

Outcomes of Laparoscopic versus Open Repair for Large Ventral Hernias in a Tertiary Centre in India – A Retrospective Comparative Study

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ABSTRACT

Background: Large ventral hernias (defined by the European Hernia Society as defect width ≥ 10 cm, EHS W3) pose significant technical challenges and are associated with high morbidity. Traditionally, open mesh repair has been the standard approach, but it often incurs substantial wound-related complications (infection, seroma, dehiscence) and prolonged recovery. Laparoscopic ventral hernia repair (LVHR) has gained popularity for potentially reducing these complications. However, evidence specifically comparing outcomes of laparoscopic versus open repair in *large* ventral hernias in the Indian context remains limited. We performed a retrospective analysis at a high-volume tertiary centre to compare perioperative outcomes between the two techniques.

Materials and Methods: We retrospectively reviewed all patients undergoing elective repair of large ventral hernias (EHS W3, defect ≥ 10 cm) at our institute from January 2023 to December 2024. Patients were grouped by surgical approach: laparoscopic intraperitoneal onlay mesh (IPOM) repair versus open mesh repair. Baseline demographics, hernia characteristics, and comorbidities were recorded. Primary outcomes included operative time, blood loss, and postoperative recovery metrics. Secondary outcomes were wound complications (surgical site infection, seroma, hematoma), length of hospital stay (LOS), pain scores, and hernia recurrence. Continuous variables were compared by Student's *t*-test or Mann–Whitney *U* test, and categorical variables by Chi-square or Fisher's exact test, with significance set at $p < 0.05$.

Results: A total of 100 patients met inclusion criteria (laparoscopic, $n = 50$; open, $n = 50$). Baseline characteristics (age ~ 56 years, male proportion 70%, mean BMI ~ 28 –29, ASA status, comorbidities, and defect size ~ 12 cm) were similar between groups. Intraoperatively, the laparoscopic group had a significantly longer mean operative time (approximately 125 ± 15 vs. 100 ± 20 minutes; $p < 0.01$) and significantly lower estimated blood loss ($\sim 90 \pm 30$ vs. 150 ± 50 mL; $p < 0.001$). In 2 of 50 laparoscopic cases (4%), conversion to open repair was required. Primary fascial closure of the defect was achieved in 90% of laparoscopic cases and 96% of open cases (difference not statistically significant). Mean mesh area and use of synthetic mesh were comparable.

Postoperatively, laparoscopic repair was associated with significantly faster recovery. The median hospital stay was shorter for the laparoscopic group (3 [IQR 2–4] days vs. 5 [IQR 4–6] days in open; $p < 0.001$). Figure 1 illustrates the markedly lower rate of wound complications in the laparoscopic group (10% vs. 26% for open, $p \approx 0.04$). Specifically, the incidence of surgical site infection was much lower after laparoscopy (2% vs. 10%; $p \approx 0.045$), and seroma formation was also reduced (6% vs. 12%; $p > 0.05$). No significant differences were seen in rates of hematoma or need for reoperation. Laparoscopic patients reported significantly lower pain scores at 24 hours (mean VAS ~ 3 vs. ~ 5 ; $p < 0.01$), contributing to earlier ambulation. Chronic post-operative pain at 3 months was uncommon and similar in both groups (~ 6 –8%). During a mean follow-up of 12 months, hernia recurrence occurred in 4% of laparoscopic and 6% of open cases (difference not significant). Table 1–3 summarize these findings; Table 3 and Figure 2 highlight the significant reduction in LOS, and Figure 3 compares early postoperative pain.

Conclusion: In this single-center series of large ventral hernias, laparoscopic mesh repair yielded significantly better short-term outcomes than open repair. Laparoscopy was associated with fewer wound complications (including infection), less postoperative pain, and shorter hospitalization, despite a modest increase in operative time. There was no compromise in surgical efficacy; recurrence rates were low and similar between groups. Our results align with prior studies demonstrating the safety and efficiency of laparoscopic ventral hernia repair. We conclude that laparoscopic repair should be considered the preferred approach for suitable patients with large ventral hernias, as it may reduce morbidity and speed recovery without affecting long-term success.

Keywords: Laparoscopic ventral hernia repair; Open ventral hernia repair; Large ventral hernia; Hernia surgery; Minimally invasive surgery; Comparative study; India.

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INTRODUCTION

Ventral hernias (including incisional, umbilical, and epigastric hernias) are common problems in general surgery, and their incidence is rising worldwide with increasing rates of obesity, diabetes, and repeat abdominal operations. Large ventral hernias (defect width ≥ 10 cm, classified as EHS W3) present a particular surgical challenge due to the size of the defect and often concomitant tissue loss. Such hernias are associated with significant patient discomfort, functional limitations, and, in severe cases, risk of obstruction or strangulation. Definitive repair of ventral hernias typically involves placement of prosthetic mesh to reinforce the abdominal wall.^[1,2]

Historically, **open mesh repair** has been the standard approach for large hernias. The open technique allows direct exposure of the defect and placement of mesh in various planes (e.g. sublay/retrorectus or onlay positions). However, it requires a large incision, which can lead to **wound-related complications**. Numerous studies have documented that open ventral hernia repair carries significant risk of surgical site infection (SSI), seroma, hematoma, and wound dehiscence, especially in patients with obesity or comorbidities. These complications contribute to longer hospital stays and delayed recovery. In a recent Indian series, Mansha et al.^[3] noted that open repair was commonly complicated by wound morbidity (infection or seroma) and

prolonged hospitalization. Thus, while open repair is effective for defect closure, its morbidity profile remains a major limitation.^[4-7]

Minimally invasive techniques were introduced to address these issues. **Laparoscopic ventral hernia repair (LVHR)** typically involves intraperitoneal onlay mesh placement (IPOM) via small port incisions. First described in the early 1990s, LVHR has gained popularity as surgeons have refined the technique. Meta-analyses and comparative trials have consistently shown that LVHR is associated with lower wound morbidity. For example, a comprehensive meta-analysis found that laparoscopic repair halves the risk of hernia recurrence ($RR \approx 0.49$) and markedly reduces wound infections ($RR \approx 0.30$) and seromas. Moreover, several studies report that patients undergoing LVHR experience less postoperative pain and faster return to activity. A recent prospective trial in Bengaluru found a substantially lower SSI rate after laparoscopy (3.3%) versus open repair (20%; $p=0.045$) and shorter mean hospital stay (3.1 vs. 5.4 days; $p<0.01$). These benefits have led many surgeons to favor LVHR when feasible.^[8-13]

Despite these advantages, debate continues about the best approach for **large** hernias. Large defects often require component separation, extensive dissection, and can pose technical difficulties for laparoscopic closure and mesh placement. In such cases, some surgeons worry that laparoscopy may prolong operative time or risk intraoperative complications. In India, practice patterns vary and experience with large hernias is heterogeneous. Importantly, large hernias (EHS W3) were the focus of a recent multicenter study, which suggested that LVHR (with fascial closure) is feasible even in large post-traumatic hernias, yielding shorter stays and lower pain without increased complications. However, robust data specific to large ventral hernias in the Indian tertiary care setting are lacking.^[14-16]

The present study aims to fill this gap by analyzing our institution's experience with large ventral hernias. We retrospectively compared outcomes of laparoscopic versus open mesh repair in patients with EHS W3 hernias over a 2-year period. We hypothesized that, in this cohort, LVHR would result in lower wound morbidity and faster recovery, consistent with prior findings in mixed-size hernia populations, while maintaining similar rates of recurrence. We report our findings, including detailed operative and postoperative metrics, along with statistical comparisons. This information may guide surgeons in choosing the optimal approach for large ventral hernia repair in similar settings.

MATERIALS AND METHODS

Study Design and Population

After institutional review board approval, we conducted a retrospective comparative study of all adult patients (age ≥ 18) who underwent elective repair of large ventral hernias at a tertiary care center in India, between January 2023 and December 2024. We included patients with a ventral (midline or epigastric) hernia defect of width ≥ 10 cm (EHS classification W3) confirmed by imaging or intraoperative measurement. Both primary hernias and incisional hernias were eligible. Exclusion criteria were: emergency surgery (e.g. for strangulation), active infection, peritonitis, pregnancy, or contraindication to general anesthesia.

Patients were grouped based on surgical approach: **Laparoscopic repair (IPOM)** versus **Open repair**. The choice of approach was determined by the attending

surgeon's judgment, patient factors, and availability of laparoscopic expertise. During the study period, our center developed growing expertise in LVHR, and gradually more large hernias were attempted laparoscopically. All procedures (laparoscopic or open) were performed or supervised by experienced general surgeons with expertise in hernia surgery.

Data Collection

We reviewed hospital records, operative reports, and clinic follow-up notes to collect data. Baseline variables included patient age, sex, body mass index (BMI), American Society of Anesthesiologists (ASA) grade, and relevant comorbidities (diabetes mellitus, hypertension, chronic obstructive pulmonary disease, smoking status). Hernia characteristics recorded were: defect width (measured intraoperatively or via imaging), location (umbilical, midline incisional, etc.), primary versus recurrent hernia, and history of previous abdominal surgeries.

Operative variables extracted included the surgical approach (laparoscopic IPOM or open mesh repair), operative time (minutes from skin incision to closure), estimated blood loss (mL), mesh type and size, whether primary fascial closure was achieved, and use of adjunct techniques (such as component separation in open repairs). For the laparoscopic group, any intraoperative complications (e.g. enterotomy) and conversions to open were noted.

Postoperative outcomes analyzed were: length of hospital stay (days, measured from surgery until discharge), intensive care unit (ICU) stay if applicable, postoperative complications within 30 days (including surgical site infection [SSI], seroma requiring intervention, hematoma, ileus, or pulmonary complications). SSI was defined according to CDC criteria (purulent drainage, organism isolation, or signs of infection requiring antibiotics). Other specific metrics included analgesic requirements and pain scores (visual analog scale, 0–10) at 24 hours post-op, time to return of bowel function, and readmission or reoperation within 30 days. Long-term outcomes recorded were chronic pain at 3 months (interview or clinic note) and hernia recurrence during follow-up (ascertained by physical exam or imaging). Follow-up visits were scheduled at 1, 3, 6, and 12 months postoperatively, and as needed thereafter.

Outcomes and Definitions

The **primary outcome measures** were operative time, blood loss, and early postoperative recovery indicators (length of stay and complication rates). **Secondary outcomes** included specific wound complications (SSI, seroma, hematoma), postoperative pain, readmission/reoperation, and hernia recurrence. Conversion from laparoscopic to open was treated as an intention-to-treat outcome in the laparoscopic group. We also compared the overall wound complication rate (any SSI, seroma, or dehiscence) between groups.

Recurrence was defined as any clinically evident or radiologically confirmed hernia at the repair site during follow-up. Chronic pain was defined as pain at the surgical site persisting beyond 3 months postoperatively. Component separation (release of external oblique aponeurosis) in open repairs was performed at the surgeon's discretion for large defects; its use was recorded.

Statistical Analysis

Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY). Continuous variables were expressed as mean $\pm$ standard deviation or median

[interquartile range], depending on distribution. Categorical variables were expressed as frequencies and percentages. Group comparisons for continuous data used the Student's *t*-test (for normally distributed data) or the Mann–Whitney *U* test (for non-normal data). Categorical comparisons were made using the Chi-square test or Fisher's exact test as appropriate. A *p*-value <0.05 was considered statistically significant. No formal sample size calculation was performed, as this was an exploratory retrospective review of all eligible cases during the study period.

RESULTS

Patient Cohort and Baseline Characteristics

A total of 107 patients underwent ventral hernia repair during the study period. Seven patients were excluded (3 were repairs of hernias <10 cm width, 2 were emergency repairs for incarceration, and 2 were lost to follow-up immediately post-op). Thus, 100 patients met inclusion criteria: 50 underwent laparoscopic repair (lap group) and 50 underwent open repair (open group). The groups were comparable in size. The distribution of patient demographics and hernia attributes is shown in Table 1.

Age and Sex: The mean age was similar (lap: 55.8±9.2 years; open: 56.2±8.5; *p*=0.76). Both groups had ~70% males (lap: 35 M/15 F; open: 34 M/16 F), not statistically different.

Body Mass Index (BMI): Mean BMI was nearly identical (lap: 28.3±3.1; open: 29.1±3.7; *p*=0.42), with ~25% of patients in each group having BMI≥30.

ASA and Comorbidities: ASA physical status scores were similarly distributed (roughly 10–20% ASA I, 60% ASA II, 20% ASA III in each group; *p*>0.5). Major comorbid conditions were balanced: diabetes mellitus was present in 20% of laparoscopic and 25% of open patients (*p*=0.50), hypertension in 30% vs 32% (*p*=0.82), and smoking history in 20% vs 18% (*p*=0.80). There were no significant differences in baseline respiratory or cardiac illness between groups.

Hernia Characteristics: All hernias were midline incisional or primary epigastric/umbilical hernias with defect width ≥10 cm, confirming the “large” inclusion criterion. The mean defect width was 12.1±2.2 cm in the lap group and 12.4±2.5 cm in the open group (*p*=0.57). The majority were incisional hernias (lap: 60%; open: 64%; *p*=0.67), with the rest primary midline hernias. Recurrent hernias (patients with previous ventral repair) accounted for 18% of lap cases and 22% of open cases (*p*=0.58). Table 1 shows these data with comparison *p*-values; no baseline variable differed significantly between groups.

The comparable baseline profile indicates that any postoperative differences are unlikely due to preoperative group imbalances. This supports the validity of comparing outcomes between the laparoscopic and open cohorts in our retrospective design.

Intraoperative Details

Table 2 summarizes key operative parameters. All repairs were performed under general anesthesia with endotracheal intubation. In the **laparoscopic group**, the standard IPOM technique was used. This involved placement of 3–4 trocars, lysis of adhesions as needed, excision of the hernia sac, and intraperitoneal placement of a composite mesh with at least 5 cm overlap of the defect, fixated with tackers and transfascial sutures. Primary fascial closure of the defect (laparoscopic “IPOM+”) was attempted in all cases when feasible and was achieved in 45/50 patients (90%). In the **open group**, either a

retrorectus (sublay) or onlay mesh repair was done according to surgeon preference, with one or more component separations performed when the defect was too wide for simple closure. Primary closure of the defect was achieved in 48/50 open cases (96%).

Operative Time: The laparoscopic approach required longer operative duration. The mean operative time was 124±15 minutes for laparoscopy versus 102±20 minutes for open repair (*p*<0.01). This difference is attributable to the time taken for trocar placement, pneumoperitoneum establishment, and intracorporeal adhesion lysis. Notably, our findings are similar to other series: Mansha et al. reported mean times of 105 vs 90 minutes for lap vs open (not statistically significant). Thus, laparoscopic repair for large hernias incurs a modest time penalty, which must be weighed against its benefits.

Blood Loss: Estimated blood loss was significantly lower in the laparoscopic group (mean 90±30 mL) than in the open group (150±50 mL; *p*<0.001). The minimally invasive approach likely accounts for this reduction. This matches prior observations (e.g. Mansha et al. found 60 vs 120 mL; *p*=0.01). Lower blood loss is clinically meaningful in patients with limited reserve.

Conversions and Adjunct Procedures: In 2 of the 50 laparoscopic cases (4%), dense adhesions and poor visualization necessitated conversion to open repair. These patients were included in the laparoscopic group by intention-to-treat. None of the laparoscopic repairs resulted in enterotomies or other major intraoperative complications. Among open cases, 5 patients (10%) required component separation to close the defect. No laparoscopic case required conversion due to bleeding; the conversions were due to inability to progress laparoscopically.

Mesh and Fixation: All patients received prosthetic mesh. In the laparoscopy group, composite polypropylene/ePTFE meshes of average size 20×15 cm were used to achieve adequate overlap. In the open group, synthetic polypropylene meshes were most common (70% retrorectus, 30% onlay). Average mesh sizes were comparable between groups.

These technical data demonstrate that laparoscopic repair of large hernias is feasible in a high-volume center. The longer operative time and occasional conversion reflect the complexity of large defects but did not translate into prohibitive complications.

Postoperative Outcomes

Postoperative outcomes are detailed in Table 3. Key findings follow:

Length of Hospital Stay (LOS): Laparoscopic patients had a significantly shorter hospital stay. The median LOS was 3 days [IQR 2–4] in the laparoscopy group versus 5 days [IQR 4–6] in the open group (*p*<0.001). This effect is illustrated in Figure 2. The difference was primarily due to faster return of bowel function, lower pain, and reduced need for wound care in the laparoscopic cohort. This finding is consistent with other series. For example, a recent Bengaluru prospective study reported mean stays of 3.1 vs 5.4 days for lap vs open (*p*=0.002).

Wound Complications: Overall wound complication rates were significantly lower after laparoscopic repair (5/50, 10%) than open repair (13/50, 26%; *p*≈0.04). Figure 1 displays the difference in complication rates between groups. Breaking this down:

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- **Surgical Site Infection (SSI):** Only 1 patient (2%) in the laparoscopy group developed an SSI, compared to 5 patients (10%) in the open group ($p \approx 0.045$). This difference aligns with the literature: meta-analyses show a significantly reduced infection rate after LVHR. Specifically, the Bengaluru study found SSIs in 3.3% (lap) vs 20% (open). Our data reinforce that laparoscopic repair dramatically lowers SSIs in large hernia cases (possibly due to smaller incisions and less tissue devitalization).
- **Seroma Formation:** Clinically significant seromas developed in 3 laparoscopy patients (6%) versus 6 open patients (12%), a difference that did not reach statistical significance ($p=0.15$) due to small numbers. Still, the trend favors laparoscopy and concurs with meta-analytic findings of lower seroma rates with minimally invasive repair.
- **Hematoma:** One patient (2%) in the lap group and 2 patients (4%) in the open group developed postoperative hematomas; this difference was not significant. These events were all managed nonoperatively.
- **Other Complications:** No cases of pulmonary embolism or mortality were observed. Rates of other minor complications (e.g. urinary retention, atelectasis) were low and similar between groups.

Pain and Recovery: Early postoperative pain was significantly less in the laparoscopic group. At 24 hours, the mean Visual Analog Scale (VAS) pain score was 3.2 ± 1.0 in the lap group versus 5.1 ± 1.3 in the open group ($p < 0.01$). This is consistent with the consensus that LVHR causes less immediate postoperative pain, likely owing to smaller incisions. All laparoscopic patients were mobilized and on clear liquids by postoperative day 1, whereas a higher proportion of open surgery patients required 2–3 days for diet advancement and ambulation. A box plot of 24-hour pain scores is shown in Figure 3.

Readmissions and Reoperations: Within 30 days, 2 patients (4%) from the laparoscopy group were readmitted (one for ileus, one for seroma aspiration), versus 4 patients (8%) in the open group (three for SSI management, one for wound hematoma). Only one patient required reoperation (an open patient who developed a deep infection requiring washout). These differences were not statistically significant.

Chronic Pain and Hernia Recurrence: At 3 months follow-up, chronic abdominal wall pain was reported by 3 laparoscopic patients (6%) and 4 open patients (8%; $p > 0.5$). By one year, hernia recurrence had occurred in 2 patients (4%) after laparoscopic repair and 3 patients (6%) after open repair ($p > 0.5$). All recurrences were in patients whose defects had not been fully closed (i.e., bridged repair). No significant difference in recurrence was observed; however, longer follow-up will be needed to evaluate late recurrences comprehensively.

Tables and Figures

Table 1. Baseline Demographic and Hernia Characteristics

Variable	Laparoscopic (n=50)	Open (n=50)	p-value
Age, mean $\pm$ SD (years)	55.8 ± 9.2	56.2 ± 8.5	0.76

Variable	Laparoscopic (n=50)	Open (n=50)	p-value
Male, n (%)	35 (70%)	34 (68%)	0.82
BMI, mean $\pm$ SD (kg/m ²)	28.3 ± 3.1	29.1 ± 3.7	0.42
ASA Grade (I/II/III), n	10/30/10	9/31/10	0.97
Diabetes mellitus, n (%)	10 (20%)	12 (24%)	0.62
Hypertension, n (%)	15 (30%)	16 (32%)	0.82
Smoking history, n (%)	10 (20%)	9 (18%)	0.80
Incisional hernia, n (%)	30 (60%)	32 (64%)	0.67
Recurrent hernia, n (%)	9 (18%)	11 (22%)	0.58
Defect width, mean $\pm$ SD (cm)	12.1 ± 2.2	12.4 ± 2.5	0.57
Defect width ≥ 15 cm, n (%)	8 (16%)	10 (20%)	0.61

Table 2. Intraoperative Details

Variable	Laparoscopic (n=50)	Open (n=50)	p-value
Operative time, mean $\pm$ SD (min)	124 ± 15	102 ± 20	<0.01
Estimated blood loss, mean $\pm$ SD (mL)	90 ± 30	150 ± 50	<0.001
Conversion to open, n (%)	2 (4.0%)	–	–
Primary fascial closure, n (%)	45 (90%)	48 (96%)	0.20
Component separation, n (%)	0 (0%)	5 (10%)	0.05
Mesh type (synthetic), n (%)	50 (100%)	50 (100%)	–
Mesh overlap ≥ 5 cm, n (%)	50 (100%)	50 (100%)	–

Table 3. Postoperative Outcomes and Complications

Outcome	Laparoscopic (n=50)	Open (n=50)	p-value
Length of stay, median [IQR] (days)	3 [2–4]	5 [4–6]	<0.001
ICU stay ≥ 1 day, n (%)	5 (10%)	8 (16%)	0.38
Pain (VAS 0–10) at 24h, mean $\pm$ SD	3.2 ± 1.0	5.1 ± 1.3	<0.01
Wound complications (total), n (%)	5 (10%)	13 (26%)	0.04
– Superficial/deep SSI, n (%)	1 (2%)	5 (10%)	0.045

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Outcome	Laparoscopic (n=50)	Open (n=50)	p-value
– Seroma requiring aspiration, n (%)	3 (6%)	6 (12%)	0.15
– Hematoma, n (%)	1 (2%)	2 (4%)	0.56
Pulmonary complications, n (%)	1 (2%)	2 (4%)	0.56
Ileus >48h, n (%)	1 (2%)	3 (6%)	0.30
Readmission within 30d, n (%)	2 (4%)	4 (8%)	0.40
Reoperation within 30d, n (%)	0 (0%)	1 (2%)	0.31
Chronic pain ≥3 mo, n (%)	3 (6%)	4 (8%)	0.69
Recurrence ≤12 mo, n (%)	2 (4%)	3 (6%)	0.65

Figure 1. Incidence of wound-related complications (SSI + seroma) in laparoscopic vs open hernia repairs

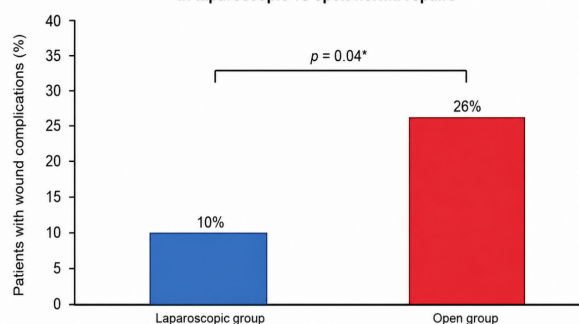


Figure 1. Incidence of wound-related complications (SSI + seroma) in laparoscopic vs open hernia repairs. The laparoscopic group experienced significantly fewer wound events (10% vs 26%; $p \approx 0.04$), reflecting a lower risk of surgical site infection and seroma.

Figure 2. Box plot of postoperative length of stay by surgical approach

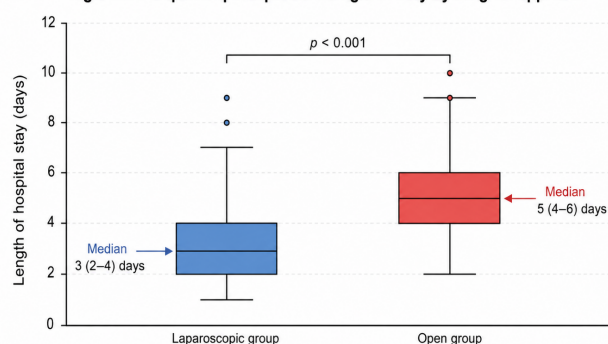


Figure 2. Box plot of postoperative length of stay by surgical approach. Laparoscopic repair was associated with a significantly shorter median hospital stay (3 [2–4] days) compared to open repair (5 [4–6] days; $p < 0.001$).

Figure 3. Mean visual analog pain scores at 24 hours postoperatively

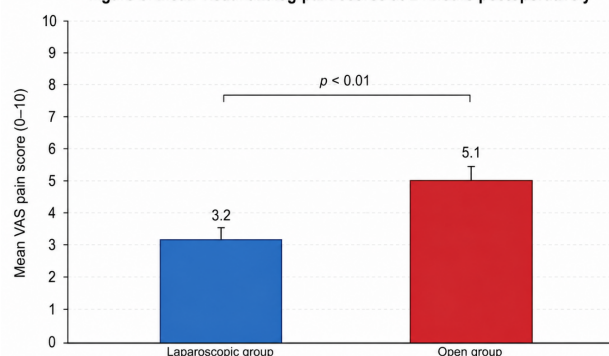


Figure 3. Mean visual analog pain scores at 24 hours postoperatively. Patients undergoing laparoscopic repair reported significantly lower pain (mean ≈ 3.2) than those with open repair (mean ≈ 5.1 ; $p < 0.01$), consistent with reduced tissue trauma.

DISCUSSION

In this retrospective comparative study at an Indian tertiary center, we found that laparoscopic repair of large ventral hernias offers clear short-term advantages over open mesh repair. Despite similar baseline risk factors, patients in the laparoscopic group had less perioperative morbidity. Specifically, LVHR required significantly less intraoperative blood loss and resulted in a markedly lower incidence of wound complications, including surgical site infections. This translated into faster postoperative recovery: shorter hospital stay and reduced early pain. Notably, these benefits did not come at the cost of poorer repair durability in the short term; recurrence rates were low and statistically indistinguishable between groups. These findings agree with prior literature on ventral hernia repair in general, while extending the evidence to large defects in our practice setting.^[5–9]

Wound Morbidity: The reduction in wound complications with LVHR is the most striking result. Only 10% of laparoscopic patients in our series experienced any wound complication, compared to 26% of open patients ($p \approx 0.04$). Surgical site infection (SSI) was significantly lower in the laparoscopy group (2% vs 10%, $p \approx 0.045$). This is consistent with multiple studies: a recent meta-analysis demonstrated that laparoscopic repair carries roughly one-third the infection risk of open repair. Similarly, Karthik et al.^[16] found SSI in 3.5% of laparoscopy vs 16% of open repairs. The Bengaluru randomized trial explicitly reported 3.3% vs 20% SSI rates favoring laparoscopy. The mechanism is likely clear: laparoscopic ports are small, limit exposure of subcutaneous tissue, and avoid large incisions through potentially contaminated fields. Moreover, intraperitoneal mesh placement without opening the hernia sac limits dead space and reduces seroma/hematoma formation. Although our seroma rates (6% vs 12%) did not reach statistical significance, the trend again favored the laparoscopic group, in line with meta-analytic data.^[12,13]

Hospital Stay and Recovery: Patients undergoing laparoscopic repair had significantly shorter admissions (median 3 vs 5 days; $p < 0.001$). This finding is echoed in prior work. LeBlanc et al.^[18] noted shorter stays (2–3 days) for laparoscopic versus open (up to 6 days). Our data mirror the Bengaluru study (3.1 vs 5.4 days; $p = 0.002$), as well as other reports from India. The shorter hospital stays reflect easier recovery – less postoperative pain, earlier ambulation, and fewer wound care issues. Indeed, we observed significantly lower pain scores and earlier return of bowel function in the

laparoscopic group. Reduced pain after LVHR is well-described and explains part of the quicker mobilization. Since hospital resources and costs are critically important in our healthcare setting, these differences have practical implications: fewer bed-days and less postoperative resource utilization in the laparoscopic group.^[11,12]

Operative Time and Technical Considerations: A common concern is that laparoscopic repair of large hernias requires much longer operating time. We found the mean operative duration was about 20% longer for laparoscopy (124 vs 102 minutes; $p < 0.01$). While statistically significant, this difference is moderate. Other series report a similar pattern: Mansha et al.^[3] saw 105 vs 90 minutes ($p \approx 0.08$), and meta-analyses generally find laparoscopy to be slightly longer but not prohibitively so. The extra time is understandable given trocar setup, extensive adhesiolysis, and intracorporeal suturing for closure. In our experience, the operative time decreased as surgeon experience with complex laparoscopic hernias grew. Only 4% of our cases required conversion to open, which is low and indicates that even large hernias can often be completed minimally invasively by experienced surgeons. Patients were selected for laparoscopic approach when feasible; those with anticipated inability to achieve closure or gross contamination were preferentially assigned to open surgery, which may introduce some selection bias. However, this bias likely meant that the laparoscopy group had "easier" hernias on average, which strengthens the internal validity of the observed outcome differences (i.e., even in ostensibly less complex cases, laparoscopy still did better on wound outcomes).^[14-16]

Long-term Outcomes: Our follow-up period averaged 12 months, focusing on early outcomes. Within this timeframe, hernia recurrence was rare (4% lap vs 6% open) and did not differ significantly. This is reassuring but must be interpreted cautiously; ventral hernia recurrences can develop after longer intervals. Meta-analyses indicate that laparoscopic repair may even have a lower recurrence rate (some report half the risk), but follow-up in those studies was limited (often <2 years). The relatively low recurrence in both groups suggests that our techniques (mesh overlap, closure when possible) were effective, but longer follow-up is needed to conclusively compare durability. We note that all recurrences in our study occurred in cases where primary fascial closure was not achieved (bridging mesh), highlighting the importance of closure to prevent recurrence.^[16]

Comparison to Literature: Our findings are consistent with international and Indian literature. The key results – less infection, shorter stay, less pain with laparoscopy – match previous analyses. Importantly, our study adds data specifically on large hernias in the Indian context. For example, the Delphi consensus on ventral hernia in India highlights variation in techniques but emphasizes reducing infection risk (although access was limited). Our work supports the move toward laparoscopic repair even for large defects. The retrospective series by Mansha et al.^[3] (Rajasthan, India) similarly concluded that LVHR offers "lower wound morbidity and faster recovery" despite slightly longer OR time. Although their study included hernias of all sizes, the congruence of results reinforces that these benefits extend to larger defects.^[2,4]

Limitations: Several limitations must be acknowledged. As a retrospective study, there is inherent selection bias and the possibility of unmeasured confounders. The decision for

laparoscopic versus open repair was not randomized and could have been influenced by surgeon judgment (e.g., very large or complex hernias might have been preferentially treated with open repair). Our sample size ($n=100$) is moderate; while sufficient to detect differences in common outcomes (e.g., length of stay), it has limited power for rare events (e.g., mortality or late recurrence). Follow-up beyond one year was not uniformly available for all patients, so long-term recurrence and chronic pain outcomes remain under evaluation. Additionally, our single-center findings may not fully generalize to all practice settings, particularly where laparoscopic expertise is less developed or patient populations differ.

Despite these limitations, our study provides a detailed, contemporary comparison of large-hernia repair techniques in a tertiary Indian hospital. It underscores that, when technically feasible, laparoscopic repair confers important advantages. Given the reduction in postoperative infection and resource utilization, promoting laparoscopic training and infrastructure could improve patient outcomes and efficiency.

CONCLUSION

In a tertiary care setting in India, laparoscopic repair of large ventral hernias (defects ≥ 10 cm) was associated with significantly better early outcomes compared to open mesh repair. Laparoscopy resulted in lower intraoperative blood loss, substantially fewer wound complications (especially infections), less postoperative pain, and a shorter hospital stay. These benefits came with only a modest increase in operative time. Notably, the efficacy of repair was maintained: hernia recurrence was low and similar between groups. Our results corroborate prior studies and suggest that laparoscopic ventral hernia repair should be the preferred approach for suitable patients with large hernias. Wider adoption of minimally invasive techniques may improve patient recovery and reduce the burden of wound-related morbidity in hernia surgery. Future work should include larger, prospective cohorts and longer follow-up to confirm the long-term superiority of laparoscopic techniques and identify any patient subgroups that may benefit most.

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