28 Self-Gripping Mesh Repair in Primary Inguinal Hernia

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28.1 Introduction

Since the first description of Lichtenstein technique [1], open anterior prosthetic tension-free hernioplasty has become the most widely used and gold standard for the treatment of primary inguinal hernias as suggested by the guidelines issued by the European Hernia Society in 2009 [2]. The choice between a laparoscopic approach or open methods of unilateral hernia repair is mainly subject to the surgeons expertise and preference, since there are no significant differences in the recurrence rates and complications [3]. Hernia recurrence rates, the primary concern following pure tissue repair, is no longer a pressing clinical problem with an estimated incidence well below 5% [4]. Conversely, the incidence of chronic postoperative inguinal pain (CPIP), also referred as inguinodynia, defined as moderate to severe pain persisting for 3 months after surgery [5], is a growing concern in the field since it arises in up to 29% of cases, particularly following open repair procedures [6], although it must be noted that severe pain occurs rarely, in 3–4% of patients [7]. The main causes of CPIP are considered to be perioperative nerve damage, postoperative fibrosis, or mesh-related fibrosis [8]. Considering that 5–7% of patients with postherniorrhaphy groin pain will sue their surgeon [9], the updated European hernia guidelines suggest that atraumatic mesh fixation could be a key element in reducing this occurrence [10]. In order to avoid mesh fixation with potentially traumatic sutures, both fibrin glue and n-butyl-2-cyanoacrylate have been used with promising results [11, 12]. In this chapter we introduce the topic of self-gripping mesh in primary inguinal hernia repair; these are self-fixating devices covered by Velcro-like hooks that stick to the inguinal wall the moment they are applied, making fixation essentially unnecessary. We will start with a description of the product presently available on the market before passing on to a step-by-step guide on how to best perform this surgical procedure; this will be enriched by a tips and tricks paragraph with advice from our experience to help you in your everyday practice. Finally, since Chastan first report on the use of self-gripping meshes for tension-free open hernia repair in 2006 [13], numerous articles have been published and different conclusions have been drawn; we will overview and discuss the available literature highlighting advantages and limitations of self-gripping mesh repair.

28.2 Description of the Self-Gripping Mesh

ProGrip™ is the most used self-gripping mesh in inguinal hernia repair (Fig. 28.1).

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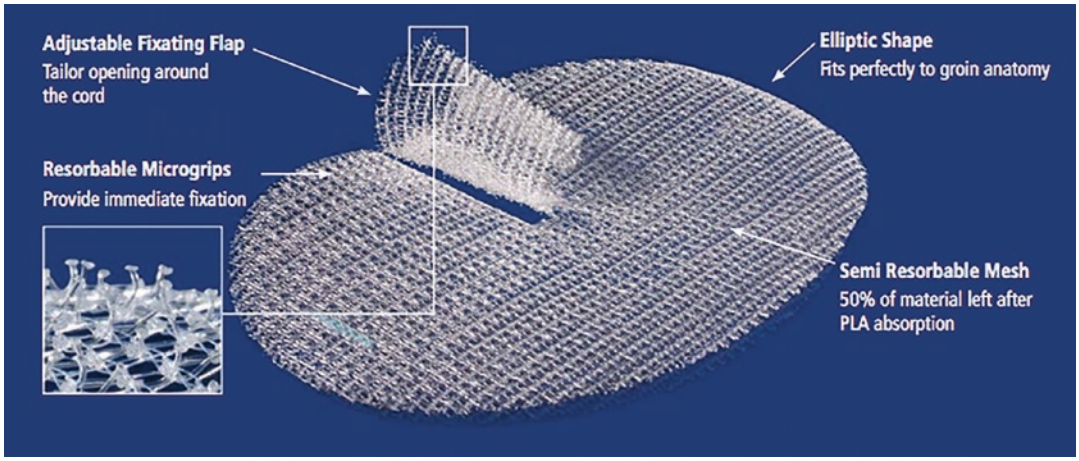

Fig. 28.1 Mesh overview (Reproduced from Medtronic)

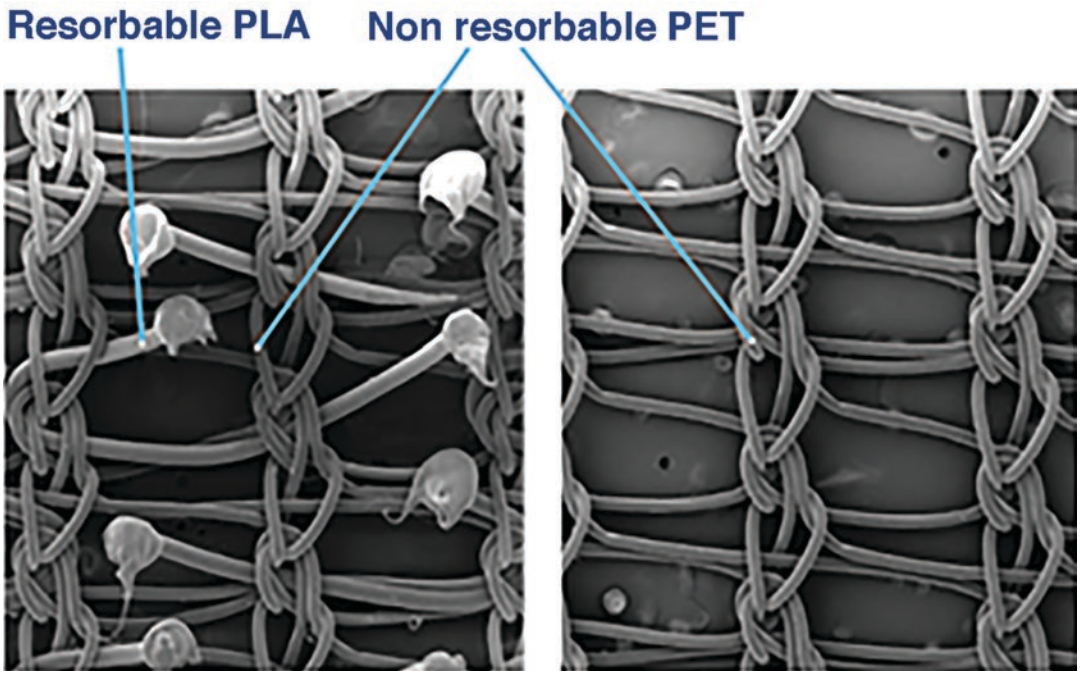

Fig. 28.2 Magnified mesh structure before and after PLA micro-hook resorption (Reproduced from Medtronic)

The Parietex ProGrip™ is a bicomponent self-fixating mesh made of hydrophilic monofilament polyester (PET) knit with resorbable polylactic acid (PLA) microgrips. The pore size of the mesh varies from 1.1 to 1.7 mm, and its weight decreases from 73 g/m^2 at insertion to 38 g/m^2 after the PLA hook resorption [14] (Fig. 28.2).

28.3 Surgical Procedure

28.3.1 Anesthesia

Inguinal hernias are mostly repaired under local anesthesia, with the possible addition of sedation. In case of recurrences or complicated hernias, it

is preferred to perform the surgery under general anesthesia.

28.3.2 Incision, Opening, and Exploration of the Inguinal Canal

Open inguinal hernia repair can be performed with two types of incisions (Fig. 28.3):

(A) a 7 cm oblique skin incision above the inguinal ligament, from an ideal point, located 2 cm medially to the anterior superior iliac spine, to the ipsilateral pubic tubercle;
(B) a 4 cm transverse skin incision in an ideal area corresponding to the lateral Pfannenstiel incision

Dissection is continued through the subcutaneous tissues and *Scarpa*'s fascia until the external oblique aponeurosis and the internal inguinal ring are identified (Fig. 28.4).

Using a *cold* scalpel, the external oblique aponeurosis is opened starting from the internal inguinal ring to expose the inguinal canal, paying attention to identify the ilioinguinal nerve and possible femoral hernias (Fig. 28.5).

The external oblique aponeurosis is then grasped with two *Kelly* forceps, and, with the help of a folded sponge, a space for mesh application is created up to the inguinal ligament (lateral). Paying particular attention to the iliohypogastric nerve, the space is extended medially with the use of curved scissor (Fig. 28.6).

The spermatic cord with his muscle, the cremaster, is identified and separated from the floor

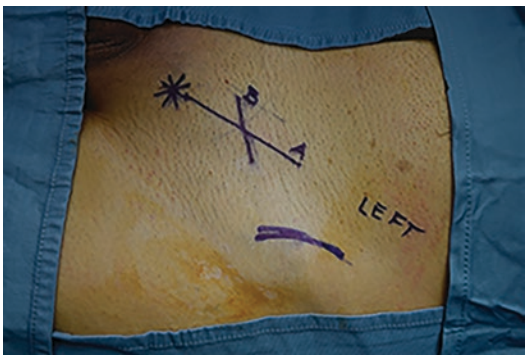

Fig. 28.3 Marked operating field: *A* = oblique incision, *B* = transverse incision

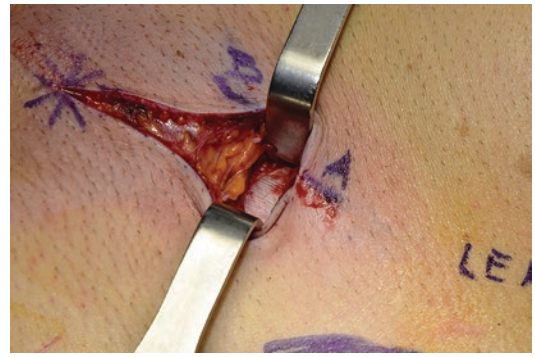

Fig. 28.4 The lateral cleft exposes the external oblique aponeurosis

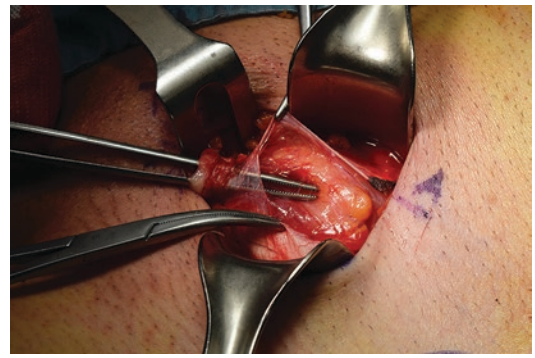

Fig. 28.5 Opening of the aponeurosis and of external inguinal ring

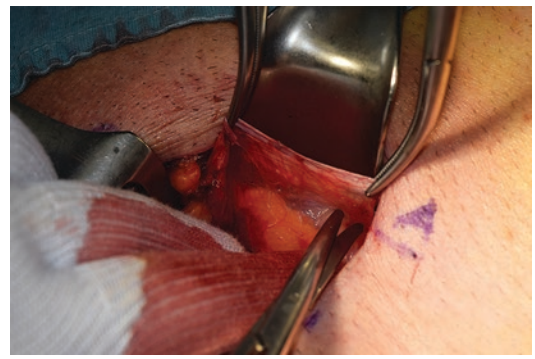

Fig. 28.6 Preparation of the medial portion of the inguinal canal

of the inguinal canal at the level of the pubic tubercle. Whenever possible, the ilioinguinal, iliohypogastric, and genital branches of the genitofemoral nerves have to be visualized and protected throughout the operation.

With the use of a vessel loop, the spermatic cord is gently suspended.

28.3.3 Hernioplasty and Mesh Application

The cremaster muscle is opened longitudinally and resected; a large and comprehensive dissection is necessary to detect a possible lateral hernia and allow a perfect allocation of the mesh around the cord.

In case of lateral (L) hernias, the hernial sac is identified and isolated from the muscle and the cord (Fig. 28.7). Without opening, when possible, the hernial sac is reduced into the internal inguinal ring (Fig. 28.8). A plastic of the inguinal ring is then performed with a 2-0 resorbable stitch.

In case of medial (M) hernias, a plastic of the *fascia transversalis* is obtained with a 2-0 continuously running resorbable suture (Fig. 28.9).

Before opening the mesh, gloves are changed.

A polypropylene self-gripping mesh is then opened paying attention in avoiding any unnecessary folding of the mesh.

A flap of the anatomically designed mesh is folded and attached on the lateral portion of the mesh itself.

The mesh is spread down to the pubic tubercle level with a 2 cm overlap on the symphysis (Fig. 28.10).

Particular attention is needed in this stage to avoid that any adipose tissue remains stranded between the mesh and the tubercle.

The mesh is slept down both medially and laterally above the inguinal ligament, and then the previously folded flap is closed around the spermatic cord.

Thanks to the Velcro-like hooks, mesh fixation is immediate and no additional sutures are usually required.

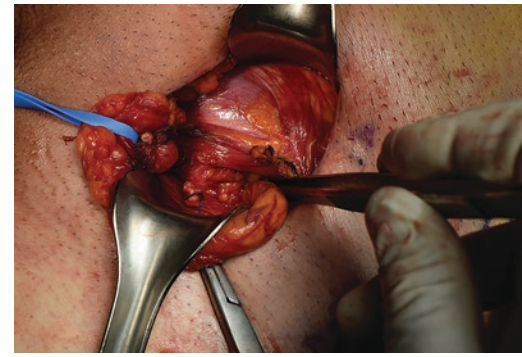

Fig. 28.8 Reduction of hernial sac

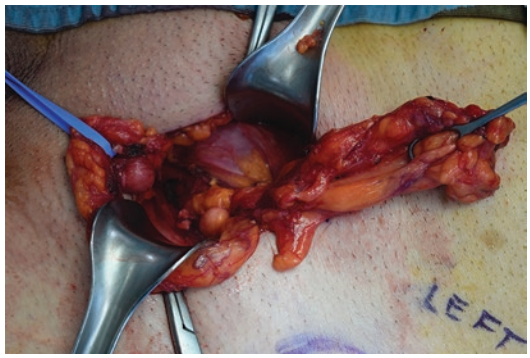

Fig. 28.7 The hernial sac (holded by Foerster forceps) isolated from spermatic cord

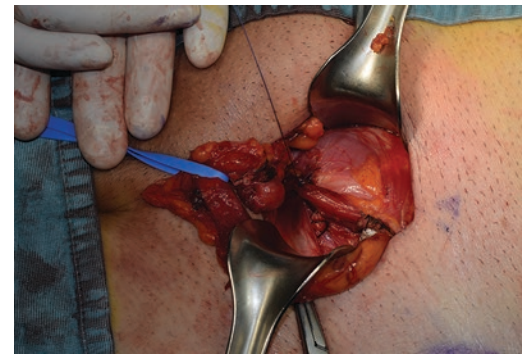

Fig. 28.9 Plastic of *fascia transversalis* helped by an antibacterial absorbable hemostat inserted in the defect

The external oblique aponeurosis is closed with two continuous sutures using slowly resorbable stitches (Fig. 28.11a, b). This type of suture is interrupted in the midline by the passage of the spermatic cord that is left in the subcutaneous tissue, just above the external oblique aponeurosis.

Scarpa's fascia is then approximated with a 3-0 absorbable interrupted suture, beginning from the inferior part of the incisional line to avoid a possible lesion of the spermatic cord. The skin is closed with 3-0 non resorbable stitches or staples.

The incision line is then covered with a compressive dressing.

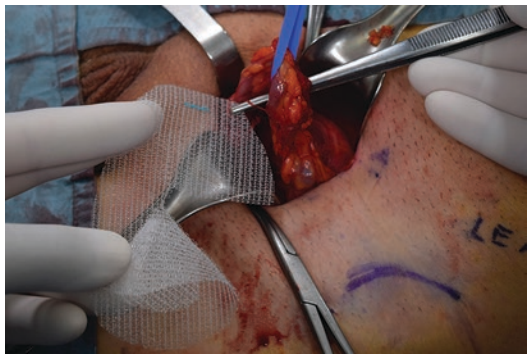

Fig. 28.10 Insertion of the folded self-gripping mesh

28.4 Tips and Tricks

28.4.1 Antibiotic Prophylaxis

- <40 years old, ASA class I: no prophylaxis
- >40 years old: a prophylactic preoperative single dose of second-generation cephalosporin
- Patients at risk (i.e., diabetes, cardiovascular comorbidities): 5 days of therapy with cephalosporin

28.4.2 Preoperative Landmarks

We use a dermographic pen to mark the anatomy.

Of the described skin incisions, we mostly use the oblique one reserving the partial Pfannenstiel to women, children, and underweight patients to ensure a better aesthetic result.

28.4.3 Anesthesia

We usually perform the procedure under local anesthesia, using the following preparations:

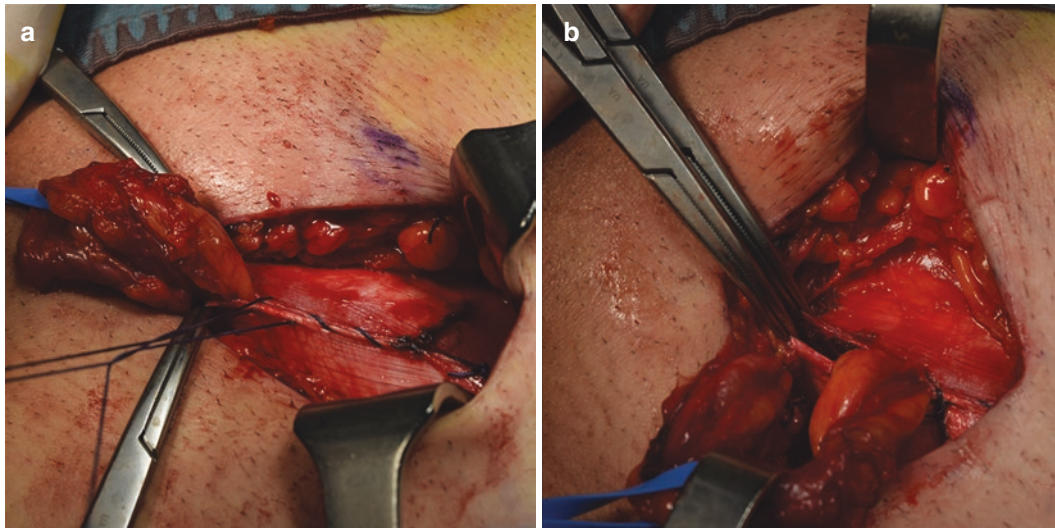

Fig. 28.11 Suture of external oblique aponeurosis interrupted by the passage of the spermatic cord

1. A mixture of 10 mL of 2% mepivacaine hydrochloride, 9 mL of saline solution, and 1 mL of sodium bicarbonate, in a 20 mL syringe
2. A mixture of 9 mL of 2% mepivacaine hydrochloride and 1 mL of sodium bicarbonate, in a 10 mL syringe
3. A mixture of 20 mL of 7.5% ropivacaine hydrochloride and 40 mL of saline, in a surgical basin

Before making the incision, we make a subcutaneous infiltration using the first of the three solutions. Mepivacaine is a local anesthetic of the amide type that has a reasonably rapid onset and medium duration of action. The solution is injected in the subcutaneous space (Fig. 28.12a) allowing a reversible block of nerve conduction that produces a temporary loss of sensations.

The second solution is then injected along the incision line into the subdermal space (Fig. 28.12b), placing the needle parallel to the skin. This infiltration is performed on a more superficial level in respect to the first injection.

During tissue dissection, we usually start by creating a cleft in the lateral third of the incisional line to easily identify the external oblique muscle aponeurosis and infiltrate the inguinal canal with 10 mL of the third solution (Fig. 28.13); this injection will block the ilioinguinal, iliohypogastric, and genital branch of the genitofemoral nerves. In doing that, we usually bend the needle of a syringe and pay special attention to avoid infiltrating the cremaster muscle that should remain on the posterior layer of the aforementioned aponeurosis. With another 10 mL of the third solution, we infiltrate the deepest subcutaneous tissue just before completing the surgical incision. We keep the remaining 40 mL of the ropivacaine solution in case this is needed for nerves or peritoneal infiltrations during surgery.

28.4.4 Nerve Management

Pain prevention is a primary goal in open inguinal hernia repair.

The EHS guidelines [2] suggest that surgeons routinely identify and protect the three nerves we encounter during this procedure, respectively, the ilioinguinal, the iliohypogastric, and genital

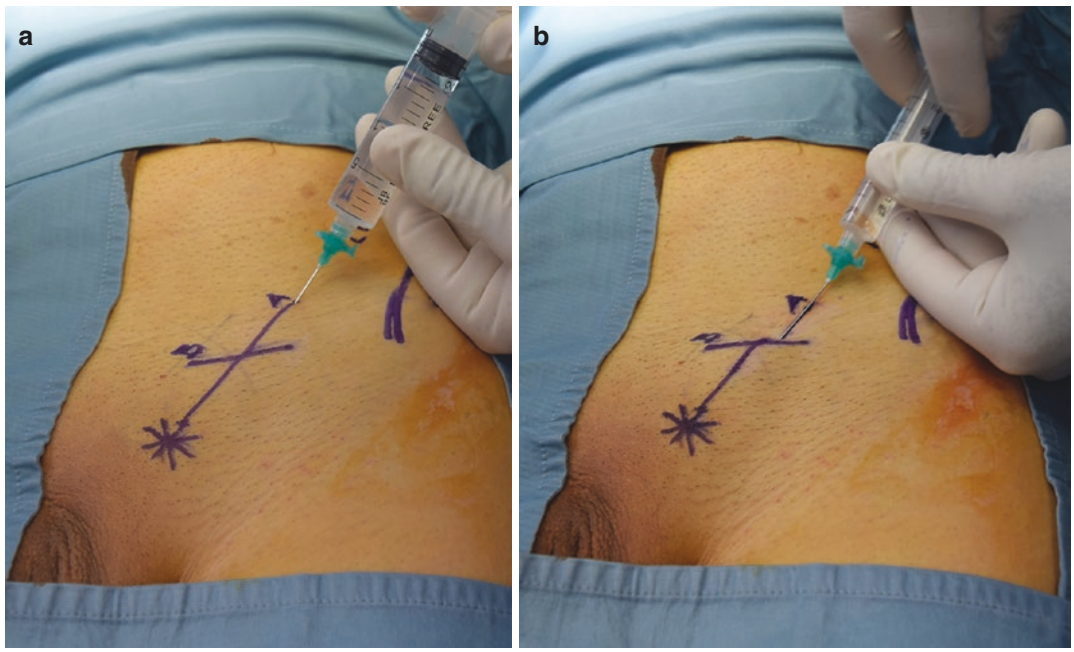

Fig. 28.12 Local anesthesia: (**a**) subcutaneous injection, (**b**) superficial infiltration

branch of the genitofemoral nerve. However, sometimes this is not safe.

We consider a nerve *at risk* when this is stressed during the dissection phase of the surgical procedure or when this will be placed in direct contact with the mesh during the reconstruction phase.

In case that any of the three nerves is considered *at risk*, this will be infiltrated using a 30 G needle with 20 mL of 7.5% ropivacaine hydrochloride diluted with 40 mL of saline and later resected (Fig. 28.14a, b). Ropivacaine is a safe long-acting local anesthetic belonging to the amino amides group. This drug permits differential nerve blocks, making it possible to anesthetize sensitive fiber without influencing the nerve's motor fiber. In addition, it has a vasoconstrictive effect, which prolongs the duration of the anesthesia.

28.4.5 Hernial Sac Management

If unnecessary, we usually don't open the hernial sac; we reduce it after a careful preparation up to its neck. In case of L2 and L3 hernias, to reduce the sac back in the abdomen, long tissue forceps are used to hold an antibacterial absorbable hemostat as a plug into the internal inguinal ring (Fig. 28.15). When the peritoneum that forms the hernia sac is stressed during the described

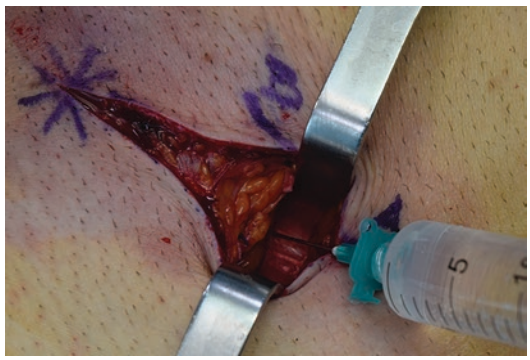

Fig. 28.13 Infiltration of the inguinal canal

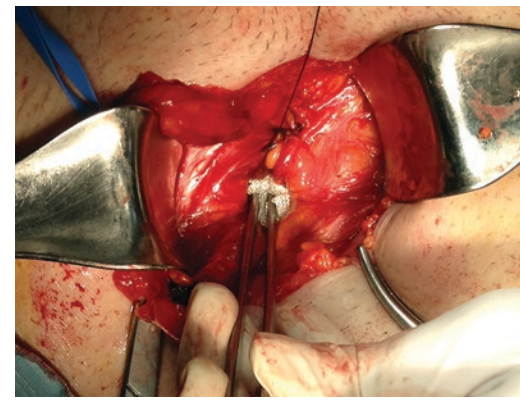

Fig. 28.15 Long tissue forceps are used to hold an antibacterial absorbable hemostat as a plug into the abdominal wall defect

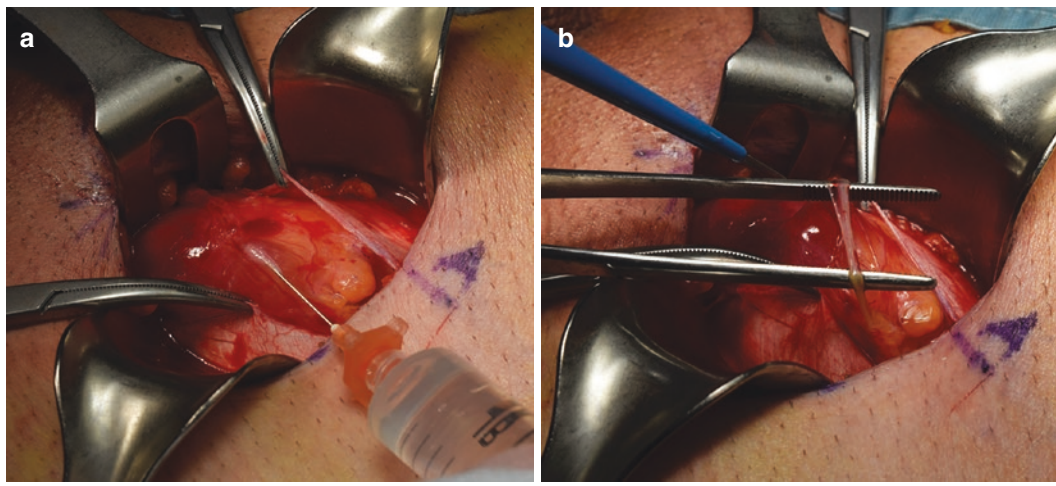

Fig. 28.14 Infiltration (**a**) and resection (**b**) of the nerve *at risk*

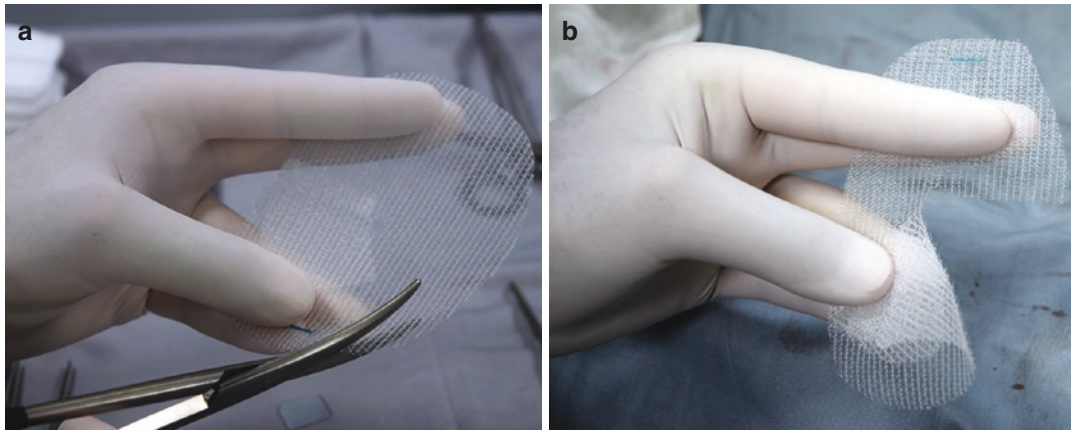

Fig. 28.16 Self-gripping mesh handle: (**a**) tailoring, (**b**) folded mesh

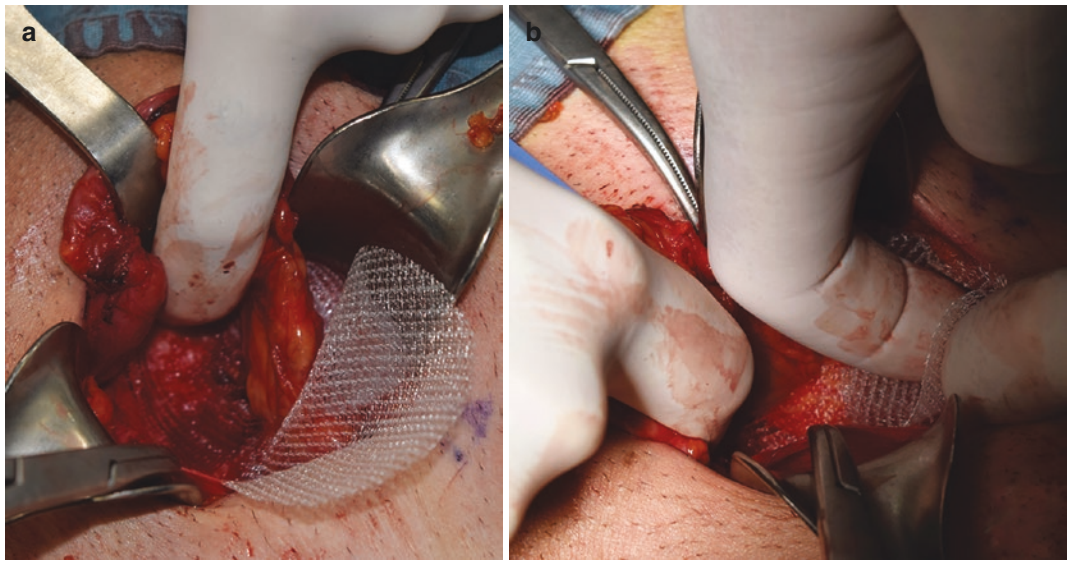

Fig. 28.17 Positioning of the mesh: (**a**) assistant's index finger holds the mesh on the pubic tubercule, (**b**) the operator slides the mesh in place

maneuvers, this should be infiltrated with the remaining ropivacaine solution.

28.4.6 Mesh Application

Even though we mostly use anatomically designed self-gripping meshes, we often tailor them according to the shape of the patient's posterior wall of the inguinal canal (Fig. 28.16a, b).

After positioning the prosthesis over the pubic tubercule, the operating surgeon gently pulls the portion of the oblique aponeurosis lateral to the spermatic cord with his left index in order to create space for the mesh to be slipped in with his right index finger (Fig. 28.17b). During this maneuver, the assistant should keep the medial portion of the mesh well in place over the symphysis to avoid any shrinkage (Fig. 28.17a). The first operator then smoothes out the mesh medially and laterally using both fingers.

Even though fixation sutures are mostly unnecessary, in case of M2 and M3 hernias, nonabsorbable suture stitches near the pubic tubercle

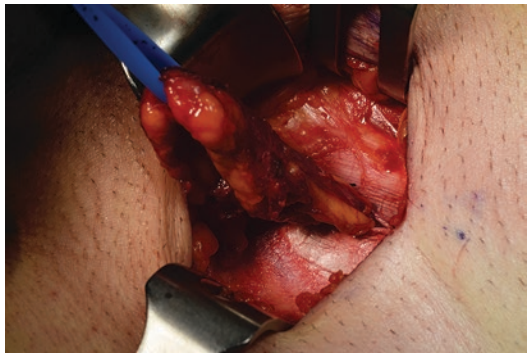

Fig. 28.18 The spermatic cord goes through the external oblique aponeurosis and remains in subcutaneous space (Trabucco)

are used to fix the mesh, one toward the rectus abdominis muscle and one toward the ligament. Important to notice, this suture should not be placed too deep right on the pubic tubercle to decrease the risk for chronic pubic pain.

Since the external oblique aponeurosis is approximated beneath the spermatic cord, the latter remains in the subcutaneous space, as in the *Trabucco* and the *Postempski* techniques (Fig. 28.18).

This strategy should be preferred over the classical *Lichtenstein* for three main reasons:

1. Having better fixation of the mesh, thanks to the creation of an *inguinal box*
2. Avoiding the mesh to get in direct contact with the spermatic cord
3. In case of recurrence, easier identification of the spermatic cord, thus less risk of lesion

28.4.7 In Females

In women, we usually implant a flat self-gripping mesh rather than an anatomically designed one. Since the genital branch of the genitofemoral nerve is contained in the round ligament of uterus, it is suggested to preserve the latter to avoid the small risk of hypersensitivity and ipsilateral labial numbness [2]. When this is the case, the self-gripping mesh is cut in its straight posterior side instead of the lateral cut visible on the anatomical design; the flaps are encompassed around the ligament and blocked placing a small piece of the self-gripping material over the mesh itself. In the case the round ligament of uterus cannot be preserved, the flat mesh is positioned as it is.

28.5 Discussion and Conclusions

After having described the surgical technique to perform an open anterior tension-free inguinal hernia repair using a macroporous semi-resorbable self-gripping mesh, we will now present and discuss an overview of the 27 papers published on the topic in the last decade (Table 28.1).

As stated previously, since the introduction of tension-free prosthetic mesh repair, the key issue regarding inguinal hernia repair has shifted from recurrence rates to incidence of patient discomfort following surgery, especially severe inguinodynia and the medicolegal consequences this occurrence implies.

The self-gripping mesh was originally designed to address this concern by eliminating the need for fixation points conferring an even distribution of tension across the repair and avoiding the stitches that are accountable for nerve entrapment and neuroma formations, the main causes of CPIP. Furthermore, the polylactic acid (PLA) microgrips that give Velcro-like properties to the device resorb naturally, leaving less material behind.

Professor Philippe Chastan in 2006 was the first to describe on a cohort of 52 patients that this sutureless mesh is easy to use, takes less than 60 seconds to be put in place, and is comparable to the Lichtenstein technique in terms of complication rates. This publication justifies the use of his eponym when referring to this surgical treatment of inguinal hernia.

Following, a number of clinical trials and meta-analysis have managed to demonstrate that this new atraumatic mesh is not inferior to the gold standard Lichtenstein technique in terms of recurrence rates and postoperative complications. The results concerning the pain and/or discomfort felt by the patients following surgery is far more controversial due to contrasting results and

Table 28.1 Overview of the conclusions of published papers (2006–present) about open anterior tension-free inguinal hernia repair using a self-gripping mesh

Publication	Journal and year	Type of study	Results
Chastan [13]	J Min Access Surg 2006	Report	Based on the first results of this clinical study, this unique concept of low-density self-gripping mesh should allow an efficient treatment of inguinal hernia. It should reduce postoperative complications and the extent of required suture fixation, making the procedure more reproducible
Chastan [15]	Hernia 2009	Report	Self-gripping mesh may be a satisfactory solution to the clinical problems of pain and recurrence following inguinal herniorrhaphy. It takes less than 60 s to place the mesh in site
Kapischke et al. [16]	Langenbecks Arch Surg 2009	Controlled prospective clinical trial	Less pain on the first postoperative day, less analgesic, and faster surgical procedures. No differences at 6 months
Bruna Esteban et al. [17]	Cir Esp 2010	Randomized clinical trial	The use of this type of mesh reduces the time of fixing the prosthesis and the total surgical time, with no effect on early postoperative pain or surgical complications
Anadol et al. [18]	Surg Today 2011	Prospective comparative study	Operating time was shorter, and early pain scores were lower in the self-adhesive mesh group
García Ureña et al. [19]	Hernia 2011	Multicentric observational study	Incidence of chronic pain at 6 months was 3% lower when using a self-gripping mesh
Kingsnorth et al. [20]	Hernia 2012	Randomized clinical trial	Surgery duration was significantly shorter, and early postoperative pain was significantly lower in the self-gripping group
Quyn [21]	Langenbecks Arch Surg 2012	Clinical trial	Self-griping mesh may lead to less chronic pain and less restriction of daily living activities
Pierides et al. [22]	BJS 2012	Randomized clinical trial	No differences regarding chronic postoperative pain
Jorgensen et al. (DANGRIP) [23]	BJS 2012	Randomized clinical trial	The use of self-gripping mesh was not accompanied by a reduction in chronic symptoms
Gys et al. [24]	Acta Chir Belg 2013	Prospective observational study	The open Lichtenstein hernia repair with the semi-resorbable self-gripping Parietex ProGrip mesh seems to offer a reliable alternative for the treatment of inguinal hernia with benefits on operating time as well as on postoperative pain
Sajid et al. [25]	Updates Surg 2013	Systematic review and meta-analysis	Chronic pain, recurrence, postoperative complications, and length of hospital stay were similar
Zhang et al. [26]	J Surg Res 2013	Systematic review and meta-analysis	No significant differences, except for the shorter mean operative duration recorded in the self-gripping mesh group
Pandanaboyana et al. [27]	The Surgeon 2013	Meta-analysis	The only significant difference found was the shorter duration of the operation
Li et al. [28]	Ann Surg 2014	Meta-analysis	No statistical difference, except for the shorter operating time
Fang et al. [29]	Am J Surg 2014	Systematic review and meta-analysis	No significant differences, except for the mean operating time that was significantly shorter in the self-gripping group
Sanders et al. [30]	BJS 2014	Randomized clinical trial	Self-gripping mesh was well tolerated and reduced early postoperative pain, without increasing the risk of early recurrence or reducing chronic pain

Table 28.1 (continued)

Publication	Journal and year	Type of study	Results
Rönkä et al. (FinnMesh) [31]	Ann Surg 2015	Randomized clinical trial	Mesh fixation without sutures does not cause less inguinodynia than suture fixation, but it is faster and easier and feasible without compromising postoperative outcome
Smeds et al. [32]	Hernia 2015	Secondary exploratory study	The use of self-gripping mesh was shown to reduce the level of postoperative pain when the iliohypogastric nerve was preserved. Resection of the nerve during Lichtenstein repair eliminates this difference
Nikkolo et al. [33]	J Surg Res 2015	Randomized clinical trial	Self-gripping mesh compared with standard Lichtenstein operation has no advantages in reducing chronic pain 6 months after surgery. The rate of foreign body feeling was higher in the self-gripping mesh group
Wang et al. [34]	Asian J Surg 2016	Retrospective study	No recurrences recorded
Fan et al. [35]	Hernia 2016	Randomized clinical trial	The use of self-gripping mesh effectively reduces the operating time with comparable long-term surgical outcome with traditional polypropylene mesh
Verhagen et al. [36]	BJS 2016	Randomized clinical trial	A self-gripping mesh for hernia repair may result in less pain in the early postoperative phase, but chronic postherniorrhaphy pain is not affected
Cadanová et al. [37]	Hernia 2016	Randomized clinical trial	No significant difference in chronic pain between the inguinal repairs with the use of a self-gripping mesh compared with a transinguinal preperitoneal (TIPP) repair at 1 year after surgery
Nikkolo et al. [38]	J Surg Res 2017	Randomized clinical trial	We failed to demonstrate the advantages of self-gripping mesh in terms of chronic pain and foreign body feeling. However, usage of self-gripping mesh does not increase hernia recurrence rate
Ismail et al. [39]	Surgery 2017	Systematic review	Data from our analysis did not favor either of the two fixation techniques over the other in terms of recurrence or postoperative chronic groin pain
Molegraaf et al. [40]	Ann Surg 2017	Randomized clinical trial	The self-gripping ProGrip mesh does not reduce CPIP rates. Outcomes of the ProGrip mesh are comparable to the Lichtenstein technique with the additional advantage of a reduced operation time

a poor definition of chronic postoperative inguinal pain. For the sake of brevity, most of the studies agree on a reduction of early postoperative pain and need of analgesic, but unfortunately there is no evidence of reduced CPIP, especially when the iliohypogastric nerve is not preserved. However, a common finding highlighted by most of the papers is the significantly shorter time needed to fix the prosthesis and an overall faster surgical procedure that would allow a more efficient utilization of the operating theater and staff; this makes the use of these devices feasible from a health economics point of view. Moreover, there is no major technical difference between the procedures apart from the fixation steps, and more than one author has stated that the sutureless technique is easy to use and learn; this is crucial since inguinal hernia repair is among the first procedures performed by general surgery residents.

In conclusion, a general surgeon dedicated to the treatment of abdominal wall defect should include in his armamentarium the ability to perform an open anterior tension-free inguinal hernia repair with a self-gripping mesh in order to tailor on the need of the patients his surgical approach.

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