

Chapter 24

The Total Extraperitoneal Inguinal Hernia Repair: A Review

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Abstract

Inguinal hernia repair ranks among the most frequently performed surgical procedures globally. The advent of minimally invasive techniques has markedly transformed the surgical management of groin hernias, with Total Extraperitoneal (TEP) repair being recognized as a well-established laparoscopic method. Unlike the transabdominal preperitoneal (TAPP) repair, TEP is conducted entirely within the extraperitoneal space, thereby avoiding entry into the peritoneal cavity. This technique minimizes the risk of intra-abdominal complications, such as bowel perforation and vascular injuries. Numerous studies have indicated that TEP repair achieves recurrence rates comparable to those of open mesh repair, while providing benefits such as reduced postoperative pain, quicker resumption of normal activities, and lower incidences of chronic groin pain. Nevertheless, the procedure presents a steeper learning curve due to the restricted working space and the complex anatomy of the posterior groin. This chapter explores TEP repair, focusing on its indications, mesh fixation methods, and comparisons with TAPP and other open inguinal hernia repair techniques.

Keywords: TEP, Inguinal hernia, Laparoscopic, Endoscopic, Recurrence, Chronic pain, Preperitoneal, and Mesh repair.

Introduction

The laparoscopic total extraperitoneal (TEP) inguinal hernia repair was initially introduced by Ferzli et al. in 1992. This procedure involves the insertion of a 10 mm subumbilical port posterior to the rectus muscle, followed by dissection to create a space in the preperitoneal area. After establishing this space, a 5 mm port is placed in the midline at the suprapubic region, and another 5 mm port is positioned midway between the subumbilical and suprapubic ports. Dissection commences at the pubis, proceeding along Cooper's ligament to open the space of Retzius. The identification of Hasselbach's triangle and potential hernia sites (inguinal, femoral, and obturator) is then conducted. The inferior epigastric vessels are identified and elevated, and blunt dissection continues towards the space of Bogros and the anterior superior iliac spine. Subsequently, the dissection of the cord structures is performed, and a 10 cm by 15 cm polypropylene mesh is placed after creating a slit for the external iliac vessels and the spermatic cord, securing it with tackers or sutures. Ferzli conducted this repair on 25 patients, reporting no morbidities or mortalities, with one patient requiring conversion to an open procedure (Ferzli et al., 1992). McKernan and Laws also performed the total extraperitoneal laparoscopic inguinal hernia repair on 51 patients, observing hematoma formation in 3 patients, which resolved within one week, and no recurrences were noted (McKernan & Laws, 1993).

The guidelines provided by the International Endo Hernia Society for the Total Extraperitoneal (TEP) approach to inguinal hernia repair recommend positioning the patient in the supine position. During the initial learning phase, balloon dissection is advised for creating extraperitoneal space. The working ports should be aligned along the midline, equidistant between the camera port and the pubic symphysis. Dissection should occur in a plane posterior to the inferior epigastric vessels. For a direct sac, inversion and anchoring to Cooper's ligament are recommended, whereas an indirect sac should be ligated proximally and divided distally. A large mesh, measuring 15 cm by 13 cm, is advised to cover all fascial defects in the groin, including the Hesselbach triangle, indirect ring, femoral ring, and obturator ring, without wrinkles. Fixation is recommended for hernias exceeding 4 cm in size (Bittner et al., 2011). Recent updates to the guidelines suggest using a pre-tied sutured loop to close the direct inguinal hernia defect. There is an increased risk of seroma formation following the proximal ligation and distal division of the indirect hernia sac; however, employing a closed suction drain may mitigate this risk. Both the Transabdominal Preperitoneal (TAPP) and TEP approaches are equally effective for managing primary inguinal hernia (Bittner et al., 2015).

This chapter seeks to evaluate the role of total extraperitoneal (TEP) repair by examining its indications and complications. A comparison will be made between TEP and other laparoscopic inguinal hernia repairs, such as transabdominal preperitoneal (TAPP) repair. Additionally, TEP will be compared with the Lichtenstein and other open inguinal hernia repair techniques. A comprehensive literature review was conducted using PubMed, Google Scholar, Semantic Scholar, and Cochrane databases to identify original research studies, observational studies, clinical trials, clinical reviews, review articles, systematic reviews, and meta-analyses from 1990 to 2026. The search utilized the following keywords: “TEP,” “Inguinal hernia,” “laparoscopic,” “endoscopic,” “recurrence,” “chronic pain,” “Preperitoneal,” and “mesh repair.” All articles were in English, and additional articles were identified through manual cross-checking. Case reports, commentaries, and editorials were excluded, while all articles involving adult patients were included in this review.

Discussion

The Total Extraperitoneal (TEP) Inguinal Hernia Repair

Krishna et al. conducted a retrospective study on total extraperitoneal (TEP) inguinal hernia repair, involving 841 patients who underwent 1,249 repairs. The success rate of TEP repair was 93.5%. After a 10-year follow-up, the recurrence rate was 1%, and the incidence of chronic pain was 1.4% (Krishna et al., 2019). Swadia's retrospective study included 1,042 patients who underwent 1,539 TEP repairs. Intraoperative complications occurred in 2.98% of cases, and the morbidity rate was 8.57%. The recurrence rate at a 3-year follow-up was 8% (Swadia, 2011). Dulucq et al. also conducted a retrospective study on laparoscopic TEP inguinal hernia repair, with a total of 3,100 hernia repairs, of which 3,007 were TEP repairs. The overall morbidity rate was 2.2%, and the recurrence rate was 0.35% (Dulucq et al., 2009).

Toma et al. conducted a retrospective study involving 303 patients who underwent total extraperitoneal (TEP) inguinal hernia repair, reporting a hematoma rate of 2.6% and a seroma rate of 1.3%. The recurrence rate following TEP repair was 1.3%, with a chronic pain incidence of 0.3% (Toma et al., 2015). Brandt-Kerkhof et al. performed TEP repair on 313 patients, and after a mean follow-up of 13 years, the recurrence rate was observed to be 8.9% (Brandt-Kerkhof et al., 2011). Messenger et al. conducted a five-year prospective follow-up study on 430 patients who underwent TEP inguinal hernia repair, finding a recurrence rate of 1% and a chronic pain incidence of 7.6% (Messenger et al., 2010). Reiner et al. carried out a retrospective study on 783 patients who underwent 1,240 TEP repairs, noting seroma formation in 3% and testicular swelling in 1.9% of cases (Reiner & Bresnahan, 2016). Tamme et al. retrospectively assessed TEP inguinal hernia repair in 3,868 patients over a seven-year period, during which 5,203 repairs were performed. Postoperative complications were recorded in 0.3% of cases, and the recurrence rate was 0.6% (Tamme et al., 2003).

Saggar et al. conducted a retrospective study on selective mesh fixation in laparoscopic total extraperitoneal (TEP) inguinal hernia repair. Among 634 patients who underwent 822 TEP repairs, mesh fixation was performed in 28 cases. The study found no differences in postoperative complications between procedures, and the recurrence rate was 0.7% at an 82-month follow-up (Saggar & Sarangi, 2008). Cristaudo et al. conducted a prospective randomized trial comparing mesh type and fixation in TEP inguinal hernia repair. This study involved 146 patients divided into four groups: Group 1 used a 10 cm by 15 cm mesh with absorbable tacks; Group 2 used a 10 cm by 15 cm folding mesh with absorbable tacks; Group 3 used a 10 cm by 15 cm mesh with non-absorbable tacks; and Group 4 used a 10 cm by 15 cm mesh with fibrin sealant. No differences were observed in postoperative complications and chronic pain among the groups (Cristaudo et al., 2015). Koch et al. conducted a randomized prospective study comparing mesh fixation versus non-fixation in TEP hernia repair. The study included 40 patients, with 20 undergoing mesh fixation and 20 without. No differences were found in postoperative pain and recurrence rates between the two methods (Koch et al., 2006).

Sahebally et al. conducted a systematic review and meta-analysis to compare fixation and non-fixation in laparoscopic total extraperitoneal (TEP) repair of primary inguinal hernia. This study encompassed eight studies with a total of 557 patients. The analysis revealed no significant differences in recurrence (RD = 0.00, 95% CI, 0.01-0.01) or seroma formation (OR = 0.70, 95% CI, 0.28-1.74) between the two approaches. However, fixation was associated with increased immediate postoperative pain (MD = 0.93, 95% CI, 0.20-1.66) (Sahebally et al., 2020). Similarly, Chaouch et al. conducted a systematic review and meta-analysis of randomized controlled trials comparing mesh fixation and non-fixation in total extraperitoneal inguinal hernia repair. This review included 16 studies with 1608 patients and found that mesh fixation was linked to a higher risk of chronic pain compared to non-fixation (RR = 1.68, 95% CI, 1.29-2.19). Nonetheless, no differences were observed in recurrence rates between fixation and non-fixation (RR = 0.53, 95% CI, 0.22-1.23), nor in seroma formation (RR = 1.05, 95% CI, 0.70-1.58) (Mohamed Ali Chaouch et al., 2026).

A meta-analysis conducted by Dong et al. examined the safety of unfixed mesh in total extraperitoneal (TEP) inguinal hernia repair through randomized controlled trials. This review encompassed 15 studies involving 1,629 patients. The findings indicated that non-fixation of the mesh was associated with a shorter operative time (MD -1.33, 95% CI, -2.13 to -0.53), reduced early postoperative pain (MD -0.50, 95% CI, -0.98 to -0.03), decreased chronic pain (RR 0.72, 95% CI, 0.43 to 1.19), and a lower recurrence rate (RR 2.17, 95% CI, 0.88 to 5.53). The study concluded that non-fixation of the mesh does not elevate the risk of recurrence in TEP hernia repair (Dong et al., 2023).

Table 1

Study	Study Type	N=Numbers	Chronic Pain	Recurrence
Sahebally et al. (2020)	Systematic Review & Meta-analysis	557	No differences between fixation & non-fixation of mesh	Non-fixation of mesh had a lower recurrence rate (RD-0)
Dong et al. (2023)	Meta-analysis of randomized controlled trials	1629	Non-fixation of mesh had reduced chronic pain (RR-0.72)	Non-fixation of mesh had reduced recurrence (RR-2.17)
Chaouch et al. (2026)	Systematic review & meta-analysis of randomized controlled trials	1608	Non-fixation of mesh was associated with reduced chronic pain (RR-1.68)	No differences in the recurrence rate between fixation & non-fixation of mesh (RR-0.53)

Table showing the recurrence and chronic pain between fixation and non-fixation of mesh during laparoscopic inguinal hernia repair.

Comparison of the Total Extraperitoneal (TEP) with the Transabdominal Preperitoneal (TAPP) repairs for inguinal hernia in adults

Varcuae et al. conducted a retrospective study to compare the TEP and TAPP techniques for laparoscopic inguinal hernia repair in adults. The study included 70 patients, with 36 undergoing TEP and 34 undergoing TAPP repair. The findings indicated no significant differences in postoperative complications, recurrence rates, or other complications between the two procedures (Vărcuae et al., 2016.). Krishna et al. performed a prospective randomized controlled trial to compare the laparoscopic TEP and TAPP approaches for inguinal hernia repair. In this study, 100 patients were divided into two groups: 53 underwent TEP, and 47 underwent TAPP. The TEP repair was associated with reduced postoperative pain; however, no differences were observed in chronic pain and recurrence rates between the procedures (Krishna et al., 2012). Bansal et al. conducted a prospective randomized study to evaluate chronic pain and quality of life following TEP and TAPP laparoscopic inguinal hernia repair. A total of 314 patients were randomized, with 160 undergoing TEP and 154 undergoing TAPP. The study found no significant differences in chronic pain and quality of life between the two procedures (Bansal et al., 2013).

Almutairi et al. conducted a systematic review and meta-analysis of randomized controlled trials concerning the laparoscopic management of inguinal hernia. This study encompassed 10 trials involving 11,148 patients, revealing that the TEP approach resulted in reduced postoperative pain and a marginally lower recurrence rate compared to the TAPP repair. No significant differences were observed in terms of postoperative infection, hematoma, and seroma formation between the two procedures (Almutairi et al., 2024). Similarly, McCormack et al. performed a systematic review comparing TEP and TAPP for inguinal hernia repair, which included 10 studies. This review found no differences in postoperative complications, chronic pain, and recurrence between the procedures (McCormack et al., 2005). Furthermore, a systematic review and network meta-analysis by Bracale et al. compared TEP and TAPP for adult inguinal hernia treatment. This analysis, comprising 5 studies with 3,355 patients, also reported no differences in postoperative complications, chronic pain, and recurrence between the TEP and TAPP procedures (Bracale et al., 2012).

Wei et al. conducted a meta-analysis comparing the transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) approaches for laparoscopic hernia repair. This review included 10 studies encompassing 1,047 patients and found no significant differences in postoperative complications (RR = 0.84, 95% CI, 0.67–1.06), recurrence rates (RR = 1.18, 95% CI, 0.47–2.98), or length of hospital stay between the two procedures (Wei et al., 2015). Similarly, Chen et al. conducted a systematic review and meta-analysis of randomized controlled trials comparing TEP and TAPP for inguinal hernia repair. This analysis included 16 studies with a total of 1,519 patients, revealing that TEP was associated with a shorter hospital stay (MD = -0.87, 95% CI, -1.67 to -0.07) but required a longer operative time (MD = 3.35, 95% CI, 0.16–6.65) (Chen et al., 2019).

Naim et al. conducted a systematic review and meta-analysis comparing Transabdominal Preperitoneal (TEP) and Totally Extraperitoneal (TAPP) approaches for inguinal hernia repair. This review included seven studies encompassing 986 patients, and it found no significant differences in hospital stay (MD -0.51, 95% CI, 1.82-0.79) or postoperative pain between the two procedures (Naim & Reza, 2026). Similarly, Aiolfi et al. performed a systematic review and trial sequential analysis of randomized controlled trials comparing TEP and TAPP for inguinal hernia. This analysis incorporated 15 studies with a total of 1359 patients (657 in the TEP group and 702 in the TAPP group), revealing no significant differences in chronic pain (RR 1.51, 95% CI, 0.54-4.22) or recurrence rates (0.83, 95% CI, 0.35-1.96) between the two surgical techniques (Aiolfi et al., 2021).

Comparison of the Total Extraperitoneal (TEP) with the open inguinal hernia repairs

Gavriilidis et al. performed a systematic review and meta-analysis of randomized controlled trials to compare total extraperitoneal (TEP) and Lichtenstein inguinal hernia repair techniques. This review encompassed 21 studies involving 6573 patients, with 3242 patients undergoing TEP repair and 3331 patients undergoing Lichtenstein repair. The findings indicated that the TEP group experienced a higher incidence of vascular injuries (OR: 2.49, 95% CI: 1.05-5.88) and a higher recurrence rate (OR: 1.58, 95% CI: 1.22-2.04), although they reported a lower rate of hematoma formation and a quicker return to work (Gavriilidis et al., 2019). Similarly, Koning et al. conducted a systematic review and meta-analysis comparing TEP and Lichtenstein repair for inguinal hernia. This analysis included 13 studies with a total of 5404 patients, revealing no significant differences in chronic pain (RR: 0.80, 95% CI: 0.61-1.04) and recurrence rate (RR: 1.41, 95% CI: 0.72-2.78) between the two procedures. However, the TEP procedure was associated with a reduction in severe adverse events (RR: 0.91, 95% CI: 0.73-1.12) (Koning et al., 2013).

Lau et al. conducted a systematic review and meta-analysis of clinical trials comparing Total Extraperitoneal (TEP) and Open Inguinal Hernia Repair. This review included 10 studies with a total of 3,212 patients. The TEP repair demonstrated a lower wound infection rate (OR 0.50, 95% CI 0.37-0.69) and facilitated a quicker return to work (WMD -0.23, 95% CI 0.31-0.15). The recurrence rate for TEP repair was superior to sutured open inguinal repairs (OR 0.54, 95% CI 0.31-0.96) but was comparable to open mesh inguinal hernia repairs (OR 1.76, 95% CI 0.60-5.22) (Lau et al., 2003). Khury et al. also conducted a systematic review comparing open or endoscopic extraperitoneal inguinal hernia repair. This review encompassed 23 studies, revealing that TEP repair was associated with a shorter hospital stay and expedited return to work, although the operative time was longer compared to open repair (Khury et al., 2007). Zhu et al. performed a meta-analysis comparing laparoscopic TEP with the open extraperitoneal approach for inguinal hernia repair. This analysis included 12 studies with 1,157 patients, indicating that TEP repair was associated with fewer postoperative complications (OR 0.544, 95% CI 0.365-0.803) and a reduced hospital stay. No significant differences were observed in chronic pain and recurrence rates between TEP and open extraperitoneal repair (Zhu et al., 2014).

Gutlic et al. conducted a randomized clinical trial to compare the total extraperitoneal (TEP) approach with the Lichtenstein inguinal hernia repair. The study included 416 patients, with 202 undergoing TEP and 214 undergoing Lichtenstein repair. The incidence of postoperative pain at 1 year showed no significant difference between TEP and Lichtenstein repair, with rates of 6.9% and 9.8%, respectively. Additionally, the rates of chronic pain and recurrence were comparable between the two procedures (Gutlic et al., 2019). In a separate randomized controlled trial, Eklund et al. compared TEP repair with Lichtenstein repair for inguinal hernia. This study involved 1,512 patients, with 665 undergoing TEP and 705 undergoing Lichtenstein repair. After a 5-year follow-up, the recurrence rate was 2.4% for TEP and 1.2% for Lichtenstein repair. No significant differences in recurrence rates were observed between the two procedures (Eklund et al., 2009).

Table 2

Study	Study Type	N=numbers	Chronic Pain	Recurrence Rate
Lau et al. (2003)	Systematic review & Meta-analysis	3212	No differences between TEP & Open inguinal hernia repair	TEP had reduced recurrence rates with open sutured repairs (OR-0.54) & comparable recurrence rates with open mesh-based repairs (OR-1.76)
Koning et al. (2013)	Systematic review & meta-analysis	5404	No differences between TEP & Lichtenstein repair (RR-0.80)	No differences between TEP & Lichtenstein repair (RR-1.44)
Zhu et al. (2014)	Meta-analysis	1157	No differences between TEP & open preperitoneal repair	No differences between TEP & open preperitoneal repair
Gavrilidis et al. (2019)	Systematic review & meta-analysis	6573	No differences between the TEP & Lichtenstein repair	Higher recurrence rate in the Lichtenstein repair (OR-1.58)

Table showing the recurrence rate and chronic pain between the TEP and open inguinal hernia repairs.

Conclusion

Total Extraperitoneal (TEP) repair represents a safe and effective laparoscopic technique for adult inguinal hernia repair, supported by evidence. This approach avoids entry into the peritoneal cavity, thereby reducing the risk of visceral injury while ensuring comprehensive coverage of the myopectineal orifice. Numerous studies have indicated that TEP repair achieves recurrence rates comparable to those of open mesh repair and Transabdominal Preperitoneal (TAPP) repair, while offering notable benefits in terms of reduced postoperative pain, shorter recovery time, and enhanced patient satisfaction. Despite the requirement for advanced laparoscopic skills and a significant learning curve, TEP repair remains a crucial aspect of contemporary hernia surgery. Ongoing advancements in mesh technology, surgeon training, and robotic-assisted techniques are anticipated to further improve the outcomes of TEP repair.

Declaration

Conflict of interest: There is no conflict of interest.

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