagen implant placed in the sublay position in 10 of the patients. With a median 6.5-month follow-up, there were no PHs in the mesh group compared to 30% (3/10) in the nonmesh group, and there were no complications [49]. Janes et al. evaluated 54 patients undergoing permanent colostomy creation (27 patients with a conventional stoma and 27 with placement of a sublay large-pore light weight polypropylene and polyglactin mesh) and found a lower rate of PH 4.8% (1/21) in the mesh group compared to 50% (13/26) in the nonmesh group at 12-month follow-up. There were no infectious complications [50]. A 5-year follow-up study again revealed a lower rate of PH in the mesh group at 13.3% (2/15) versus 81% (17/21) in the nonmesh group ($p<0.001$) [9]. The RCT by Serra-Aracil evaluated 54 patients undergoing end colostomy for distal rectal cancer and utilized a sublay lightweight mesh in 27 patients. At a median 29-month follow-up, there were fewer PHs in the mesh group at 14.8% (4/27) compared with 40.7% (11/27) in the nonmesh group ($p=0.03$), and the morbidity between the two groups was similar [51]. In 2012, Sajid et al. and Shabbir et al. performed systematic reviews of the RCT literature. Sajid et al. analyzed the three RCTs by Janes, Hammond, and Serra-Aracil encompassing 128 patients who underwent colorectal resections with stoma creation (64 patients in the mesh group versus 64 patients in the nonmesh group), and found an OR of 1.0 (95% confidence interval [CI] 0.36–3.2, $p=1.0$) for developing postoperative complications and an OR of 0.11 (95% CI 0.05–0.27, $p<0.00001$) for developing a PH with the use of mesh [52]. Shabbir et al. reviewed 27 RCTs and excluded all but the same three RCTs as the Sajid paper.

This review demonstrated an incidence of PH of 12.5% (8/64) in the mesh group compared to 53% (34/64) in the control group ($p<0.0001$). There were no differences in mesh-related complications between the two groups [53]. A similar systematic review that included the same three RCTs but also three prospective observational studies and one retrospective study also found a lower rate of PH in the mesh group at 7.82% (14/179) versus 55% (32/58) in the nonmesh group with similar morbidity during a follow-up period ranging 1–83 months [54]. All three systematic reviews concluded that the use of prophylactic mesh at the time of stoma creation can reduce the incidence of PH. A multicenter RCT in the Netherlands known as the PREVENT trial is currently underway and is evaluating whether prophylactic lightweight monofilament polypropylene mesh in a preperitoneal, retromuscular position reduces the incidence of PH formation in patients undergoing elective formation of permanent end colostomies via an open procedure. Follow-up is scheduled for 3 weeks,; 3 months; 1, 2, and 5 years postoperatively [55].

Diagnosis

History and Physical Exam

In a series by Moreno-Matias, 27 of the 33 patients (85%) with clinically detectable PHs had associated symptoms including pain on exertion, interference with irrigation devices, or detachment of the appliance with changes in position [5]. A study of the French federation of ostomy patients found 76% patients suffered symptoms related to PH including pain, difficulty with appliance fit or leakage [21]. Physical exam can show bulging with a Valsalva maneuver or palpation of a fascial defect [10], but one study demonstrated low interobserver reliability in diagnosing PH based on patient history and clinical examination [56]. Median length of time between the formation of the stoma and the diagnosis of the PH was 44 months (0–331 months) in one study [57].

Imaging

Imaging can be used as an adjunct to clinical exam in diagnosing PH and, as previously mentioned, may increase the rate of PH detection [5, 10, 23]. However, some PH may not be detected by CT scan [5, 56]. Janes et al. recommended performing CT scans in the prone position and demonstrated good correlation between clinical and radiographic diagnoses when doing so [58]. Contrast can be administered via the stoma to better delineate the anatomy and patency of the bowel. Intrastomal ultrasonography utilizing a 9 MHz probe with rectal setting and render mode enabled the real-time identification of fascia, bowel, rectus muscle, and mesh and had the added benefit of evaluating the patient in the upright and supine positions [59]. As with all ultrasound, diagnostic utility is dependent on availability, operator experience, and equipment quality. Magnetic resonance imaging is rarely needed for PH diagnosis but can be considered in the case of diagnostic uncertainty or in the presence of contraindications to ionizing radiation and should include the diffusion-weighted imaging sequence [60].

Management

Nonoperative Management

Nonoperative management may be attempted pending the patient's level of discomfort or the severity of the PH complications. Expert consultation with a stoma nurse, if available, can be helpful. A flexible appliance can mold to uneven contours of the skin, and aperture size should leave no more than a 2–3 mm rim around the stoma [61, 62]. Protective skin sealants may improve appliance adhesion and stoma belts may improve appliance security [63]. Similarly, abdominal binders may relieve the discomfort caused by the PH [63].

Operative Management

Open Approach

The various approaches to open PH repair include primary fascial repair, stoma reversal, stoma relocation, or repair utilizing a mesh material. Stoma reversal is not an option in every clinical situation. Primary fascial repair after hernia sac reduction results in recurrence rates of 46–100% [3, 64–67]. Local fascial repair has the theoretical benefit of minimizing morbidity by avoiding a laparotomy but overall complication rates associated with this repair have been reported at 50% [3]. A 2012 systematic review by Hansson et al. deemed fascial repair outdated due to an overall morbidity rate of 22.6, 11.8% surgical site infection and 69.4% rate of recurrent PH [68]. Stoma relocation can result in recurrent PH in 0–76.2% of patients [3, 64–66, 69–71]. Stoma relocation can carry the added risk of a laparotomy and thus create three potential sites for hernia formation; however, in one series, 76% of stoma relocation cases were successfully accomplished without a laparotomy [64]. Incisional hernia development at the site of the prior stoma can occur in as many as 50% [60]. Overall complication rate for stoma relocation was 88% [3].

Given the high recurrence and complication rates for the above approaches, the use of prosthetic mesh material has gained in popularity. The mesh can be placed in a number of anatomical locations including onlay, inlay, sublay and intraperitoneal. In the onlay technique, the mesh is placed extraperitoneal, on the top of the musculofascial layer. A recent systematic review demonstrated an overall morbidity rate of 12.7%, 1.9% surgical site infection, 2.6% mesh infection, 8.2% rate of other complications, and an 18.6% recurrent PH rate with the onlay technique [68]. The inlay method of placing the mesh within the fascial defect and suturing it to the fascial edges has been abandoned. In the sublay technique, the mesh is placed in a retromuscular or preperitoneal space either via an incision around the stoma, to the side of the stoma, or via a vertical incision that can enable mesh coverage of the midline anterior abdominal wall. A wound infection rate of 4.8%, no mesh infections or other complications, and a 6.9% recurrent PH rate have been reported with the sublay technique [68]. Sugarbaker was the first to introduce an intraperitoneal mesh repair in 1985 describing a technique of securing the mesh circumferentially around the entire fascial defect with the exception of lateral to the stoma allowing for the creation of a flap valve [72]. This technique was 100% successful in his series of seven PHs with a 4–7-year follow-up period [72]. A retrospective review of 20 paracolostomy hernia repairs using the open Sugarbaker technique resulted in 5% wound infection and 15% recurrence rate [73]. An alternative intraperitoneal technique is the keyhole method in which a small hole corresponding to the size of the stoma is cut out of the mesh to enable the stoma to pass through while still covering the entirety of the fascial defect as described in van Sprundel's study [74]. A review of this study and three others resulted in an overall morbidity rate of 22%, wound infection rate of 2.2%, and a recurrent PH rate of 9.4% [68]. There have been a number of studies evaluating the outcomes of each of the techniques; however, most studies consist of a very small case series of patients. Table 41.2 shows the outcomes for those studies with greater than or equal to ten patients.

Laparoscopic Approach

Laparoscopy has the added benefit of limiting the potential sites for new hernia formation. Similar to open intraperitoneal repairs, a modified Sugarbaker and the keyhole technique can be utilized laparoscopically in addition to a combination of the two methods known as the sandwich technique. The sandwich technique utilizes two pieces of mesh; the first in a fashion similar to the keyhole technique with an additional piece of mesh covering the first piece of mesh and the remaining abdominal wall [75]. The 2012 Hansson review evaluated 11 laparoscopic PH repair studies which demonstrated a 3.6% conversion to open, 4.1% iatrogenic bowel injury, overall morbidity of 17.2%, 3.3% wound infection, 2.7% mesh infection, and 11.6% recurrence rate for the Sugarbaker technique versus 34.6% recurrence for the keyhole technique versus 2.1%

Table 41.2 Outcomes of open parastomal hernia repairs with greater than or equal to ten patients

Study	No of repairs	Type of repair and mesh	Recurrence (%)	Complications excluding recurrence (%)	Infection (%)	Mean follow-up (range)
Onlay						
Steele et al. [79]	58	"Stove pipe hat" polypropylene	26	20.6	3	50.6
Geisler et al. [80]	16	Nonabsorbable	63	–	13	39
de Ruiter and Bijnen [81]	46	Central ring enforced polypropylene mesh prosthesis	15.9	–	Early 4.3 Late 2.3	60 (12–156)
Luning and Spillenaar-Bilgen [82]	16	Keyhole -Polypropylene -Polyethylene -Vicryl and Central ring enforced polypropylene mesh prosthesis	19	12.5	6.2	33 (6–110)
Heo et al. [83]	17	Prolene	11.8	17.6	0	29.6
Smart et al. [84]	27	Acellular porcine dermal collagen mesh	55.6	7.4	3.7	16.6[a] (0.2–39.3)
Sublay						
Egun et al. [85]	10	Keyhole Polypropylene	0	70	20	54 (22–69)
Longman and Thompson [86]	10	Keyhole Polypropylene	0	10	0	30[a] (2–40)
Guzman et al. [87]	25	Keyhole Polypropylene	8	16	8	12 (8–24)
Liu et al. [88]	34	Polypropylene	6.3	26.5	3	32 (6–75)
Fei [89]	11	Modified sublay keyhole Polypropylene	9	27	0	23.5 (11–39)
Intraperitoneal						
Hofstetter et al. [90]	13	Keyhole PTFE	0	0	0	–
Stelzner et al. [73]	20	Sugarbaker/ Rives-Stoppa ePTFE	15	20	5	42 (3–84)
van Sprundel and van der Hoop [74]	15	Keyhole ePTFE	6.7	0	26.7	29[a] (5–52)

ePTFE expanded polytetrafluoroethylene[a] Denotes median follow-up

recurrence for the sandwich technique, although the latter was based solely on one series of 47 patients [68]. The Sugarbaker technique resulted in a significantly lower PH recurrence rate compared to the keyhole technique (OR 2.3, 95% CI 1.2–4.6, $p=0.016$) [68]. Table 41.3 shows the outcomes of laparoscopic PH repair studies with greater than ten patients.

It is our preference to perform the laparoscopic modified Sugarbaker technique for PH and recurrent PH repairs. A first-generation cephalosporin is given within 1 h of the incision. Laparoscopic monitors are positioned on both sides of the patient. After induction of general anesthesia, the patient is placed in the supine position with both arms tucked and a Foley catheter is placed into the bladder, if needed. An additional Foley catheter is placed into the ostomy to allow for easy identification of the correct loop of intestine, which can be helpful in the case of dense adhesions. The abdomen, stoma, and additional Foley catheter are prepped and then covered by an Ioban drape (3M Company, St. Paul, MN). A Veress needle placed subcostally in the left upper quadrant in the midclavicular line is utilized to gain access to the peritoneal cavity. Once adequate pneumoperitoneum is obtained (15 mm Hg of carbon dioxide), a 5-mm Optiview port is used to enter the peritoneal cavity laterally, on the side opposite of the stoma. Two additional 5-mm trocars are placed in the lateral position near the Optiview port. External manipulation of the Foley catheter in the ostomy can help to identify the loop of bowel ending in the ostomy and can guide lysis of adhesions accordingly (Fig. 41.1). Once adhesiolysis is complete, the hernia contents, with the exception of the stoma, can be reduced. Now the entire abdominal wall and the hernia defect, including any coexisting ventral or incisional hernia defects, can be visualized and measured. Spinal needles are used to mark the extent of the defect at the superior, inferior, and lateral most aspects. A laparoscopic ruler is then inserted to measure the extent of the defect from superior to inferior spinal needles for length and from lateral to lateral spinal needles for width. The defect is also measured and marked on the patient's abdominal skin to assist with centering the prosthesis later in the procedure (Fig. 41.2). The size of mesh is selected based on the defect measurements and allowing for a 5-cm overlap beyond all fascial edges. The mesh is then trimmed to the appropriate size. We, like the majority of studies in Table 41.3, utilize expanded polytetrafluoroethylene (ePTFE, Gore DUALMESH; W.L. Gore, Flagstaff, AZ). The textured surface of the mesh is marked to identify the superior and inferior portions of the mesh. A single Gore-Tex transfascial suture (CV-0) is placed at the edge of the mesh on the three of the four sides that are not associated with the stoma. Two Gore-Tex transfascial sutures are placed on the fourth side on either side of where the stoma will lay creating a mesh flap valve. A 5-mm trocar is then placed in the lateral abdomen on the ipsilateral side of the stoma. A 12-mm trocar is placed through the hernia defect where it will later be covered by the mesh repair to prevent the risk of trocar site hernia. The two marked edges of the mesh are rolled tightly toward one another, and an additional mark is made on the rolled mesh for orienting purposes. A grasper is placed through the ipsilateral trocar and is brought out through the 12-mm trocar where it grasps the mesh helping to guide it into the abdomen (Fig. 41.3). The mesh is unrolled utilizing two graspers and oriented according to the earlier markings. The open jaws of an atraumatic bowel grasper are used to measure a 5-cm overlap from the edge of each of the fascial defects and these areas are marked with new spinal needles. A suture passer is used to pass the transfascial sutures through the sites marked by the new spinal needles while being careful to avoid the stoma as it traverses the edge of the mesh (Fig. 41.4). The mesh flap valve is crafted such that the stoma crosses the lateral or inferior edge. The transfascial sutures are secured with hemostats rather than tied until the most ideal mesh coverage and placement has been achieved. A laparoscopic tacker is used to secure the mesh in place circumferentially with the exception of around the stoma (Fig. 41.4). Additional Gore-Tex transfascial sutures are placed with a suture passer every 4–5 cm around the mesh. The transfascial sutures are tied with their knots in the subcutaneous tissues, and the skin is freed

Table 41.3 Outcomes of laparoscopic parastomal hernia repairs with greater than ten patients

Study	Type of repair and mesh	No of repairs	Conversion (%)	Recurrence (%)	Complications excluding recurrence (%)	Infection (%)	Median follow-up (range)
LeBlanc et al. [91]	Sugarbaker/ Keyhole ePTFE	12	0	8.3	33	0	20[a] (3–39)
Berger and Bientzle [75]	Sugarbaker/ Sandwich ePTFE and polyvinylidene fluoride	66	1.5	12	10.6	4.5	24 (3–72)
Mancini et al. [77]	Sugarbaker ePTFE	25	0	4	12	8	19 (2–38)
McLemore et al. [92]	Sugarbaker/ Keyhole ePTFE	19	–	10.5	63	11	20[a]
Craft et al. [93]	Sugarbaker/ Keyhole ePTFE	21 (incl. 9 IC)	0	4.8	48	14	14 (1–36)
Berger and Bientzle [94]	Sandwich polyvinylidene fluoride	47 (+297 IH)	0	2	–	1.2 (entire 344 pt cohort)	20
Hansson et al. [95, 96]	Keyhole ePTFE	54	14.5	37	14.4	3.6	36 (12–72)
Pastor et al. [97]	Sugarbaker/ Keyhole PTFE	12	8.3	33.3	33.3	25	13.9
Liu et al. [98]	CK parastomal patch	24	25	4.2	33	0	27[a] (6–39)
Wara and Andersen [78]	Keyhole Polypropylene and PTFE	72	4	3	22	4.2	36 (6–132)
Mizrahi et al. [76]	Keyhole Bard CK parastomal hernia patch polypropylene and ePTFE	29 (incl. 1 IC)	6.9	46.4	17.2	3.4	30 (12–53)

ePTFE expanded polytetrafluoroethylene, *incl.* including, *IC* ileal conduit, *IH* incisional hernia, *pts* patients[a] Denotes mean follow-up

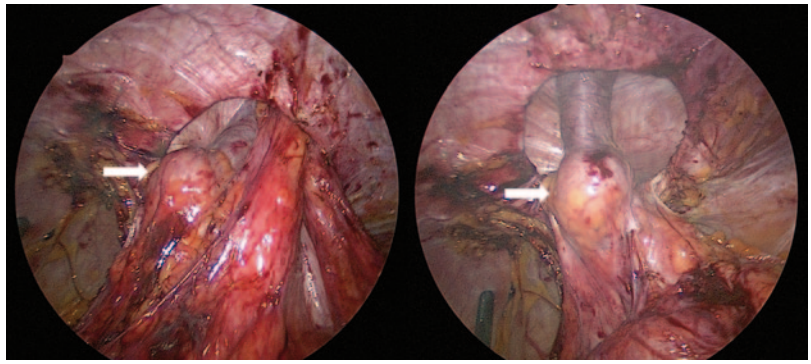

Fig. 41.1 Foley catheter balloon (*white arrow*) placed in the ostomy helps to localize the correct loop of intestine, especially during adhesiolysis

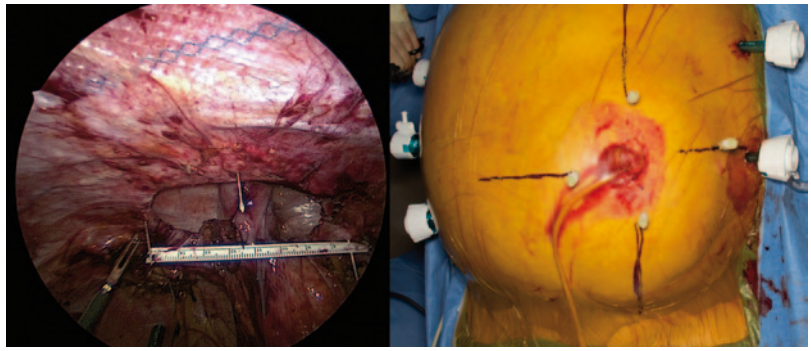

Fig. 41.2 A laparoscopic ruler is used to measure the hernia defect size (*left*) as delineated by externally placed spinal needles (*right*)

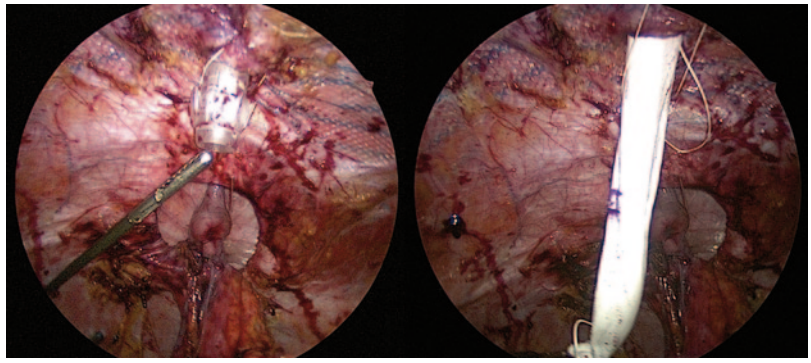

Fig. 41.3 A grasper is placed into the trocar on the ipsilateral side of the stoma and brought through the 12-mm port (*left*) to guide the mesh into the abdomen (*right*)

from the knot with a hemostat. The trocar sites are closed with 4-0 monocryl suture and the stab incisions from the suture passer are closed with skin adhesive. Final repair is shown in Fig. 41.5.

Postoperative Complications

The overall complication rate for PH repair has been reported as high as 65 % [57]. Complications

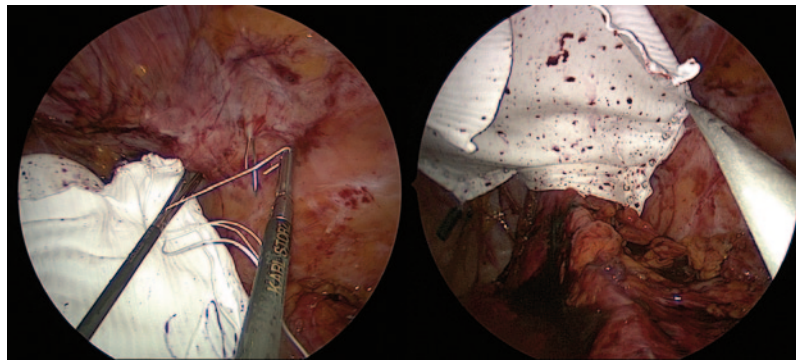

Fig. 41.4 The transfascial sutures are pulled through at a point allowing for a 5-cm overlap of the mesh from the fascial edge (*left*) and the mesh is further secured into place with a tacker (*right*)

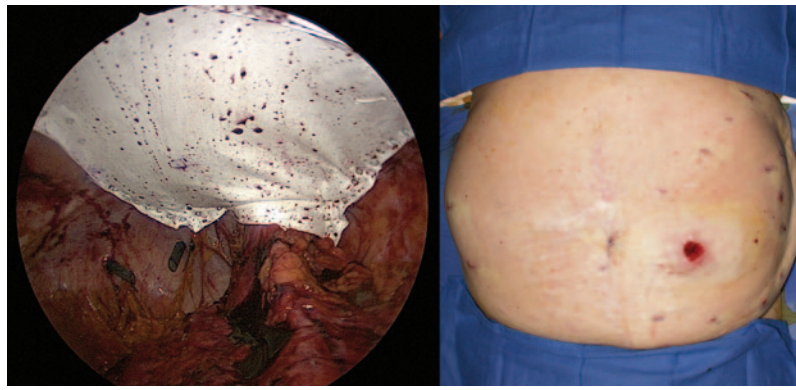

Fig. 41.5 View of the final sugarbaker repair internally (*left*) and externally (*right*)

include infectious (wound infection, mesh infection, abscess, urinary tract infection), stoma complications (necrosis, stenosis, obstruction, bleeding), intraoperative (enterotomy either recognized or unrecognized), general postoperative complications (ileus, cardiopulmonary), recurrence, and death. Logistic regression analysis from the 2012 Hansson systemic review demonstrated a significantly increased risk of recurrence and wound infection for primary suture repair compared to the other techniques. Interestingly, primary suture repair aside, the other open techniques did not differ compared to the laparoscopic approach with respect to mesh infection, overall postoperative morbidity, or recurrence. Mortality rates range from 3 to 7% and are higher in emergent compared to elective cases [7, 57, 75–78].

Management of Recurrent Parastomal Hernias

Repair of recurrent PHs poses the same challenges as initial PH repair, and the data for recurrent repairs are limited. In Sugarbaker's original description, six of the seven PHs in his series were recurrent PHs, and he reported 100% success rate [72]. In another study; however, fascial repair failed in all cases, stoma relocation failed in 71%, and fascial repair with prosthetic material failed in 33% [3]. We approach recurrent PH much the same as for initial PH with a laparoscopic modified Sugarbaker technique as described above.

Key Points: Diagnosing/Managing Parastomal Hernia

1. Parastomal hernia is almost an inevitable occurrence after stoma creation with an incidence reported as high as 80%.
2. Imaging with CT scan, particularly in the prone position or with the Valsalva maneuver, or with intrastomal ultrasonography can be used as an adjunct to clinical diagnosis.
3. One-third of patients with parastomal hernia end up undergoing reoperation usually for bowel obstruction or incarceration or due to poor appliance fit.
4. For open repairs, the use of mesh in a sublay or intraperitoneal position is favored.
5. For laparoscopic repairs, the Sugarbaker technique has a lower recurrence rate at 11.6% versus the keyhole technique at 34.6%.

Key Points: Avoiding Parastomal Hernia Complications

1. Many risk factors for parastomal hernia are nonmodifiable including age, female sex, and comorbidities such as chronic obstructive pulmonary disease, hypertension, or Crohn's disease, but risk factors such as increased body mass index, tobacco use, and diabetes control should be optimized as much as possible, especially for elective cases.
2. Primary fascial repair of parastomal hernias carries an increased risk of wound infection and recurrence and should be avoided.
3. The use of prosthetic mesh in parastomal hernia repairs decreases the rate of recurrence.
4. The use of prophylactic prosthetic mesh has been shown to decrease the rate of parastomal hernia development and has not been associated with increased infectious complications.
5. The data on managing recurrent parastomal hernias is limited but repair with prosthetic mesh is advised.

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