e-ISSN: 0975-9506, p-ISSN: 2961-6093

Available online on www.ijpqa.com

International Journal of Pharmaceutical Quality Assurance 2025; 16(12); 47-51

Original Research Article

A Comparative Meta-Analysis of the Transabdominal Preperitoneal and Total Extraperitoneal Techniques for Inguinal Hernia Repair

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Received: 25-09-2025 / Revised: 23-10-2025 / Accepted: 26-11-2025
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Conflict of interest: Nil

Abstract:

Introduction: The shift from traditional open techniques to minimally invasive approaches in hernia surgery has been widely embraced, with laparoscopic methods demonstrating advantages such as reduced long-term post-operative discomfort, lower risk of wound-related complications like infections and hematomas, and faster recovery. This analysis focuses on evaluating two laparoscopic inguinal hernia repair modalities: transabdominal preperitoneal (TAPP) and total extraperitoneal (TEP) techniques.

Methodology: The Purpose of the study is to assess the clinical outcomes and procedural efficiency of TAPP and TEP in the treatment of inguinal hernias, emphasizing their comparative strengths and limitations. A systematic review was conducted, incorporating peer-reviewed randomized controlled trials (RCTs) comparing TAPP and TEP procedures, sourced from PubMed, Embase, and the Cochrane Library up to December 2024. Key metrics evaluated included operative duration, postoperative pain intensity, and length of inpatient stay, stratified by hernia type.

Results: The analysis included 12 RCTs involving 905 participants randomized into TAPP or TEP groups. TEP was associated with prolonged operative times, abbreviated hospitalization, and diminished postoperative pain levels. However, a notable subset required conversion to open surgery in TEP cases. Conversely, TAPP demonstrated shorter procedural times but did not consistently reduce inpatient duration.

Conclusion: Both TAPP and TEP offer distinct clinical benefits. TEP proves advantageous in minimizing postoperative pain and reducing hospitalization for primary hernia cases, albeit with potential trade-offs in procedural duration and conversion rates. TAPP, while expedient in terms of operation time, may not consistently yield superior outcomes in recovery metrics. These findings underscore the importance of patient-specific factors and collaborative decision-making when selecting between these two laparoscopic techniques for inguinal hernia repair.

Keywords: Inguinal Hernia, Transabdominal Preperitoneal Repair, Total Extraperitoneal Repair.

Introduction

On a global scale, over twenty million individuals annually undergo elective surgery for inguinal hernias [1,2]. The predominant operative method remains the Lichtenstein tension-free repair, a procedure celebrated for its minimal risk of recurrence and postoperative complications [3].

Advances in surgical techniques and the development of innovative equipment have since led to the emergence of laparoscopic methods like Transabdominal Preperitoneal Repair (TAPP) and Total Extraperitoneal Repair (TEP) [4,5]. The fundamental objective for all these interventions is consistent: to return the hernia sac and its contents to their proper position and to correct the defect in the abdominal wall [6,7]. The TAPP operation requires the surgeon to enter the peritoneal cavity, make an incision in the peritoneum, and access the preperitoneal space to place a reinforcing mesh over the hernia, after which the peritoneum is sutured shut [8,9,10]. Conversely, the TEP approach avoids entering the peritoneal cavity altogether.

In this procedure, the preperitoneal space is created externally, and the mesh is positioned within it. This key distinction helps reduce TAPP-associated

hazards, such as infection, adhesions, perforation, and injury to internal organs [11,12,13].

Methodology

Following the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)[14], we performed a systematic review. Searches were carried out in PubMed, Embase, and the Cochrane Library up to 31 December 2024. The query combined the keywords "inguinal," "hernia," "herniorrhaphy," "mesh," "prosthetic material," "laparoscopic," "transabdominal preperitoneal" (TAPP), and "totally extraperitoneal" (TEP) to generate the appropriate Mesh terms.

Titles, abstracts and reference lists were screened for relevance.

Figure 1: Study Flow According To Prisma Guidelines

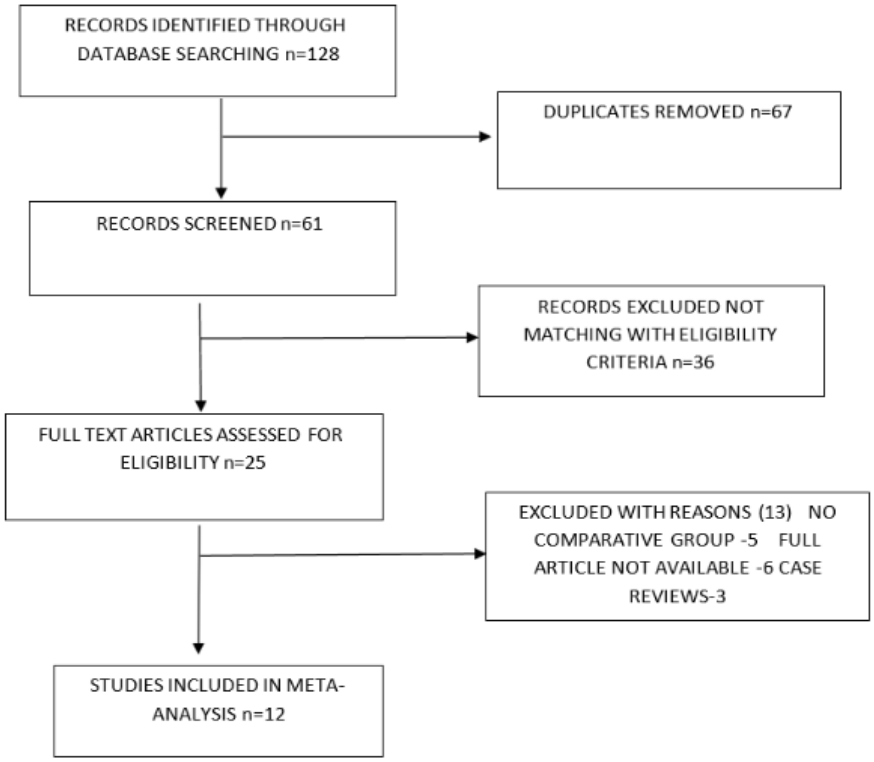

Figure 1: Study flow according to Prisma guidelines

We included both observational studies and randomized controlled trials that directly compared TAPP and TEP techniques for inguinal hernia repair. No exclusions were made based on the number of defects (unilateral versus bilateral), hernia location (inguinal or femoral), hernia type (direct, indirect, or mixed), hernia status (reducible, strangulated, or irreducible), surgical setting (elective or emergency), sample size, participant demographics (sex, age, health condition), length of follow-up, or the specific outcomes reported.

All of these factors were considered acceptable and did not lead to study exclusion. A comprehensive dataset was compiled, encompassing essential details such as authorship, publication date, geographical location, research methodology, patient demographics (including gender, age, and body mass index), surgical approaches, and initial post-operative outcomes. To ensure accuracy, three separate researchers inputted the data, which was then cross-checked and verified after a thorough review. A fourth expert (GC) subsequently conducted a quality control audit of the database, resolving any inconsistencies that arose during the process. An electronic search of the databases initially retrieved 128 records.

Following the removal of 67 duplicate entries, abstract screening led to the exclusion of 36 studies that were not randomized. A total of 25 articles proceeded to the final review stage, where 13 were eliminated for specific reasons. Consequently, 12 articles met the predefined eligibility requirements and were selected for inclusion in the meta-analysis.

Table 1: Literature Survey

Author	Period	Study Type	Popula-tion	Operative Time (TAPP/ TEP)	Post-Operative Pain (TAPP/ TEP)	Length of Stay (TAPP/TEP)
Gong Et All	2006-09	RCT	102	76/79	1.6/1.7	3.4/3.6
Krishn A Et All	2007-09	RCT	100	62/72	2/2	1.5/1.5
Zhu Et Al L	2009	RCT	40	NR	3/2.7	3.5/3.2
Debors Hi Et All	2010-2013	RCT	77	108/120	3.4/3.89	2.1/2.1
Jeelani Et India All	2013-2015	RCT	60	75/80	2/2	1.5/1.5
Milind Et India All	2014-15	Obser-vational	60	121/50	2/2	NR
Ambar Et All	2016-17	RCT	80	86/99	7.9/7.6	5.2/2.6
Vinay Et All	2016-18	RCT	90	68/54	2/2	2.48/2.16
Mahaeer Etal	2018-20	RCT	68	101/76	2/3	1.3/1.3
Talreja Et Al	2019-21	Obser-vational	78	NR	NR	4.2/3.8
Kancham Et All	2020-23	Obser-vational	30	99/78	NR	2.8/2.0
Satish Et All	2021-22	RCT	120	92/89	2/1	1.3/1.3

Results

Surgical Duration: The operative time was a key metric examined in ten studies comparing TAPP and TEP repairs. Analysis of data from 791 patients demonstrated a statistically significant disparity between the two techniques. The mean surgical time was 69 minutes for the TAPP group and 74.0 minutes for the TEP group (CI –0.3 to 2.6). These findings indicate that TAPP procedures are performed more quickly than TEP procedures (Figure 2).

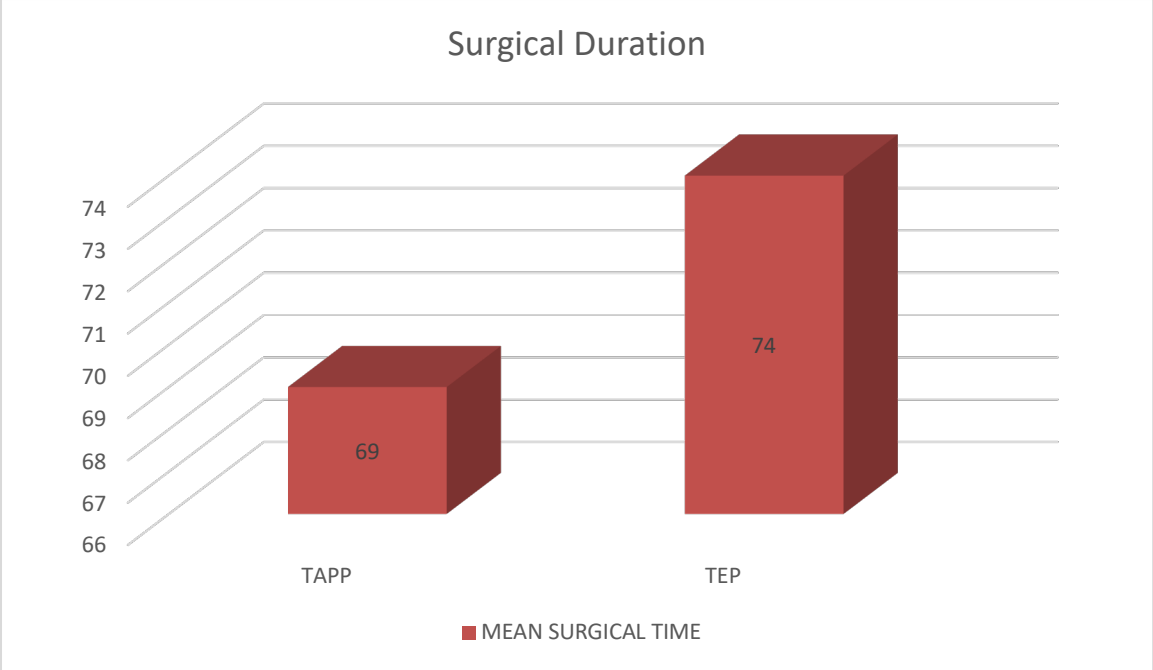

Figure 2: Surgical Duration

Post-Surgical Pain: Ten studies, encompassing 787 patients, reported on pain levels 24 hours following hernia repair, with pain scores measured via a visual analog scale.

The analysis did not reveal a statistically significant distinction in pain between the TAPP and TEP groups (CI -0.6 to 2.6). Despite this, the data pointed towards a trend of reduced pain reported by patients who underwent the TEP repair.

Hospitalization Length: Ten studies provided data on the duration of hospital stays for TAPP versus TEP repair. Evidence from 705 patients showed a

significant difference between the groups (CI –0.6 to 2.2), leading to the conclusion that the TEP repair method is associated with a shorter post-operative hospital stay compared to the TAPP approach.

Discussion

The purpose of inguinal hernia surgery is to reconstruct the natural anatomical structures of the inguinal canal and provide lasting relief from symptoms. A clear shift toward less invasive surgical methods is underway, driven by their lower rate of local complications, faster patient recovery, and reduced postoperative pain. Although earlier comprehensive analyses indicated no significant distinctions in the clinical outcomes of different laparoscopic hernia repairs, the present systematic review and meta-analysis, which incorporated more robust and recent randomized controlled trials, has identified specific benefits for both TEP (Totally Extraperitoneal) and TAPP (Transabdominal Preperitoneal) techniques. This new analysis found that TAPP repair offered the advantage of a decreased operative time. In contrast, the TEP approach was associated with less postoperative discomfort and a reduced length of hospitalization. A significant divergence in pain scores was observed during the first week after surgery. However, pain levels for the TEP group converged with those of the TAPP group at the three- and six-month marks. This long-term pain reduction is likely attributable to the extraperitoneal nature of the TEP method, which correlates with less peritoneal irritation. The parietal peritoneum is known to be highly sensitive to pain, temperature, touch, and pressure due to its innervation from spinal nerves T7–T12, L1, and the obturator nerve. TEP repair is performed in the space between the abdominal wall and this sensitive lining, whereas TAPP requires incising it. Consequently, the preservation of the peritoneum during TEP explains the lower pain scores compared to TAPP. It is important to note, however, that peritoneal irritation following laparoscopic repair is typically a self-resolving issue, which accounts for the transient nature of the pain differences. The findings regarding pain scores are consistent with the data on analgesic consumption, a more objective measure of pain intensity. While some primary data indicated that patients in the TAPP group required significantly more pain medication than the TEP group, the overall analysis of analgesic use ultimately showed no discernible difference between the two cohorts. Hernia recurrence may be linked to damage of sensory nerve endings during previous surgeries. A key limitation of this study is the absence of specific information on the types of prior surgeries patients had undergone, which may explain the high degree of variability (heterogeneity) in the recurrence data. This limitation is a plausible reason for the significant variation observed in this subgroup. Among the primary cases, the shorter hospital stay was a clear advantage for the TEP repair. The duration of a hospital stay can be influenced by numerous factors, with postoperative pain being one of the most significant. For patients undergoing surgery for recurrent hernias, the TAPP procedure demonstrated a considerably shorter surgical time. This advantage likely arises because scar tissue from previous operations can make the preperitoneal space—used in TEP repair—smaller and more challenging to navigate. In such cases, creating and maintaining this workspace is more difficult than working within the peritoneal cavity, which is the primary site of dissection in the TAPP technique

Conclusion

Based on a comparative evaluation of surgical techniques for inguinal hernia repair, practitioners with expertise in the TEP method are advised to continue employing this approach. The outcomes for the TAPP procedure, while slightly less pronounced, were sufficient to endorse its ongoing use, as there is no conclusive data pointing to long-term patient detriment. Consequently, this study does not call for a sweeping revision of current clinical practices. However, for any surgeon capable of performing either the TEP or TAPP method, the evidence suggests giving preference to a TEP repair, assuming no patient-specific conditions prevent its use. The findings from this research provide the medical community with a clearer basis for weighing the merits of each surgical option.

Now that both techniques have been validated as effective and generally safe, future investigations can explore whether one strategy might be better suited for distinct patient groups. For instance, additional studies could determine which approach yields more favourable results in populations such as the elderly, the obese, or those with multiple co-existing health issues.

Acknowledgements: Ethical approval- The study was approved by the institutional ethics committee.

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