

# Minilaparoscopic Technique for Inguinal Hernia Repair Combining Transabdominal Pre-Peritoneal and Totally Extraperitoneal Approaches

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## ABSTRACT

**Introduction:** Endoscopic surgical repair of inguinal hernia is currently conducted using 2 techniques: the totally extraperitoneal (TEP) and the transabdominal (TAPP) hernia repair. The TEP procedure is technically advantageous, because of the use of no mesh fixation and the elimination of the peritoneal flap, leading to less postoperative pain and faster recovery. The drawback is that TEP is not performed as frequently, because of its complexity and longer learning curve. In this study, we propose a hybrid technique that could potentially become the gold standard of minimally invasive inguinal hernia surgery. This will be achieved by combining established advantages of TEP and TAPP associated with the precision and cosmetics of minilaparoscopy (MIND).

**Materials and Surgical Technique:** Between January and July 2011, 22 patients were admitted for endoscopic inguinal hernia repair. The combined technique was initiated with TAPP inspection and direct visualization of a minilaparoscopic trocar dissection of the preperitoneum space. A10-mm trocar was then placed inside the previously dissected preperitoneal space, using the same umbilical TAPP skin incision. Minilaparoscopic retroperitoneal dissection was completed by TEP, and the surgical procedure was finalized with intraperitoneal review and correction of the preperitoneal work.

**Discussion:** The minilaparoscopic TEP-TAPP combined approach for inguinal hernia is feasible, safe, and allows a

simple endoscopic repair. This is achieved by combining features and advantages of both TAPP and TEP techniques using precise and sophisticated MINI instruments. Minilaparoscopic preperitoneal dissection allows a faster and easier creation of the preperitoneal space for the TEP component of the procedure.

**Key Words:** Microlaparoscopy, Minimally invasive, Needle-scope, Microlaparoscopic, Inguinal hernia.

## INTRODUCTION

Two main laparoscopic techniques are currently used for the surgical repair of inguinal hernias: the totally extraperitoneal hernioplasty (TEP) and the transabdominal technique with preperitoneal fixing of mesh (TAPP). Over the years, TEP has proven to be more efficient than TAPP, with very similar results to the best open surgery techniques.<sup>1,2</sup> TEP eliminates the need to create a peritoneal flap and mesh fixation, resulting in minor postoperative pain and faster recovery.<sup>1,3-5</sup>

Minilaparoscopy (MIND) is a natural advancement of laparoscopy, because it diminishes surgical trauma by reducing the diameter of the standard laparoscopic instruments.<sup>6,7</sup> Improvement was observed in surgical precision during dynamic tasks (e.g., dissection of hernia sac), by using longer, low-friction, and more sophisticated trocars, resulting in reduced stress and higher efficacy. Trocar dislocation and skin reinsertions were significantly diminished, consequently reducing skin trauma and improving aesthetics.<sup>8</sup>

Although valuable in several ways, TEP has not been widely adopted, because of its complexity in creating the preperitoneal space and understanding its anatomy. In addition, TEP does not allow intraperitoneal inspection, which is crucial for treating incarcerated hernias.<sup>1,3-5</sup> By combining the established advantages of TEP with those of TAPP associated with the precision and cosmetics of MINI, we propose a technique that could potentially become the gold standard of minimally invasive inguinal hernia surgery.

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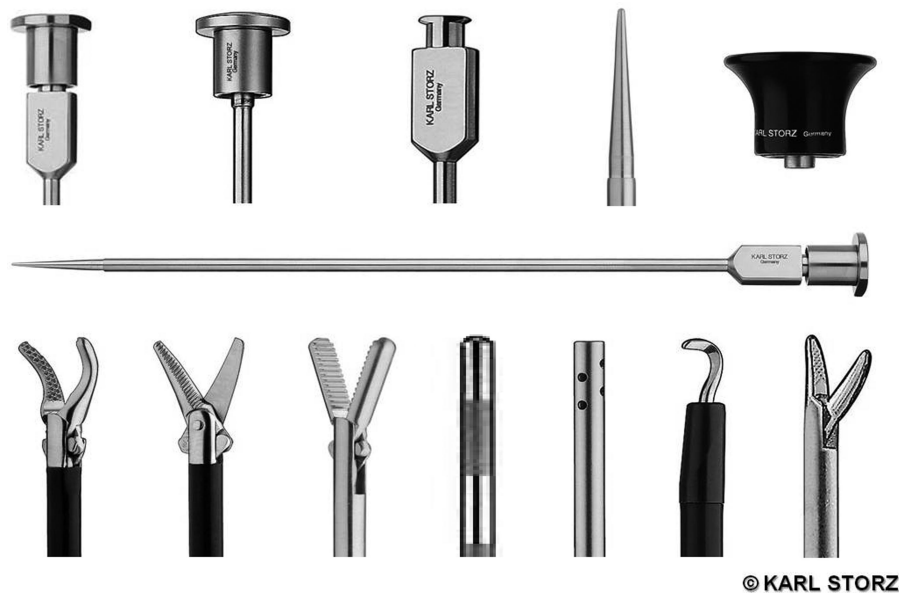
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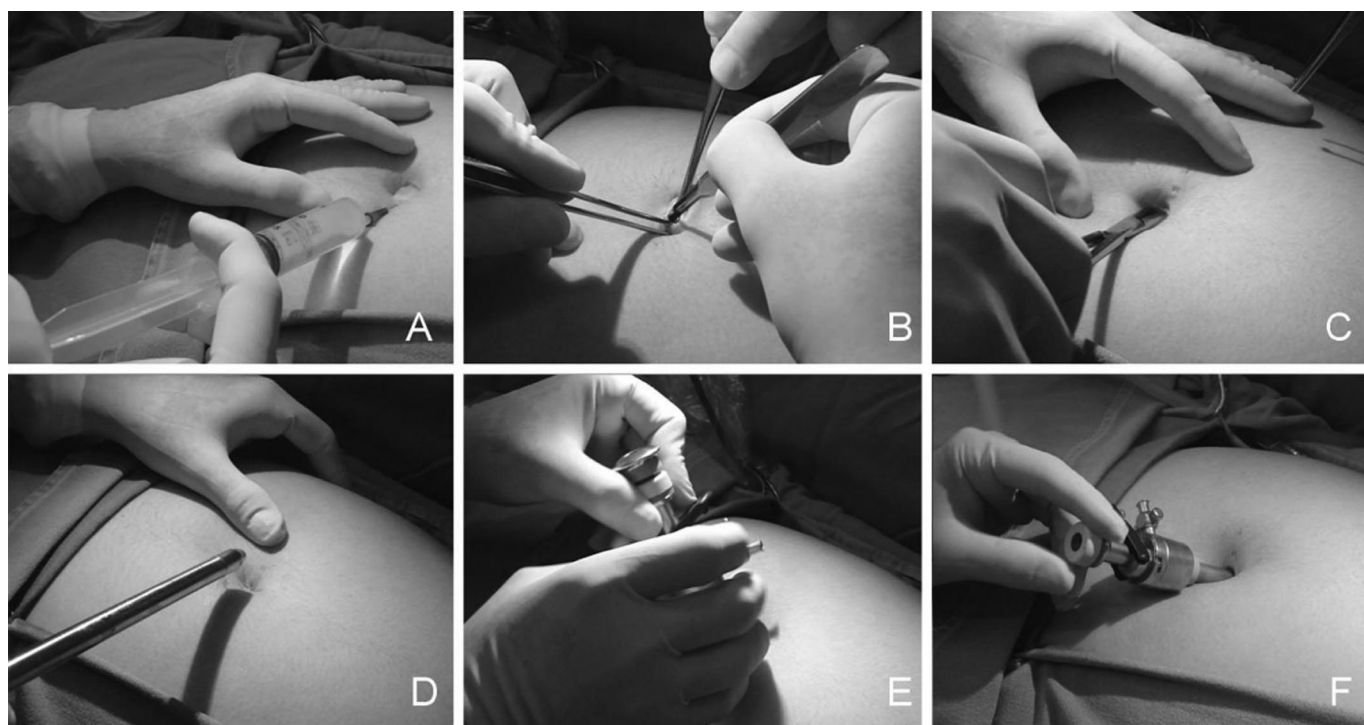
**MATERIALS AND SURGICAL TECHNIQUE**

Between January and September 2011, 21 male patients and 1 female patient underwent surgery. Three had bilateral hernias, one of which was discovered intraoperatively. Among the total, 14 hernias were on the right side and 11 were on the left. Among the unilateral hernias, 7 were simultaneously direct and indirect, 5 were recurrent, and 3 were incarcerated. Seventeen patients also had small umbilical hernias, associated with pain in 2 patients. The MINI instruments used are summarized in **Figure 1**, and the surgical steps are summarized in **Figures 2 through 7**. The procedure starts with the creation of an open pneumoperitoneum (**Figure 2**). After local anesthesia infiltration [bupivacaine (0.25%): 20 mL], a vertical transumbilical incision is performed in the infraumbilical direction. The aponeurotic umbilical orifice is carefully dilated with the tip of a needle holder. A 10-mm trocar with a blunt dilating tip is gently inserted within the aponeurotic orifice. A 10-mm 30-degree laparoscope is used throughout the procedure. Veress needle and 3-mm scope are not used.<sup>7</sup> After inspection of the abdominal cavity, the first 3.5-mm trocar is inserted by transperitoneal visualization, medial to the epigastric vessels using a 3-mm blunt dilating tip insert, to avoid peritoneal perforation. This mini trocar is then used to make a small

dissection under laparoscopic direct vision, between the peritoneum and the muscle-aponeurotic planes. After removing the insert, CO<sub>2</sub> is connected to the mini trocar by a Luer lock. A second 3-mm trocar can be inserted to facilitate the dissection of the preperitoneal space by bimanual technique. The 10-mm intraperitoneal umbilical trocar valve is left open halfway. At this point, we can directly visualize the CO<sub>2</sub> inflation and the creation of the preperitoneal space, as previously described (**Figure 3**).<sup>9</sup> After preperitoneal inflation, an 18-F catheter is left inside the abdomen through the umbilicus to drain the CO<sub>2</sub> that could possibly escape from the preperitoneal space, either by diffusion or accidental damage of the peritoneum during hernia sac dissection. The 10-mm trocar is reintroduced by the same umbilical skin incision, but directed toward the preperitoneal space, providing the room needed for dissection. A balloon dissector is not needed, because the proper workspace is progressively established with the tip of the optics, and 3-mm dissection instruments are introduced by the 3.5-mm trocars. At the end of the setup, a transperitoneal hole is kept open by an 18-F catheter. An additional aponeurotic hole with a 10-mm trocar, and 2 more 3.5-mm mini working trocars are the optical paths to the preperitoneal space. The TEP part of the procedure can be carried out under direct preperitoneal view.



**Figure 1.** All necessary minilaparoscopic equipment is illustrated here (Karl Storz GmbH, Tuttlingen, Germany). The upper row (from left to right) shows details of the new low-friction mini trocar (3.5 mm) that resembles a long needle composed of a low-profile cannula with Luer lock type connector to facilitate attachment of its insert as well as a connection for CO<sub>2</sub> inflation. Its insert has a long dilating blunt tip that facilitates insertion, to prevent trauma or injuries. The black funnel (insertion aid) when attached to the Luer lock can be used to facilitate forceps exchange. The lower row shows the 3-mm minilaparoscopic instruments (36cm long): (left-to-right) Kelly dissector forceps, Metzenbaum scissors, grasper forceps, palpation probe, suction irrigation, Hook electrode, and needle holder.



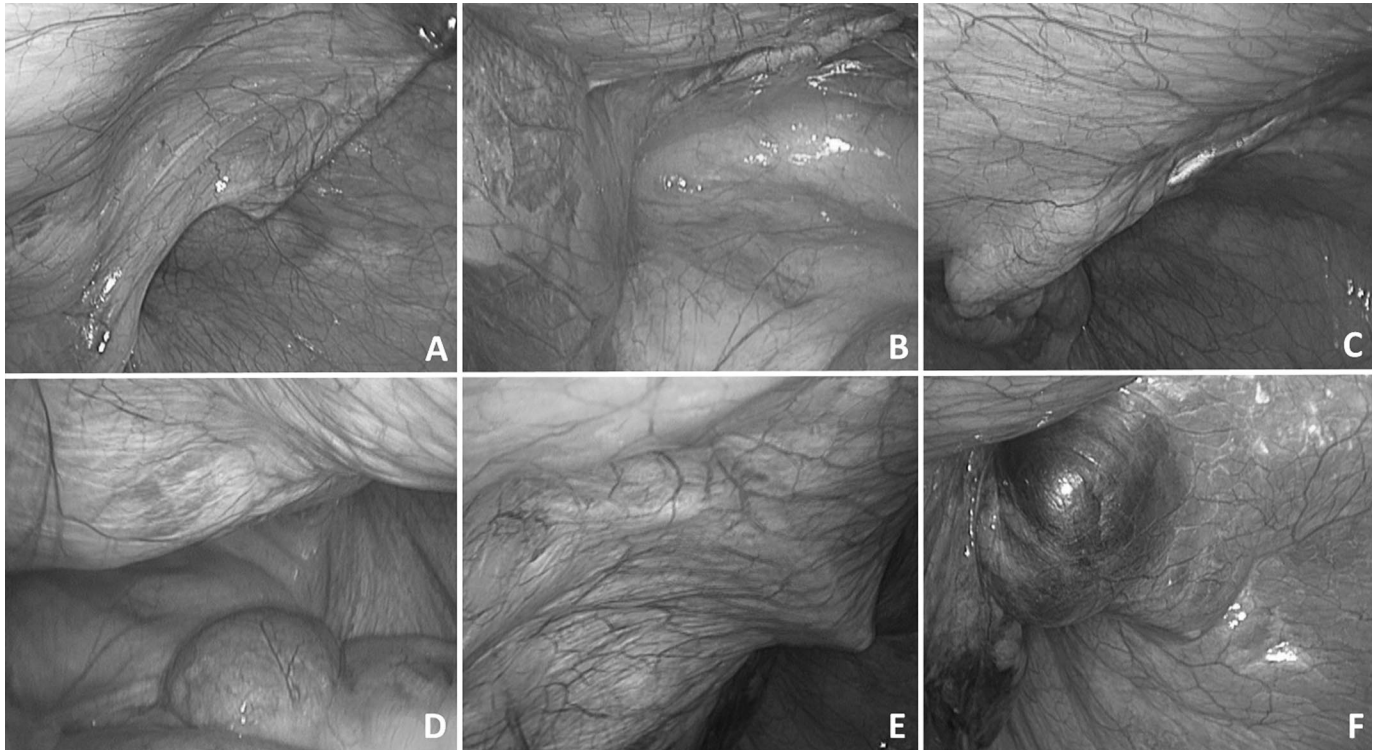
**Figure 2.** Sequence of open pneumoperitoneum. Following local anesthesia infiltration (A) [bupivacaine (0.25%): 20 mL], a vertical transumbilical incision more prominent for the infraumbilical direction is performed (B). An aoneurotic hole is made by the tip of a needle holder (C). A 10-mm trocar is gently inserted after blunt dilation of the aoneurotic umbilical orifice (D–F).

After acquiring adequate preperitoneal space to fully understand the inguinal anatomy, by using bimanual dissection, the hernia sac is properly dissected and the preperitoneal space is expanded to accommodate a 13 × 15-cm polypropylene mesh with rounded edges. At this point, the hernia orifice and the inguinal anatomic landmarks, including the vas deferens, the gonadal and epigastric vessels can be visualized (**Figures 4 through 6**). The polypropylene mesh is blindly inserted through the 10-mm trocar and completely covers the entire inguinal-crural region. Preperitoneal CO<sub>2</sub> is released allowing the peritoneum to compress the mesh keeping it in place and eliminating the need for mesh fixation. After positioning the mesh correctly, the 10-mm trocar is removed and reintroduced into the abdominal cavity, through the hole kept open by the 18-F catheter. This is done to correctly observe the mesh inner aspect, which should appear correctly placed without folds. If the mesh needs to be rearranged, one or two 3.5-mm trocars can be introduced laparoscopically through the same skin holes into the peritoneal cavity (**Figure 7**). Subsequently, CO<sub>2</sub> is fully evacuated and the umbilicus is closed. Mini trocar incisions do not require suturing covered with surgical tape. Our preliminary results show a mean operative time of 43 min. Two accidental peritoneum perforations occurred, and at the end the

procedure, 2 peritoneal perforations and 6 transected inguinal scrotal hernia sacs were sutured laparoscopically, after proper TEP mesh accommodation. We prefer laparoscopic suturing, because it is easier and faster. There were no conversions and no intraoperative complications. Small hematomas were found in the scrotum and penis of 4 patients, but were not considered of clinical relevance. One patient developed an asymptomatic small hydrocele, partially regressed after 2 mo, but no infection occurred. All patients were discharged within 6 h to 16 h of the end of the procedure, and analgesics were administered as needed. No patient used analgesics for more than 5 d, and no pain was reported for longer than a week. No recurrence was observed during the 3-mo follow-up period. All patients were very satisfied with the overall results of the surgery, and they all returned to their activities 3 d to 2 wk after the procedure.

## DISCUSSION

TAPP and TEP are the most prominent laparoscopic techniques for inguinal hernioplasty and are both effective and safe. MINI is a refined laparoscopic technique that uses instruments with reduced diameter. MINI was originally used for TEP in the late 1990s,<sup>10–12</sup> although an interest in the



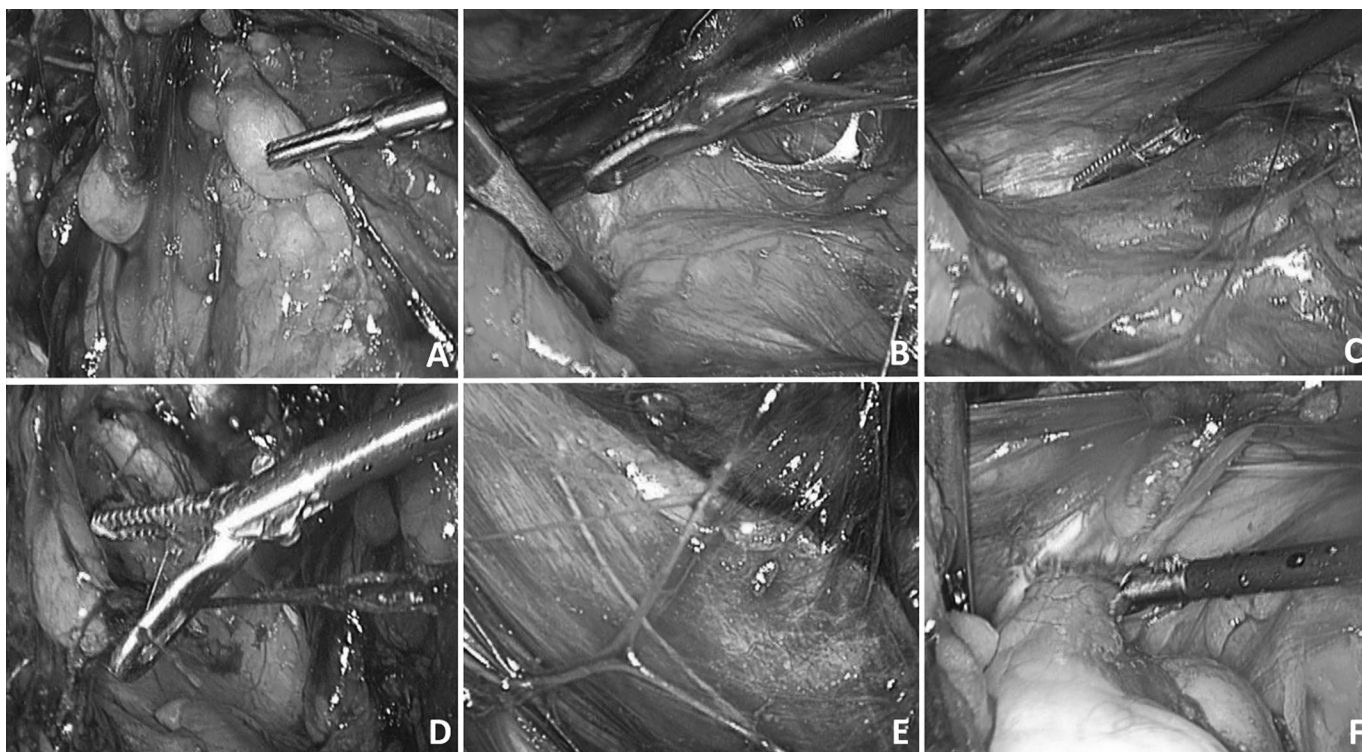
**Figure 3.** Sequence of mini trocar insertion and creation of a preperitoneal space. After inspection of the abdominal cavity, the first 3.5-mm trocar is inserted by transperitoneal visualization medial to the epigastric vessels using a 3-mm blunt dilating tip insert, to avoid trauma and peritoneal perforation. Through this mini trocar, a small dissection is made under laparoscopic direct vision between the peritoneum and the muscle-aponeurotic planes (A, B). After the insert is removed, CO<sub>2</sub> is connected to the mini trocar by the appropriately placed Luer lock (C, D). A second 3-mm trocar can be inserted to facilitate the dissection of the preperitoneal space by bimanual technique (E). The 10-mm intraperitoneal umbilical trocar valve is left open halfway. At this point, the CO<sub>2</sub> inflation and the creation of the preperitoneal space can be directly visualized (F), as previously described.<sup>9</sup>

technique has recently been revived.<sup>13</sup> Due to the use of thinner instruments, MINI not only improves aesthetics, but also provides better visibility, especially in the narrow retroperitoneal space. With the development of new low-friction trocars, MINI can be performed with better ergonomics and higher precision. The TAPP hernia repair provides additional space within the intraabdominal cavity, facilitating routine evaluation of intraabdominal organs. By using this approach, it is possible to diagnose and treat additional hernias and other intraabdominal diseases. TAPP allows the treatment of incarcerated and strangulated hernias, through evaluation of ischemic bowel viability. It also allows the diagnosis and treatment of unsuspected bilateral hernias, which can occur in up to 25% of assumed unilateral hernias.<sup>14</sup> Despite the advantages, TAPP is costly and time consuming. It requires mesh fixation with either staples or sutures and closure of the peritoneum flap, which is technically difficult. TEP is an attractive technique due to its simplicity, speed of execution, low cost, and it minimizes the risk of complications, because

it eliminates the need for laborious opening and peritoneum closure.<sup>1,3,15</sup>

Initial transperitoneal access facilitates TEP. TAPP is immediately followed by TEP as previously described,<sup>16-18</sup> but in this particular case the combination of the 2 techniques is contraindicated. The addition of MINI allows easy exchange of trocar position between the intra- and extraperitoneal spaces, increasing flexibility of laparoscopic hernioplasty.

In addition to increasing visibility of the preperitoneal space, this combined approach also provides a number of benefits over TEP alone. It allows adequate evaluation of all the anatomical elements involved in hernia repair, and addresses unusual situations, such as underestimated hernia size, direct coalescing bilateral hernias, displaced epigastric vessels and abdominal contents within the hernia sac. This anatomical preview may decrease potentially severe perioperative complications.



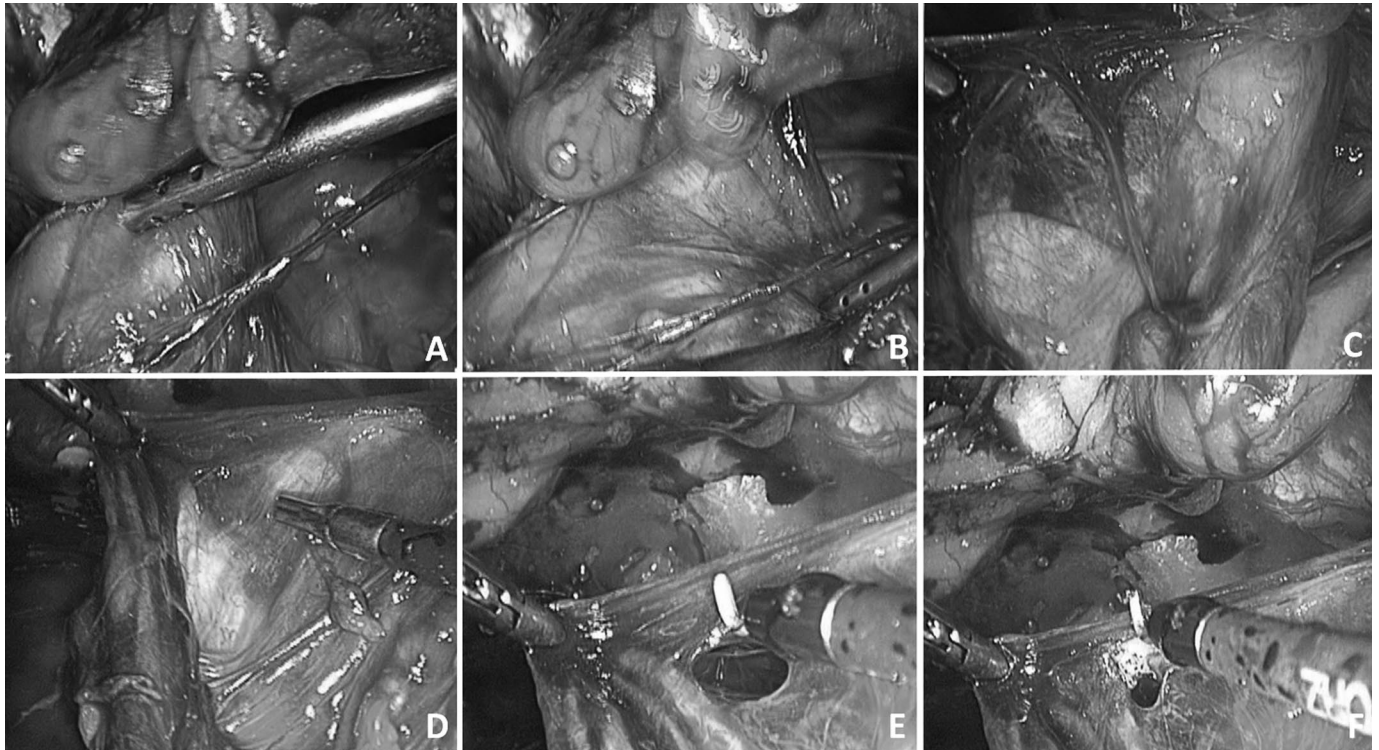
**Figure 4.** The formation of the preperitoneal space is under direct view. The sequence shows adequate exhibition of the preperitoneal space through bimanual dissection.

When an opening of the peritoneum occurs due to technical difficulties or the presence of large inguinal scrotal hernias, the correction can be made by transperitoneal access. This complication was detected and fixed in 5 patients by the use of 3.5-mm trocars inserted intraperitoneally and subsequently sutured. This technique also helped correcting the mesh positioning in case of small folds.

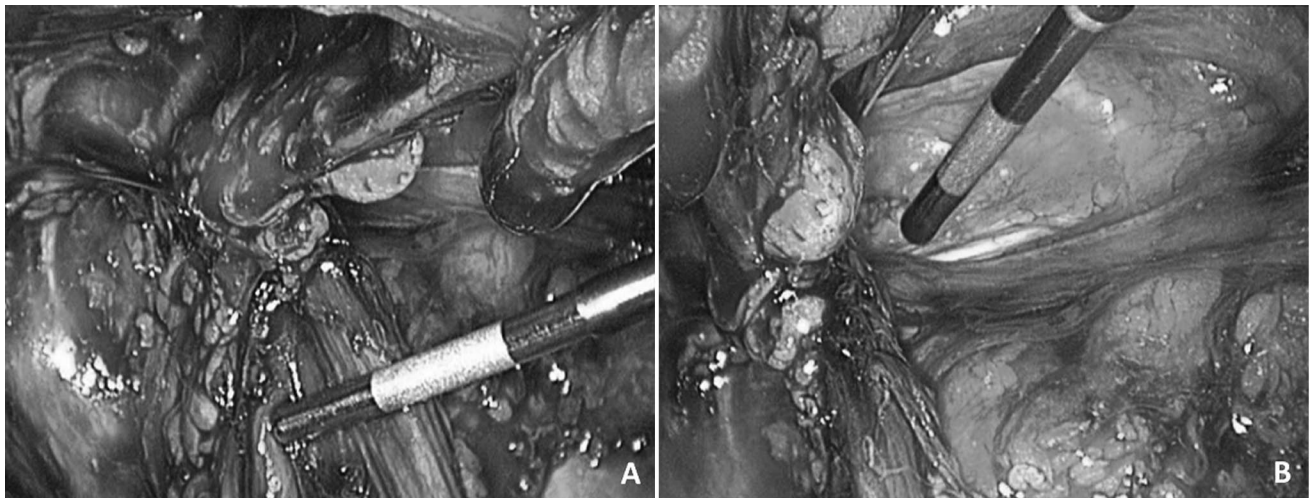
The combination of MINI-TEP-TAPP with the use of MINI instruments is simple, safe, and versatile. Reduced costs can be anticipated, because the use of balloon dissection and mesh fixation is eliminated. Minilaparoscopic preperitoneal dissection also allows faster and easier formation of the preperitoneal space, reducing the learning curve.

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**Figure 5.** The identified hernial sac is now being separated from the spermatic cord structures by blunt dissection and electrocautery.



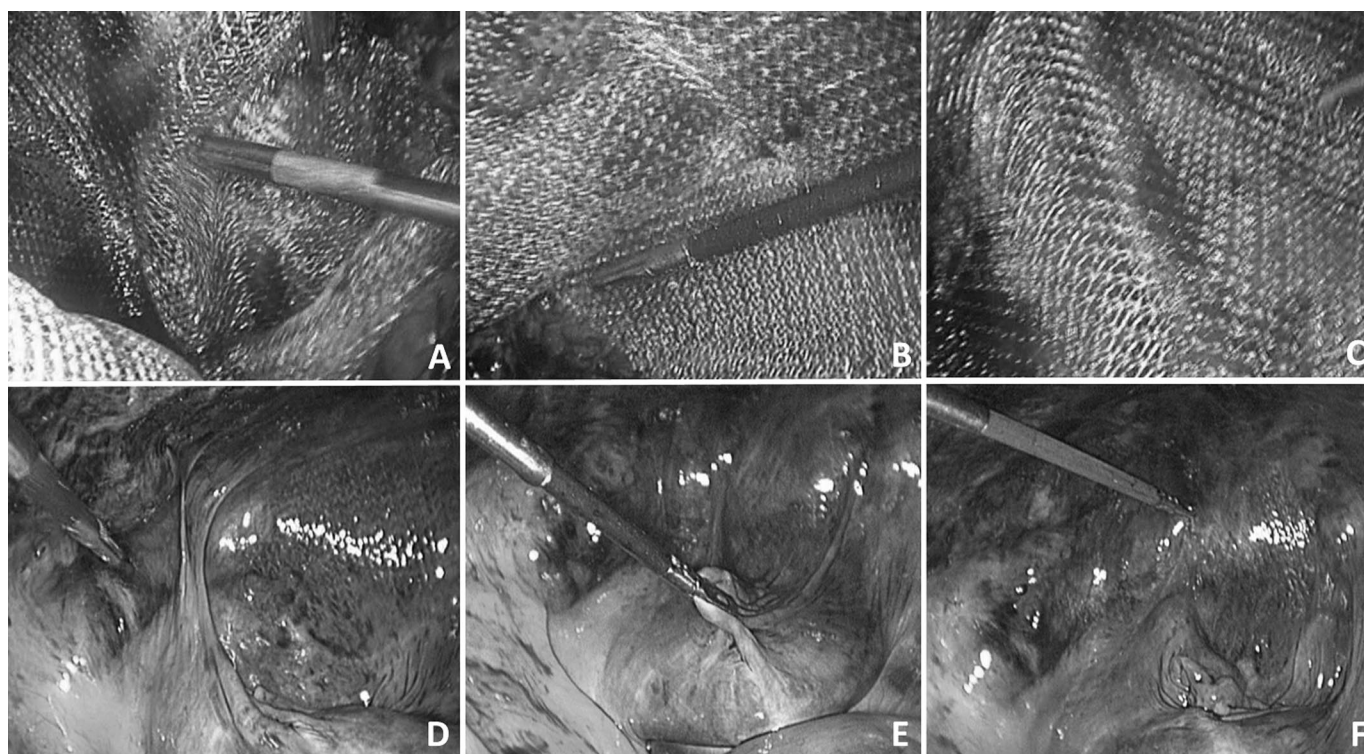
**Figure 6.** Before mesh insertion, adequate preperitoneal space must be attained to fully understand the inguinal anatomic landmarks. A - Right inguinal region - The vas deferens, the gonadal and epigastric vessels can be identified. B - Hernia orifice that will be covered by the mesh.

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**Figure 7.** The polypropylene mesh is blindly inserted through the 10-mm trocar completely covering the entire inguinal-crural region (A–C). Preperitoneal CO<sub>2</sub> is released allowing the peritoneum to compress the mesh and keeping it in place. Laparoscopic view to observe the mesh inner aspect, which should appear correctly placed without folds (D). The looseness of the hernia sac can be observed (E). Placement of the mesh with the aid of a 3-mm forceps (F).

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