

REVIEW

TAPP procedure step by step

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ABSTRACT

Inguinal hernia repair is one of the most common procedures performed by general surgeons. With the advent of laparoscopic approach, two major methods - Total Extraperitoneal repair (TEP) and Trans-Abdominal Pre-Peritoneal repair (TAPP) have emerged. Here we describe the approach to TAPP procedure, including the basic steps, some major pitfalls as well as tips and tricks related to the operation.

Keywords: inguinal, hernia, TAPP

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Introduction

TAPP is a minimally invasive procedure that can be applied to most unilateral and bilateral hernias, with significant advantages, such as less chronic pain, and a lower chance of wound infection than open repair, with most other outcomes being similar. It is particularly useful in cases of small bilateral hernias, as well as hernias in females, which may often be femoral, and thus prone to be overlooked by the open approach.

TEP vs TAPP

The choice of approach is generally dependent on the surgeon's preference and familiarity with the procedure. In terms of outcomes and complications, the two procedures are comparable¹, with some suggestion that the TAPP approach leads to slightly less pain in the immediate postoperative period², while TEP takes less time to complete, especially in case of bilateral hernias³. There are also important considerations in patient selection, the major difference being that TAPP includes entry into the abdominal cavity, carries a risk of injury to intraabdominal organs and should be used with caution in patients with previous lower abdominal surgery. Similarly, obliteration and scarring of the preperitoneal space, such as from previous surgery, would preclude the use of the TEP procedure. While both procedures are in the domain of advanced laparoscopy, TAPP offers a larger field of vision and is therefore the better procedure for learning the complex anatomy of the region, as well as an opportunity to inspect (and repair) the contralateral side and is therefore our preferred method of laparoscopic hernia repair.

Patient selection

TAPP involves a substantial learning curve of at least 65 procedures to reach proficiency⁴. It is therefore paramount to use good judgment when selecting the patients during early experience. It should be avoided for large hernias in obese patients, as well as any recurrent or incarcerated hernias. Once sufficient proficiency is achieved, more complex cases may be attempted, with the understanding that sometimes a conversion to an open procedure might be necessary.

Step by step procedure

Preparation

Prior to induction of general anesthesia, the patient is asked to empty their bladder. Alternatively, in older patients, or in cases of bilateral hernia which may take longer, a urinary catheter may be inserted. The usual pre-operative antibiotics are administered, ideally within one hour of the procedure.

Patient is placed in a supine position, in a slight Trendelenburg (15 degrees) with their arms tucked in the case of bilateral, or ipsilateral arm extended, in case of unilateral hernia. A monitor is placed at the foot of the bed. It is our preference to use a 0-degree camera, since it offers adequate field visualization, without having to change the viewing angle mid-procedure. Entry into the abdominal cavity is achieved by the means of the standard supraumbilical Hasson technique.

The abdomen is insufflated with CO₂ to 14 mm Hg. Working trocars are inserted on the left and right sides, at the lateral borders of the rectus abdominis muscle. In the case of bilateral hernias, the trocars are at the same, umbilical level. In unilateral hernias, the port is placed 1-2 cm higher on the side with the hernia and lower on the contralateral side (Figure 1).

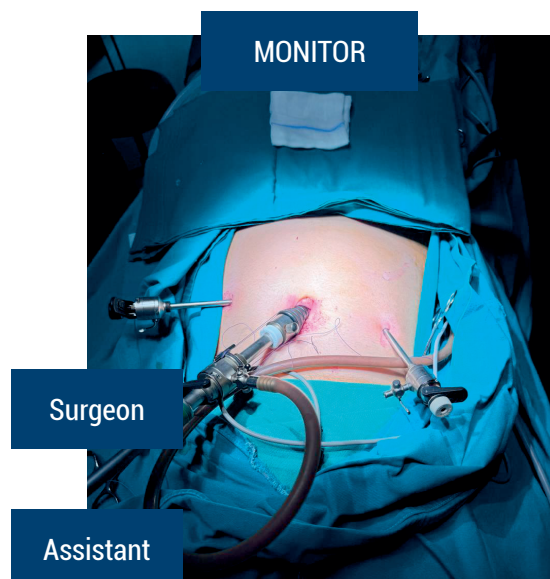


Figure 1: Positioning of the trocars, and the patient set up for a right-sided hernia.

After entry in the abdominal cavity, both inguinal fossae are examined to determine the type, size, and contents of the hernias (Figure 2). With larger inguinoscrotal hernias, omentum or bowel can be visualized entering the internal opening (Figure 3). A direct hernia is located medial to the inferior epigastric vessels (Figure 4). After inspection, dissection is begun.

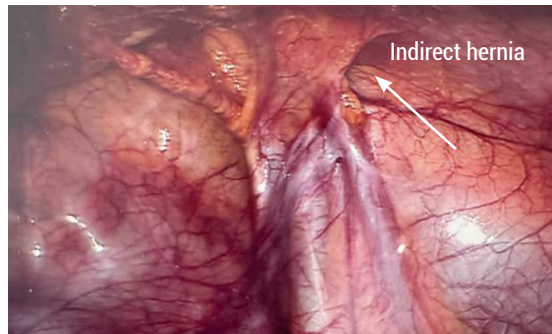


Figure 2. Site of indirect hernia shown here with white arrow.

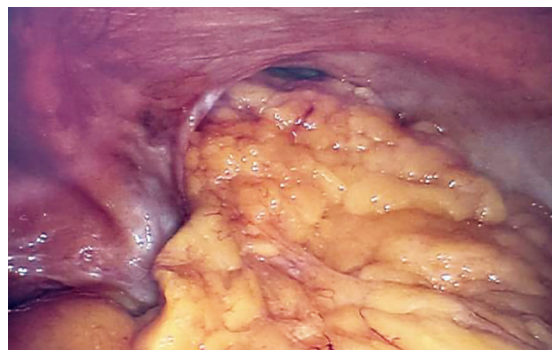


Figure 3. Inguinoscrotal hernia with omentum passing through internal ring.

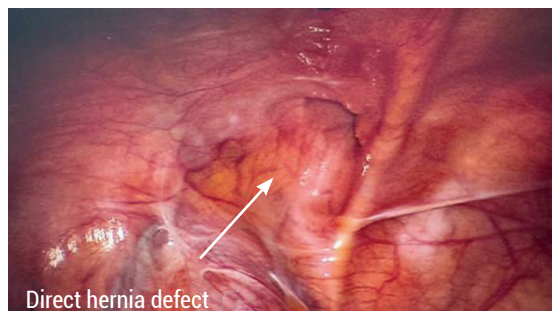


Figure 4. Left-sided direct hernia. Note the hernia defect is medial to inferior epigastric vessels and lateral of the medial umbilical fold (within the Hasselbah's triangle).

Dissection

Dissection of the peritoneal flap begins with monopolar scissors in the dominant hand, and a grasper in the other. It is helpful to use the tip of the instrument to determine the level in cm from the upper border of the hernia, which should be approximately 5 cm. Laterally, the incision should end at the level of the Anterior Superior Iliac Spine (ASIS), and medially at the level of the medial umbilical ligament. At this site, an additional upward extension of the incision can be made to expose the pre-peritoneal space better. When making the peritoneal flap, it is helpful to use monopolar scissors to mark the incision level and the lateral and medial points, since it makes it easier to “connect the dots” more effectively. When we first enter into the preperitoneal space, air dissection in the space occurs which makes it easier to establish the correct plane. We usually recommend dissecting the lateral part or space of Bogros first, since the anatomy is more straightforward, and the instrument positions are not at their extremes. It is important to pay attention when creating the peritoneal flap, to keep fat and nerves dissected away from the peritoneum, as it is easy to slip into the wrong plane, and cause bleeding and nerve injury. After completing the lateral dissection, we move all the way medially and proceed towards the pubic symphysis. The rectus muscle is exposed, as well as the inferior epigastric vessels. When dissecting the space of Retzius it is helpful to use both hands simultaneously to push the tissues in an up and down manner. Once the pubic symphysis is reached, we need to expose Cooper's ligament and dissect down at least 2-3 cm below the bone to create enough space for the corner of the mesh to lie comfortably. In this area, it is important to find and preserve the corona mortis, which is often found coursing along the lateral border of the pubic symphysis. Medially, the dissection is carried to the level of the midline (linea alba). Finally, dissection of the hernia sac is begun.

Direct sacs can usually be easily reduced, by pulling on pre peritoneal fat content. This will leave behind a cavity, lined by the attenuated fascia transversalis,

the so called “pseudo sac”. If the pseudo sac is large, it is recommended to anchor it towards the pubic bone with a suture or tack, to avoid formation of a seroma.

Large indirect sacs can be somewhat difficult to dissect. It is best to approach the dissection both from the medial and the lateral side, taking care not to create holes in the peritoneum. The hernia sac is generally located laterally and anteriorly to the cord structures. In the case of a very large sac, the sac can be transected after appropriate reduction at the level of the external ring, with subsequent repair of the resulting defect. The appropriate dissection of the hernia sac can also be confirmed from the peritoneal side, by lifting the peritoneal flap. It is important to dissect the sac all the way to the level of the iliac vessels to achieve complete parietalization of the vas deferens and the testicular vessels. Between these two structures are the iliac vessels (triangle of doom), where dissection has to be performed with great care. All potential areas of hernia have to be explored, particularly in women, where there is a greater incidence of simultaneous femoral hernia (Figure 5). Usually, at this point, a preperitoneal lipoma is encountered. It needs to be dissected along with the peritoneum, so that, in the end, it will lie on top of the mesh, along with the flap.

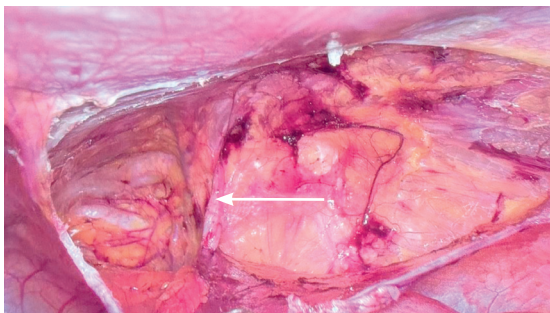
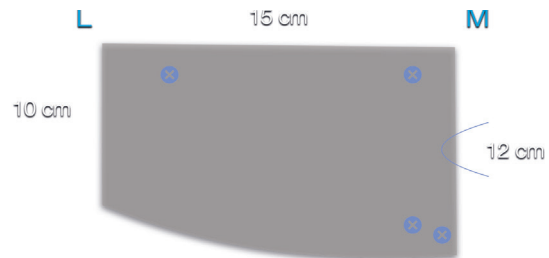


Figure 5. Dissection of the preperitoneal flap in female. Round ligament is marked with an arrow.

Mesh preparation and insertion

For our repair, we start with a 15x15 cm piece of polypropylene mesh, which is cut along one border

to obtain the shape and size shown below. A vicryl suture is placed on the medial part of the mesh as a marker, in order to facilitate better positioning once within the body (Figure 6).



The mesh is then rolled along the long

Figure 6. Modifications to the 15x15 polypropylene mesh with planned tack placement.

The mesh is then rolled along the long

The mesh is then rolled along the long axis, and the medial (marked) side is then grasped with an instrument and inserted through a camera port. The way it has been rolled will then facilitate the unrolling of the mesh once it is within the dissected space. It is important to tuck the lower medial corner no less than 2 cm below the pubic bone. We place 1-2 tacks into Cooper's ligament, taking care not to injure the Corona mortis. The remainder of the mesh is positioned within the preperitoneal space, while ensuring complete coverage of the myopectineal orifice. An additional tack is placed medially, attaching the mesh to the rectus muscle. The use of further tacks is optional, sometimes in the case of larger defects, 1-2 tacks can also be added laterally, while ensuring that they are placed above the ileopubic tract, thus avoiding the nerves. The lower border of the mesh must lie above the level of the dissection of the peritoneal flap, in order to avoid the mesh “rolling” once the flap is raised. This can be tested intraoperatively, and additional dissection can be carried out, if needed (Figure 7).



Figure 7. Polypropylene mesh covering the myopectineal orifice with adequate overlap.

After the mesh is in position, we begin the peritoneal closure. It is customary to start from the right, and proceed towards the left side. It is helpful to use a 3-0 Stratafix suture, 15 cm in length or a similar locking suture. If this is not available, a regular vicryl or monofilament suture can be used instead. Alternatively, the flap can also be closed with tacks, although we would not recommend this routinely, since we feel that there is an increased risk of nerve or vascular injury, particularly to the inferior epigastric vessels. In addition to having more control over closure, suturing is a challenging practice, which is beneficial for maintaining one's laparoscopic skills.

It is helpful to reduce the intraabdominal pressure to 10 mm Hg during this step, to reduce tension when closing the flap. At the end of closure, the V-lock suture can be clipped and cut, or locked by throwing a few more sutures in reverse (Figure 8).



Figure 8. Peritoneal flap closure with a v-lock suture.

The abdomen is then desufflated under direct visualization of the flap. The trocars are removed, also under direct vision. The supraumbilical access port and skin are closed in the standard fashion. The patient can usually be discharged home the following day.

Pitfalls and complications

Peritoneal flap defects

Any defects in the peritoneal flap can usually be dealt with upon the completion of the case. Even when the defect is large, reducing the intraabdominal pressure to 10 mmHg and using the available preperitoneal flap tissue, which is commonly redundant due to hernia reduction, usually leads to a satisfactory closure. In the case of a thin peritoneum or an unusually adherent hernia sac, where dissection is difficult at the outset, and the peritoneum is tearing excessively, conversion to open procedure should be considered. In that case, the peritoneum must be closed completely before proceeding with the conversion.

Bleeding

The planes in which the operation takes place are largely avascular and can for the most part be dissected bluntly. Bleeding is usually from testicular vessels, or pre-peritoneal fat. An unusual amount of bleeding signals wrong dissection plane. Bleeding can be controlled with cautery or clips, with the help of a suction device. It can be helpful to insert a small gauze, in order to apply pressure to a bleeding site, especially in the case of a large vessel injury. In such a case, conversion to an open procedure might be needed to control the bleeding.

We have not found it helpful to use drains in this type of surgery. A needle may be used to decompress the closed flap after closure, however, we have found this step to be cumbersome and unnecessary. If however, there is bleeding into the flap or bladder injury, placement of a vacuum drain is reasonable.

Infection

Although extremely rare, infections of the mesh usually involve immediate removal of the mesh using laparoscopic or open methods, with drain placement as needed. The hernia can then be addressed later, if necessary.

Subcutaneous emphysema

Occasionally, insufflated CO₂ can track into the subcutaneous tissues along the fascial planes. This happens when there is a more extensive dissection needed. Management is usually conservative, and most subcutaneous emphysemas will improve within a few hours of surgery.

Bowel obstruction

As with any laparoscopic intraabdominal procedure, there is a theoretical risk of bowel injury, although this appears to be rare⁵. Also, there are documented instances of bowel obstruction from either prolapse into an incompletely closed peritoneal flap, or the entanglement of a barbed suture used to close the flap. This could be minimized by ensuring meticulous closure, and avoiding any large openings, as well as avoiding leaving any unnecessary length of the barbed suture intra-abdominally⁶.

If it does occur, bowel injury can be repaired in the standard fashion. However, in the case of significant contamination, placement of mesh is not recommended, and conversion to an open, tissue-type repair should be considered. Of particular note is that management of incarcerated hernias can also be approached laparoscopically, by using gentle traction on the bowel. If there is a concern of necrotic bowel and a need for bowel resection, an open approach is recommended.

Seroma formation

Seroma is a fairly common occurrence in direct and large indirect hernias⁷. Obliteration of the transversalis fascia by tacking to Cooper's ligament or the pubic bone generally reduces seroma in the case of a direct hernia⁸. Preoperative counseling, combined with scrotal elevation

in the postoperative period is recommended in cases of large indirect hernias. Occasionally, drain placement may be necessary⁷.

Recurrence

Recurrence rate after TAPP repair has been reported to be less than 1%⁹, with most recurrences being due to small mesh size. We therefore recommend that the mesh to be used is no smaller than 15x12 cm, in order to ensure adequate coverage of the myopectineal orifice. While some data suggest that a fibrin sealant may be just as effective as tacks in providing adherence of the mesh¹⁰, it is generally recommended to use tacks in most direct and large indirect hernias, to minimize the risk of recurrence.

Chronic pain

Incidence of chronic pain after minimally invasive surgery is reported to be less than 3%¹⁰. While most of the pain is caused by peritoneal dissection it is imperative to avoid placing tacks below the ileopubic tract, as this may lead to nerve damage. Various techniques of dealing with nerve pain, including medications, neurectomy and even mesh explantation, have been described¹¹.

Conflict of interests

The author has no relevant financial or non-financial interests to disclose.

Authors Contribution:

Amila Husic: Data curation, Conceptualization, Methodology, Writing-Original draft. Samir Custovic: Supervision, Writing-Reviewing.

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