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Original article

A Prospective Evaluation of Laparoscopic Inguinal Hernia Repair Outcomes at Tobruk Medical Center, Libya

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Abstract
Inguinal hernias are among the most common surgical pathologies worldwide, with laparoscopic Transabdominal Preperitoneal (TAPP) repair emerging as a preferred minimally invasive technique. However, continuous evaluation of short-term outcomes and identification of modifiable risk factors for postoperative complications remain essential for optimizing patient care. This study aimed to evaluate the clinical outcomes and identify independent predictors of complications following laparoscopic TAPP inguinal hernia repair. This prospective observational study was conducted at the Department of General Surgery, Tobruk Medical Center, Libya, over two years from 2023 to 2024. A total of 60 patients diagnosed with primary inguinal hernias and medically fit for general anesthesia underwent TAPP repair. Patients with irreducible/obstructed hernias, previous lower abdominal surgeries, recurrent hernias, severe cardiopulmonary comorbidities, or those lost to follow-up were excluded. All participants were monitored postoperatively for complications, pain scores (using the Numeric Rating Scale), and hernia recurrence over a one-year follow-up period. Multivariate logistic regression analysis was performed to identify independent predictors of overall complications. The mean patient age was 44.9 ± 12.5 years, and the mean BMI was 24.8 ± 1.36 kg/m^2. The mean operative time was 73.2 ± 8.3 minutes. Patients demonstrated rapid recovery, with a mean hospital stay of 31.5 ± 5.1 hours and a mean return to work of 7.5 ± 1.9 days. Postoperative pain scores decreased progressively from 4.9 on day 1 to 2.7 by the first week. Only 20% of patients required ongoing analgesics. Seroma occurred in 15% of patients at day 7, resolving spontaneously to 5% by the first month. Foreign body sensation was reported in 20% of patients. No recurrences, wound infections, hematomas, or chronic pain syndromes were recorded. Multivariate analysis identified chronic cough (OR: 2.66; p = 0.001), constipation (OR: 1.50; p = 0.01), heavy lifting (OR: 2.17; p = 0.001), diabetes mellitus (OR: 1.02; p = 0.02), and smoking (OR: 1.92; p = 0.001) as independent predictors of overall postoperative complications. Laparoscopic TAPP inguinal hernia repair is a safe, feasible, and effective procedure that offers rapid recovery, low morbidity, and excellent short-term outcomes with no recurrence at one year. Modifiable risk factors, particularly smoking, chronic cough, constipation, heavy lifting, and diabetes mellitus, should be systematically addressed preoperatively to minimize complication rates and optimize surgical success.
Keywords. Cephalometric Analysis, Class II Division 1, Maxillary Base Length, Mandibular Body Length, and Ramus Height.

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Abstract
Keywords: TAPP, recurrence, infection, seroma, laparoscopic hernia repair.

Introduction:

Inguinal hernias account for approximately 90% of all spontaneous abdominal wall hernias, making them the most frequently encountered type of hernia in general surgical practice [1]. The lifetime risk of developing an inguinal hernia is estimated at 27% in men and 3% in women, translating to over 20 million repair procedures performed globally each year [2].

The surgical management of inguinal hernias has evolved significantly over the past few decades. Historically, primary tissue repairs were the standard of care; however, the advent of synthetic meshes established tension-free mesh repair as the contemporary gold standard [3]. Within this paradigm, minimally invasive approaches have gained substantial traction. Transabdominal preperitoneal (TAPP) repair is a prominent laparoscopic technique that allows for excellent visualization of the posterior inguinal anatomy and direct access to the myopectineal orifice. During TAPP, the peritoneal cavity is entered, the peritoneal flap is raised, the hernia sac is dissected, and a mesh is deployed in the preperitoneal space to reinforce the abdominal wall [4].

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TAPP offers several distinct advantages. It is particularly beneficial for bilateral and recurrent hernias (following prior open repair), as it allows for simultaneous diagnostic laparoscopy and the assessment of the contralateral side without the need for additional incisions. Furthermore, the standardization of the TAPP technique has contributed to a more favorable learning curve compared to totally extraperitoneal (TEP) approaches [5]. Despite these benefits, laparoscopic hernia repair is not devoid of complications. The spectrum of postoperative issues ranges from mild, self-limiting events—such as seroma formation and transient neuralgia—to more severe sequelae, including chronic pain, hematoma, and recurrence [6]. The identification of patient-specific risk factors that predispose individuals to these complications remains a critical goal in surgical research [7]. Therefore, this study aimed to evaluate the clinical outcomes and identify the independent predictors of complications in patients undergoing laparoscopic inguinal hernia repair using the TAPP technique.

Methods

Study Design and Population

This prospective observational study was conducted at the Department of General Surgery, Tobruk Medical Center, Libya, over a two-year period from January 2023 to December 2024. The study protocol was reviewed and approved by the institutional ethics committee and was conducted in strict accordance with the principles of the Declaration of Helsinki. Written informed consent was obtained from all participants prior to their enrollment in the study.

Eligibility criteria

The study included patients older than 18 years who were medically fit for general anesthesia and diagnosed with a primary inguinal hernia. Exclusion criteria encompassed patients presenting with irreducible or obstructed hernias, those with a history of previous lower abdominal surgery or radiotherapy, and individuals with severe comorbidities rendering them unfit for laparoscopic procedures (e.g., severe cardiac diseases, coagulopathies, or severe obstructive airway disease). Patients with recurrent inguinal hernias and those lost during the follow-up period were also excluded.

Preoperative Assessment

All patients were evaluated via the outpatient clinic. A comprehensive history was taken, with specific emphasis on predisposing factors for hernia development, including smoking habits, chronic cough, chronic constipation, difficult micturition, and occupational hazards such as heavy lifting. General and local examinations of the inguino-scrotal region were performed to classify the hernia type and size and to rule out complicated presentations. Routine preoperative laboratory investigations, electrocardiograms (ECG), and chest X-rays were conducted to ensure cardiopulmonary fitness. Abdominopelvic ultrasonography was routine, and scrotal ultrasound was utilized in cases suspicious of concurrent varicocele or hydrocele

Operative Technique (TAPP)

All procedures were performed under general anesthesia with endotracheal intubation. Patients were positioned supine in the Trendelenburg position with arms tucked to their sides. The surgeon stood on the side contralateral to the hernia, with the camera operator adjacent to the surgeon, and the video monitor positioned at the foot of the table. A prophylactic dose of Cefotaxime sodium (1g) was administered at anesthesia induction. A broad sterile preparation was applied to the entire abdominal wall, upper thigh, penis, and scrotum to allow for external counter-pressure during manipulation. Pneumoperitoneum was established, and trocars were inserted. The peritoneal flap was raised, and meticulous dissection of the hernial sac from the cord structures was performed. A synthetic mesh was appropriately sized and placed in the preperitoneal space to cover the myopectineal orifice, followed by peritoneal closure to completely isolate the mesh from the abdominal viscera.

Postoperative Care and Follow-up

Postoperatively, patients were observed in the recovery room for approximately one hour before being transferred to the ward. Oral fluids were initiated four hours post-surgery. Foley's catheterization, inserted prior to surgery, was removed once the patient regained ambulatory capability. Pain management transitioned from intramuscular NSAIDs to oral diclofenac potassium (50 mg) twice daily as needed. Patients were encouraged to mobilize early and resume standard daily activities. Most patients were discharged within 24 to 48 hours. A structured follow-up schedule was implemented: the first visit at 7–8 days, the second at 2 weeks, the third at 1 month, followed by visits at 3 months, 6 months, and 1-year post-surgery. Clinical evaluations (history and physical examination) and ultrasonography (at 1 and 6 months) were utilized to detect complications such as seroma, hematoma, and recurrence.

Statistical Analysis

Data were collected, coded, and entered into a statistical database. Analysis was performed using SPSS software (version 25.0; IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) and ranges,

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while categorical variables were presented as frequencies and percentages. Multivariate logistic regression analysis was performed to identify independent predictors of overall postoperative complications, with odds ratios (OR) and 95% confidence intervals (CI) calculated. A p-value of < 0.05 was considered statistically significant.

Results:

A total of 60 patients underwent laparoscopic transabdominal preperitoneal (TAPP) inguinal hernia repair at the Department of General Surgery, Tobruk Medical Center, Libya, over the two-year period from 2023 to 2024. All patients were successfully followed up for a minimum of one-year post-surgery, with no dropouts during the study period.

The baseline characteristics of the study cohort are summarized in Table 1. The mean age of the patients was 44.9 ± 12.5 years (range: 25–83 years), and the mean body mass index (BMI) was 24.8 ± 1.36 kg/m^2 (range: 22.9–28.5 kg/m^2). Regarding comorbidities, diabetes mellitus (DM) was present in 15 patients (25%), hypertension (HTN) in 12 patients (20%), end-stage renal disease (ESRD) in 5 patients (8.3%), and liver disease in 7 patients (11.7%). Smoking was reported by 30 patients (50%). Among predisposing risk factors, chronic cough was noted in 30 patients (50%), lifting of heavy objects in 18 patients (30%), and chronic constipation in 15 patients (25%). Unilateral hernias were observed in 48 patients (80%), while bilateral hernias were present in 12 patients (20%). The mean hernia defect diameter was 2.9 ± 0.6 cm.

Table (1): Baseline Demographic and Clinical Characteristics of the Study Population (N=60)

Variables	Laparoscopic inguinal hernia repair (N=60)
Age	44.9 ± 12.5 (25-83)
BMI	24.8 ± 1.36 (22.9-28.5)
DM	15 (25%)
ESRD	5 (8.3%)
Liver disease	7 (11.7%)
HTN	12 (20%)
Smoking	30 (50%)
Chronic cough	30 (50%)
Constipation	15 (25%)
Lifting heavy objects	18 (30%)
Side of hernia	
Unilateral	48 (80%)
Bilateral	12 (20%)
Hernia diameter (cm)	44.9 ± 12.5 (25-83)

The operative times recorded for all procedures are presented in Table 2. The mean operative time was 73.2 ± 8.3 minutes, with a range of 62 to 90 minutes. No intraoperative complications requiring conversion to open surgery were encountered in any patient.

Table (2): Intraoperative Operative Time

Variables	Laparoscopic inguinal hernia repair (N=60)
Operative time (min)	73.2 ± 8.3 (62 - 90)

Postoperative recovery metrics are detailed in Table 3. The mean duration of bed activity was 25.2 ± 4.1 hours (range: 15–35 hours). The mean length of in-hospital stay was 31.5 ± 5.1 hours (range: 25–39 hours). Patients returned to work at a mean of 7.5 ± 1.9 days (range: 5–10 days) following surgery.

Table (3): Postoperative Recovery Parameters: Bed Activity, Hospital Stay, and Return to Work.

Variables	Laparoscopic inguinal hernia repair (N=60)
Postoperative bed activity time (h)	25.2 ± 4.1 (15-35)
Length of in-hospital stay	31.5 ± 5.1 (25-39)
Return to work, day	7.5 ± 1.9 (5 -10)

Postoperative pain scores, assessed using the Numeric Rating Scale (NRS) at three time points, are shown in Table 4. The mean NRS score on the first postoperative day was 4.9 ± 0.95 (range: 2–6). Prior to discharge, the mean score decreased to 3.87 ± 0.79 (range: 3–5). By the first postoperative week, the mean NRS score had further declined to 2.7 ± 0.9 (range: 1–4), indicating a progressive and satisfactory resolution of pain. As presented in Table 5, only 12 patients (20%) required ongoing analgesic use during their postoperative course, reflecting adequate pain control with the standardized analgesia protocol.

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Table (4): Postoperative Pain Scores (Numeric Rating Scale) at Three Time Intervals

Variables	Laparoscopic inguinal hernia repair (N=60)
Postoperative Numeric Rating Scale At the 1st day	4.9 ± 0.95 (2-6)
Postoperative Numeric Rating Scale Prior to discharge	3.87 ± 0.79 (3-5)
Postoperative Numeric Rating Scale at 1st week	2.7 ± 0.9 (1-4)

Table (5): Postoperative Analgesic Requirement

Variables	Laparoscopic inguinal hernia repair (N=60)
Number of cases of analgesic use in post-operative patients	12 (20%)

The distribution of postoperative complications is summarized in Table 6. Overall, 48 patients (80%) experienced no complications. Seroma was the most frequently observed complication, occurring in 9 patients (15%) at the 7-day follow-up visit. By the first postoperative month, the seroma rate had spontaneously decreased to 3 patients (5%), with no intervention required in any case. Foreign body sensation was reported by 12 patients (20%). Importantly, no cases of hernia recurrence were documented during the entire one-year follow-up period. Additionally, no wound infections, hematomas, or chronic pain syndromes were recorded.

Table (6): Postoperative Complications at 7 Days, 1 Month, and 1 Year.

Variables Complications	Laparoscopic inguinal hernia repair (N=60)
No	48 (80%)
Seroma 7 days	9 (15%)
Seroma 1 month	3 (5%)
Recurrence	0 (0%)
Foreign body sensation	12 (20%)

Multivariate logistic regression analysis was performed to identify independent predictors of overall postoperative complications, with overall complication rate set as the dependent variable. The results are presented in Table 7. Chronic cough (OR: 2.66; 95% CI: 1.12–6.37; p = 0.001), constipation (OR: 1.50; 95% CI: 1.12–2.02; p = 0.01), lifting heavy objects (OR: 2.17; 95% CI: 1.31–3.59; p = 0.001), diabetes mellitus (OR: 1.02; 95% CI: 1.01–1.02; p = 0.02), and smoking (OR: 1.92; 95% CI: 1.12–3.31; p = 0.001) were all identified as statistically significant and independent predictors of overall postoperative complications. These findings highlight that both modifiable lifestyle factors (smoking, heavy lifting) and underlying patient comorbidities (DM, chronic cough, constipation) contribute significantly to the risk of adverse postoperative outcomes following laparoscopic TAPP inguinal hernia repair.

Table (7): Multivariate Logistic Regression Analysis of Predictors of Overall Postoperative Complications.

Overall complications	MVA OR (95% CI)	P value
Chronic cough	2.66 (1.12-6.37)	0.001
Constipation	1.50 (1.12-2.02)	0.01
Lifting heavy objects	2.17 (1.31-3.59)	0.001
DM	1.02 (1.01-1.02)	0.02
Smoking	1.92 (1.12-3.31)	0.001

Discussion

Inguinal hernias remain a highly prevalent pathology in modern surgical practice, requiring effective and durable interventions [8]. The transabdominal preperitoneal (TAPP) approach has emerged as a robust minimally invasive alternative to open repair, offering the benefits of reduced surgical trauma, lower rates of early postoperative morbidity, and expedited functional recovery [9].

In our cohort, the mean patient age was 44.9 ± 12.5 years, with a mean BMI of 24.8 ± 1.36. The most prevalent comorbidities and risk factors included smoking (50%), chronic cough (50%), heavy lifting (30%), and diabetes mellitus (25%). The majority of patients (80%) presented with unilateral hernias, exhibiting a mean defect diameter of 2.9 ± 0.6 cm. These demographic profiles are consistent with contemporary literature. For instance, Kockerling et al. [10] reported similar demographic distributions in large multicenter registries, noting that middle-aged males with occupational lifting requirements and smoking histories constitute the primary demographic for inguinal hernia presentations. Similarly, Chavan et al. [11] highlighted that chronic respiratory stressor, such as cough, are heavily represented in hernia patient cohorts.

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Regarding surgical efficiency, the mean operative time in our series was 73.2 ± 8.3 minutes. Patients demonstrated rapid postoperative recovery, with a mean bed activity time of 25.2 ± 4.1 hours, a mean hospital stay of 31.5 ± 5.1 hours, and a return to work at 7.5 ± 1.9 days. These metrics align with the findings of Bittner et al. [12], who emphasized that the standardized nature of TAPP allows for predictable operative times, generally ranging between 60 and 80 minutes. Furthermore, a meta-analysis by Aiolfi et al. [13] corroborates our short hospital stays and rapid return to work, noting that minimally invasive preperitoneal repairs consistently outpace open Lichtenstein repairs in terms of functional recovery.

Pain management is a critical metric of postoperative quality of life. In our study, the Numeric Rating Scale (NRS) scores were 4.9 on the first postoperative day, decreasing to 3.87 prior to discharge, and further dropping to 2.7 by the first week. Additionally, only 20% of patients required ongoing analgesic use. These findings are supported by the randomized controlled trial conducted by Tolver et al. [14], which demonstrated that TAPP is associated with significantly lower early postoperative pain scores compared to open repair, with a rapid tapering of analgesic requirements within the first week.

Our complication profile revealed that 20% of patients experienced foreign body sensation and seroma. Specifically, seroma was noted in 15% of patients at day 7, resolving in all but 5% by the one-month mark. Importantly, no recurrences were documented during the follow-up period. Seroma formation is widely recognized as the most common transient complication following laparoscopic preperitoneal repair due to the extensive dissection of the preperitoneal flap and the immediate presence of a mesh foreign body [15]. The self-limiting nature of these seromas observed in our study mirrors the findings of Berrevoet et al. [16], who noted that the vast majority of postoperative seromas resolve expectantly within four weeks without necessitating intervention. The absence of recurrence in our series reinforces the structural integrity of the TAPP approach, as supported by long-term registry data showing recurrence rates of less than 2% when standardized preperitoneal mesh placement is achieved [17].

To identify predictors of overall complications, our multivariate analysis identified chronic cough, constipation, heavy lifting, DM, and smoking as independent risk factors. This is pathophysiological intuitive: chronic cough, constipation, and heavy lifting generate sustained intra-abdominal hypertension, which can disrupt the early integration of the preperitoneal mesh and promote fluid collection or seroma formation [18]. Furthermore, smoking and diabetes mellitus are well-established systemic factors that impair wound healing, reduce tissue oxygenation, and increase susceptibility to localized inflammation and infection [19]. Bracale et al. [20] similarly identified uncontrolled comorbidities and lifestyle factors as primary drivers of postoperative morbidity in laparoscopic hernia repair, emphasizing the need for preoperative optimization, such as smoking cessation and glycemic control, to minimize adverse outcomes.

Limitations

This study has several limitations that should be acknowledged. First, the sample size was relatively small (n = 60), which may limit the generalizability of our findings and the statistical power to detect less frequent complications or weaker associations. Second, this was a single-center study conducted at a single institution in Libya, and our results may not be directly generalizable to other populations or healthcare settings with different patient demographics, surgical expertise, or resource availability. Third, the follow-up period was limited to one year, which is insufficient to assess long-term outcomes, particularly late recurrence rates, mesh-related complications, or chronic pain syndromes that may manifest beyond this timeframe. Fourth, the lack of a comparative control group (e.g., open repair or TEP technique) precludes direct comparison of outcomes between different surgical approaches. Fifth, although we identified several risk factors, the observational design of the study does not allow for definitive causal inferences. Finally, we did not assess the impact of surgeon experience or learning curve on outcomes, which may be a relevant confounder. Future multicenter studies with larger sample sizes, longer follow-up periods, and randomized controlled designs are warranted to validate our findings and further refine preoperative optimization protocols.

Conclusion

Laparoscopic TAPP inguinal hernia repair is a safe, feasible, and effective procedure that offers rapid recovery, low morbidity, and excellent short-term outcomes, with no recurrences observed at one-year follow-up. The identification of smoking, chronic cough, constipation, heavy lifting, and diabetes mellitus as independent predictors of postoperative complications underscores the critical importance of preoperative risk stratification and modification. Addressing these modifiable factors, particularly smoking cessation, glycemic control, and management of respiratory and gastrointestinal symptoms, should be an integral component of the preoperative optimization pathway to minimize complications and enhance surgical outcomes.

Conflict of interest. Nil

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