Parastomal Hernia Prevention and Treatment

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66.1 Introduction

66.1.1 Definition and Incidence

Parastomal hernia (PH) is the most frequent complication associated with the presence of a colostomy [1]. According to EHS [2], a PH can be defined as an abnormal protrusion of the contents of the abdominal cavity through the abdominal wall defect created during placement of a colostomy, ileostomy, or ileal conduit stoma. The incidence of the disease is variably depicted in current literature biased by the retrospective nature of most of the studies. In recent years thanks to well-conducted RCTs, a clearer picture of the problem has been defined. Considering control arms of RCTs on mesh prophylaxis, the true overall incidence of PH has been estimated to be 55%, with a follow-up ranging from 10 to 80 months [3]. When analyzing time pattern of development, mainly in retrospective studies, it has been showed [4] that the risk of hernia development remains nearly constant over time, confirming the degenerative and iatrogenic nature of the condition. No direct study has ever compared directly techniques of construction, so there's some form of uncertainty with respect to hernia rates among different type of ostomy. An overview of the literature suggests that end colostomy is associated with the highest incidence of parastomal hernia. Loop ileostomy was associated with a parastomal hernia incidence of 16% at 4 months in a RCT, where diagnosis was done during surgery for continuity restoration [5]. A similar incidence was reported in a case series with a clinical diagnosis of parastomal hernia at a mean follow-up of 9 years [6].

The figures of PH repair are not satisfying, in latest meta-analyses [7], depending on technique of repair. It ranges between 46.2% and 80.6% after suture repair, 0% and 28.6% for mesh repair, and 2.1% and 41.7% for laparoscopic repair.

66.1.2 Predisposing Factors and Pathogenesis

Several conditions have been individuated as possible factors associated with the development of this complication, such as advanced age (>75 years), neoplastic processes with dissemination, obesity (BMI > 25 kg/m^2), diabetes, increased intra-abdominal pressure (chronic cough, constipation, enlargement of the prostate), and postoperative infection around the stoma [8].

According to its pathogenesis, the main causative factor of a PH is that the simple opening of the trephine creates a defect, under the traction forces exerted by the lateral muscles of the abdomen, and by the raises of intra-abdominal pressure, this defect enlarges becoming quite invariably a true hernia.

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According to traditional literature, various techniques have been claimed to reduce the occurrence of PH if adopted during stoma construction, for example, the extraperitoneal route of the stoma, its transrectal position, or the rule of keeping the trephine no more than 3.5 cm wide. After a careful examination of the data available and their quality [9–11], none of the aforementioned precautions could be recommended with a high level of evidence, except for the advice to keep the size of the trephine as narrow as possible.

66.1.3 Prevention

Considering the high prevalence of the disease and the relatively scarce results of the repair of PH, surgeons have been forced to look for different solutions to lower the occurrence of hernia.

In 1986 Bayer [12] was the first to introduce a Marlex mesh for the surgical prevention of parastomal hernias with good results (no recurrence among 43 patients operated with a 4-year follow-up). Since then a multitude of papers have been published addressing this type of procedure firstly in form of case series and currently in well-conducted RCTs. From meta-analysis [7] of 412 patients recruited in these trials, there's a clear evidence that placing a mesh during stoma construction at the index procedure significantly lowers the risk of PH occurrence in comparison to no mesh placement (OR 0.24; 95% CI 0.10–0.58; $p = 0.034$; $I^2 = 53.8\%$). Moreover, the presence of a mesh does not predispose to stoma complications as showed by the similar frequency of stoma site infection among the groups with and without the device (OR of 0.88; 95% CI 0.28–2.73; $p = 0.9901$; $I^2 = 0\%$).

Accordingly, it is currently strongly recommended from European Hernia Society guidelines to place a mesh during the construction of the stoma as prophylaxis of PH.

66.2 EHS Classification

Four classifications [13–16] can be found in medical literature published from 1994 with the aim to guide treatment and prognostic stratification of the patients with a PH. They rely mainly on radiological and intraoperative findings related to the type of hernia and its content. Their main weaknesses could be showed by the fact that they are not adopted in any surgical study after the first publication. They have not gained popularity since they are unable to determine the clinical behavior or the best type of treatment or the highest risk of recurrence for each of the different groups individuated.

Table 66.1

EHS parastomal hernia classification		Small (≤5 cm)	Large (>5 cm)
Concomitant incisional hernia?	No	I	III
	Yes	II	IV
		Primary	Recurrent

To effectively compare results among operated patients, it's mandatory to adopt a classification that should be simple, appropriate, practicable, and universally accepted. On this assumption, in 2014 on behalf of EHS, experts were gathered to create a new classification of PH that could be well accepted by the scientific community [2]. The resulting classification has only two variables chosen from literature on PH treatment [16, 17] represented by defect diameter evaluated intraoperatively and categorized in more or less than 5 cm and the coexistence of a midline defect. The PHs are also categorized according to their primary or recurrent nature (see Table 66.1).

The new EHS classification is very appealing for its simplicity, immediacy, and the fact that it is able to define patients at higher risk for acute complications (mainly those with PH diameter <5 cm), local complications, and stoma dysfunction (those with diameter >5 cm) and those requiring different surgical approaches (those with a concomitant midline incisional hernia).

66.3 Prophylactic Mesh Placement During Stoma Construction

Our preferred position for mesh placement at the time of stoma construction is the retromuscular plane with a keyhole configuration. We do it dur-

ing open and laparoscopic colorectal resections requiring a stoma without modifying the technique and with minimal time consumption. In our division laparoscopy is the first approach for the treatment of colorectal malignancies; in case of palliative colic resection, the specimen is exteriorized from the same site of the future stoma; in case of curative abdominoperineal resection, the specimen is exteriorized from the perineum, stapled, and then reinserted in the peritoneal cavity.

The transected colon is extracted from an abdominal incision preoperatively marked after inspection of the abdominal wall in the standing and sitting positions. A traditional circular incision with skin excision is performed and the subcutaneous tissue minimally dissected; a 6 cm incision is made on the anterior rectal aponeurosis. The rectus muscle is retracted, and before entering the peritoneal cavity, a blunt dissection of the retromuscular plane is performed to achieve a retromuscular/preperitoneal space at least 7–8 cm wide.

A large pore lightweight 10 × 10 cm polypropylene mesh is placed in the retromuscular or preperitoneal position trimmed to fit the space. Two perpendicular incisions are made in the mesh to allow passage of the colon. The mesh is then secured with two absorbable stitches to the underlying aponeurotic tissue.

The subsequent stoma construction respects principles of traditional surgery. No drains are left in place.

66.4 Indications to Parastomal Hernia Repair

Complicated PHs need immediate correction because they represent a life-threatening condition; out of this situation, in our practice, the presence of a parastomal hernia per se is not an indication to repair. No data concerning watchful waiting can be found in literature, so the risk and benefit of the procedure must be carefully weighted before judging suitability for surgery. Our current indication for surgery falls on patients affected by PH with or without concomitant midline defects showing symptoms of impaired quality of life (pain, recurrent obstruction, inability to keep in place stoma bags). PH patients often are excluded from surgery because of advanced age, comorbid conditions, and low life expectancy; consequently the rate of cases submitted to repair remains low.

66.5 Techniques of Parastomal Hernia Repair

66.5.1 General Considerations

According to EHS classification, we usually adapt our technique to the type of hernia and the presence of concomitant midline defect: in cases of types I and III PH, we prefer a laparoscopic approach; in cases with associated incisional hernia (II–IV), we do advise the adoption of an open reconstructive approach.

The choice of Sugarbaker among the technique of PH repair comes from experience and several considerations.

Non-mesh techniques and stoma relocation are not considered valuable option for their poor result in terms of recurrence [18]. Open mesh techniques are not inferior to laparoscopy but suffer from a higher risk of infection, require extensive dissection (in particular for onlay repair), and carry a theoretical risk to cause an incisional hernia at the midline when such an access is used. Laparoscopy, on the other side, offers the potential to lower surgical site occurrences, quickens recovery, and solves the problem of postoperative incisional hernia even if the risk of port-site hernia still remains. Among laparoscopic techniques, we have abandoned keyhole in favor of modified Sugarbaker technique for the better results in terms of recurrence provided by this latter approach [17, 18].

On the opposite hand, when repairing PH with concomitant incisional hernia, several factors must be taken into account:

1. As stated by EHS classification on incisional hernias [19], when dealing with multiple abdominal wall defects, the final size of the defect to be treated corresponds to an area of abdominal wall comprehending all the defects (see definition in detail). Accordingly, the area

to be protected by the mesh is quite wide, the dissection is extensive, and very often an anatomic reconstruction must be privileged for correction of abdominal deformity.
2. The use of intraperitoneal meshes has shown issues related to materials, foreign body reaction, and prosthesis manufacturing [20, 21]: when dealing with large defects, the need for large amount of implanted material must be addressed. The larger the mesh, the higher the risk of developing unexpected complications.
3. The intraperitoneal laparoscopic manipulation and adequate fixation of large prosthesis are possible but represent a challenge even in experienced hands.

According to these concepts, our current strategy is to treat these types of defects by an open approach and use a composite or traditional simple mesh in the retromuscular position.

66.5.1.1 Patient Preparation

The presence of PH on clinical examination is not sufficient as preoperative workup; usually the patients are submitted to a dynamic CT scan to better define the characteristics of the hernia sac and content but more importantly to identify the concomitant presence of an incisional hernia.

Linear ultrasound has currently no role in workup strategy.

The technique described by Janes [22] with the patient in the prone position lying on an inflatable plastic ring is used only in doubtful cases and in obese patients.

For the procedure no bowel preparation is prescribed since the eventual spillage of liquid stools during the procedure is less likely.

66.5.2 EHS Types I–III: Modified Laparoscopic Sugarbaker Technique

66.5.2.1 Positioning of the Patient

The commonest position of the stoma is in the left aspect of the abdominal wall in the form of an end colostomy; the subsequent description will thus refer to a standard left terminal PH repair.

The patient under general anesthesia lies in the supine position with the leg adducted. A venous access is placed with the left arm abducted. A urinary catheter is placed to monitor urine output and reduce the risk of inadvertent injury during dissection. Stomach decompression is not routinely requested. If used, the nasogastric tube is removed soon after the end of the surgical procedure.

The antibiotic prophylaxis is given according to local infective politics and usually covers aerobic and anaerobic flora.

After complete disinfection, a gauze is placed in the stoma to avoid fecal spillage, and a Steri-Drape is used to cover all the abdominal wall. This is done in order to keep the mesh far from the stoma during the procedure and reduce the risk of contamination. The surgical field, as in laparoscopic incisional hernia repair, is kept broad to expose all the aspects of the anterolateral abdominal wall.

The surgeon stands on the right side of the patient, the camera assistant on surgeon's left; the scrub nurse is on the right. The monitor and video equipment is on the side of the stoma.

66.5.2.2 Induction of Pneumoperitoneum and Trocar Disposition

Parastomal hernias should be regarded as incisional hernias; thus most of the general surgical techniques adopted for incisional hernia can be generalized to them. According to current evidences and recommendations, a safer technique to establish pneumoperitoneum does not exist [23]. However, in our division, whenever possible, we prefer the Veress needle placed in right or left subcostal position on the middle clavicular line. Midline placement is always avoided for the frequent presence of a laparotomy, and some caution is taken in case of known previous spleen flexure mobilization for the risk of underlying adhesions.

In case of failed attempts to establish pneumoperitoneum with Veress needle or previous history of diffuse peritonitis or extended adhesions, an open trocar insertion technique might be preferred even if charged by a higher risk of trocar-site incisional hernia.

After induction, the capnoperitoneum is maintained at 12 mmHg during the initial phase of the procedure.

On principle we do not use sharp cutting trocars for the associated risk of severe injury to the parietal (epigastric) vessels and chose instead reusable dilating trocars which are considered more safe [24].

The first 10 mm optical trocar is placed in the right flank halfway between the costal margin and the iliac crest on the anterior axillary line. This optic trocar is then used to place two additional operative ports, usually 5 and 10 mm lateral to the first to have a correct triangulation. The trocars are placed far from the PH taking into account the required mesh overlap and the possible individuation of a midline defect.

66.5.2.3 Dissection

After placing the trocars, a complete liberation of the front abdominal wall is achieved, as recommended by guidelines, with the use of sharp dissection [24]. The use of energy sources is limited to reduce at maximum the risk of bowel injury. It is already commonly acknowledged that this step of the procedure is crucial: an unidentified bowel injury can start an acute peritonitis and multiorgan failure possibly fatal to the patient. Thus, great attention is given to achieve a safe adhesiolysis by traction and countertraction of the involved viscera pursuing the avascular plane between them and the aponeurotical sheath possibly sacrificing little portions of the latter in difficult cases of tight adhesions.

After the laparotomy is freed from visceral adhesions and inspected for additional incisional hernias, the area of the ostomy is treated to prepare the "landing zone" for the mesh; the bowel content of the hernia sac is carefully reduced; the adhesions in a circular area of least 5 cm are taken down; the umbilical ligament is released if necessary, but more frequently the Retzius space is partially or totally taken down to reach the pubic bony region (especially in case of PH type III). The final step is the full circular mobilization of the stomal bowel and its mesentery as far as it can be parietalized without tension. At the end of this maneuver, we always check for the absence of deep visceral adhesions between the stomal bowel and other loops to reduce the risk of postoperative obstruction.

We usually keep the peritoneal sac in place without removing it, and we stretch downward the colon to reduce a stomal prolapse if present.

On a routine base, we close the defect with transfascial USP 0 polypropylene passed with a Bercy clamp and tie the knots to the anterior abdominal wall; this maneuver in our opinion reduces the occurrence of postoperative seroma and helps in stabilizing the mesh and reconstructing the anterior abdominal shape.

Once this step is completed, the colon is usually fixed with serofascial absorbable suture to the deep anterior abdominal wall in a lateral position.

66.5.2.4 The Mesh

For this type of repair, the mesh should be suitable for intraperitoneal use; accordingly polypropylene meshes are excluded for their intense foreign body reaction and the subsequent risk of adhesions and fistula formation.

In our practice the ideal mesh should be resistant, transparent to avoid inadvertent bowel injury during fixation, and have a barrier to prevent adhesions. Several meshes have been proposed so far and can be used to repair a PH; none of them has showed clear superiority over the others, and the available studies are mainly retrospective, so a definitive conclusion cannot be made.

According to Coda's classification [25]:

Simple material meshes: The only mesh of this type suitable for intraperitoneal use is ePTFE. It was the first material adopted for the laparoscopic repair of incisional hernias [26] and has allowed laparoscopy to become a widespread technique. It is a good option since it offers a permanent stable repair, and in the last years, the features of the mesh have been greatly improved with reduction in material and better handling, but it still suffers from a certain weakness toward infection, and it forms a visual barrier during mesh fixation.

Composite meshes also known as barrier lightweight meshes: These highly ingegnerized

devices are our first choice to repair a PH; they are designed for intraperitoneal use, contain reduced prosthetic material, induce less inflammatory reaction, and can be seen through. Their main weakness is the presence of a barrier only on one side living open the possibility of bowel erosion on the unprotected surface.

PVDF: It's the latest material introduced in hernia surgery and one of the most appealing. Its elasticity and high porosity and the reduced risk of adhesion could make it a good solution in this field [27, 28].

Biologic meshes: We do not recommend their use in intraperitoneal position for the higher rate of resorption caused by the enzymatic hydrolysis. Their use is currently not supported by meta-analysis [29, 30] because at higher costs they provide a repair not superior to traditional synthetic meshes in terms of recurrence or surgical site infections. Nonetheless they represent an option when placed extraperitoneally for the advantage in SSI.

The mesh is adapted to the measure of the defect to obtain an overlap of at least 5 cm of the original gap.

The mesh is marked for orientation; six stay sutures are passed; it is then folded and entered through a trocar without touching the surgical field.

66.5.2.5 Fixation

Once the mesh is unfolded and oriented, sutures are passed with needle passer transfascially and suspended. At this point an absorbable tacker is used to fix the mesh. During fixation the pneumoperitoneum is lowered at 7 mmHg. A modified double-crown technique is adopted, and two rows of tacks are placed under vision around the parietalized bowel at 2 cm intervals.

Usually the transfascial sutures are tied on the aponeurosis at the end of the procedure with pneumoperitoneum at 0 mmHg.

66.5.2.6 End of Procedure

After careful hemostasis, usually no drains or nasogastric tube is left in place. The trocars are extracted under vision and the port entry infiltrated with long-acting local anesthetic agents.

Before waking up the patients, the stoma is checked for patency.

66.5.3 EHS Types II–IV: Modified Retromuscular Mesh Repair

Before the publication of the posterior component separation technique with transversus abdominis release [31] by Novitsky, the treatment of this clinical scenario was really challenging with frequent recurrences and unsatisfactory results.

Currently this technique has proven valuable in our hands and represents our first choice in case of double abdominal wall defect.

66.5.3.1 Patient Position

Except for absence of video equipment and first assistant lying on the left side, the patient position does not differ from the one described for the laparoscopic repair.

66.5.3.2 Dissection

The abdomen is opened with excision of the previous scar if necessary. The peritoneal cavity is immediately entered and inspected for recurrent disease. A complete adhesiolysis of the anterolateral wall is performed, the herniated bowel is taken down, and the margin of the defect as well as the bowel is fully mobilized.

As for the Rives-Stoppa technique, the rectal sheath is opened longitudinally starting on its deep aspect laterally to the midline 0.5–1 cm. The retromuscular plane is completely dissected in a cranio-caudal fashion from the costal margin to the pubic region. Care is taken to completely free and preserve from injury the stoma bowel and outline the intercostal nerve emergence. The next step is the transection of the transversus abdominis: as in the original technique, we prefer to start the release at the cranial end of the muscle at the level of the costal margin where the structure is readily recognized and more represented. This step can be very challenging in PH treatment in case of recurrent hernias because of peritoneal scar fusion and at the level of the stoma where adhesions to the bowel can raise serious difficulties.

After release of the muscle, dissection is taken further in the avascular preperitoneal plane as far as requested to obtain a tension-free closure.

Usually we follow the same steps on the right side extending the dissection only to the lateral margin of the right rectus muscle as described in Rives-Stoppa technique. We perform TAR on the right side in type IV midline defects requiring abdominal reconstruction.

According to the original technique, the subxiphoid fat pad is dissected completely to allow cranial fixation; the pubic region and the inguinal region are also exposed.

On principle we reduce the parastomal defect by narrowing the fascial edges with slowly absorbable interrupted suture; the hernia sac is excised in very few cases.

Stoma relocation is not routinely adopted except for those patients with concomitant stricture or stoma prolapse; in those cases the bowel is transected and moved on the opposite side.

66.5.3.3 Reconstruction

The deep aponeurotic layer is closed with a running slowly absorbable USP 0 suture. Peritoneal tears wherever done during dissection are closed with absorbable sutures. A wide mesh trimmed on the defect usually at least 30 × 30 cm with a 5 cm overlap is inserted in the dissection plane developed with TAR and fixed to the subxiphoid area and the pubic region and with transfascial nonabsorbable sutures to the posterolateral abdominal wall. The mesh is split from a lateral end creating a slit to allow passage of the bowel. The two tails are solidarized with a running USP 0 polypropylene suture behind the bowel to reconstruct mesh integrity and then fixed to the abdominal wall.

66.5.3.4 The Mesh

Thanks to the extraperitoneal position, this technique offers the possibility of using several types of meshes and prevents, even with interindividual variability, from erosions, adhesions, and fistula formation with the underlying visceral content.

Lightweight polypropylene or polyester meshes have a good handling, large pores resulting in less foreign body reaction, better tissue incorporation, and less long-term chronic pain [32]. Moreover the high tensile strength decreases the recurrence risk of the hernia [29]. Adding these properties with the low cost of the materials and the possibility to have them shaped in large sheaths results in these meshes being our first choice for the reconstruction of such cases.

Another option can be represented by *composite meshes* especially in cases with a fragile deep layer, in which the possible exposure of the mesh is an actual risk and the barrier layer offers further protection from contact with viscera.

The use of *biologics* is appealing since the sublay position is optimal for tissue ingrowth, mechanical stability, and the potentially contaminated nature of the surgical field. However, the results in our practice and those published in literature are not superior to simple material meshes [29]. If we consider also the difficulties in providing large meshes and the high cost of these devices, it seems very unlikely their widespread adoption.

66.5.3.5 End of Procedure

After careful hemostasis, usually two drains are placed on the mesh. Nasogastric tube is not used. The anterior aponeurosis is sutured with a running slowly absorbable suture. The wound is usually infiltrated with long-acting local anesthetic agents. The skin is closed with traditional technique.

Before waking up the patients, the stoma is checked for patency.

66.6 Postoperative Care

All operated subjects are mobilized the same day and allowed clear liquids the night of the procedure. On the first postoperative day, the patient is given light laxatives to fasten bowel movements. Routinely we don't use abdominal binder in the postoperative period. The patient is encouraged to resume normal activity and usual stoma management. Discharge in uneventful cases is usually on the third or fourth postoperative day.

The first postoperative visit is planned 10 days after surgery to remove sutures and check the surgical field.

Follow-up is scheduled at 1–6–12 months postoperatively.

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