

Comparison of Open Sublay Mesh Repair and IPOM Technique for Ventral Hernia Repair

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Abstract: Ventral hernias, caused by a weakness in the abdominal wall muscles, are common in Pakistan and pose significant challenges to patient well-being. These hernias can manifest in various forms, including incisional, para-stromal, umbilical, epigastric, and Spigelian types, each with distinct surgical considerations. Both traditional open repair and minimally invasive techniques have been employed to manage these defects. This study aims to evaluate and compare the clinical outcomes of Open Sublay Mesh repair versus the laparoscopic intraperitoneal onlay mesh (IPOM) technique, focusing on key parameters such as hospital stay duration, postoperative pain, and infection rates. **Methods:** A Prospective Comparative study was conducted over nine months at the Department of Surgery, Nishtar Medical University, Multan. A total of 144 patients meeting the inclusion criteria were enrolled and randomly assigned to two groups: Group A (n = 72) underwent the conventional Open Sublay Mesh repair, and Group B (n = 72) received the Laparoscopic IPOM technique. Preoperative evaluation included demographic data and baseline clinical parameters. Postoperative outcomes were assessed at three intervals: on the first postoperative day, at 15 days, and one month. Pain was measured using standardized scoring systems, and infection was assessed based on clinical examination and laboratory results. Statistical analysis was performed using appropriate tests, with a significance level set at a P-value of less than 0.05. **Results:** The mean age was 39.43 years in Group A and 42.13 years in Group B, with no statistically significant difference in age (P = 0.61). However, the gender distribution differed significantly between the groups (P = 0.049), with a higher proportion of females. The mean hospital stay was substantially more extended in Group A (4.18 days) compared to Group B (2.32 days), with a p-value of 0.031. On the first postoperative day, 29.16% of patients in Group A reported pain, which decreased to 9.72% by one month. In contrast, Group B experienced pain in 22.22% of patients on day 1, with complete resolution by one month (P = 0.021). Infection rates were lower in the IPOM group, with 4% of patients exhibiting infection at 15 days and 1.38% at one month, compared to 8.33% and 2.77%, respectively, in the Open Sublay Mesh group (P = 0.012). **Conclusion:** The Laparoscopic IPOM technique demonstrated superior clinical outcomes, including shorter hospital stays, reduced postoperative pain, and lower infection rates, compared to the traditional Open Sublay Mesh repair. These findings suggest that IPOM may be a more favorable approach for managing ventral hernias, offering significant advantages over conventional open repair techniques.

Keywords: Ventral hernia, Open Sublay Mesh repair, Laparoscopic IPOM, minimally invasive surgery

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Introduction

Ventral hernias are a common surgical condition characterized by a weakness or defect in the abdominal wall. The management of ventral hernias remains a subject of ongoing debate in the medical literature, particularly regarding the optimal criteria for repair, the choice of surgical technique, and long-term patient outcomes. The heterogeneity of ventral hernias, which vary in terms of etiology, defect size, location, and comorbidities, complicates the development of a universally applicable repair strategy. Historically, hernia repair techniques have evolved significantly, shifting from sutured repairs to prosthetic meshes, which have been shown to reduce recurrence rates, particularly in large or recurrent hernias. However, the role of mesh in smaller hernias, particularly in open repair techniques, remains a topic of debate (1, 2).

Two primary approaches dominate the surgical management of ventral hernias: laparoscopic and open techniques. Mesh placement, a critical factor in the success of hernia repairs, can be performed using onlay, inlay, or sublay approaches. The sublay technique, often employed for large incisional hernias, involves positioning the mesh beneath the abdominal muscle layers, enhancing stability and reducing recurrence rates (3, 4). In contrast, laparoscopic intraperitoneal onlay mesh (IPOM) repair, introduced in 1993, has gained widespread use for treating incisional and para-stromal hernias. This minimally invasive approach

requires precise dissection and wide mesh overlap for optimal outcomes, underscoring the technical complexity involved in its application (5).

In our clinical setting, the open sublay mesh repair remains the predominant method for hernia treatment. However, due to their potential benefits, there is a growing trend toward adopting less invasive techniques, such as laparoscopic IPOM. This study aims to compare the open sublay mesh repair and laparoscopic IPOM techniques by evaluating three critical factors: postoperative pain levels, duration of hospital stay, and postoperative infection rates. This analysis seeks to contribute to the evolving landscape of ventral hernia management by identifying the advantages and limitations of each approach.

Methodology

This study aims to compare the outcomes of Laparoscopic Intraperitoneal Onlay Mesh (IPOM) versus Open Sublay Mesh repair for elective ventral hernia repair, focusing on postoperative pain, infection rates, and the duration of hospital stay. This study was conducted at the Department of General Surgery, Nishtar Medical University, Multan, over nine months from April 1 to December 31, 2024. Simple random sampling was employed to select participants. The sample size was calculated using a formula to compare two proportions. Based on the data from F. Köckerling (October 2019), with P1 = 18% and P2 = 5%, a 5% margin of error, 0.2 for β (for a power of 80%), and a 90% confidence level, the



calculated sample size for each group was 72, resulting in a total sample size of 144 patients.

Eligible patients for inclusion in the study were adults aged 18 years or older with primary or incisional ventral hernias in the midline. Only those deemed suitable for elective surgery and capable of tolerating general anesthesia were considered. Patients were excluded if they had non-midline hernia defects, required emergent surgery due to acute incarceration or strangulation, were unable to tolerate general anesthesia, or had a condition where fascial closure was not achievable.

After receiving approval from the hospital's ethics review board, patients who met the inclusion criteria were recruited from the general surgery outpatient department and randomly assigned to Group A (Open Sublay Mesh repair) or Group B (Laparoscopic IPOM technique). Upon admission, detailed demographic information, including age, gender, and address, was collected. A thorough clinical evaluation was performed to identify and address any preoperative issues. Before the surgery, all patients received a detailed explanation of the procedure, its potential benefits, and associated risks, ensuring they were adequately informed to provide written consent.

A general surgery consultant performed surgical procedures, and each procedure's duration was recorded for both groups. Following the procedure, patients were discharged when they were free from immediate postoperative symptoms, such as pain, nausea, or vomiting, and when adequate pain control had been established. Follow-up appointments were scheduled on the fourth day, the fifteenth day, and one month after surgery to monitor recovery. During these follow-up visits, key parameters, including the duration of surgery, postoperative pain intensity, and length of hospital stay, were assessed. Pain levels were measured using the Numeric Pain Rating Scale (NRS-11), with 0 indicating no pain and 10 indicating the most severe pain. Data were collected on a standardized proforma for each patient, ensuring consistency and accuracy in recording all relevant clinical parameters. The data analysis was performed using SPSS version 23 (Statistical Package for the Social Sciences). Categorical data were represented as frequencies and percentages, while quantitative data were presented as means and standard deviations. The t-test was used

to assess the differences between the groups for group comparisons. Statistical significance was defined as a p-value of 0.05 or less.

Results

The mean age of patients in Group A (Open Sublay Mesh repair) was 39.43 years, with a standard deviation 15.35. In Group B (IPOM technique), the mean age was slightly higher at 42.13 years, with a standard deviation 14.29. The gender distribution was similar between the two groups, with 40.27% males and 59.72% females in Group A and 43.05% males and 56.94% females in Group B. The mean operative time for Group A was 112.44 minutes, significantly shorter than the 145.13 minutes for Group B. The mean hospital stay was also notably longer in Group A (4.18 days) compared to Group B (2.32 days), highlighting the potential advantages of the minimally invasive approach used in the IPOM technique. (Table 1). Table 2 shows pain frequency using the Numeric Rating Scale (NRS). Pain was reported more frequently in Group A (Open Sublay Mesh Repair) compared to Group B (IPOM technique) across all observed time points. Statistical analysis indicated a significant difference (P = 0.021), with the IPOM technique demonstrating a more favorable trend in pain reduction. Table 3 compares mean pain scores (NRS) at various time points between the two groups. Patients in Group A (Open Sublay Mesh Repair) initially experienced higher pain scores and a slower reduction over time compared to those in Group B (IPOM technique). The reduction in pain scores for the IPOM technique was statistically significant (P = 0.021), indicating a more rapid and pronounced decrease in postoperative pain. Table 4 illustrates infection rates reported in both surgical groups. By day 15, Group A (Open Sublay Mesh Repair) had six infections (8.33%), reducing to 2 infections (2.78%) by one month. Group B (IPOM technique) showed fewer infections at both intervals: 4 (5.56%) at day 15 and 1 (1.38%) after one month. Statistical analysis revealed a significant difference (P = 0.012), indicating that the IPOM technique was associated with a lower risk of postoperative infections.

Table 1: Demographic and Clinical Characteristics of the Study Groups

Characteristic	Group A: Open Sublay Mesh Repair	Group-B: IPOM Technique	Total
N	72	72	144
Mean Age (years)	39.43	42.13	40.78
Standard Deviation	15.35	14.29	14.82
Male (%)	40.27	43.05	41.66
Female (%)	59.72	56.94	58.34
Mean Operative Time (minutes)	112.44	145.13	123.78
Length of Hospital Stay (days)	4.18	2.32	3.25

Table 2. Frequency of Patients Reporting Pain According to NRS Scale in Both Study Groups

Study Groups	1st Day (%)	4th Day (%)	15th Day (%)	After 1 Month (%)	P-value
Group-A: Open Sublay Mesh Repair	21 (29.16%)	17 (23.61%)	11 (15.27%)	7 (9.72%)	0.021
Group-B: IPOM Technique	16 (22.22%)	8 (11.11%)	1 (1.38%)	0 (0%)	
Total	37 (25.69%)	25 (17.36%)	12 (8.33%)	7 (4.86%)	

Table 3. Mean Pain Scores According to NRS Scale in Both Study Groups

Study Groups	1st Day	4th Day	15th Day	After 1 Month	P-value
Group-A: Open Sublay Mesh Repair	8.12 ± 1.6	5.4 ± 1.4	3.1 ± 0.8	1.5 ± 0.4	0.021
Group-B: IPOM Technique	7.9 ± 2.1	3.5 ± 1.6	1.7 ± 0.7	0.3 ± 0.01	

Table 4. Comparison of Infection Rates in Both Study Groups

Study Groups	15th Day (%)	After 1 Month (%)	P-value
Group-A: Open Sublay Mesh Repair	6 (8.33%)	2 (2.78%)	0.012
Group-B: IPOM Technique	4 (5.56%)	1 (1.38%)	
Total	10 (6.94%)	3 (2.08%)	

Discussion

Ventral hernias, which occur along the midline of the abdominal wall—including umbilical, periumbilical, epigastric, and incisional hernias—remain a common challenge in surgical practice. Various mesh repair techniques, such as onlay, inlay, sublay, underlay, and intraperitoneal onlay mesh (IPOM), are employed based on limited and sometimes anecdotal evidence (6,7). In our study, we compared the Open Sublay Mesh repair (Group A) and the IPOM technique (Group B) in 144 patients treated at Nishtar Medical University, Multan, a tertiary care center that manages a high volume of ventral hernia cases.

The overall mean age of the study cohort was 40.78 ± 14.82 years, with Group A averaging 39.43 ± 15.35 years and Group B averaging 42.13 ± 14.29 years. While previous studies have reported mean ages of around 50 years, 6, 7 our slightly lower values may reflect regional demographic differences. The gender distribution (male-to-female ratio of 1:1.4) was variable, as the literature reports conflicting data regarding gender predisposition (8-10).

Our results showed that the mean operative time for Open Sublay Mesh repair was significantly shorter (112.44 ± 19.81 minutes) than that for the IPOM approach (145.13 ± 24.92 minutes, $P = 0.041$). This finding aligns with earlier studies that have documented reduced operative durations with open sublay repairs compared to IPOM procedures. 11, 12 However, operative time may be influenced by factors such as the complexity of the hernia and the surgical expertise.

The duration of hospital stay was also significantly different between the groups, with Group-A patients staying an average of 4.18 ± 1.01 days compared to 2.32 ± 0.56 days in Group-B ($P = 0.031$). This finding is consistent with previous reports that have demonstrated shorter hospitalizations with minimally invasive approaches (13-16).

Postoperative pain evaluation revealed that both groups experienced high pain levels immediately after surgery; however, pain decreased more rapidly in the IPOM group. By one month, the mean pain score on the Numeric Rating Scale (NRS) was 1.5 ± 0.4 in Group A compared to 0.3 ± 0.01 in Group B ($P = 0.021$). These findings support systematic reviews indicating that IPOM is associated with reduced acute postoperative pain and faster recovery. 17, 18 conversely, some registry-based studies report no significant differences in chronic pain outcomes at one-year follow-up (19).

Infection rates were lower in the IPOM group, with Group A reporting 8.33% infections on day 15 and 2.78% at one month, versus 4% and 1.38%, respectively, in Group B ($P = 0.012$). These results are in line with meta-analyses that have demonstrated a lower risk of surgical site infections with IPOM compared to open sublay repair 20, 21, 22; however, some long-term registry data do not show significant differences (23).

In summary, while Open Sublay Mesh repair offers the benefit of shorter operative times, the IPOM technique appears to provide advantages in terms of reduced postoperative pain, shorter hospital stays, and lower rates of short-term infection. These findings are consistent with the previous literature; however, further large-scale, randomized studies are warranted to evaluate long-term outcomes, such as recurrence and chronic pain (24, 25).

This single-center study in Pakistan, with a modest sample size of 144 patients, may limit the generalizability and statistical robustness of its findings. The lack of blinding introduced potential bias, and the omission of long-term outcome analysis restricted insights into the sustained efficacy of the two techniques.

Conclusion

The IPOM technique demonstrated superior outcomes compared to Open Sublay Mesh repair for ventral hernia, including shorter operative time, reduced hospital stay, less postoperative pain, and lower infection rates. These findings suggest that IPOM is a safer and more effective approach, offering significant advantages for ventral hernia management.

Declarations

Data Availability statement

All data generated or analysed during the study are included in the manuscript.

Ethics approval and consent to participate

Approved by the department concerned. (IRBEC-ANNS-03-24)

Consent for publication

Approved

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The authors declared the absence of a conflict of interest.

Author Contribution

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