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Minimally Invasive Surgery of the Groin: Inguinal Hernia Repair

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Abstract

The minimally invasive surgical technique for inguinal hernia repair (eTEP and TAPP) are gaining acceptance among surgeons worldwide. With the superior benefits of the laparoendoscopic techniques (less postoperative pain, numbness, and chronic pain, fewer complications, and faster return to normal activities), the protocolization and standardization of these approaches are essential to improve patient outcomes and reduce costs. Improved laparoscopic skills, well-selected patients, simulator training, and anatomy knowledge of the groin are the cornerstone for these approaches. We recommend starting the learning curve with the TAPP procedure, because it is easier to get familiarized with the anatomical landmarks of the pelvis and groin.

Keywords: inguinal hernia, TAPP, TEP, E-TEP, minimally

1. Introduction

When dealing with groin hernia, we believe that surgeons must be familiarized with an open technique (Lichtenstein), a posterior open technique (e.g., Rives-Stoppa), a non-mesh technique (Shouldice or McVay), and a laparoendoscopic technique (TAPP or eTEP). The former is because the groin hernia has a lifetime occurrence of 27–43% in men and 3–6% in women [1]. Therefore, inguinal hernia repair (IHR) is one of the most common surgeries performed worldwide, doing approximately 20 million each year [2].

It is now well recognized that laparoendoscopic techniques are superior to open approaches concerning less postoperative pain, numbness [3], chronic pain, fewer complications, and faster return to normal activities [2–4]. Nevertheless, longer operative time, increased costs, and major complications such as great vessels and intestinal injuries are attributable to the laparoendoscopic approach [2–4]. Even though laparoendoscopic surgery is more expensive than open procedures [2], improved surgical skills, experienced surgeons, high-volume centers, and some patient characteristics (e.g., Bilateral inguinal hernia) enhance this approach [2, 4–6].

The minimally invasive surgical techniques for inguinal hernia repair (MISr): extended-view totally extraperitoneal approach (eTEP) and transabdominal pre-peritoneal approach (TAPP); are gaining ground in the surgeons' armamentarium.

Improved laparoscopic skills, well-selected patients, simulator training, and anatomy knowledge of the groin are the cornerstone for these approaches.

2. Anatomical considerations

The myopectineal orifice (MPO) is an inherently weak area of the abdominal wall where the direct, indirect, femoral, and oblique hernias occur [7], being delimited medially by rectus abdominis muscle, inferiorly by pectineus ligament, laterally by psoas muscle, and superiorly by the transverse arch (transversus abdominis and internal oblique muscle) [8]. The anatomical landmarks are described in **Figure 1**.

Two classic triangles have been described in the laparoscopic inguinal view: The triangle of doom (**Figure 2**) where the external iliac artery and vein are, and the triangle of pain (**Figure 2**), within this triangle, are from lateral to medial: the lateral femoral cutaneous nerve, the femoral branch of the genitofemoral nerve and the femoral nerve.

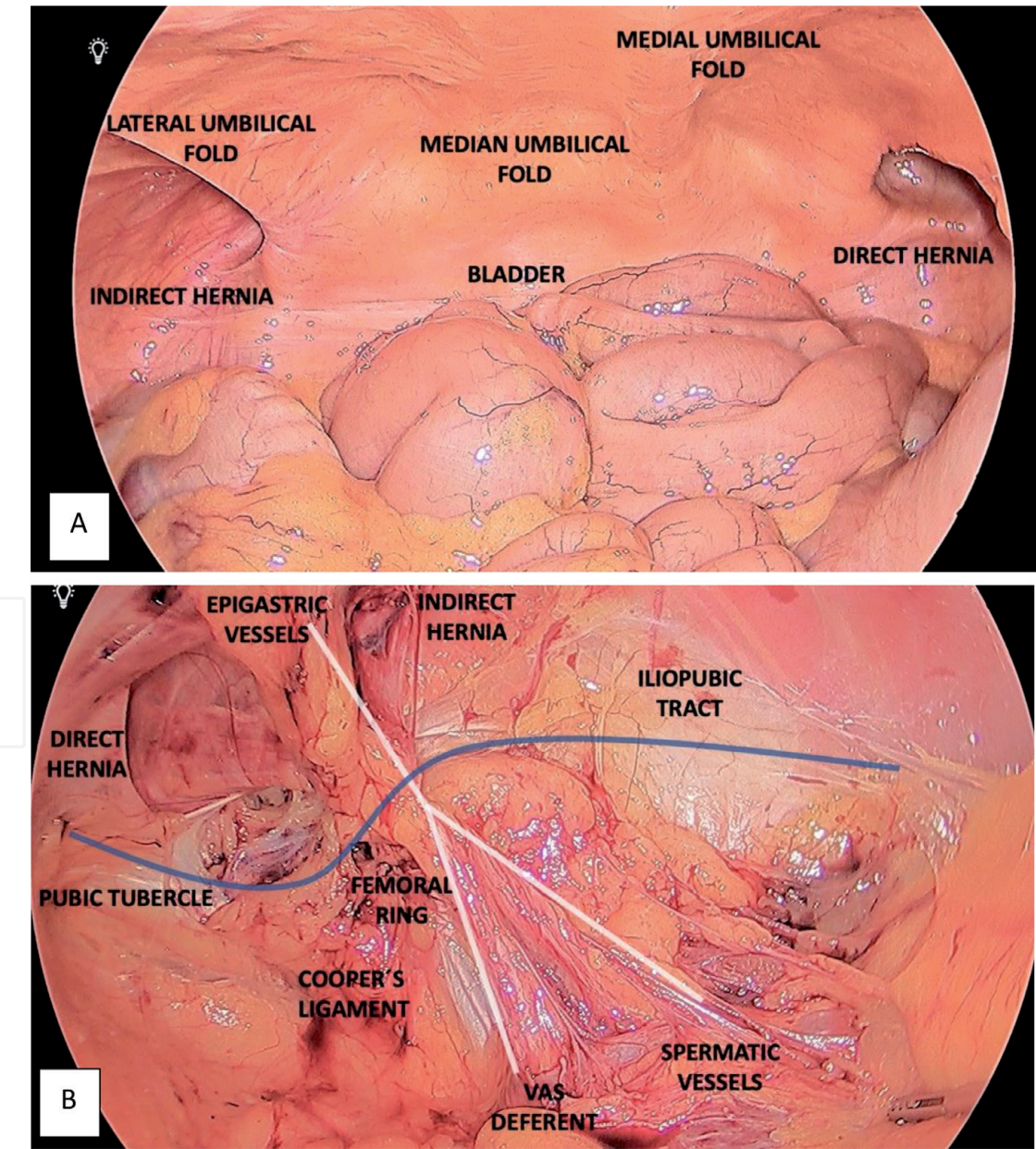


Figure 1.
Anatomical landmark of laparoscopic pelvic view (A) and inguinal laparoscopic view (B). Own by the author.

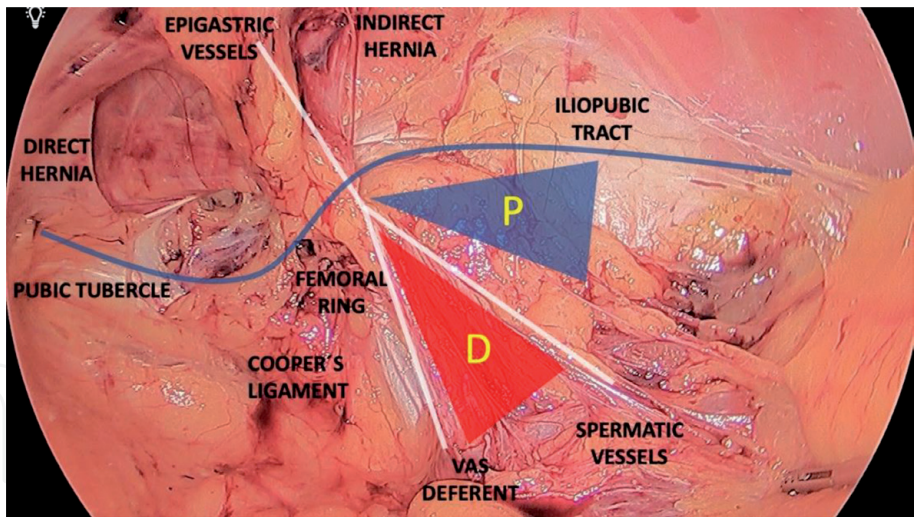


Figure 2.
Triangle of pain (P) and triangle of doom (D). Own by the author.

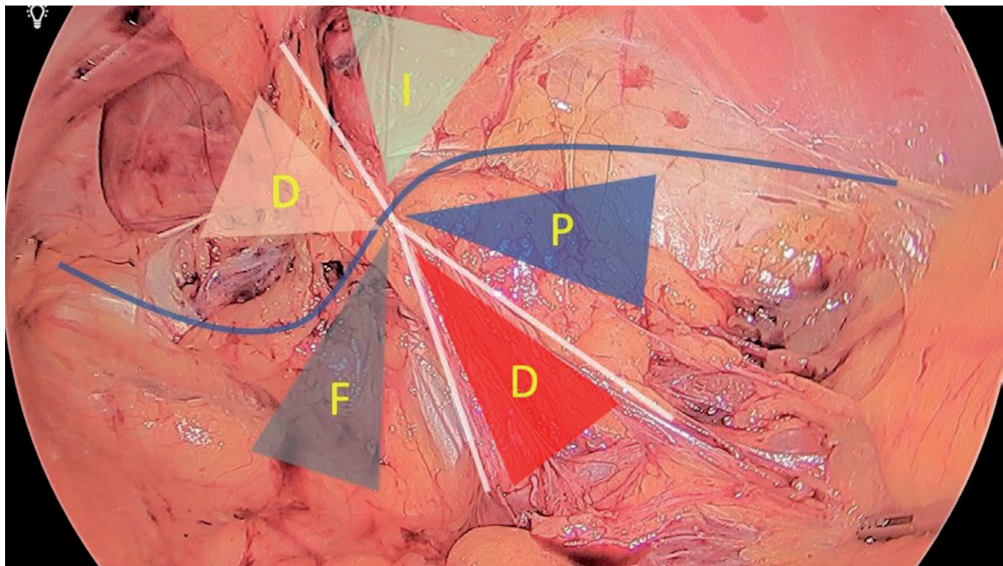


Figure 3.
Inverted “Y” and five triangles of the inguinal region. Femoral hernia (F), direct hernia (D), indirect hernia (I), doom (D) and pain (D) triangles. Own by the author.

A more didactic description of the MPO’s posterior visualization dividing this region into three zones and five triangles was described to facilitate the comprehension and recognition of anatomical structures during MISr [8] (see **Figures 3** and **4**).

3. Surgical aspects

Even though the eTEP and the TAPP require a different initial approach, both techniques need to accomplish the MPO’s critical view to assurance a correct mesh placement after the creation of the peritoneal pocket.

3.1 Indications and contraindications

The indications to perform a MISr of inguinal hernia are the same as those for an open approach. The more important indications to do MISr are: knowledge of the

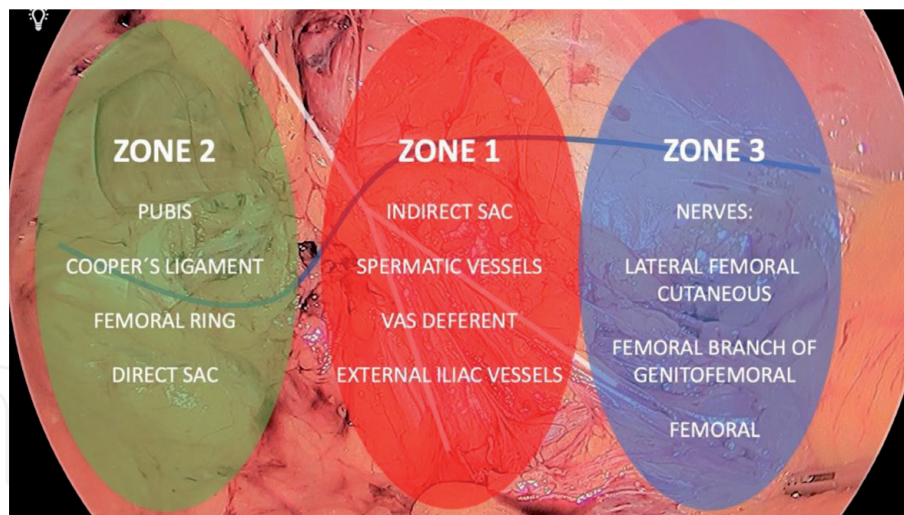


Figure 4.
Zones of the inguinal region. Own by the author.

technique with a clear laparoscopic anatomy concept, having laparoscopic skills for intracorporeal suture, and bimanual dissection capacity. In the case of an incarcerated or strangulated hernia, we recommend the TAPP approach to inspect the bowel; if small bowel resection must be done, intracorporeal stapler use or exteriorization of the bowel through the umbilical port (minilaparotomy of 5 cm) can be used.

The contraindications are the patient's intolerance to pneumoperitoneum, childhood, and pregnancy after the second trimester. Relative contraindications are severe ascites, strangulated hernia, recurrence inguinal hernia after a posterior approach.

As for the initial cases, we recommend starting with small, unilateral hernias and progressively, increase the difficulty of the cases.

3.2 Preoperative planning

Patient: patient's position on the operating table is supine with both arms secured at their respective side. Bladder drainage with a Foley catheter is unnecessary if the patient urinates immediately before entering the operating room; We suggest draining the bladder with a Foley catheter during the initial cases.

Instrument: laparoscopic tower, a 30 degrees 10 mm angular scope, two grasper or Croce-Olmi forceps, one Maryland dissector, one Metzenbaum scissors, one laparoscopic needle driver, monopolar energy.

The surgeon's position is on the hernia's contralateral side (Dr. Ploneda-Valencia usually operates at the patient's head). The camera's operator is on the hernia's side (or at the opposite of the hernia if the surgeon is at the patient's head). The operating table is kept in the Trendelenburg position with a contralateral rotation of the hernia. The monitor is placed at the patient's feet.

Comment: Our anesthetist usually applies a TAP block guided with ultrasound.

3.2.1 Standardize technique: critical view of the myopectineal orifice

The following are the steps to gain the critical view of the MPO, which are necessary to increase surgical success [9]:

1. Create a large peritoneal flap. Dissect across the midline and identify the pubic tubercle and Cooper's ligament (CL). For large, direct hernias, extend the dissection to the contralateral CL.

2. Rule out a direct hernia by visualizing the anatomy. Remove unusual fat in the Hesselbach's triangle.
3. Dissect the space of Retzius at least 2 cm between the CL and bladder to facilitate flat placement of the mesh.
4. Rule out a femoral hernia by dissecting between the CL and iliac vein.
5. Parietalize the cord's elements. To ensure compliance with this requirement, the dissection must continue until the cord's elements lie flat. Pull the sac and peritoneum upward; this maneuver will not trigger any movement of the cord's elements if this step is achieved.
6. Identify and reduce cord lipomas.
7. Dissect the peritoneum lateral to the cord's elements beyond the anterior superior iliac spine.
8. Perform the dissection and ensure that mesh provides adequate coverage of all defects. Mechanical fixation must be placed above an imaginary inter-anterior superior iliac spine line and any defects to avoid recurrence and nerve injury.
9. Place the mesh only when items 1 to 8 are completed, and hemostasis has been verified. The mesh size should be at least 15–10 cm and be placed without creases or folds. Ensure that its lateral-inferior corner lies deep against the wall and does not roll up during space deflation.

3.2.2 eTEP technical features

The initial incision is made on the flank 3 cm above and 5 cm lateral to the umbilicus line [6, 10, 11]. See **Figure 5** for unilateral hernia and **Figure 6** for bilateral hernia trocar setup. At the selected location, a 12 mm incision is made, and the anterior fascia is exposed with the use of "S" retractors, the anterior fascia is incised with a no. 11 blade, the fibers of the rectal abdominis muscle are separate, and the posterior sheath is exposed. Blunt dissection with the finger is done, and the space created is lifted with the help of the "S" retractor to allow the introduction of the balloon dissector (**Figure 7**). Once the balloon dissector (Spacemaker™ Plus Dissector System) is inserted, the camera is introduced, and the balloon is inflated with the hand pump with 25–30 hand pumps of air under direct vision. The next step should follow the critical view of the myopectineal orifice [9].

3.2.3 TAPP technical features

The trocar setup we recommend is demonstrated in **Figure 8**; the initial incision is transumbilical [12, 13], either Veress or Hasson technique can be done as the surgeons' preference, and a 12 mm trocar is introduced. After laparoscopy is done, two 5 mm trocar to the right and left of the umbilicus are introduced. Our recommendation for the peritoneal flap creation is to initiate the lateral side 2 cm upper and 2 cm medial to the anterior superior iliac spine. In a horizontal direction, it incises the peritoneum to the medial umbilical ligament (See **Figure 1**). The following dissection should be in a bloodless space, which could be done either in Zone 1 or in Zone 2 (See **Figure 4**). We recommend doing first the Zone 2 dissection because it

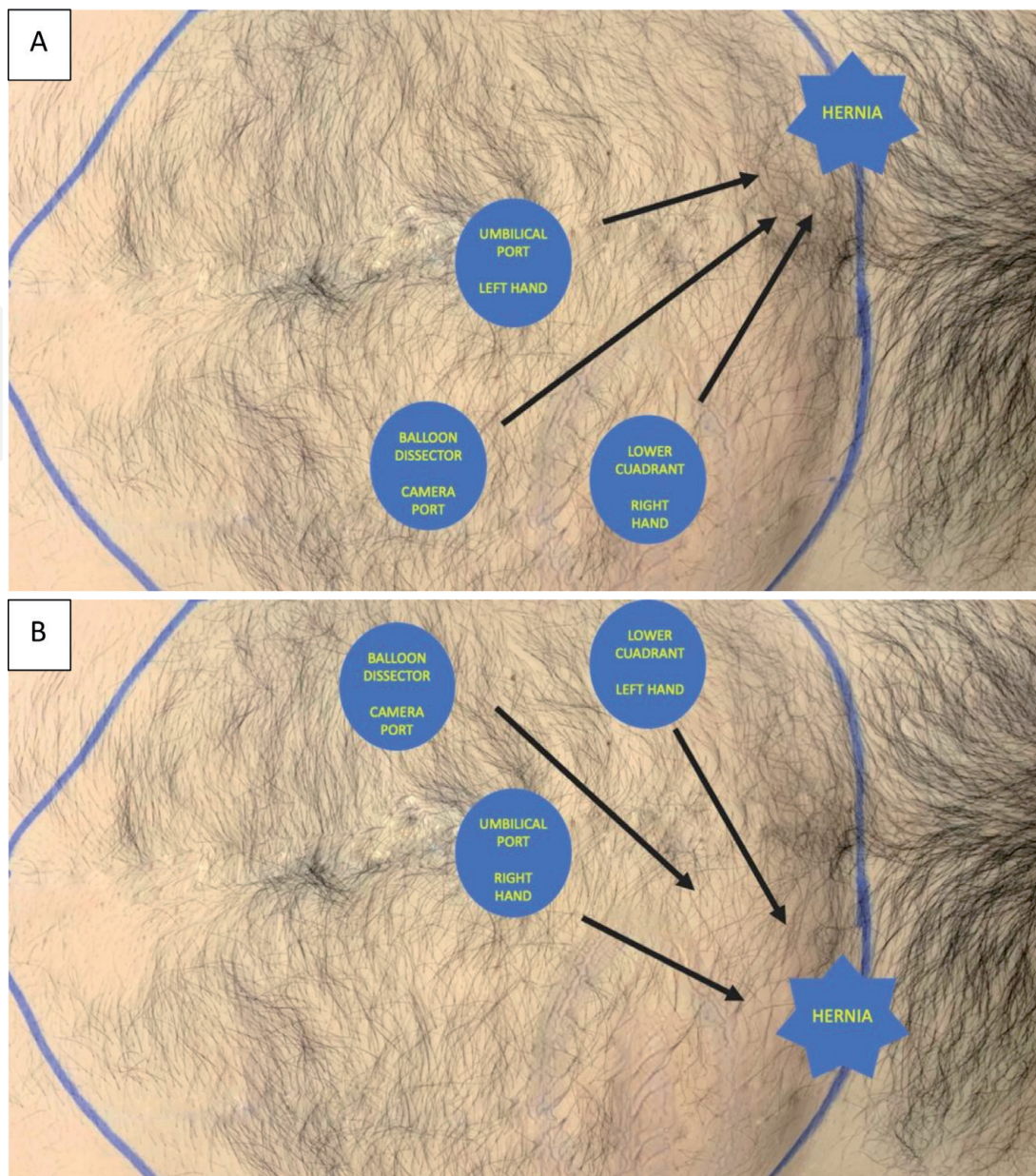


Figure 5.
eTEP for unilateral inguinal hernia trocar setup. “A” left hernia and “B” right hernia. Own by the author.

is easier to identify the CL and the pubic tubercle (**Figure 9**). The next step should follow the critical view of the myopectineal orifice [9].

3.2.4 Pitfalls and pearls

- The TAPP technique is easier to learn and has a more “friendly” view of the anatomical landmarks than eTEP.
- The dissection of Zone 2 is easier to do and has a more consistent anatomy.
- The medial defect should be close if it is larger than 2 cm. We recommend the use of the European Hernia Classification to describe the hernias [14].
- The lateral hernia sac should be traction medially. Remember, “traction” and “counteraction” are the key steps to dissect the sac.
- “Twist” medially the sac to improve the traction.

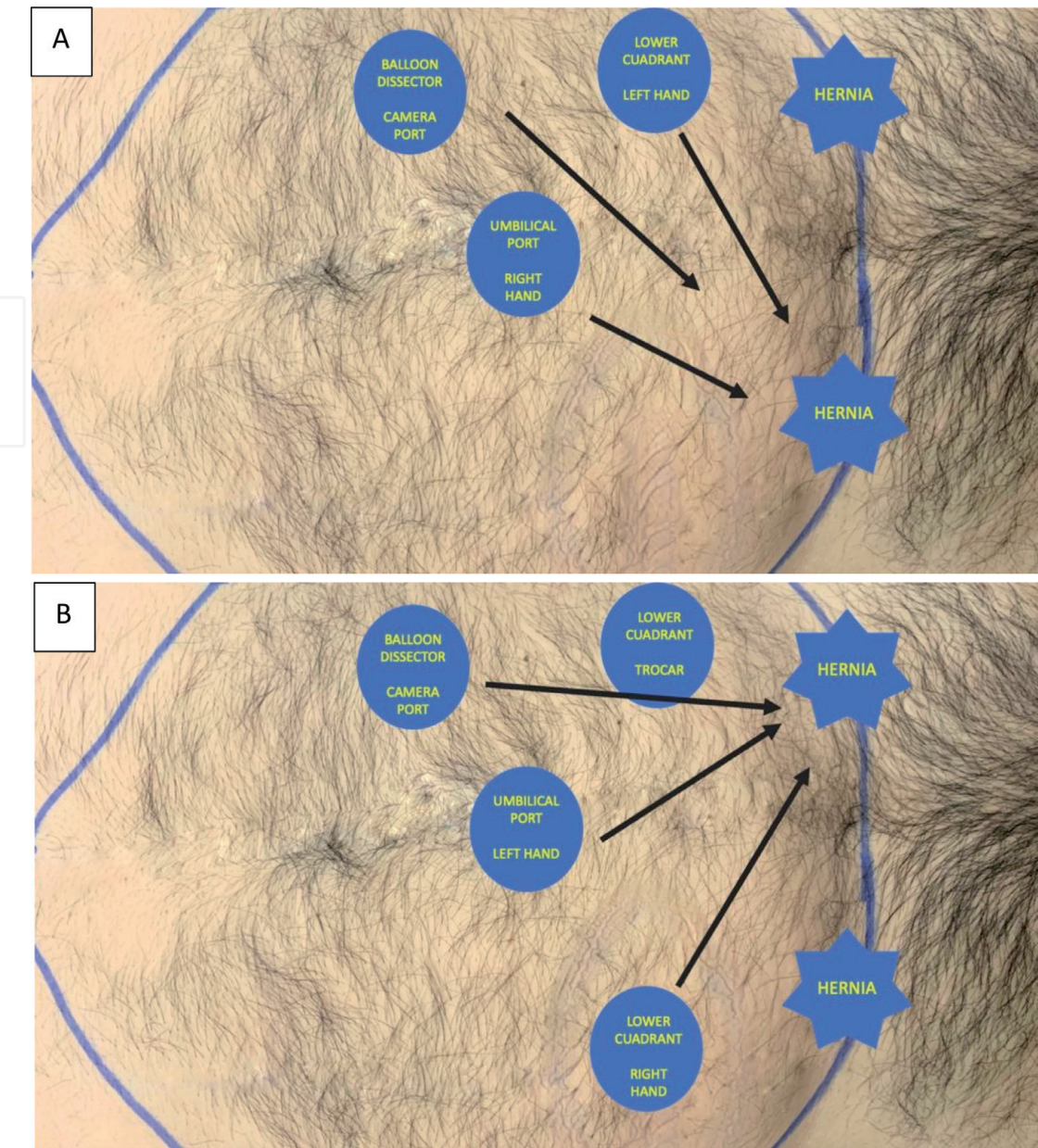


Figure 6.
eTEP bilateral inguinal hernia trocar setup. “A” start with the right hernia; “B” insert a fourth trocar in the right lower quadrant to do the left hernia.

- The dissection of the cord’s elements is achieved when we tract the peritoneal flap, and the movement is not transmitted to the cord’s elements; the sac must reach the peritoneal flap.
- In larger sacs, the “ligation and section” approach is a valid option
- If bleeding from the “Corona Mortis” occurs, simple compression with two or three gauzes is usually enough for 5 to 10 minutes. We do not recommend using electrocautery as it may tear the vessel or increase the zone of bleeding.
- The mesh should be at least 12 cm transversely and 11 cm vertically. We usually use a 14×14 cm mesh.
- We do not recommend using a pre-shaped mesh because it only increases the cost of the procedure. We use a polypropylene mesh of 15×15 cm (Ultrapro™ or Prolene™) and cut it to fix. We only cut the border of the mesh. See **Figure 10**

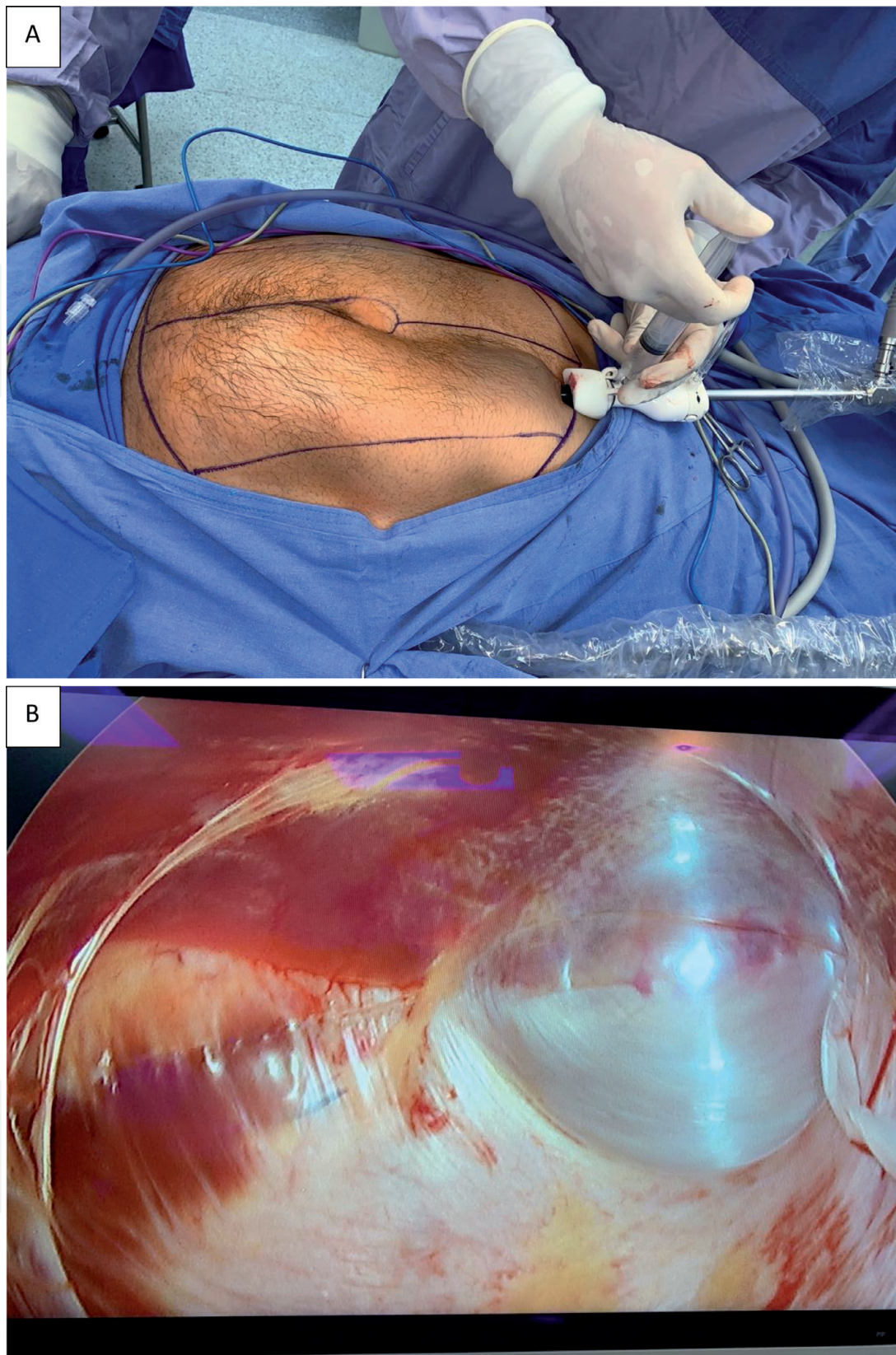


Figure 7.
Balloon dissector outside (A) and inside (B) view of the abdomen. Own by the author.

- We recommend rolling up the mesh to introduce the mesh and place an external stitch to maintain the position. Once inside, cut the stitch and unroll it, pulling the mesh's inferior medial aspect downward and unrolling upward. See **Figure 11**
- To fix the mesh, either use 1–2 Tackers in CL, 1 Tacker medial, and 1 Tacker lateral and in the most upper part of the mesh to avoid the triangle of pain or use

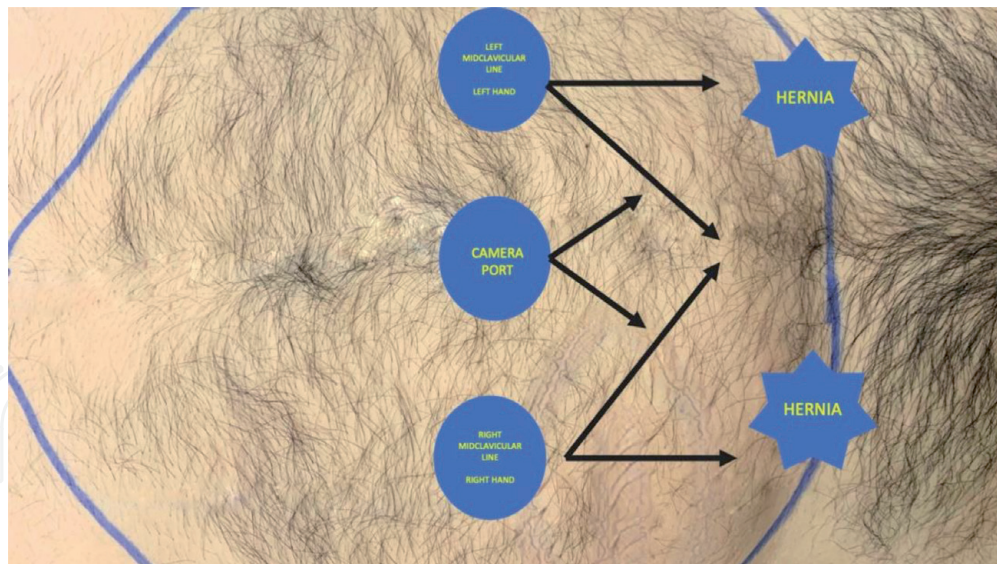


Figure 8.
TAPP trocar setup. Own by the author.

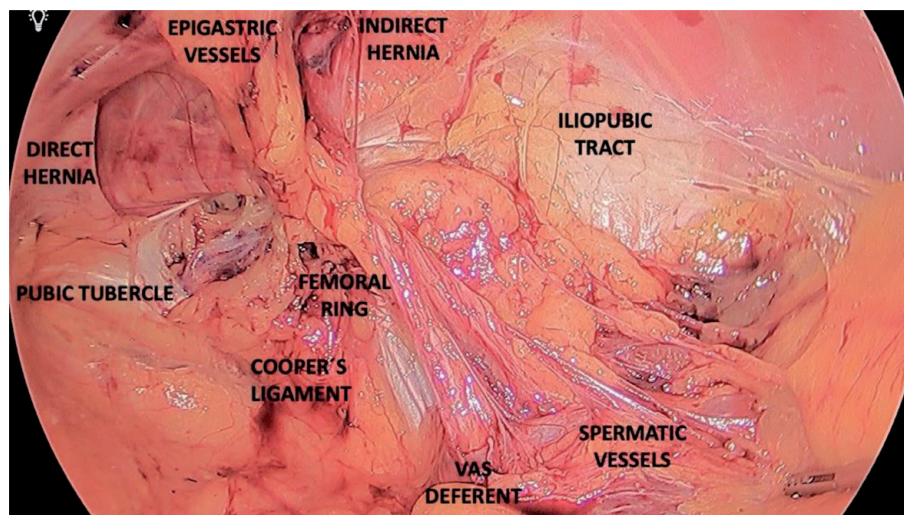


Figure 9.
Complete inguinal dissection. Own by the author.

absorbable stitches instead. Always remember not to apply it over the inferior epigastric vessels or beneath an imaginary line that runs transversely from the iliopubic tract to the pubic tubercle (See **Figure 3**). See **Figure 12**.

- Even though experts do not fix the mesh [15], we strongly recommend fixing it to diminish migration risk. On the other hand, the mesh's excessive fixation won't prevent a recurrence if the surgical technique isn't performed correctly and will increase the risk of postoperative pain and chronic pain [16].
- Tears can appear during the creation of the peritoneal flap, making it complicated to cover the mesh. Using the redundant peritoneal sac to cover the mesh with peritoneum is a feasible option.

3.2.5 Postoperative care

In the small or medium-sized hernias ($L/M < 3$), we managed the patient as an outpatient; during the learning curve, a 12–24 hours observation may be advisable.

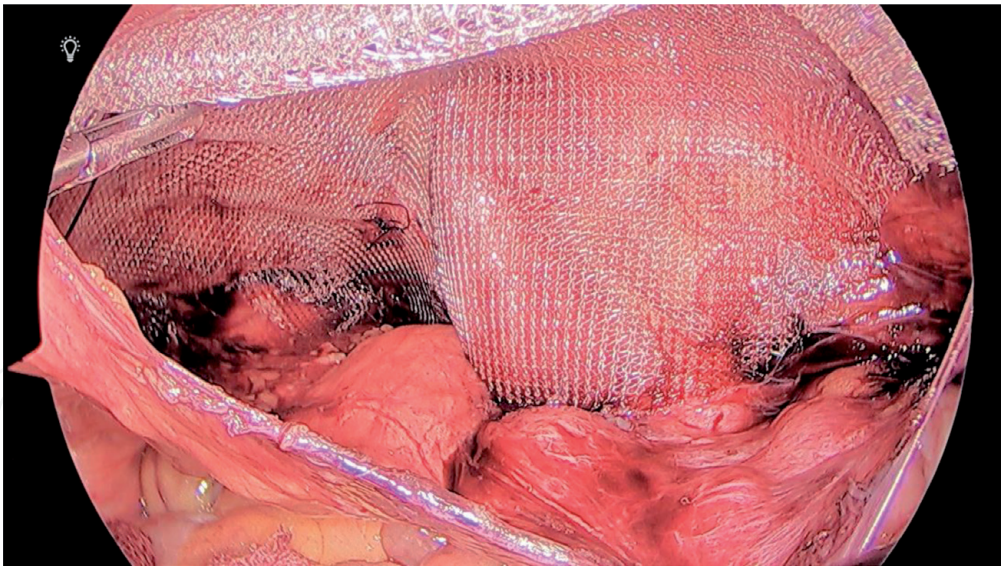


Figure 10.
Mesh configuration. Own by the author.

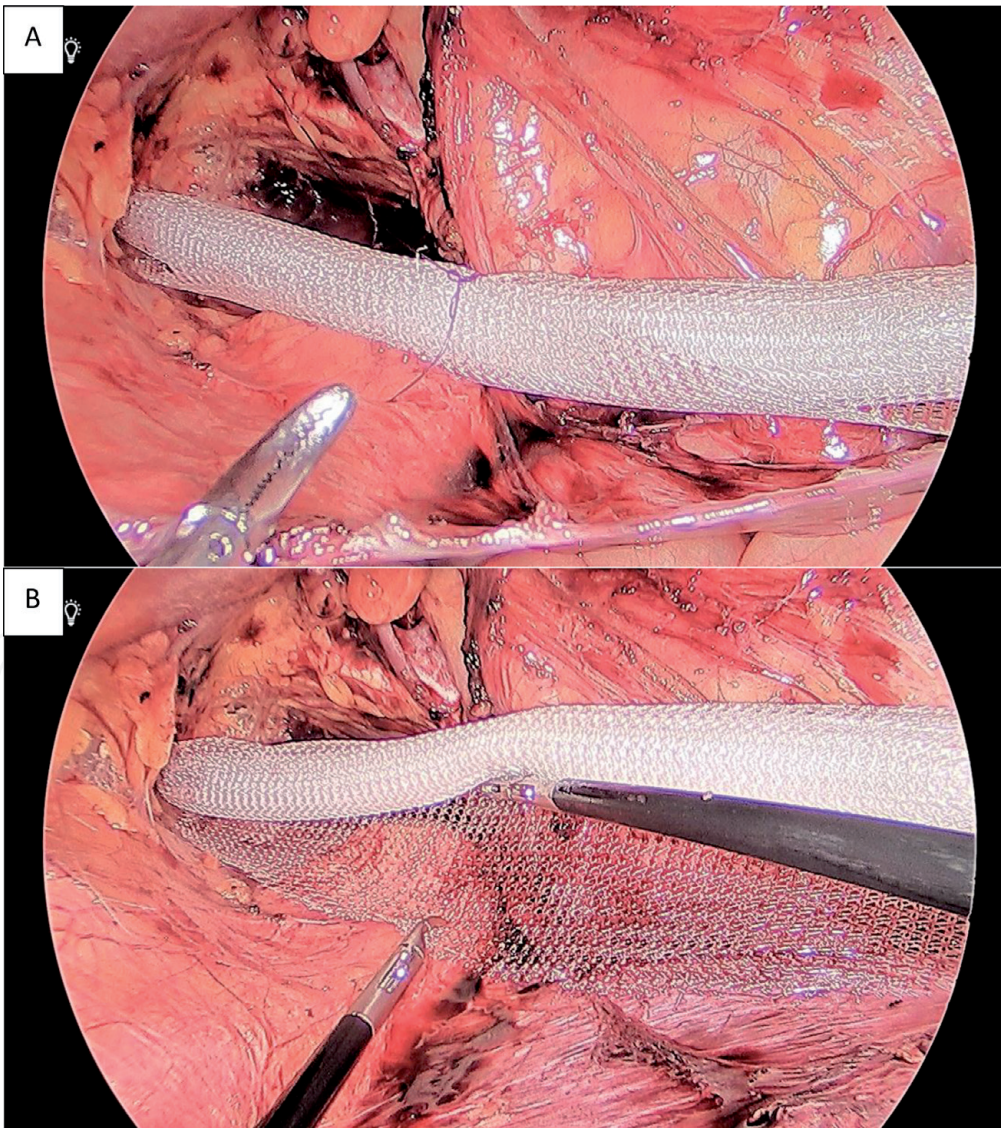


Figure 11.
Roll up mesh (A) and unroll the mesh from downward to upward (B). Own by the author.

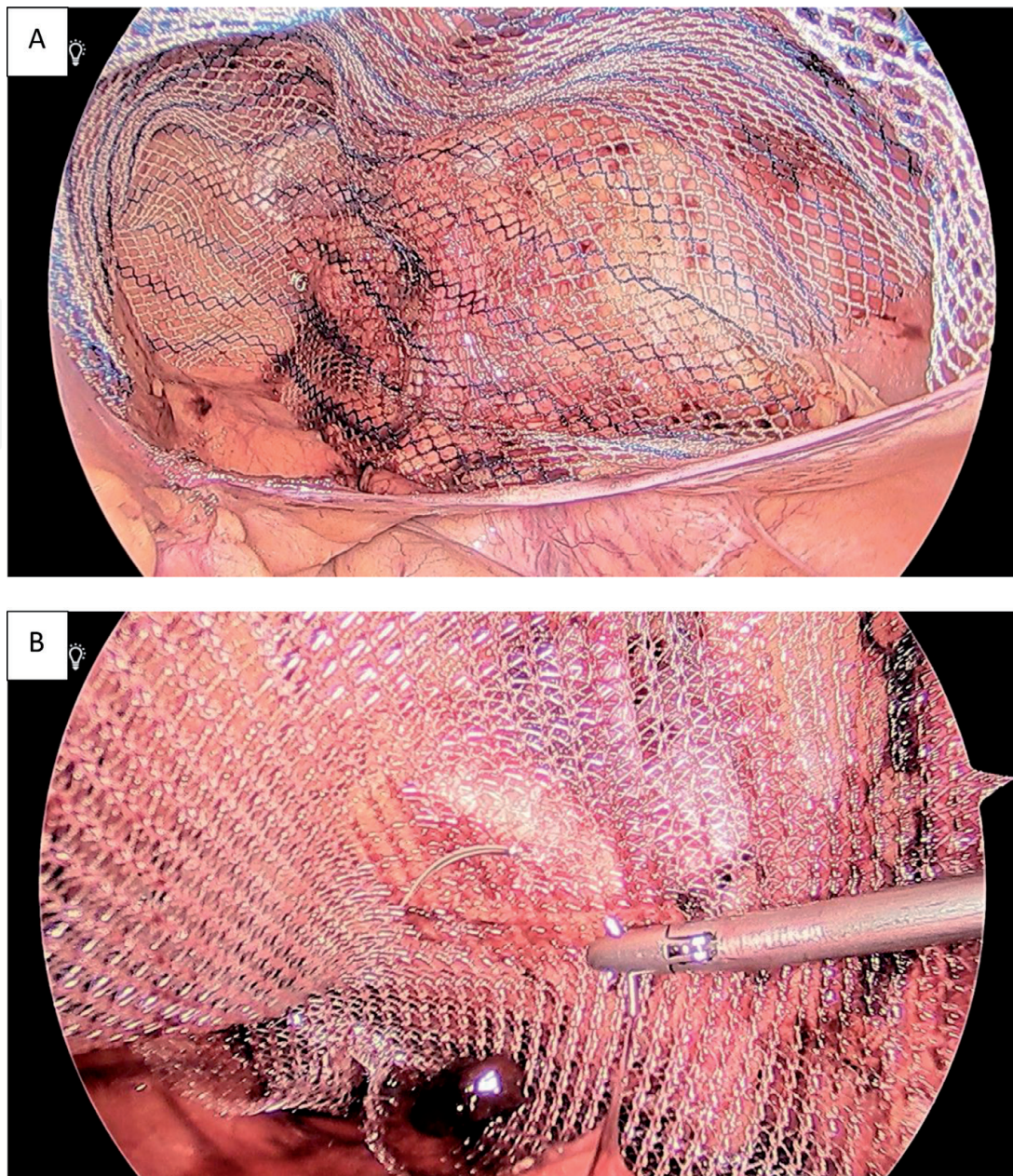


Figure 12.
Fix mesh either with tackers (A) or stitches (B). Own by the author.

The use of tight boxers and an icepack application in the groin region reduces postoperative pain and the inflammatory response. We recommend using the icepack for 30 minutes four times a day during the first seven days. Physical activity, mild activities (such as driving or going to work) are recommended after the 7th postoperative day; lifting over 10 kg or doing exercise is recommended after the 4th postoperative week.

3.3 Complications

Transoperative complications: the most common complication is peritoneal flap tear, which can be closed with the remanent sac or by diminishing the insufflator's pressure to do a primary closure. Bleeding of large vessels is a life-threatening complication. The more frequent injured vessels are the inferior epigastric vessels or the obturator vessels. If bleeding occurs, compression with gauze for

10 minutes is usually enough; using titanium clips or an advanced hemostatic device (LigasureTM or HarmonicTM) may resolve the problem. The surgeon must be ready to convert the surgery if the bleeding is abundant. As for the intestinal lesion, the surgeon's ability to do a primary closure with intracorporeal suture will decide the course of action. If the surgical field is contaminated, an open non-mesh technique should be done.

Postoperative complications include pain, seroma, hematoma, hydrocele, surgical site infection, chronic pain, mesh rejection, mesh infection, recurrence, testicular atrophy, among other less common complications (e.g., mesh penetration of the bladder). Seroma is the most frequent complication, usually appears in a large hernia, secondary either to death-space or to an exhaustive dissection of a large sac. Hematoma is another frequent complication which diminishes its appearance if tight boxers and icepack on the groin are used. Generally, watchful waiting is enough to manage either seroma or hematoma, but surgical drainage may be needed if large and painful.

4. Conclusions

MISr is safe and feasible if the surgeon is familiarized with the anatomical landmarks and the technique. Surgical skills and experience are essential to improve patient outcomes. Reviewing the surgery video, especially during the learning curve or in complicated cases, and comparing it with the expert's videos, enhances the surgeon's growth and diminishes the learning curve.

Conflict of interest

The authors declare no conflict of interest.

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