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An Overview on Transabdominal Preperitoneal Procedure (TAPP)

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Abstract:

Laparoscopic transabdominal preperitoneal (TAPP) repair has become a widely accepted technique for inguinal hernia repair. It offers several advantages over conventional open repair, including less postoperative pain, reduced surgical trauma, shorter hospital stay, and earlier return to daily activity. However, controversies still exist regarding the necessity of mesh fixation, as chronic groin pain (CGP) remains one of the most concerning postoperative complications. Avoiding fixation may decrease postoperative pain and cost without increasing recurrence risk.

Keywords: Inguinal hernia; Laparoscopic repair; TAPP; Mesh fixation; Non-fixation; Chronic groin pain; Recurrence; Cost-effectiveness.

Introduction:

Hernia is a common surgical condition, especially in males. Groin herniorrhaphy is one of the most frequent operations performed by general surgeons. Over 20 million groin hernia repairs are done annually worldwide, accounting for about 10–15% of all general surgical procedures **(1).** About 75% of all hernias occur in the inguinal region, of which two-thirds are indirect.

The laparoscopic approach to hernia repair has evolved significantly since the 1990s. The transabdominal preperitoneal (TAPP) technique provides less postoperative pain, faster recovery, and earlier return to normal activity compared to open methods **(2).** Despite these advantages, concerns regarding chronic groin pain and recurrence persist, mainly attributed to mesh fixation by tackers or staples **(3).**

Recent studies suggest that non-fixation of mesh may reduce postoperative pain, operation time, and hospital stay without compromising hernia recurrence rates **(4).**

Inguinal hernia repair is one of the most frequent surgical procedures performed around the world. However, although laparoscopic inguinal hernia repair was initiated more than 28 years ago, most hernioplasties are still performed with an open approach (**5).**

Although the laparoscopic approach is widely recognized as a valid treatment for many diseases and some laparoscopic surgical procedures have become gold standard techniques (e. g. cholecystectomy, appendectomy, gastro-esophageal junction surgery), the minimally invasive approach for groin hernia treatment is still very controversial today. The main pretexts are the higher costs, the use of general anesthesia and the possible higher rate of major complications associated with laparoscopic procedures. Another reticence related to laparoscopic approach is the greater surgical complexity linked to need to recognize a “new” anatomy of the posterior inguinal wall, which is still unusual for general surgeons. Furthermore, the choice of laparoscopic approach (TransAbdominal PrePeritoneal (TAPP) versus Totally Extraperitoneal (TEP)) is also controversial (**6).**

Indications and contraindications

With very few exceptions the TAPP approach can be performed in theory for any hernia, even in strangulated or incarcerated cases; however, the indication depends on the surgeon’s clinical judgment and skills. The best indications according to Nyhus classification are (**7):**

- Type 3 and 4 hernias
- Bilateral hernias
- Hernias in obese patients
- Hernias in subjects with intense physical activity (sport, strenuous working)
- Recurrence of hernia after open repairs.

They are very few contraindications for these procedures, such as (**7**)**:**

- Intolerance to capnoperitoneum (severe cardiopathies or severe pneumopathies)
- Extensive intra-abdominal adhesion
- Large scrotal hernia
- After radical prostatectomy
- Strangulated or perforated hernia with intercurrent sepsis
- Severe ascites
- Recurrence of hernia after laparoscopic repair
- Pediatric patients
- Pregnancy after the second trimester
- Severe clotting disorders

Preoperative preparation

The patient has to be carefully prepared for the operation. The evaluation of comorbidities as well as an adequate skin preparation is mandatory. The patient has to be informed about the details of the surgical procedure and the possible negative outcomes, as the latest guidelines recommended (**8).**

1. Skin preparation

A preoperative antiseptic shower is performed on the eve of the intervention. The hair is removed, half an hour before the surgery, from middle thorax until the upper third of the thighs using an electric barber clipper. Alcohol based solutions (Iodine or Chlorexidine gluconate in case of iodine allergy) are used for skin preparation after anesthetic induction (**7).**

2. Urinary Catheter

Always empty the bladder to facilitate the dissection in the Retzius space and to avoid bladder injuries. In selected cases (e. g. bilateral hernia, recurrent hernia), a urinary catheter can be left throughout the surgery (**8**).

3. Patient and surgical team position

The patient is placed in the supine position, with both arms along the body and fixed to the operating table. At the start of the surgery a Trendelenburg position (15–20°) is given with lateral inclination opposite to the hernial defect. The surgical team is organized with the surgeon on the contralateral side to the hernia to be repaired and the cameraman is positioned on the same side, or on the side as the hernia. The scrub nurse stands in front of the surgeon near the patient's feet. In case of bilateral inguinal hernioplasty, the surgical team switch positions when they have finished the first hernia (Figure 1). In case of bilateral hernioplasty it is preferable to use a column with two monitors; this is to avoid changing of the laparoscopic column between one side and the other (**9**).

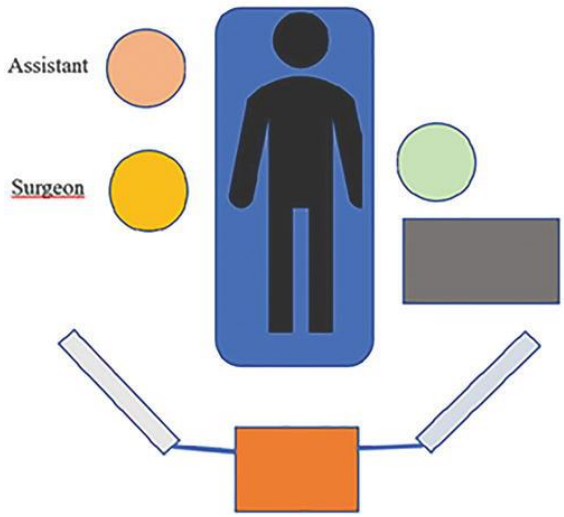

Figure 1. Surgical team position (**9**).

4. Anesthesia

General anesthesia is preferred for the patient, as muscle relaxation improves surgical maneuvers and, again, orotracheal intubation protects the airways from vomiting or regurgitation favored by increased intra-abdominal pressure. The preoperative antibiotic prophylaxis (single dose of cefazolin 2 g during anesthetic induction) is reserved in presence of high-risk factors for wound infection based on patient (recurrence, advanced age, immune deficiency) or surgical (forecast of long surgical intervention, use of drains) factors (**10**).

Surgical procedure

1. Pneumoperitoneum and trocar placement

Although many surgeons create pneumoperitoneum with Verres needle, an open technique can be used, by using a 10 mm Hasson trocar, through an upper horizontal paraumbilical incision. Under direct vision, two additional 5 mm operating trocars are placed in each flank, in a horizontal plane with the umbilicus. It must be remembered that a small number of patients present with a contralateral hernia although not diagnosed preoperatively. This trocars position is convenient for both unilateral and bilateral hernias (Figure 2) (**7).**

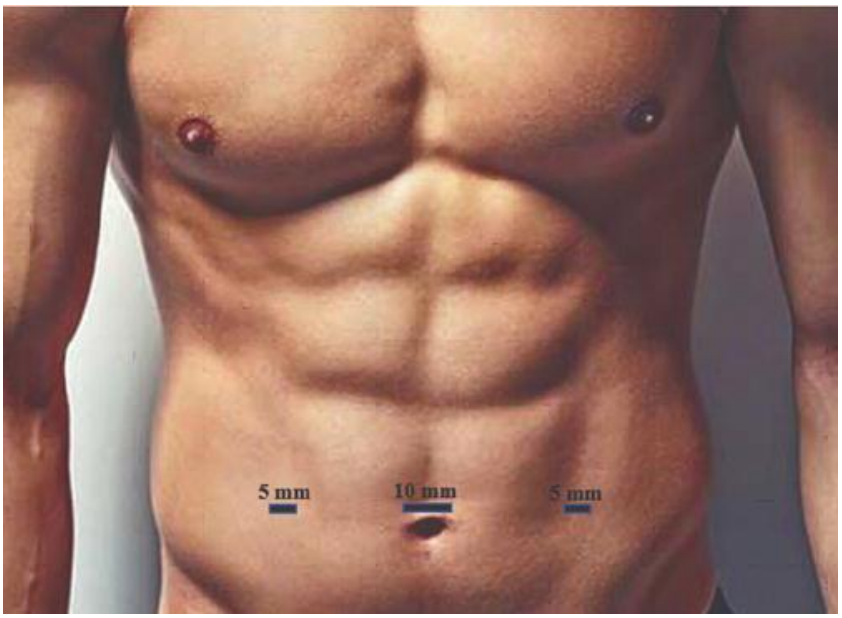

Figure 2. Trocar's position (**7).**

2. Abdominal Exploration

The aim of the laparoscopic exploration is to identify the superficial anatomical landmarks (Urachus, umbilical folds, epigastric vessels, spermatic vessels, vas deferens or uterine round ligament) and the site and type of hernia. The two "dangerous triangles", vascular and pain triangles, must be correctly identified. To perform the exploration and to ensure a good exposure of the inguinal region the position of the operating table is kept in 15° Trendelenburg with 15° lateral rotation to the side opposite the hernia (**Figure 3**) (**6).**

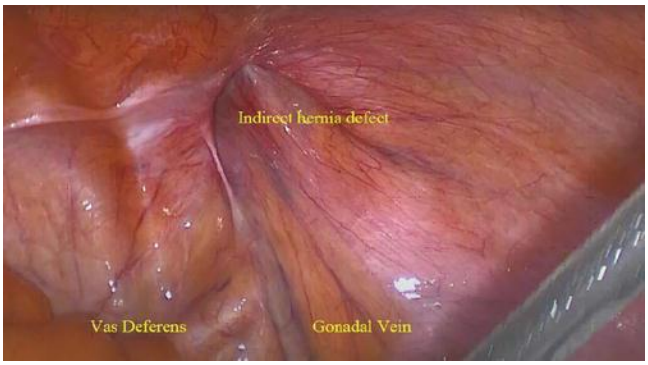

Figure 3. The intra-abdominal view (**6).**

3. Peritoneal incision

The TAPP procedure starts with peritoneal cut 2 cm above and 1 cm medial from the anterior superior iliac spine and continue horizontally, in medial direction to the lateral umbilical ligament (umbilical artery), then the incision continues vertically along the umbilical ligament, using the monopolar hook or scissors (Figure 4). This creates an "L" shape incision. After the first peritoneal cut, the CO2 peumoperitoneum will enter into the preperitoneal space, facilitating the dissection (**11).**

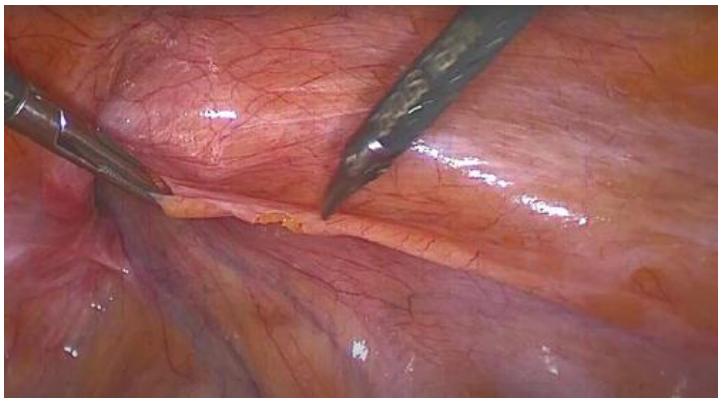

Figure 4. Peritoneum incision (**11).**

4. Dissection of lower Peritoneal Flap

The aim of this step is to create a preperitoneal pocket to ensure the best positioning of the mesh. This step consists of three phases: 1) Medial dissection over the Retzius space, 2) Lateral dissection on the space of Bogros, 3) Central dissection over the site of the hernia and its hernial sac. The medial dissection (Retzius space) is usually started with dividing the conjunctive fibers in contact with the rectus abdominal muscle to avoid bladder injuries; this way the bladder is detached from the abdominal rectus muscles. The dissection is conducted to the pubis to expose Cooper's ligament (Figures 5, 6), which it was almost invariably found on dissecting 1 cm medial and 1 cm inferior to the origin of the deep epigastric vessels. Usually, in contact with the pubic bone there are several fine vessels originated from the corona mortis. It is preferred to coagulate them to avoid further bleeding during the dissection or mesh stapling. The dissection is then conducted laterally on the space of Bogros, pulling the peritoneum in the medial direction, from the epigastric vessels until the spermatic vessels (Figure 7)**.** The sac

dissection is performed using traction counter-traction maneuvers and fine coagulation. To avoid the injuries of the ductus deferens and spermatic vessels the sac dissection always starts anteriorly (Figures 8,9). To facilitate dissection of the peritoneal flap, endo peanuts can be helpful. When the hernia sac is very large, it is preferred to cut and leave it in situ. This avoids the risk of involuntary injury to the elements of the spermatic cord, reducing the risk of ischemic orchitis, inguino-scrotal hematoma and/or testicular atrophy. However, the incidence of inguino-scrotal seroma or "pseudo-hydrocele" is higher when this maneuver is adopted **(7).**

It is necessary to extend the dissection caudally to the obturator fossa to identify eventual occult obturator hernia especially in women. The preperitoneal dissection ends when the anatomic landmarks previously described are well exposed and the two dangerous triangles (vascular and of the pain) can be identified. For large parietal defects, the transversalis fascia has to be inverted and stapled to the Cooper ligament. This simple maneuver seems to decrease the postoperative seroma rate (**12**).

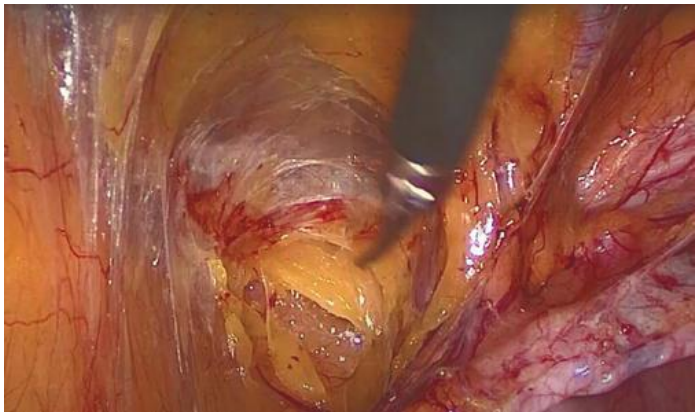

Figure 5. Medial dissection (**7).**

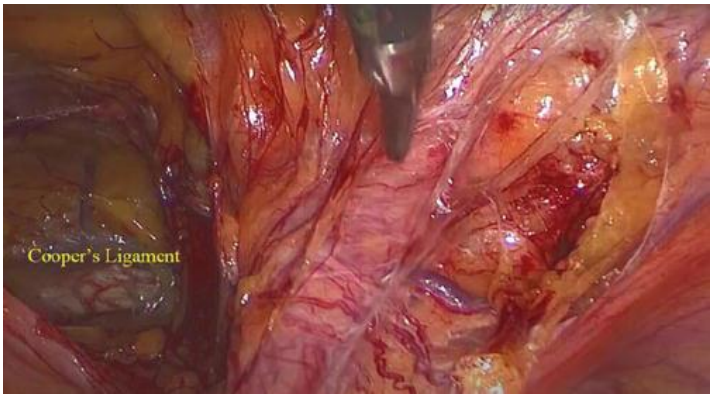

Figure 6. Medial dissection (**7).**

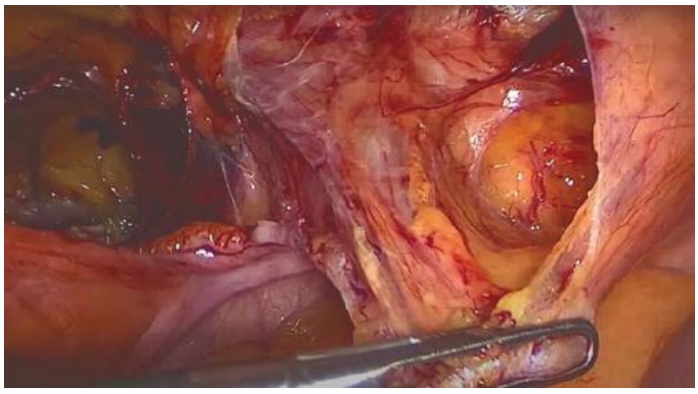

Figure 7. Lateral dissection **(7).**

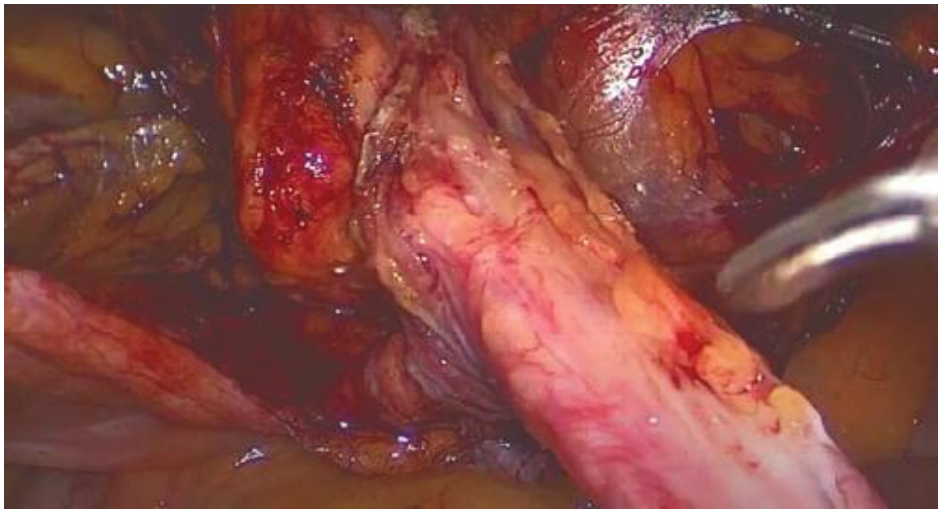

Figure 8. Sac dissection (**7).**

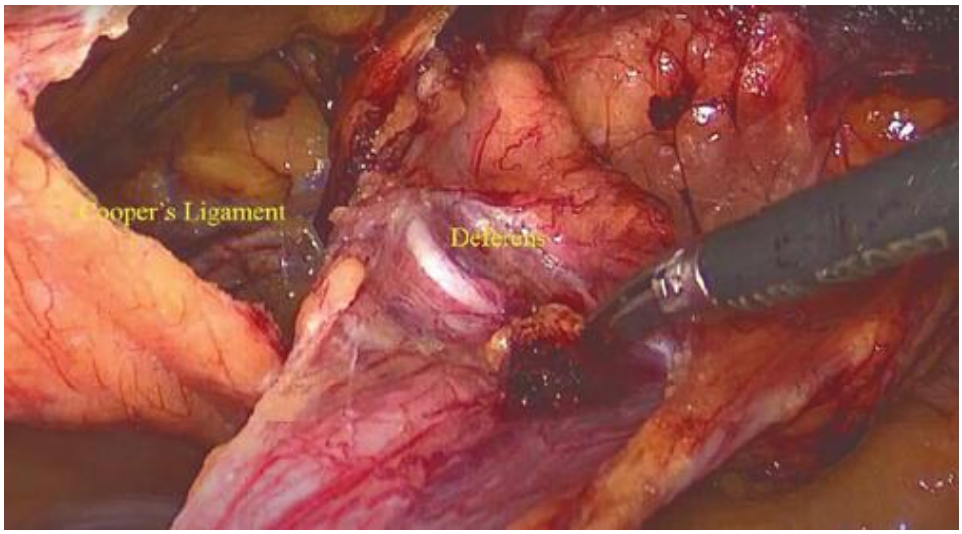

Figure 9. Sac dissection (**7).**

5. Mesh placement

One of the most important issues the laparoscopic approach to inguinal hernioplasty is the need to use a prosthetic mesh to fully cover the hernial defect and all possible herniation sites in the area. The mesh should reach at least the pubic symphysis medially and the iliopsoas muscle laterally. Inferiorly it should reach 1–2 cm below the pubis and superiorly cover the anterior abdominal wall, exceeding the hernial defect by 3–4 cm. A large "anatomical pre-shaped" (12 x 15 cm) polypropylene mesh is usually used which is inserted from the optical trocar. The prosthesis is rolled up on its long side and grasped with the grasper at the medial end and is easily introduced through the trocar into the abdomen. The medial end of the prosthesis is brought over the Cooper. The prosthesis is then unrolled and the medial head is anchored to the Cooper with the absorbable tacking staples, taking care not to injure the "corona mortis vessels" (Figure 10). This first tack facilitates further unrolling of the prosthesis and its placement in the preperitoneal pocket and fixation, with the absorbable tacking staples, on the upper and medial edge, as well as at the level of the iliac spine (Figures 11, 12) (**7).**

Some alternatives to staple fixation are noted in the literature: the use of fibrin glue, the self-gripping mesh, trans parietal sutures, or even the recent no fixation technique. For bilateral hernia two separate meshes were used covering the bilateral defects overlapping and stapled together on the median line; this technique is easier than the deployment of one single large mesh (**13).**

Figure 10. Mesh fixation to Cooper's ligament (**7).**

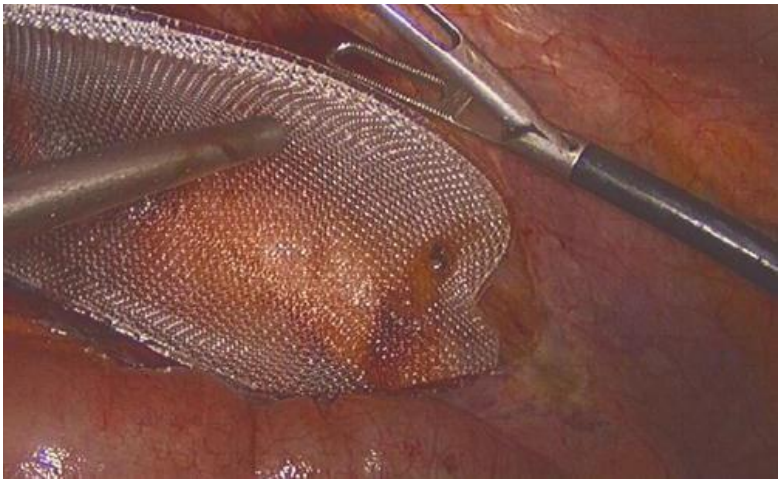

Figure 11. Lateral fixation of the mesh (**7).**

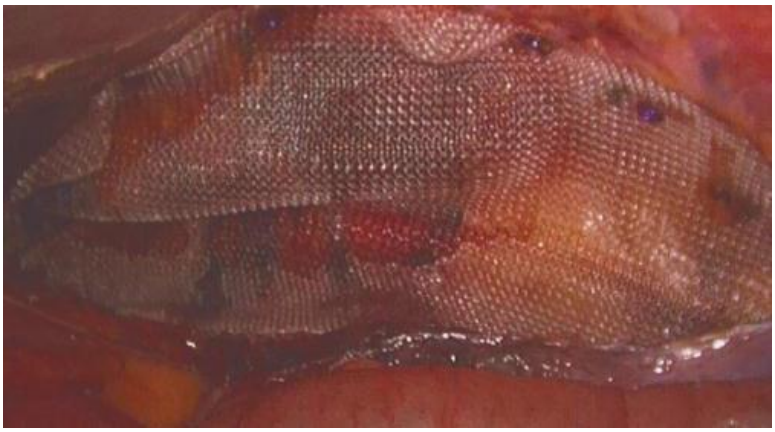

Figure 12. Implanted mesh (**7).**

6 Drainage

Some authors emphasize the role of suction-draining in decreasing postoperative seroma and hematoma rates, as the release of carbon dioxide pressure is followed by bleeding from capillaries. 24 hours suction-drainage is used for selected cases: difficult dissection, anticoagulant or antiplatelet therapy, intraoperative hemorrage, partial hernial sac resection **(14).**

7 Peritoneal closure

The peritoneal flap is closed with the aid of helicoidal absorbable tacks. This maneuver is fast and cost-effective. Alternatively, the flap is closed with continuous suture (2–0 monofilament or 3–0 barbed suture) (Figure 13). Before the peritoneal closure, capnoperitoneum pressure is lowered to 8 mmHg to facilitate the approximation of the edges of the peritoneum under less tension **(8).**

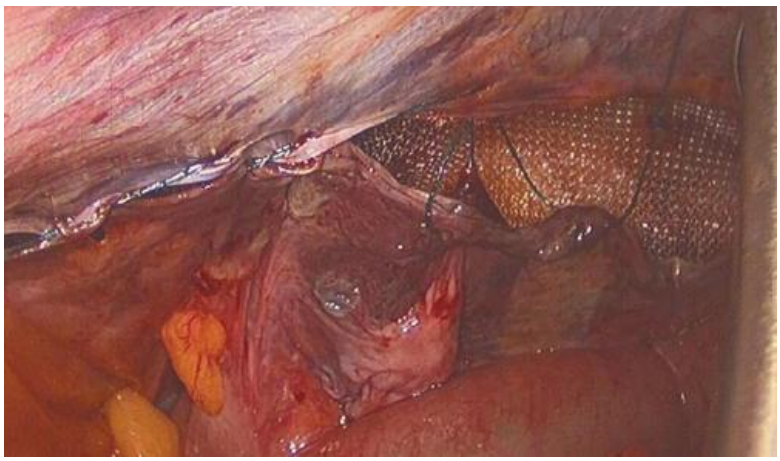

Figure 13. Peritoneum closure (**7).**

8 Abdominal closure

After the careful examination of the peritoneal closure, the trocars are removed under laparoscopic control. The aponeurosis is closed at umbilical site with a purse string suture with absorbable suture. The operative wounds are infiltrated with long-acting anesthetics (Levobupivacaine) for a better control of postoperative pain. Alternatively, the laparoscopic TAP Block can be used. The skin is closed using inverted fast absorbable sutures or staples (**15**).

9 Intraoperative complications

Intraoperative bleeding is one of the potential complications of TAPP. The injuries of the deep epigastric vessels, the testicular artery, the gonadal veins or the corona mortis can cause abundant bleeding which, if not controllable by laparoscopy, require immediate conversion to open. Obviously, the lesion of the iliac vessels requires an immediate conversion to laparotomy for vascular control and the relative repair of the damage (**5).**

Postoperative complications

These include seromas, hematomas, postoperative chronic pain, infection of wounds, rejection or infection of the mesh, recurrences, testicular atrophy and infertility. Seroma is the only complication more frequent in laparoscopic technique than in open repairs. While the rate of this complication is about 5.7% in the literature (**15**).

Hematoma is less frequent in laparoscopic hernia repair than in open repairs, with a rate of about 8% and rarely requires drainage or transfusions. Chronic pain, defined as persistence of pain 3 months after the operation, is less frequent after TAPP and is related to tack stapled nerve damage. The recurrence rate is described between 0.4 and 4.8% and correlates with the degree of experience of the surgeon. A significant and repeated increase in intra-abdominal pressure appears to be the predisposing factor for relapses. In case of recurrence, guidelines recommend open repair, however, many experienced surgeons are able to treat relapses laparoscopically without any problems (**5).**

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