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REVIEW PAPERS

PARASTOMAL HERNIA – CONTEMPORARY METHODS OF TREATMENT

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A parastomal hernia is a type of incisional hernia that allows protrusion of abdominal contents through the abdominal wall defect created during ostomy formation (i.e. ileostomy, colostomy or ileal conduit urostomy, also known as Bricker's loop). Ostomy creation introduces an abdominal wall defect, the trephine, for which no healing is expected. A parastomal hernia forms as the trephine is continually stretched by the forces tangential to its circumference and raised abdominal pressure. Less frequently its development is a result of a technical error (using improper sutures, creating a large-diameter hole or a wound infection). Regardless of the etiology, this type of pathologic visceral protrusion is the most frequently observed late local stoma complication (1, 2). Symptomatic parastomal hernias occur in up to 50 percent of patients with a stoma, depending on the type of ostomy, with the greatest risk of their development occurring in patients with the end-colostomy. The appearance of this type of postoperative hernia favours patients of an older age (over 70 years), the hole diameter greater than 3.5 cm, neoplastic processes with dissemination, obesity (BMI> 25 kg / m^2), diabetes, increased intra-abdominal pressure (cough, constipation, enlargement of the prostate) and infection of the tissues around the stoma (3, 4).

Parastomal hernia is a condition related to numerous noticeable quality of life deteriorations for the patients. Some patients complain of only a mild discomfort in the abdomen, while others report intense abdominal pain due to stretching of the abdominal wall. There are also issues related to ostomy care, including methods of limiting ostomy leakage and peristomal skin breakdown. In extreme cases, obstruction and intestinal necrosis may occur as a result of bowel loops incarceration within the hernial orifice. For some patients, aesthetic reasons are also important (significant deformation of anterior abdominal wall, unattractive appearance of the stoma, problems with the selection of the clothes) (5, 6, 7).

A diagnosis of parastomal hernia is primarily clinical and can usually be made by history and physical examination of the stoma (fascial defect palpated in a supine patient or visible bulge during Valsalva maneuver in upright position). Sometimes it is necessary to perform diagnostic imaging tests (ultrasound, computed tomography, magnetic resonance imaging) (8, 9).

Indications for parastomal hernia surgery is the difficulty in securing the pouching system, chronic abdominal pain related to the parastomal hernia, recurrent symptoms of bowel obstruction or just practical aesthetic

issues. Urgent or emergent surgical repair is necessary for patients with a bowel obstruction resulting from an incarcerated hernia, because of the risk for strangulation and bowel ischemia.

Contraindications for parastomal hernia surgery are patients with non-operable malignancies or numerous metastases.

History of hernia repair procedures

Treatment aimed at effective parastomal hernia repair has always been a great challenge for surgeons. Multiple surgical techniques differing in terms of the effectiveness for relapse prevention have developed over the years. The basic procedure performed in the second half of the 20th century was a direct suture in order to reduce the diameter of the enlarged hernial trephine, however due to the very high recurrence rate, surgeons resigned from the use of this technique. Transfer of the ostomy to another place (i.e. relocation) although it allowed to decrease the relapse rate (which still ranged 0-76%), required more sophisticated treatment and in 20-30% of cases hernia occurred in places undergoing surgery. Currently, the two methods described above are only of historical significance (10, 11).

A breakthrough in the medical approach to the parastomal hernia treatment were conclusions of a study conducted by Klinge and Schumpelick, who discovered that metabolism

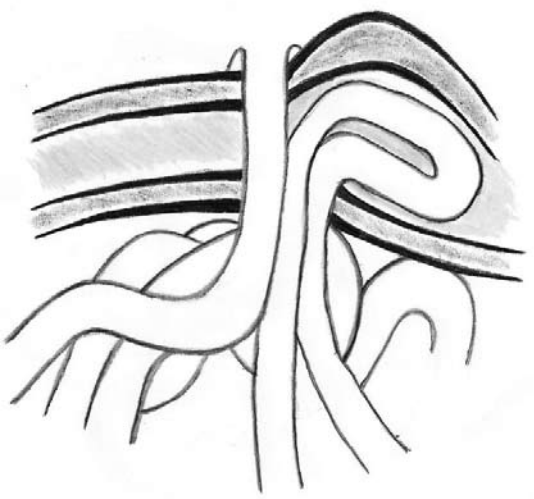

Fig. 2. Scheme of parastomal hernia

Fig. 1. Parastomal hernia, a 70 year-old patient after an abdominoperineal resection of the rectum

of collagen, manifested by a reduction ratio of collagen type I to type III are a contributory factor to the formation of incisional hernias (12). According to conclusions stemming from their research, hernia repair using non-absorbable prosthetic implants has grown to the status of a standard method of treatment of local stoma complications.

Currently, parastomal hernia repair is strongly individualized. Many research findings have led to the development of a number of different surgical techniques. The first criterion for their classification is the type of surgical approach: open (traditional) and laparoscopic (transabdominal preperitoneal approach). Another division determines position of the mesh-placement: inlay (prosthesis is placed to bridge the fascial defect), onlay (prefascial) and sublay (retromuscular-preperitoneal space). The classification of modern techniques is also attributed to the types of mesh prostheses (13, 14).

Modern surgery in the treatment of parastomal hernia uses a combination of various methods to relieve postoperative pain and minimize the likelihood of relapse and reduce the risk of infection associated with mesh implantation (15, 16, 17).

Prosthetic implants

Mesh prostheses are used in the parastomal hernia surgical repair. These implants are made of specially selected materials to allow the closure of the fascial defect. Mesh prostheses are generally divided into two types: synthetic and biologic (18).

Synthetic meshes were first introduced to the catalog of surgical tools for parastomal hernia repair. A widely used type of synthetic mesh is a polypropylene mesh that is in use continuously since 1985 – it was the first time when synthetic mesh implantation was offered for patients with parastomal hernia. However, today's medicine draws attention to the production of mesh implants composed of more durable materials, as well as less prone to infection. Among the anti-adhesive meshes used intraperitoneally the choice is very wide. The problem is only their availability and cost (19, 20). Improved type of synthetic prosthesis is anti-adhesive mesh made of expandable polytetrafluoroethylene (ePTFE), currently the most widely used meshes in laparoscopic parastomal hernia repair. In comparison with its polypropylene counterpart, ePTFE mesh is more soft and flexible, and has a minimum shrinkage and causes less tissue adhesions (21, 22).

Biological mesh is another invention in the history of abdominal hernia surgery. Its widespread use was related to dynamic development of biotechnology. An example of a bioimplants are meshes with collagen lattice, the production of which lasts from the 90s of the twentieth century (23). These prostheses are made of acellular collagen matrix, which are slowly degraded and replaced by collagen fibers derived from patient's own tissues. Their properties depend on the species and the type of tissue from which the sample material is taken and the chosen processing method (such as cell removal and sterilization). Biological mesh used to repair abdominal wall hernias are derived from a human or porcine dermis, submucosa of porcine small intestine or bovine pericardium. During production process, the material is deprived of cells, to prevent foreign body reactions, while retaining the extracellular collagen structure to allow tissue ingrowth of the host. Sterilization of the final product makes it free from pathogens. Sometimes mesh matrix is further subjected to cross linking to slow the enzymatic degradation (24, 25).

Methods of treatment with the use of mesh

In assessing the effectiveness of surgical techniques used in the treatment of parastomal hernias, two main factors are taken into account: the relapse rate and degree of risk of infection. Mesh hernioplasty results in a much lower percentage of hernia recurrence (7-17%) with a percentage of infection reaching only 2.4% as compared with tension hernioplasty (26). In the case of traditional approach the polypropylene non-absorbable mesh is most frequently positioned onlay (prefascial) or sublay (retromuscular). In both cases, a 10x10 cm mesh is used with a circular defect of 2.5-3 cm in the centre to accommodate the end of the intestine, taking care that the edges of the mesh do not come into contact with the wall of the intestine.

Parastomal hernia treatment using synthetic mesh via laparoscopic approach comprises three methods. The first one was developed by Sugarbaker and highlighted the advantages of anti-adhesive mesh prostheses (19). After the pneumoperitoneum is applied, intraperitoneal adhesions are carefully released. Then the stoma loop is completely dissected free from the fascia and the peritoneum around the trephine opening is freed from adhesions to allow an overlap of at least 3-5 cm between the abdominal wall and the prosthesis, around the hernia defect. Overlapping of the mesh and fascia reduces relapse rates and is commonly applied as the so called modified Sugarbaker technique. The trephine opening is covered with an intraperitoneally placed ePTFE patch. The bowel is lateralized, passing from the hernia sac between the abdominal wall and the prosthesis into the peritoneal cavity. In this way a tunnel is created between the abdominal wall and the prosthesis (fig. 3). It is of utmost importance to prevent

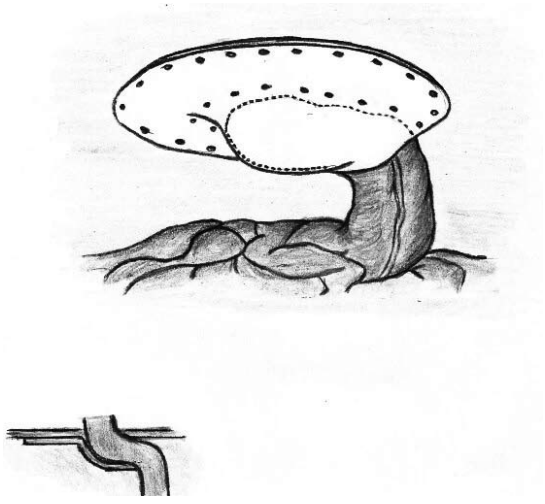

Fig. 3. Sugarbaker's hernia repair

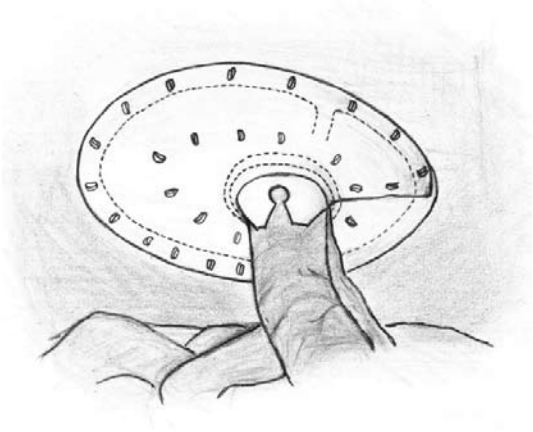

Fig. 4. "Keyhole" technique for parastomal hernia repair

Table 1. EHS grid for classification of parastomal hernias

EHS grid for classification of parastomal hernias	
Type I	Parastomal Hernia (PH) ≤ 5 cm without cIH
Type II	PH ≤ 5 cm with cIH
Type III	PH > 5 cm without cIH
Type IV	PH > 5 cm with cIH

narrowing of the bowel in the tunnel and angulation of the bowel when entering the abdominal cavity and the hernia sac. The prosthesis is fixed to the abdominal wall using the double-crown technique, as described by Morales–Conde.

The second method of parastomal hernioplasty is referred to as a "keyhole" technique. In this technique, a 2 to 3 cm "keyhole" cutout is made to surround the ostomy while covering the entire hernia defect (fig. 4). However, there is a risk of obstructing the enterostomy if a small keyhole is made and a risk of recurrence if the keyhole is large. Fenestrated mesh is then mounted to the fascia by means of single interrupted sutures or secured with titanium tacks ensuring the overlapping is performed, as in Sugarbaker's procedure.

According to the systematic review of available methods of parastomal hernia repair made by Hansson and al., one can state that the recurrence rate via laparoscopic approach is lower in case of the modified Sugarbaker's method than keyhole technique, and the overall rate of mesh related infection is comparable (27, 28).

Third, as described by Berger layered or sandwich technique, is in turn a combination of the two aforementioned techniques. This method involves implanting the mesh according to "keyhole" technique with subsequent placement of a second mesh layer in a Sugarbaker's fashion. Although surgical repair is associated with high hopes, there is still too little data on its effectiveness (29).

Polish surgery is also involved in the development of methods of parastomal hernia repair. The team of surgeons of Bielański Hospital introduced an author's method that combines the advantages of both laparoscopic and classical technique (Hyper – Hybrid Endoscopic Parastomal Re-do). This method is based on four main steps: 1 – laparoscopic stage, 2 – open stage, 3 – re-conversion to laparoscopic approach, 4 – final open stage with neo-stoma formation. In the first stage pneumoperitoneum is applied in order to visualize peritoneal cavity and hernia sac. In second stage hernia sac is opened and removed, a DynaMesh-IPST is inserted. The hernia orifce is narrowed to the appropriate size using single nonresorbable sutures (usually 4-6 stitches). After the second application of insufation the mesh is placed in the proper location using ProTacks tackers. In the last, fourth stage, the trockars are being removed and single nonabsorbable 3-0 sutures are used to form the proper stoma orifice (30).

The use of biological mesh implants is a response to concerns associated with implantation of synthetic mesh in the vicinity of the intestine and the stoma, which always remains at risk of perforation and fistula formation (31). In addition, the dense adhesions may hinder future operations of the abdominal cavity. Furthermore, there is a fear of infection evoked by the presence of a foreign body, particularly in the contaminated environment. In theory, the mesh of biological origin is better suited for such conditions. Practically, surgical repair using both types of meshes gives similar results – the recurrence rate related with biological mesh implantation is 15.7%, while infection is not observed. The advantage of this

mesh is the possibility to leave it in situ within the infected surgical field, and the disadvantage is its high cost (32, 33).

Studies have also shown that simultaneous implantation of a light-weight mesh prosthesis in sublay position during primary stoma placement is of greater importance for parastomal hernia prevention (34). Light-weight, macro porous (pore size diameter about 5 mm) mesh prostheses, with a reduced content of polypropylene and an increased content of absorbable components are applied in such procedures.

Conclusion

Parastomal hernia is a late complication of stoma and occurs in most patients following the construction of a colostomy or an ileostomy. Distressing clinical symptoms and an unpleasant aesthetic experience for people suffering from this type of hernia tend to implement surgical techniques preventing from its recurrence.

In 2013, "Hernia" journal published the official classification of parastomal hernias established by European Hernia Society (35). The classification of parastomal hernias is needed to compare different populations described in various trials and cohort studies, complete the previous inguinal and ventral hernia classifications of the European Hernia Society (EHS) and will be integrated into the EuraHS database (European Registry of Abdominal Wall Hernias). The classification proposal is based on the parastomal hernia defect size (small is ≤5 cm) and the presence of a concomitant incisional hernia (cIH). Four types were defined: Type I, small PH without cIH; Type II, small PH with cIH; Type III, large PH without cIH; and Type IV, large PH with cIH. In addition, the classification grid includes details about whether the hernia recurs after a previous PH repair or whether it is a primary PH. Clinical validation is needed in the future to assess if the classification allows us to differentiate the treatment strategy and if the classification impacts outcome in these different subgroups. EHS classification is largely based on the one published earlier by Stoma Clinic at Bielański Hospital in Warsaw, Poland (36). In 2013 Polish guidelines for the treatment of patients with peristomal hernia were established (37, 38).

In recent years the work of many researchers in the parastomal hernia theme has succeeded in developing a number of different methods of treatment, whose effectiveness is measured by comparing the rate of recurrence, infection and other complications. Simple methods of treatment, involving direct suturing of hernial opening and/or stoma relocation, are out-of-date and currently not recommended in abdominal wall surgery due to excessively high recurrence rate. Instead, it is proposed to repair a parastomal hernia using a mesh prosthesis composed of different materials. The risk of PH recurrence affects only a few percent of patients due to mesh implantation.

Laparoscopic parastomal hernia repair using the Sugarbaker technique with an ePTFE mesh is safe and feasible in experienced hands. Conversion to open repair is rare. Morover, laparoscopy is minimally invasive to the patient's abdominal wall, which is already at risk for herniation. The recurrence rate of the keyhole technique tends to be higher than that of the Sugarbaker technique. In terms of complications, both open and laparoscopic approach yield similar results, so the surgeons are free to choose one, referring to their personal preferences and habits. At present, the most preferred method is the laparoscopic Sugarbaker technique.

The risk of mesh infection starts the discussion about the material of which the implant should be composed. Although synthetic mesh prostheses are slightly more likely to be infected as compared with the biological ones, recurrence and complication rates remain at the same level in both groups. A disadvantage is also the price, a biological mesh can be up to 10 times more expensive than its synthetic equivalent.

In summary, abdominal surgery, despite it's clearly visible progress, still faces challenges regarding parastomal hernia treatment. There is a need to improve both existing surgical techniques, as well as improving the quality of the implants themselves.

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