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Effects of obesity on outcomes of laparoscopic TAPP inguinal hernia repairs: a retrospective analysis

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AI was used for grammar and speling corrections.

Abstract

Introduction: Inguinal hernia repair, particularly the Transabdominal Preperitoneal (TAPP) technique, is common worldwide. Obesity (BMI ≥ 30) can influence surgical outcomes, potentially leading to longer operative times, higher complication rates, and prolonged hospital stays.

Aim: This study aimed to evaluate the impact of obesity on surgical outcomes following laparoscopic TAPP inguinal hernia repair.

Material and methods: This retrospective study reviewed data from patients who underwent laparoscopic TAPP inguinal hernia repair between September 2021 and December 2023.
Included were patients aged 18 years or older who had elective unilateral TAPP repair for primary inguinal hernia. Patients were categorized based on BMI: obese (BMI ≥ 30) and non-obese (BMI < 30). Outcomes assessed included recurrence rate, surgical site infections (SSIs), operative time, and length of hospital stay. Data analysis was performed using SAS Studio.

**Results:** We analyzed 201 patients: 30 (14.8%) were obese and 171 (85.2%) non-obese. Recurrence rates were 6.67% in obese and 2.35% in non-obese patients (p = 0.222). No SSIs were observed in obese patients, compared to 1.76% in non-obese patients (p = 1.000). Mean operative time was 78.87 minutes for obese and 70.28 minutes for non-obese patients (p = 0.203). Hospital stays averaged 3.13 days for obese and 3.05 days for non-obese patients (p = 0.086).

**Conclusions:** There were no significant differences in recurrence rates, SSIs, operative time, or hospital stay between obese and non-obese patients. Appropriate surgical expertise and perioperative management can result in comparable outcomes for both groups. Further research is recommended to understand obesity's impact on hernia recurrence.

**Key words:** BMI, inguinal hernia, TAPP, Obesity, Recurrence rate
Introduction

Inguinal hernia repair is one of the most performed surgical procedures worldwide, with the Transabdominal Preperitoneal (TAPP) technique being a widely accepted minimally invasive approach.[1] Despite its popularity, various patient-specific factors, such as obesity, can significantly influence surgical outcomes. Obesity, defined by a Body Mass Index (BMI) of 30 or higher, is a growing global health concern that has been associated with increased surgical risks, including longer operative times, higher complication rates, and prolonged hospital stays.[2-5] The relationship between obesity and surgical outcomes in inguinal hernia repair remains complex and multifaceted. Previous studies have highlighted the technical challenges posed by increased adipose tissue, such as reduced visibility and accessibility during laparoscopic procedures, which can potentially compromise the efficiency and effectiveness of the TAPP technique.[6,7] Additionally, obesity is often associated with comorbid conditions, such as diabetes and cardiovascular diseases, which may further complicate postoperative recovery.[8] Given the rising prevalence of obesity and its potential implications on surgical practice, it is crucial to understand how this condition specifically affects the outcomes of TAPP inguinal hernia repair.

Aim

This study aims to evaluate the impact of obesity on various surgical outcomes following laparoscopic TAPP inguinal hernia repair. Specifically, we will assess the recurrence rate of inguinal hernia, hypothesizing that obese patients (BMI ≥ 30) will have a higher recurrence rate compared to non-obese patients (BMI < 30). We will also examine the incidence of surgical site infections (SSIs), with the expectation that obese patients will experience a higher rate of SSIs.
Additionally, we will compare the operative time, hypothesizing that it will be longer in obese patients, and determine the length of hospital stay, hypothesizing that obese patients will have a longer hospital stay compared to non-obese patients.

**Materials and Methods**

**Study Design**

This study was designed as a retrospective observational analysis set in our surgical center. We reviewed clinical data of patients who underwent laparoscopic TAPP inguinal hernia repair from September 2021 to December 2023. The study followed STROBE guidelines for observational studies.[9]

**Participants**

To the study we included patients who met following inclusion criteria:

- aged 18 years or older;
- underwent elective unilateral TAPP repair for primary inguinal hernia.

Exclusion criteria included:

- bilateral inguinal hernia repairs;
- open Inguinal Hernia Repair;
- emergency hernia repair;
- insufficient follow-up data.
Participants were selected from the hospital's electronic medical records. Follow-up was conducted through routine postoperative visits and review of medical records up to one-year post-surgery. Patients were divided into two groups based on their BMI:

- a case group - those with BMI ≥ 30 kg/m²;
- a control group – patients with BMI < 30 kg/m²;

No additional matching criteria were applied, as this was not a matched study.

Procedure Description

Laparoscopic Transabdominal Preperitoneal Patchplasty (TAPP) inguinal hernia repair was performed under general anesthesia. Pneumoperitoneum was established, and three trocars were inserted in a standard configuration. The peritoneum was incised to access the preperitoneal space, where the hernia sac was identified and reduced. A synthetic mesh, with a minimum size of 15x10 cm, was placed to cover the hernia defect, ensuring it extended beyond the defect margins by at least 5 cm. For hernias classified as M3 or L3 according to the EHS classification, the mesh was secured with glue or sutures.[10-12] The peritoneum was then closed over the mesh to restore the anatomy. Operative time, postoperative complications, and patient recovery were meticulously recorded.

Outcomes

The primary outcomes assessed in this study included the following: Recurrence Rate, defined as the incidence of hernia recurrence within one year post-surgery; Surgical Site Infections (SSIs), defined as infections at the surgical site within 180 days post-surgery; Operative Time, measured in minutes from the initial incision to the completion of the surgery; and Length of Hospital Stay, measured as the number of days from surgery to discharge.
Data Sources and Measurement

Data were sourced from electronic medical records. BMI was calculated using standard height and weight measurements. Operative time, length of hospital stay, and recurrence rates were directly extracted from surgical and follow-up records. SSIs were diagnosed based on clinical criteria and documented in postoperative notes.

Bias

Efforts to address potential sources of bias included: standardized data collection procedures and consistent follow-up protocols for all patients.

Study Size

The study size was determined by the number of eligible patients meeting the inclusion criteria within the specified time frame. Sample size calculations were not performed due to the retrospective nature of the study.

Quantitative Variables

Quantitative variables (operative time, length of hospital stay) were handled using means and standard deviations for continuous variables. Groupings were based on BMI categories to compare obese and non-obese patients.

Statistical Analysis

Data analysis was conducted using SAS Studio statistical software. Descriptive statistics, such as means, standard deviations, and percentages, were calculated for demographic and operative variables. Categorical variables were compared between the two reinforcement groups using
the Chi-squared test or Fisher's exact test. The Wilcoxon signed-rank test was employed to compare continuous variables. Statistical significance was determined at $p < 0.05$.

**Ethical Considerations**

This retrospective analysis adhered to ethical principles and guidelines, with approval obtained from the institutional ethics committee. Patient confidentiality and data privacy were rigorously upheld throughout the study. Informed consent was waived due to the retrospective nature of the analysis.

**Results:**

**Baseline Characteristics**

We analyzed a total of 201 cases of patients who underwent inguinal TAPP repair. Among these, 30 patients (14.8%) were classified as obese (cases), while the remaining 171 patients (85.2%) served as controls. The mean age of the cases was 54.03 years (Standard Deviation, SD 14.82). Patients in this group had an average body weight of 101.3 kg (SD 10.63). The mean height in this group was 175.93 cm (SD 13.23). The average BMI for patients in this group was 32.96 kg/m² (SD 4.35). Approximately 90% of patients in the case group were male.

The mean age of controls was 59.50 years (SD 14.72). Patients in this group had an average body weight of 78.38 kg (SD 11.08). The mean height in this group was 175.49 cm (SD 8.29). The average BMI for controls was 25.37 kg/m² (SD 2.46). Most patients in the control group, 88.89%, were male.

Additionally, patients with obesity had right-sided hernia in 53.22% of instances, whereas right-sided hernia was noted in 76.67% of controls. Difference in age and hernia-site was statistically significant. Table 2 presents hernia types of representation according to EHS classification.
Surgical Outcomes

The recurrence rate within one-year post-surgery was 6.67% in the case group and 2.35% in the control group. This difference was not statistically significant (p = 0.222). No surgical site infections were observed in the case group (0%), whereas the control group had an SSI rate of 1.76%. The difference was not statistically significant (p = 1.000). The mean operative time for the cases was 78.87 minutes (SD 31.88), while for the control group, it was 70.28 minutes (SD 27.25). The difference in operative time between the two groups was not statistically significant (p = 0.203). The mean length of hospital stay for the cases was 3.13 days (SD 0.35), compared to 3.05 days (SD 0.28) for the control group. This difference approached but did not reach statistical significance (p = 0.086). The findings for the cases (obese patients) and control (non-obese patients) groups are summarized in Table 2.

In summary, while the obese group had a higher recurrence rate, longer operative times, and longer hospital stays, these differences did not reach statistical significance when compared to the non-obese group. No significant difference was observed in the rate of surgical site infections between the two groups.

The post-hoc logistic regression analysis indicated that neither obesity (OR = 3.082, 95% CI: 0.495 to 19.205, p = 0.228), age (OR = 0.978, 95% CI: 0.927 to 1.032, p = 0.413), nor hernia side (left vs. right; OR = 1.745, 95% CI: 0.315 to 9.668, p = 0.524) were statistically significant predictors of hernia recurrence following TAPP repair. The c-statistic of 0.682 indicates moderate predictive power of the model. While the odds ratio for obesity suggested a potential increase in the risk of recurrence, the wide confidence intervals and high p-values reflect a lack of statistical significance. Future research with larger sample sizes and additional covariates is recommended to better understand the relationship between these factors and hernia recurrence.
Discussion

This study aimed to assess the impact of obesity on surgical outcomes in patients undergoing laparoscopic Transabdominal Preperitoneal Patchplasty (TAPP) for inguinal hernia repair. Prior research suggests that the incidence of inguinal hernias is lower among obese patients, potentially due to the protective effect of increased abdominal fat.[13,14] However, obesity may pose challenges during surgical procedures, potentially leading to higher complication rates and extended hospital stays.[15-17] Inguinal hernia surgery can lead to significant improvements in patients' physical functioning and emotional well-being postoperatively. Specifically, patients often experience enhanced physical capabilities and better emotional role functioning, while their perceptions of general health and energy levels are generally satisfactory.[18] This suggests the notion that hernia surgery should be offered to all patients with a clinically detectable hernia, regardless of BMI. However, in cases with very high BMI, a multimodal approach that includes both bariatric surgery and hernia repair should be considered. For patients with severe obesity and ventral hernias suitable for laparoscopic repair, this combined strategy has proven to be safe and yields good short-term outcomes. Incorporating bariatric surgery can address the underlying obesity, potentially lowering the risk of hernia recurrence and enhancing overall surgical success.[16]

The outcomes assessed in our study were recurrence rate, surgical site infections (SSIs), operative time, and length of hospital stay. Our findings provide valuable insights into the influence of obesity on these critical surgical outcomes. The recurrence rate was higher in obese patients (6.67%) compared to non-obese patients (2.35%), although this difference did not reach statistical significance. This result is consistent with some previous studies suggesting that obesity may contribute to higher recurrence rates due to increased intra-abdominal pressure and technical challenges during surgery.[17] The lack
of statistical significance in our study may be attributed to the sample size, and further research with larger cohorts may be necessary to clarify this relationship.

No SSIs were observed in the obese group, whereas the non-obese group had an SSI rate of 1.76%, with no significant difference between the groups. This finding contrasts with the general expectation that obesity is associated with a higher risk of SSIs due to factors such as impaired wound healing and increased skin folds.[19] The discrepancy may be due to effective perioperative care and stringent infection control measures at our institution. Nonetheless, it underscores the importance of meticulous surgical technique and postoperative care in minimizing infection risks.

The mean operative time was longer for obese patients (78.87 minutes) compared to non-obese patients (70.28 minutes), but this difference was not statistically significant. This aligns with existing literature indicating that obesity can increase operative time due to technical difficulties such as reduced visibility and maneuverability during laparoscopic procedures. The absence of a significant difference in our study suggests that with experienced surgeons and optimized surgical techniques, the impact of obesity on operative time can be mitigated.

The length of hospital stay was slightly longer for obese patients (3.13 days) than for non-obese patients (3.05 days), but this difference did not achieve statistical significance (p = 0.086). This finding is in line with previous research indicating that obesity may prolong hospital stay due to more complex postoperative care needs. However, the marginal difference observed in our study highlights the potential for enhanced recovery protocols to standardize care irrespective of BMI.

Our study contributes to the ongoing debate regarding the impact of obesity on surgical outcomes in TAPP inguinal hernia repair. While some studies have demonstrated significant adverse effects of obesity, our findings suggest that with appropriate surgical expertise and perioperative management, these effects can be minimized. The lack of significant differences
in recurrence rates, SSIs, operative time, and length of hospital stay between obese and non-obese patients highlights the potential for tailored surgical strategies to address the challenges posed by obesity. Our results correspond with the previous study investigating the effect of obesity on the safety of cholecystectomy. In the study we found that obesity was not a risk factor in terms of surgical safety.[20]

Limitations
This study has several limitations. The retrospective design may introduce selection bias and limits the ability to control for all potential confounding variables. The relatively small sample size, particularly in the obese group, may reduce the power to detect significant differences. Additionally, the single-center setting may limit the generalizability of the findings.

Conclusion
In conclusion, while obesity presents certain challenges in TAPP inguinal hernia repair, our study suggests that with skilled surgical practice and rigorous perioperative care, outcomes for obese patients can be comparable to those of non-obese patients. Future research with larger, multicenter cohorts is warranted to further elucidate the impact of obesity on surgical outcomes and to develop optimized management protocols for this patient population.

Disclosures
Authors have nothing to disclose.

References:


**Table 1. Baseline characteristics**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cases N= 30</th>
<th></th>
<th>Control N= 171</th>
<th></th>
</tr>
</thead>
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<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
<td>Mean</td>
<td>Std. Dev.</td>
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<tr>
<td>Age [years]*</td>
<td>54.03</td>
<td>14.82</td>
<td>59.497</td>
<td>14.72</td>
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<tr>
<td>Body Weight [kg]</td>
<td>101.27</td>
<td>10.634</td>
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<tr>
<td>Height [cm]*</td>
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<td>13.23</td>
<td>175.488</td>
<td>8.295</td>
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<tr>
<td>BMI [kg/m2]*</td>
<td>32.96</td>
<td>4.348</td>
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<td>2.464</td>
</tr>
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<td>Male [%]</td>
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<td>88.89%</td>
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</table>

* - indicates p-value < 0.05; BMI - Body mass index,
Table 2. EHS inguinal hernia classification

<table>
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<th>Controls</th>
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<tbody>
<tr>
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<td>2</td>
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<td></td>
<td>26.67%</td>
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<tr>
<td>3</td>
<td>66.67%</td>
<td>100%</td>
<td>64.29%</td>
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<tr>
<td>Lateral (L)</td>
<td>58.54%</td>
<td>75%</td>
<td>56.76%</td>
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<tr>
<td>1</td>
<td>20.83%</td>
<td>33.3%</td>
<td>16.67%</td>
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<td>2</td>
<td>68.50%</td>
<td>66.7%</td>
<td>54.17%</td>
</tr>
<tr>
<td>3</td>
<td>16.67%</td>
<td></td>
<td>16.67%</td>
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<tr>
<td>Femoral (F)</td>
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<td></td>
<td>5.46%</td>
</tr>
<tr>
<td>1</td>
<td>100%</td>
<td></td>
<td>100%</td>
</tr>
<tr>
<td>2</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>3</td>
<td>-</td>
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<td>-</td>
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Table 3. Surgical outcomes

<table>
<thead>
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<th>p-value</th>
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<td>Std. Dev.</td>
<td>Mean</td>
</tr>
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<td>Operative time [min]</td>
<td>78.87</td>
<td>31.88</td>
<td>70.28</td>
</tr>
<tr>
<td>Length of hospital [days]</td>
<td>3.13</td>
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<td>Surgical Site Infection [%]</td>
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<td>1.76%</td>
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<tr>
<td>Recurrence [%]</td>
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<td>2.35%</td>
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