Chapter 11

Parastomal Hernia

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Abstract

Parastomal hernia (PSH) is a type of incisional hernia defined as a protrusion of abdominal contents through a weakness in the abdominal wall. PSH is the most common and significant complication following enterostomy construction, with an incidence of 30–50%. The risk is higher in colostomies than in ileostomies. Diagnosis of PSH is based on clinical examination or imaging. Most patients with PSH are usually asymptomatic. On the other hand, PSHs may affect an individual's physical function and decrease their quality of life. Surgical repair is indicated in 10–30% of patients with PSH. For repair, no single technique is superior to another. Therefore, several surgical methods have been developed and attempted, including primary repair, stoma relocation, and repair with different types of mesh either via the open or laparoscopic approach. However, high recurrence rates have been reported after repair. Because this is a difficult and problematic entity, the prevention of PSH occurrence is clearly the most appropriate management approach.

Keywords: parastomal hernia, repair, Sugarbaker, laparoscopy, prevention, mesh

1. Introduction

Ostomy creation is usually associated with potential weakness of the abdominal wall, and parastomal hernia (PSH) is a common complication of permanent stoma formation [1, 2]. PSH is a type of incisional hernia located near an intestinal stoma (**Figure 1**). Although PSH is rare (ranges from 0 to 3%) in the early postoperative period, it occurs most commonly within the first 2 years after surgery, with a prevalence of 30–50%, and the risk persists for more than 20 years [2–4]. Ostomy creation and one of its major complications, PSH may negatively affect an individual's physical function and quality of life (QoL) [5]. There is no current consensus on the surgical procedure or optimal technique for stoma formation [1, 6]. On the other hand, high recurrence rates have been reported after repair [1, 3, 7]. Presently, the prevention of PSH development is clearly considered the best management approach for this difficult and problematic entity [1–4, 8]. In this chapter, an overview of parastomal hernia will be presented, and its clinical features, incidence and risk factors, preventive strategies, and surgical management techniques will be discussed.

Figure 1. A patient with parastomal hernia on the left side of the abdominal wall.

2. Incidence and risk factors

It is difficult to establish the exact incidence of PSH; however, it has been estimated at 4–48% for colostomies and 2–28% for ileostomies in surgical practice [1, 6] (**Table 1**). This discrepancy is presumably because of the lack of a consistent definition of PSH, variations in clinical or radiological diagnostic methods (which have yet to be standardized), variations in follow-up time, and small or heterogeneous patient groups [4, 6, 9–11]. The use of imaging methods, such as ultrasonography (US) or computed tomography (CT), may have contributed to the high PSH rates reported during the last years because they can detect smaller hernias that are not apparent at clinical examination [2, 4, 6]. Cingi et al. [12] reported a PSH incidence of 52% at physical examination, while it was up to 78% with the addition of CT scan. Although majority of parastomal hernias most commonly occur within the first 2 years, the risk of herniation persists for up to 20 years following stoma creation [3, 6]. The lower rate for loop stoma, especially loop ileostomy, is most probably associated with the temporary nature of loop ostomies and the short follow-up period [1]. Rates of PSH after laparoscopic stoma formation are low and have been reported in the range of 0–6.7% [1, 8]. However, there is some evidence that PSHs are more common after laparoscopic surgery than after open surgery

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(18 vs. 2%, respectively; $p = 0.04$), especially when the specimen is removed from the future ostomy site [13].

Development of parastomal herniation has been associated with patient- and technical-related risk factors (**Table 2**). Patient-related risk factors for parastomal hernia include female sex; age >60 years; obesity (waist circumference of >100 cm or body mass index of >25 kg/m^2); smoking; comorbidities such as hypertension, chronic respiratory disease, and ascites; poor nutritional status; inflammatory bowel disease; immunosuppression; corticosteroid use; postoperative sepsis; concomitant incisional hernia; and increases in intra-abdominal pressure [8, 10, 11, 14, 15]. Surgery or technique-specific factors that should be taken into consideration include emergency stoma placement, the type of stoma (**Table 1**), surgical technique for ostomy construction, the diameter of the trephine, or size of the aperture in the abdominal wall, bringing the stoma out through the resection site, placement of prophylactic mesh, and position of the stoma [2, 6, 7, 10, 16]. However, the exact pathogenesis of PSH formation remains unclear. A reduction ratio of mature type I collagen to immature type III collagen during healing is thought to be a contributing factor to PSH formation [8, 17].

Type of enterostomy	Incidence of PSHs (%)
Loop ileostomy	0–6.2
Loop colostomy	0–30.8
End ileostomy	1.8–28.3
End colostomy	4–48.1
Laparoscopic stoma formation	0–6.7
Trephine stoma formation	6.7–12
Placement of prophylactic mesh	0–8.3

Table 1. Incidence of parastomal hernias for different types of enterostomies.

Patient-related risk factors		Technique-specific factors
Age	Hypertension	Emergency surgery
Female gender	Steroids	Colostomy > ileostomy
Obesity	Immunosuppression	End stoma > loop stoma
Malnutrition	Postoperative sepsis	Stoma aperture size
Smoking	Ascites	Trephine size
Inflammatory bowel disease	Concomitant incisional hernia	Preventing mesh placement
Chronic obstructive pulmonary disease	Increased intra-abdominal pressure	Stoma placement - Transrectal > lateral pararectal

Table 2. Risk factors for the development of a parastomal hernia.

3. Clinical features, diagnosis, and classification

PSHs are mostly asymptomatic; as with other types of hernias, patients generally present with a bulge or a protrusion near the stoma. However, some patients may complain of mild abdominal discomfort or pain, intermittent cramping, distention, difficulty with device application, and life-threatening complications such as strangulation, perforation, and obstruction [1, 5, 7, 9, 10]. Furthermore, in almost all patients with PSH, a significant decline in QoL is observed [5].

As a rule, PSHs are typically diagnosed clinically by history and physical examination [2, 4, 15, 18]. However, in case of doubt, imaging studies such as CT scan and US should be performed as an adjunct to clinical evaluation [2, 4, 10, 12, 18, 19] (**Figure 2**). Assessment of the patient in the upright and supine positions is important for an adequate physical examination. The Valsalva maneuver in the standing position, straight leg raising in the supine position, or coughing can increase the detection of PSHs and should be performed in this evaluation [2, 15, 17]. In addition, Jänes et al. [20] claimed that CT scan in the prone position and placement of the stoma in the center of an inflatable plastic ring produced a stronger correlation with clinical findings than that of conventional tomography.

There are several classification systems for PSH that are based on clinical, radiological, or intraoperative criteria; however, none of the classification proposals have been universally adopted because each has its own limitations (**Table 3**). Although these classification systems may be useful in academic research, there is little requirement for them in clinical practice because assessment, management, and diagnosis are usually based on symptoms and clinical

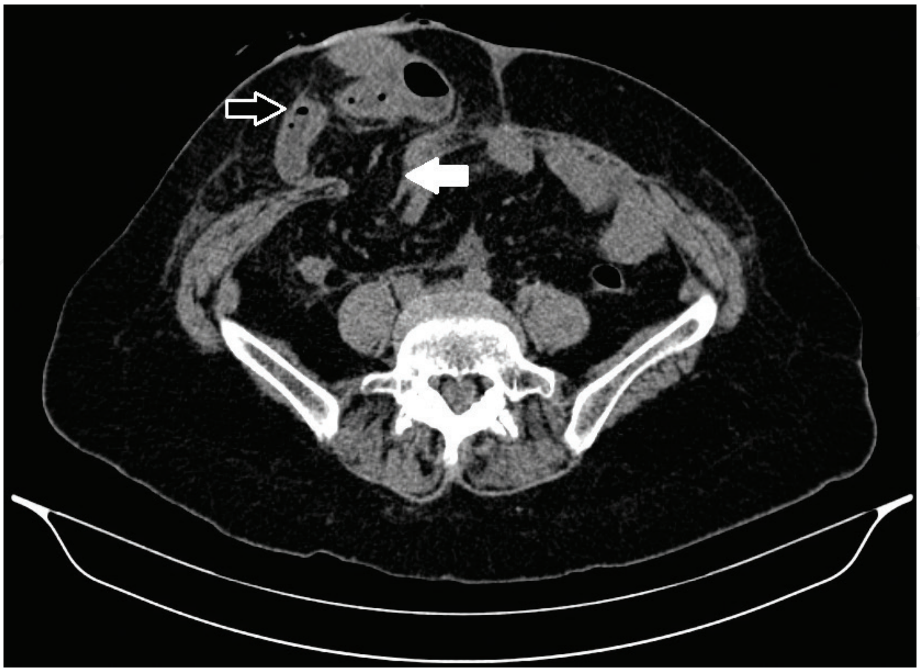

Figure 2. An axial CT scan showing a fascial defect (white arrow) and a parastomal hernia (black/white arrow).

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examination. More recently, the European Hernia Society assembled to review the existing classification systems and expanded upon the definitions proposed by Gil and Szczepkowski to include a size cutoff of 5 cm; however, this new system has not yet been validated as a clinical tool [8, 18, 19, 21–24].

Author and year	Classification proposals
Devlin (1983) [22] • Intraoperative findings • Clinical validation: Yes	Type I: interstitial hernia Type II: subcutaneous hernia Type III: intrastomal hernia Type IV: peristomal hernia (stoma prolapse)
Rubin (1993) [23] • Intraoperative findings • Clinical validation: No	Type I: true PSH Type Ia: interstitial Type Ib: subcutaneous Type II: intrastomal hernia Type III: subcutaneous
Moreno-Matias (2007) [19] • Tomography findings • Clinical validation: Yes	Type 0: peritoneum follows the wall of the bowel forming the stoma, with no formation of a sac Type Ia: bowel forming the colostomy with a sac of <5 cm Type Ib: bowel forming the colostomy with a sac of >5 cm Type II: sac containing omentum Type III: intestinal loop other than bowel forming the stoma
Gil and Szczepkowski (2011) [24] • Physical examination • Clinical validation: Yes	Type I: isolated small PSH Type II: small PSH with cIH (without any wall deformity) Type III: isolated large PSH (with abdominal wall deformity) Type IV: large PSH with cIH (with abdominal wall deformity)
Śmietański (2013) [21] • Intraoperative findings • Clinical validation: No	Type I: PSH <5 cm without cIH Type II: PSH 5 cm with cIH Type III: PSH >5 cm without cIH Type IV: PSH >5 cm with cIH P → primary PSH R → recurrent PSH

Abbreviations: PSH, parastomal hernia; cIH, concomitant incisional hernia.

Table 3. Hernia types in different classifications with basis of classification and clinical validation.

4. Treatment strategies

4.1. Conservative management

Most patients with PSH are usually asymptomatic; therefore, they can be managed conservatively [1, 2, 6, 13, 16, 25]. Conservative management is preferred because surgical treatment can be challenging, with no guarantee of success. Patients who agreed to be followed up with nonoperative approaches should be educated about life-threatening signs and symptoms and should be prompted to seek medical assistance to avoid a delay in diagnosis. The uses of stomal-supporting devices, such as abdominal support belts especially while undertaking heavy work during the first year after the surgery, patient education regarding the avoidance of lifting heavy objects, weight loss, diet changes, and abdominal exercises to strengthen the abdominal muscle, are successful strategies for conservative management of PSHs [2, 15, 18, 26]. Unfortunately, despite all attempts, one-third of all patients with PSH require surgical repair [15, 17, 27–29].

4.2. Surgical treatment

Urgent or emergent surgical repair is indicated for patients who develop acute PSH-related complications, such as bowel obstruction, incarceration or strangulation of hernia content, stomal ischemia, fistulization, and prolapse, and for those with chronic symptoms that impair the QoL [1–4, 8, 30, 31]. Other indications are relative and include failure of conservative measures, chronic abdominal pain related to the PSH, ulceration of the surrounding skin, and dissatisfaction with the aesthetic appearance [18]. For repair, there is no single technique that is superior to another [1, 6, 31]. These surgical techniques include local repair of enlarged fascial defects, relocation of stoma to a new site, and prosthetic mesh repair via laparotomy or laparoscopic approach [2, 8, 10, 16, 17, 31, 32]; all are associated with high rates of hernia recurrence (57.6–69.4% vs. 24–86% vs. 6.9–17.8%, respectively) and high rates of overall complication ranging from 24–88% [7, 8, 30, 31, 33].

4.2.1. Primary fascial repair without mesh

Primary local fascial repair is technically simple, does not require a laparotomy or dissection, and has low morbidity [8]. However, the results are disappointing, with recurrence rates up to 50%, thus limiting its clinical applicability [3, 4, 7, 8, 30–33]. A systematic review by Al Shakarchi and Williams [7] reported an overall complication rate of 14.1%, wound infection rate of 9.4%, and PSH recurrence rate of 57.6% at a mean follow-up of 30 months (range, 7–65 months). Therefore, primary fascial repair of PSHs has been largely abandoned and should be performed only in exceptional circumstances because of the significantly higher recurrence rate than that of mesh repairs; it should also be performed in patients with small defects for whom there is a strong desire to avoid prosthetic mesh or more extensive surgery [2, 3, 18, 30].

4.2.2. Repair by stoma relocation

Stoma relocation is another choice for repair of PSH, and it is associated with a high recurrence rate (range, 24–86%), morbidity rate (23%), and an additional risk of incisional hernia development in the midline or at the old ostomy site of 20% [4, 8, 34]. This technique usually requires a formal laparotomy or peristomal incision, dissection of the PSH along with other parts of the bowel, and mobilization of the intestine to enable stoma repositioning [18]. Although short-term outcomes seem to be favorable, the recurrence rates appear to be significantly high with longer follow-up periods [3]. Hernia recurrence rate for stoma relocation is lower than that for primary fascial repair; however, the complication rate is higher with longer hospitalization [3, 4, 18]. Moreover, stomas relocated to the contralateral side of the abdomen appear to have a decreased risk of subsequent herniation compared with the risk for those relocated to the same side [4, 15]. Patients treated with relocation of the stoma should be carefully selected because this approach may be difficult, especially in patients with intra-abdominal adhesions [18].

4.2.3. Repair with mesh

Mesh repair is well established as the method of choice for repairing PSHs [1, 25, 28]. Recurrence rates for PSH with mesh repair are in the range of 6.9–17.8%, which compares favorably to those for both direct repair and relocation [30]. Meshes can be implanted in several different layers of the abdominal wall: onlay, inlay, sublay (retromuscular), or underlay (intraperitoneal onlay). Onlay mesh is placed subcutaneously and fixed onto the anterior rectus aponeurosis. Inlay mesh is placed in the abdominal wall defect and sutured to fascial edges. Sublay mesh is placed between the rectus abdominis muscle and posterior rectus sheath. With an underlay technique (both keyhole and Sugarbaker techniques), the mesh is placed intra-abdominally onto the peritoneum [4].

The advantage of the onlay technique is that a laparotomy is not required. The disadvantages are the high risk of mesh infection and impaired wound healing or superficial skin ischemia [2, 4, 25]. This technique has been associated with an overall morbidity rate of 12.7%, a wound infection rate of 1.9%, a mesh infection rate of approximately 2%, and a PSH recurrence rate of 14.8–17.2%. The sublay and intraperitoneal onlay mesh (IPOM) techniques may be theoretically more effective in preventing recurrent PSH formation because the mesh is located on the high-pressure side of the abdominal wall, and this pressure supports the mesh fixed to the fascia [7, 35, 36]. Perhaps because of this, the sublay and IPOM techniques appear to have lower recurrence rates (6.9–7.9 and 7.2–9.2%, respectively) than that of the onlay technique; however, this difference is not statistically significant (**Table 4**). Although laparotomy is necessary for both techniques, the IPOM technique may have the added risk of adhesions between the mesh and bowel, mesh infection, and fistula formation. Despite the advantages and disadvantages of each technique, there are no differences in recurrence, wound infection, and other complication rates between the methods [7]. The inlay mesh technique has already been abandoned in PSH repair because of the high failure and recurrence rates [30].

4.2.4. Laparoscopic repair

Laparoscopic PSH repair techniques have been gaining popularity over the past several decades. According to the American College of Surgeons National Surgical Quality Improvement Program data records, only approximately 10% of the PSH cases are repaired laparoscopically [27]. The main advantages of laparoscopic surgery over open repair are less postoperative pain, reduced rate of wound infection, shorter hospital stay, fast recovery, and the possibility of diagnosis and treatment of other abdominal wall hernias [2, 4, 7, 8, 27]. Additionally, it has been shown that laparoscopic repair of a PSH is both safe and feasible and enables better visualization of the abdomen [15]. Presently, three methods have been described for laparoscopic PSH repair that apply the synthetic mesh intraperitoneally: the modified Sugarbaker technique, keyhole technique, and "sandwich" technique (which combines the first two techniques). In the modified Sugarbaker approach, a mesh is placed to cover the stoma site, fascial defect, and the lateralized bowel segment going to the stoma of ≥5 cm beyond the edge of the defect. When the keyhole technique is used, the bowel is inserted through a 2–3 cm funnel in the center of the mesh. The sandwich repair uses two pieces of mesh; the first mesh is placed in a keyhole configuration, and the larger second mesh covers the first mesh, stoma site,

Author	Technique	Number of study/ patient	Follow-up duration	Recurrence	Complications
Hansson et al. [30]	Primary repair	5/106	27 months[a]	69.4%[*]	WI: 11.8%[*]
	Onlay mesh	7/157	36 months[a]	17.2%	WI: 1.9% MI: 2.6%
	Sublay mesh	3/42	12 months[a]	6.9%	WI: 4.8% MI: 0%
	Underlay mesh	4/45	28 months[a]	7.2%	WI: 2.2% MI: 2.2%
Al Shakarchi et al. [7]	Primary repair	7/141	30 months[b]	57.6%[*]	WI: 9.4%[*]
	Onlay mesh	13/216	40 months[b]	14.8%	WI: 1.9% MI: 1.9%
	Sublay mesh	4/76	24 months[b]	7.9%	WI: 3.9% MI: 0%
	Underlay mesh	5/65	38 months[b]	9.2%	WI: 3.1% MI: 1.5%

Abbreviations: WI, wound infection; MI, mesh infection.

[*]Statistically significant.

[a]Median.

[b]Mean.

Table 4. The results of recently published meta-analyses on open parastomal hernia repair techniques.

and lateralized bowel and reinforces the weak point of the lateral abdominal wall using the Sugarbaker technique [2, 4, 37].

For parastomal hernias, recurrence rates are significantly lower for laparoscopic Sugarbaker technique (10.2–11.6%) than for the keyhole technique (27.9–34.6%), as shown in recent studies [30, 37]. Additionally, the laparoscopic sandwich technique has been reported to have the lowest rate of recurrence (2.1%) [38]. In laparoscopic procedures, DeAsis et al. [37] reported rates for wound infection, mesh infection, and other complications (such as ileus, pneumonia, or urinary tract infection) of 3.8, 1.7, and 16.6%, respectively and a conversion to open repair rate of 3.1%. According to the recent studies, there was no difference in postoperative morbidity between any of the laparoscopic procedures, except for recurrence rates [8, 15]. Therefore, it appears that global trends are shifting toward the use of the modified Sugarbaker technique rather than the keyhole technique. Open and laparoscopic repairs also have been found to be comparable in terms of short- and long-term results [15, 17].

Currently, several mesh types are being used for PSH repair; however, available data are insufficient to determine the optimal mesh type and remain controversial [4, 8, 38]. Expandable polytetrafluoroethylene (ePTFE) mesh is the most widely preferred prosthetic material in laparoscopic PSH repair [39]. It is softer and more flexible, has lower shrinkage, and causes fewer tissue adhesions and less fistula formation than does the polypropylene mesh, which has been predominantly used in the past. The only drawback of using ePTFE meshes is the high infection risk when it is used in a contaminated field [2, 6, 39, 40]. Therefore, biological prostheses have gained popularity in PSH repair because of their resistance to mesh infection in potentially contaminated areas [3, 14, 36]. However, it cannot be concluded that biologic meshes are preferred over synthetic prostheses for reducing the rates of short- or long-term complications [36]. Biological grafts are also very expensive and associated with higher rates of seroma formation than those of synthetic meshes [40]. In addition, a recent systematic review showed that biological grafts have recurrence rates comparable to those of synthetic meshes [2, 36].

5. Prevention

The recurrence rate after PSH repair is reported up to 50% even after successful repair [6]. Thus, the prevention of PSH occurrence from the very beginning, at the time of stoma creation, appears to be more rational and ideal approach than repairing the defect [1, 4, 8, 10, 33–35, 38]. This method was first implemented by Bayer et al. in the late 1980s and favorable short- and long-term outcomes have been reported [2, 3]. In view of these encouraging preliminary results, an increasing number of clinical studies have documented the safety and effectiveness of prophylactic placement of mesh. Very recently, four meta-analyses (**Table 5**) have shown that prophylactic mesh application at the time of stoma creation is a promising method and may reduce the incidence of PSH, without an increased risk of mesh-related peristomal complications [33, 41–43]. These results have been evident when obtained using either clinical (6.5–10.8 vs. 28.8–32.4%) or radiological (34 vs. 55%) outcome measures [33, 43]. Mesh reinforcement as prophylaxis at initial stoma creation has also been shown to have a lower incidence of PSH requiring surgical repair (2.3 vs. 8.4%; $p = 0.005$) than that of a control group [33]. However, these four recent meta-analyses demonstrated no significant increases in stoma-related complications such as parastomal infection [33, 42, 43], wound infection [43], stomal prolapse [33], stricture [33], necrosis [42, 43], and stenosis [43].

In one of these studies, Cornille et al. [41] reported that the use of synthetic meshes as prophylaxis resulted in a significantly lower PSH occurrence (23.4 vs. 54.7%, $p = 0.008$) than that for biological meshes (10.2 vs. 15.9%, $p = 0.510$), when the different types of mesh were separately compared with controls (no mesh). In another study, Lee et al. [44] demonstrated a cost-effectiveness analysis and reported that prophylactic mesh insertion might be cost-effective unless the incidence of mesh infection and the cost of the mesh were high.

Another point of interest is the worldwide increase in the use of laparoscopic approach for the prevention of PSHs. As in open intraperitoneal repairs, the modified Sugarbaker and keyhole techniques can be utilized laparoscopically in addition to the sandwich technique [25, 45]. Placement of a mesh using the modified Sugarbaker technique has been shown to be effective and safe in the prevention of PSH [45]. Furthermore, promising new devices and techniques such as the stomaplasty ring (Koring™), three-dimensional funnel mesh, and stapled mesh stoma reinforcement technique (SMART) have been developed to prevent PSH occurrence [46–48]. Despite these significant advancements, the determination of the optimal mesh type, the best position of implantation, and cost-effectiveness are yet to be established.

Author	No. of cases (m - c)	Follow-up duration	Definition of PSH	Incidence of PSH (m - c)	Complications (m - c)
Cornille et al. [41]	430 (217 - 213)	30 days to 83 months	I: 1 study C: 1 study C+R: 6 studies	19.4–43.2%*	6.9–7.0%
Chapman et al. [33]	432 (218 - 214)	Min. 12 months	C: 2 studies R: 2 studies C+R: 3 studies	C: 10.8–32.4%* R: 34.6–55.3%*	PSI: 2.0–1.5% Prolapse: 0.6–2.9% Stricture: 4.5–1.8% PSH repair: 2.3–8.4%*
Cross et al. [42]	649 (324 - 325)	12 months to 5 years	C: 2 studies R: 2 studies C+R: 6 studies	16.4–36.6%*	PSI: 2.2–3.4% Stenosis: 4.9–1.4% Necrosis: 4.7–5.7% PSH repair: 2.5–8.9%*
Zhu et al. [43]	522 (259 - 263)	3–60 months	C: 3 studies R: 2 studies C+R: 3 studies	C: 6.5–28.8%* R: 34.1–54.9%*	PSI: 1.5–3.1% WI: 6.1–8.4% Stenosis: 2.4–1.2% Necrosis: 4.4–8.6% PSH repair: 2.2–8.8%*

Abbreviations: No., number; PSH, parastomal hernia; m - c, mesh - control; I, intraoperative findings; C, clinical examination; R, radiological imaging; min., minimum; PSI, parastomal infection; WI, wound infection.
*Statistically significant.

Table 5. The characteristics and outcomes of four recently published meta-analyses on prophylactic mesh placement.

6. Conclusion and summary

- A parastomal hernia is a type of incisional hernia occurring at the site of stoma formation, with an incidence of 30–50%.
- Risk factors are comparable to those recognized for incisional hernia and include female sex, advancing age (>60 years), obesity, chronic respiratory disease, inflammatory bowel disease, chronic or recurrent increases in intra-abdominal pressure, poor nutritional status, type of stoma, size of the aperture in the abdominal wall, and placement of the prophylactic mesh.
- Most patients with PSHs are asymptomatic. As a rule, PSHs are typically diagnosed clinically by history and physical examination. In case of doubt, imaging studies should be performed as an adjunct to clinical evaluation.
- For open repairs, the use of mesh in a sublay or an intraperitoneal position is favored; in laparoscopic repairs, the recurrence rate for the Sugarbaker technique is lower than that for the keyhole technique.
- Although biological grafts are associated with lower rates of infection, their costs are much higher than those of synthetic meshes.

- Prevention of PSH occurrence from the very beginning appears to be more rational and better approach than defect repair. Therefore, prophylactic meshes can be effectively used in various anatomical locations to dramatically decrease subsequent parastomal herniation without increasing perioperative morbidity, especially in patients with high-risk factors for PSH.

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