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A Prospective Study on Early Postoperative Outcomes Following Laparoscopic and Open Ventral Hernia Repair

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Abstract

Background: Ventral hernia repair is a common surgical procedure that involves evolving approaches. Laparoscopic repair is increasingly performed due to its potential to minimize postoperative morbidity; however, evidence from Bangladesh remains limited. This study aimed to compare the early postoperative outcomes between laparoscopic and open ventral hernia repair in a tertiary-care setting.

Methods: This prospective comparative study was conducted at the Shaheed Suhrawardy Medical College Hospital and Enam Medical College Hospital, Dhaka, from January 2024 to July 2025. Seventy-eight patients with ventral hernias were randomized into two equal groups: laparoscopic (n = 39) and open (n = 39). Data on the perioperative outcomes, hospital stay, return to activity and early post-operative complications were collected and analyzed using SPSS 25.0.

Results: The mean operative time was longer for laparoscopic repair (110.5 ± 28.6 min vs. 85.2 ± 22.1 min, $p < 0.001$). However, laparoscopic repair resulted in significantly less blood loss (40 ± 25 mL vs. 120 ± 90 mL), lower pain scores, fewer analgesic doses, shorter hospital stay (2.8 ± 1.4 days vs. 5.6 ± 2.9 days) and earlier return to activity (10 days vs. 22 days). However, the mesh-related complications were collectively higher after laparoscopic repair (25.6% vs. 5.1%).

Conclusion: Laparoscopic ventral hernia repair provides superior short-term recovery benefits but carries an increased risk of wound and mesh-related complications. The choice of technique should therefore be individualized, balancing recovery advantages against the higher risk of mesh-specific morbidity.

Keywords: Ventral hernia; Laparoscopic repair; Open repair; Postoperative outcome

Introduction

Ventral hernias, encompassing both primary and incisional defects of the anterior abdominal wall, represent a common and challenging condition in general surgery, with an estimated lifetime incidence of 10–20% following laparotomy [1]. These hernias occur due to weakening or disruption of the fascial layers, often secondary to prior surgery, trauma, obesity or chronic increases in intra-abdominal pressure [1,2]. Surgical repair remains the mainstay of treatment, with the aim of restoring abdominal wall integrity and preventing complications, such as obstruction or strangulation.

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Open Ventral Hernia Repair (OVHR) with mesh reinforcement has been the standard approach. Although effective, it is often associated with extensive tissue dissection, higher postoperative pain, wound complications and prolonged recovery [3,4]. In contrast, Laparoscopic Ventral Hernia Repair (LVHR), first introduced in the early 1990s, has gained widespread acceptance for its minimally invasive nature and superior postoperative recovery profile [2]. By allowing intraperitoneal mesh placement with minimal incision, LVHR reduces wound morbidity, shortens hospitalization and facilitates a quicker return to normal activity [5].

A growing body of comparative studies and randomized trials has evaluated these two approaches. Most have reported reduced postoperative pain, shorter hospital stays and fewer wound infections with LVHR, albeit at the cost of a longer operative duration and technical complexity. Pereira and Rai found significantly reduced early postoperative morbidity in laparoscopic repair [6], while Rubby et al. and Basheer et al. also reported faster recovery and lower complication rates compared with open methods [3,4]. Nonetheless, the choice of technique is influenced by hernia size, location, surgeon expertise and resource availability [7].

Recent advancements in laparoscopic hernia repair, such as improved mesh materials, fixation techniques, and the IPOM-Plus method involving primary fascial closure before mesh placement, have further enhanced the outcomes. A study by Silfvenius et al. demonstrated better postoperative comfort and reduced recurrence rates with such techniques [8]. Additionally, newer fixation methods, including barbed sutures and absorbable tacks, have improved procedural efficiency and decreased postoperative pain [9,10]. Evidence from randomized controlled trials and systematic reviews continues to validate these refinements, emphasizing the reduced seroma formation and improved cost-effectiveness of minimally invasive strategies [11,12].

Quality of life (QoL) is another critical parameter that influences surgical decision-making. Research by Pîrșac et al. and Bayomi et al. highlighted superior postoperative QoL and aesthetic satisfaction following laparoscopic repair [13,14]. However, debates persist regarding the long-term recurrence risk, especially for larger or complex hernias, where open sub-lay repair may still have advantages [2].

Despite extensive global research, regional evidence from South Asia, including Bangladesh, remains scarce. Variations in patient characteristics, surgical infrastructure and postoperative care may influence outcomes and generalizability. Hence, there is a need for prospective comparative studies in local contexts to assess the early postoperative outcomes following both techniques.

This prospective study was conducted to compare early postoperative outcomes, including operative time, blood loss, postoperative pain, analgesic requirement, hospital stay, return to activity and early complications, between laparoscopic and open ventral hernia repair in a tertiary-care setting. The findings aimed to provide context-specific evidence to support surgical decision-making and enhance patient-centered care in abdominal wall reconstruction.

Methodology and Materials

This prospective comparative study was conducted in the Department of General Surgery at Shaheed Suhrawardy Medical College Hospital and Enam Medical College Hospital, Dhaka, Bangladesh, from January 2024 to July 2025. The study enrolled a total of 78 patients diagnosed with ventral hernia who met the inclusion criteria. Participants were divided into two equal groups: Group A (n = 39) underwent laparoscopic ventral hernia repair and Group B (n = 39) underwent open ventral hernia repair.

Selection Criteria

Inclusion Criteria

- Adults aged 18–70 years diagnosed with primary or incisional ventral hernia.
- Patients are medically fit for general anesthesia.
- Hernia defect size between 2 cm^2 and 12 cm^2 (measured intraoperatively).
- Patients provide informed written consent for participation.

Exclusion Criteria

- Recurrent ventral hernia after previous mesh repair.
- Complicated hernia (strangulated, obstructed or incarcerated).
- Presence of significant cardiorespiratory or hepatic impairment precluding laparoscopy.
- Pregnancy or inability to provide consent.
- Patients lost to follow-up within the 30-day postoperative period.

Data Collection and Study Procedure

After obtaining informed consent, consecutive patients with ventral hernias were assessed for eligibility. Demographic information, clinical history, body mass index (BMI), comorbidities and clinical characteristics were collected. All patients underwent standard preoperative investigations, including complete blood count, liver and renal function tests, fasting glucose and abdominal ultrasonography.

Surgical procedures were performed under general anesthesia by consultant surgeons experienced in both techniques. In the laparoscopic group, a standard three-port approach was used, with pneumoperitoneum established at

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12–14 mm Hg. Adhesiolysis was performed as required and the composite mesh was fixed intraperitoneally using tacks and transfascial sutures. In the open group, a midline incision was made, the defect was dissected and the mesh was placed in the sublay or onlay positions using interrupted polypropylene sutures. In both groups, mesh fixation techniques and sizes were standardized according to the defect dimensions.

Intraoperative data (operative time and blood loss) and postoperative variables (pain scores, analgesic doses, length of hospital stay and return to activity) were recorded prospectively. Postoperative pain was assessed using a 10-point visual analog scale (VAS). The analgesic consumption was converted to intravenous morphine equivalents to ensure uniformity. Patients were followed up for 30 days to document early complications, such as surgical site infection, seroma, hematoma, wound bleeding and postoperative ileus. Confidentiality was properly maintained throughout the study.

Statistical Analysis

The data were analyzed using SPSS version 25.0. Continuous variables are expressed as mean ± standard deviation or median (IQR) and categorical variables are expressed as frequencies and percentages. Between-group comparisons were made using the independent Student's t-test or Mann–Whitney U test for continuous data and the Chi-square or Fisher's exact test for categorical variables. Statistical significance was set at $p < 0.05$.

Table 1 presents baseline characteristics of the study population. Mean age was 46.8 ± 12.5 years in the laparoscopic group and 49.6 ± 13.8 years in the open group. Females constituted slightly more than half of the participants, with a similar gender distribution between groups. Mean body mass index (BMI) was 25.1 ± 3.2 kg/m² for the laparoscopic group and 25.8 ± 3.6 kg/m² for the open group. Most patients had hernia defect sizes between 5–7 cm², with no significant difference between groups ($p = 0.45$). Hypertension and diabetes mellitus were the most frequent comorbidities, present in 20% and 10% of participants, respectively.

Table 2 compares intraoperative and early postoperative outcomes. Mean operative time was longer in the laparoscopic group (110.5 ± 28.6 min) compared to the open group (85.2 ± 22.1 min; $p < 0.001$). However, laparoscopic repair showed lower estimated blood loss (40 ± 25 mL vs. 120 ± 90 mL; $p < 0.001$). Postoperative pain scores on day 1 (VAS) were lower following laparoscopic repair (3.2 ± 1.1) than open repair (5.1 ± 1.3; $p < 0.001$). The mean analgesic requirement and hospital stay were reduced in the laparoscopic group. Patients with laparoscopic repair resumed normal activities earlier, with a median recovery of 10 days versus 22 days for open repair ($p < 0.001$).

Table 1: Baseline characteristics of the study population (n = 78).

Characteristics	Variable	Laparoscopic (n = 39)	Open (n = 39)	p-value
Age group (years), Mean ± SD		46.8 ± 12.5	49.6 ± 13.8	0.23
Sex, n (%)	Male	18 (46.2)	20 (51.3)	0.63
	Female	21 (53.8)	19 (48.7)	
BMI (kg/m²)		25.1 ± 3.2	25.8 ± 3.6	0.38
Hernia defect size (cm²)		6.2 ± 3.1	6.8 ± 3.6	0.45
Comorbidities, n (%)	None	25 (64.1)	22 (56.4)	0.46
	Hypertension	7 (17.9)	9 (23.1)	
	Diabetes mellitus	3 (7.7)	5 (12.8)	
	COPD / other chronic disease	4 (10.3)	3 (7.7)	

Table 2: Comparison of intraoperative and early postoperative outcomes.

Outcome	Laparoscopic (n = 39)	Open (n = 39)	p-value
Operative time (min), mean ± SD	110.5 ± 28.6	85.2 ± 22.1	< 0.001
Estimated blood loss (mL), mean ± SD	40 ± 25	120 ± 90	< 0.001
Pain (VAS) Day 1, mean ± SD (0–10)	3.2 ± 1.1	5.1 ± 1.3	< 0.001
Analgesic requirement (IV morphine-equivalent doses, 0–48 h)	1.1 ± 0.9	2.6 ± 1.2	< 0.001
Length of hospital stay (days), mean ± SD	2.8 ± 1.4	5.6 ± 2.9	< 0.001
Return to normal activity (days), median (IQR)	10 (8–14)	22 (14–30)	< 0.001

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Table 3: Early postoperative complications (≤ 30 days).

Complication	Laparoscopic (n = 39)	Open (n = 39)	p-value
Wound infection (SSI)	5 (12.8)	2 (5.1)	0.21
Mesh infection	2 (5.1)	0 (0.0)	0.15
Mesh rejection	1 (2.6)	0 (0.0)	0.31
Meshoma	2 (5.1)	0 (0.0)	0.15
Postoperative ileus (>48 h)	0 (0.0)	2 (5.1)	0.15
Composite mesh related complication	10 (25.6)	2 (5.1)	0.01

Table 3 presents the key postoperative complications directly related to wound integrity and mesh performance. Wound infection, mesh infection, mesh rejection and meshoma were consistently higher after laparoscopic repair, resulting in a significantly greater composite mesh-related complication rate compared with open repair.

Discussion

This prospective comparative study evaluated early postoperative outcomes following laparoscopic and open ventral hernia repair in a tertiary-care setting. The findings demonstrate the complex balance between perioperative advantages and complication profiles associated with the two approaches. As expected, laparoscopic repair showed several short-term benefits, including reduced blood loss, postoperative pain, and length of hospital stay, along with earlier resumption of normal daily activities. These observations are consistent with previously published studies and reflect the advantages inherent to minimally invasive techniques. Reduced tissue dissection, limited incision size and more controlled operative exposure contribute to decreased nociceptive input and shorter recovery periods, as highlighted in both regional and international comparative studies.

The longer operative time observed in the laparoscopic group mirrors the findings of Pereira and Rai as well as Prakash et al., who attributed the increased duration to the technical demands of trocar placement, adhesiolysis and mesh fixation [6,15]. This trend is widely established in laparoscopic hernia literature and is expected in settings where advanced energy devices or fixation systems are still evolving. Nevertheless, despite the prolonged duration, the improved postoperative comfort and functional recovery continue to represent meaningful advantages for patients.

The perioperative benefits of laparoscopic repair observed in this study align with the experiences reported by Basheer et al., who demonstrated reduced intraoperative blood loss and favorable early outcomes associated with minimally invasive hernia repair [4]. Pain scores and analgesic requirements were also substantially lower following laparoscopic repair, reflecting similar findings from Rasul et al. and Chawla et al. [16,17]. These benefits translate into earlier mobilization and reduced dependency on postoperative support measures, which have important implications in resource-limited settings.

However, the analysis of postoperative complications highlights a different and clinically significant dimension. This study found higher rates of wound infection in the laparoscopic group than in the open group, a finding that contrasts with many earlier reports. While previous comparative studies such as those by Basheer et al. and Pereira and Rai, reported lower wound morbidity with laparoscopic repair [4,6], variation in surgical expertise, case selection and mesh handling may influence postoperative outcomes across different clinical contexts. Factors such as prolonged operative duration, adhesiolysis in previously operated fields and characteristics of the mesh material may contribute to wound-related complications, even in minimally invasive procedures.

More notably, mesh-related complications—mesh infection, mesh rejection, and meshoma formation—were observed more frequently following laparoscopic repair. Mesh infection remains an uncommon but serious concern in hernia surgery and its occurrence may be influenced by mesh type, fixation method or proximity to intra-abdominal contents. Modern technological refinements, such as composite meshes and improved fixation devices, aim to reduce these risks, yet they remain clinically relevant considerations. Mesh rejection and meshoma formation may reflect host inflammatory response, inadequate mesh integration or mechanical factors such as folding or contraction. Studies evaluating IPOM-Plus techniques, such as those by Silfvenius et al. and Basukala et al. emphasize the importance of fascial closure in enhancing mesh stability and improving postoperative comfort [8,18]. Nonetheless, even with evolving techniques, individual patient factors may influence mesh behaviour and the biological response to prosthetic material.

The contrast between improved perioperative outcomes and higher mesh-related morbidity underscores the importance of individualized surgical decision-making. As highlighted by contemporary guidelines from SAGES, the choice between laparoscopic and open repair should be tailored to the patient's hernia characteristics, comorbidities, surgical history and preferences [12]. Surgeons must weigh the benefits of faster recovery against the potential for mesh-related complications, particularly in individuals where intraperitoneal mesh placement may pose additional risks.

The findings reinforce the broader understanding that no single operative approach is universally superior for all ventral hernias. Laparoscopic repair offers meaningful advantages in terms of recovery and postoperative comfort, while open repair may provide a more favorable profile concerning

mesh stability and certain postoperative complications. The variability in outcomes observed across different studies also highlights the importance of ongoing refinement in surgical techniques, mesh materials and perioperative management strategies. As minimally invasive technologies continue to evolve, further research will be essential to optimize patient selection criteria and reduce the risk of mesh-related complications.

Limitations of the study

This study was conducted in two hospitals with a small sample size. Therefore, the results may not be representative of the entire community. Long-term outcomes, such as recurrence and chronic pain, were not assessed because of the short follow-up period.

Conclusion

Laparoscopic Ventral Hernia Repair (LVHR) provides meaningful advantages in early postoperative recovery, including reduced pain, shorter hospital stays and faster return to daily activities. However, the procedure is associated with higher rates of wound infection and mesh-related complications—specifically mesh infection, mesh rejection and meshoma—compared with open repair. These risks suggest that laparoscopic surgery is not inherently superior for all patients and should be selected based on individualized assessment. The findings highlight the need to balance recovery-related benefits against the potential for increased mesh-specific morbidity in laparoscopic repair.

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Conflicts of interest

There are no conflicts of interest.

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