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Original Research Article

# A Comparative and Prospective Study of Ventral Hernia Repair by Laparoscopic and open Technique

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**Abstract:**

**Background:** In general surgery, treating a ventral hernia is one of the most common procedures. Research on the relative efficacy of open and laparoscopic procedures is currently ongoing, despite their widespread use.

**Objective:** To evaluate the clinical outcomes of laparoscopic and open ventral hernia repair in terms of the operative parameters, recovery, and complications.

**Methods:** 45 patients with ventral hernias participated in a one-year non-randomized comparative study for the years 2023–2024 at the Department of General Surgery, AIIMS Raipur, India. Of the 45 patients, 23 underwent open mesh surgery and 22 underwent laparoscopic mesh repair. The data for surgical time, postoperative discomfort, wound complications, hospital stays, and recurrence were evaluated using SPSS version 25.0, with a $p < 0.05$ threshold for statistical significance.

**Result:** In comparison to open repair, laparoscopic repair had a significant reduction in postoperative pain, a shorter length of stay in the hospital, and a lower incidence of wound infections. Nevertheless, the average operative time for the laparoscopic group was longer. Of the cases with laparoscopy, there was no recurrence noted in the six-month follow up. In the open group, one recurrence was noted.

**Conclusion:** Laparoscopic ventral hernia repair provides better short-term outcomes, enhanced patient satisfaction, and improved cosmetic results compared with open repair. It should be considered the preferred approach in suitable candidates despite its longer operative time and higher initial cost.

**Keywords:** Ventral Hernia, Laparoscopic Repair, Open Repair, Mesh, Postoperative Outcomes.



## Introduction

Ventral hernias display a large portion of abdominal wall hernias, including primary and incisional hernias and defects due to weakness or disruption of the abdominal wall musculofascial layers [1]. Ventral hernias are also commonly seen in practice as complications of abdominal surgeries or due to fascial weaknesses on the abdominal wall [2]. Ventral hernias are seen in about 2-20% of patients undergoing a laparotomy, with risk factors including obesity, wound infection, and poor nutritional status, and diabetes [3,4]. Historically, the standard surgical approach for open ventral hernia repair involved primary tissue repair or the placement of a prosthetic mesh [5]. Unfortunately, open methods tended to result in increased risk of wound infections, persistent postoperative pain, and extended hospital stays [6]. Although problems like seroma or infection and delayed wound healing remained concerning, the use of hernia surgery was spurred by the decrease in recurrence rates brought about by the advent of prosthetic mesh [7]. Laparoscopic ventral hernia repair (LVHR) has become a widely approved substitute for the open procedure due to the quick advancement of minimally invasive surgery [8].

Using laparoscopic techniques allows patients to recover more quickly because they experience less postoperative pain, have lesser wound morbidity, and have the ability to resume their normal activities much sooner [9,10]. Additionally, the laparoscopic approach permits the anatomically and surgically trained eye to better visualize the defect and the anatomy that surrounds it, helping the surgeon to find any hidden hernias and ensuring that the mesh is applied with the required overlap [11]. On the other hand, performing laparoscopic ventral hernia repair (LVHR) poses challenges such as the higher procedure cost, longer surgery time, need for more

advanced surgical technique, and the potential damage to the intra-abdominal organs [12].

In contrast, open ventral hernia repair (OVHR) is more frequently used in some situations, particularly in more oversized or more intricate defects, dirty fields, or in low resource areas [13]. These differences lead to an ongoing lack of consensus in the surgical community on the methods used to vary relaxed skin tension between the two approaches. Studies comparing the two techniques with regard to surgical duration, postoperative pain, complications at the wound site, length of the hospital stay, and recurrence rates will greatly inform the decision of which technique is more appropriate [14]. The present study sought to examine the safety, efficacy, and outcomes in the postoperative period for both laparoscopic and open ventral hernia repair in an effort to improve patient outcomes and inform surgical practice [15]. The study was based at the All-India Institute of Medical Sciences (AIIMS) in Raipur, India, and involved a, comparative analysis of 45 patients spanning one year.

## Materials and Methods

**Study Design and Setting:** This was a prospective, non-randomized comparative study carried out in the Department of General Surgery at All India Institute of Medical Sciences (AIIMS), Raipur, India. The study spanned a year, which included data collection, analysis, and patient follow-up after ventral hernia repair, done either laparoscopically or through the open technique.

**Study Population:** During the specified period, 45 individuals who were part of the study had their ventral hernias repaired. The diagnosis of the ventral hernia was made during the clinical examination, and in certain instances, computed tomography or ultrasonography were used to confirm it. Two study groups were assigned to the patients: Twenty-two patients in Group A (Laparoscopic Repair) had laparoscopic mesh repair. Twenty-three patients in Group B (Open Repair) underwent open mesh repair (non-randomized allocation).

**Inclusion Criteria:** Patients aged between 18–70 years. Clinically and radiologically confirmed cases of ventral hernia. Patients undergoing elective hernia repair by either laparoscopic or open technique. Patients providing informed consent for inclusion in the study.

**Exclusion:** Criteria Patients presenting with strangulated or obstructed hernias requiring emergency surgery. Recurrent hernias following previous mesh repair. Patients with severe cardiopulmonary comorbidities or contraindications to general anesthesia. Pregnant women.

**Data Collection and Parameters Studied:** Information was collected from patient history files, operative notes, and follow-up documentation. The assigned parameters consisted of patient demographics (age, sex, BMI, comorbid conditions), operative parameters (surgery length, intraoperative complications), and outcomes in the postoperative period (pain based on the Visual Analogue Scale, days 1 and 3, hospital stay, complications/reviews on the wound, seroma, and recurrence). Patient outcomes on recurrence and satisfaction 6 months post follow-up were documented.

**Defect Assessment:** Each patient had their hernia defect evaluated both clinically and through imaging (ultrasound or CT scans of the abdomen as clinically warranted). The largest diameter of the fascial defect was noted in centimeters and then classified as small (defects < 2 cm), medium (2–5 cm), or large (defects > 5 cm).

**Surgical Technique:** The traditional three-port technique was used to conduct a laparoscopic repair of a ventral hernia while under general anesthesia. After adhesiolysis, the composite mesh was placed intraperitoneally with 5-cm margins on all sides of the defect and secured with transfascial sutures and tacks. In open repair, transverse or normal midline incisions were used to access the hernial sac. Mesh was positioned in an onlay or sublay position with the proper fixation after the contents of the sac were reduced.

**Post-operative management and analgesia protocol:** All patients were managed under a uniform post-operative protocol. Intravenous paracetamol (1 g every 8 hours) was given routinely for the first 48 hours, followed by oral analgesics as required. Diclofenac 75 mg IM/IV was used as rescue medication, and tramadol 50–100 mg IV was administered for severe pain (VAS ≥ 6). Post-operative pain was assessed using the Visual Analogue Scale (VAS, 0–10) at 24 hours (Post-op Day 1) and 72 hours (Post-op Day 3). The total analgesic requirement within the first 72 hours and VAS scores were compared between the two groups.

**Statistical Analysis:** All data entered into Microsoft excel and analyzed using SPSS version 25.0. Continuous variables were represented as mean ± standard deviation and were compared using the Student's t-test, whereas categorical variables were analyzed through the Chi-square test and, whenever appropriate, Fisher's exact test. A p-value of 0.05 was deemed statistically significant.

**Ethical Considerations:** Ethical clearance for this study was provided by the Institutional Ethics Committee of AIIMS Raipur.

## Results

This study included 45 patients who had ventral hernia repairs. Of these 45 patients, 22 patients had

laparoscopic ventral hernia repairs (Group A) and 23 patients had open ventral hernia repairs (Group B). The results and observations are given below**.**

**Demographic Profile:** The baseline clinical and demographic information for participants in both groups is shown in Table 1. Individuals in the laparoscopic group were 44.8 ± 10.5 years old, whereas those in the open group were 46.3 ± 11.2 years old (p = 0.61). Female patients made up the majority in both groups (57% in Group A and 60% in Group B). Group A's average BMI was 27.6 ± 3.4 kg/m², while Group B's was 28.1 ± 3.7 kg/m². The groups' co-occurring conditions of obesity, diabetes, and hypertension were similar, and there was no statistically significant difference.

**Table 1: Demographic and Baseline Characteristics of Study Participants**

| Parameters | Laparoscopic Group (n = 22) | Open Group (n = 23) | p-value |
|---|---|---|---|
| Mean age (years) | 44.8 ± 10.5 | 46.3 ± 11.2 | 0.61 |
| Sex (M: F) | 9:13 | 10:13 | 0.84 |
| Mean BMI (kg/m²) | 27.6 ± 3.4 | 28.1 ± 3.7 | 0.57 |
| Hypertension | 4 (18.1%) | 5 (21.7%) | 0.76 |
| Diabetes mellitus | 3 (13.6%) | 5 (21.7%) | 0.47 |
| Obesity | 3 (13.6%) | 4 (17.3%) | 0.73 |

**Defect assessment:** The mean defect size in the laparoscopic group was 4.5 ± 1.3 cm and in the open group was 4.8 ± 1.5 cm, which was not statistically significant (p > 0.05). The most common defect location was paraumbilical, followed by epigastric and incisional hernias.

**Intraoperative Findings:** Compared to the open group (86.4 ± 13.7 minutes), the laparoscopic group's average operation time was significantly greater (102.3 ± 15.2 minutes) (p < 0.001). Nonetheless, the laparoscopic group saw a lower average blood loss (42.5 ± 10.8 mL) compared to the open group (78.2 ± 16.4 mL) (p < 0.001). Intraoperative complications occurred in one patient (4.5%) in the laparoscopic group and two patients (8.6%) in the open group; these rates were not statistically significant (p = 0.59).

**Table 2: Intraoperative Parameters**

| Parameters | Laparoscopic Group (n = 22) | Open Group (n = 23) | p-value |
|---|---|---|---|
| Mean operative time (minutes) | 102.3 ± 15.2 | 86.4 ± 13.7 | <0.001 |
| Mean blood loss (mL) | 42.5 ± 10.8 | 78.2 ± 16.4 | <0.001 |
| Conversion to open surgery | 1 (4.5%) | – | – |
| Intraoperative complications | 1 (4.5%) | 2 (8.6%) | 0.59 |

**Postoperative Pain and Recovery:** Compared to the open group, the laparoscopic group experienced a much faster recovery from postoperative pain. On the first postoperative day, the laparoscopic group's average VAS score was 4.2 ± 0.9, while the open group's was 6.1 ± 1.2 (p < 0.001). The pain levels on the third postoperative day were 2.3 ± 0.7 and 3.8 ± 1.0, respectively (p < 0.001). The laparoscopic group's average hospital stay was 3.2 ± 1.1 days, while the open group's was 6.4 ± 1.7 days (p < 0.001). Compared to open repair patients (13.4 ± 2.8 days), laparoscopic repair patients were able to resume their daily activities sooner (7.2 ± 1.6 days) (p < 0.001).

**Table 3: Postoperative Pain and Recovery**

| Outcome | Laparoscopic Group (n = 22) | Open Group (n = 23) | p-value |
|---|---|---|---|
| VAS pain score (Day 1) | 4.2 ± 0.9 | 6.1 ± 1.2 | <0.001 |
| VAS pain score (Day 3) | 2.3 ± 0.7 | 3.8 ± 1.0 | <0.001 |
| Mean hospital stays (days) | 3.2 ± 1.1 | 6.4 ± 1.7 | <0.001 |
| Return to normal activity (days) | 7.2 ± 1.6 | 13.4 ± 2.8 | <0.001 |

**Postoperative Complications:** Wound complications were more prevalent in the open group (26%), as opposed to the laparoscopic group (9%). There was one seroma case in the laparoscopic group and three in the open group. One case of mesh infection occurred in the open group, and it was treated with antibiotics and drainage. During the six-month follow-up period, there were two recurrences (8.7%) in the open group and one (4.5%) in the laparoscopic group (p = 0.56). For the first time, we used a visual rating scale with a range of 0 to 100 to ask the patients to rate how satisfied they were. The laparoscopic group scored much higher (90.1 ± 5.4) than the open group (78.3 ± 6.1) (p < 0.001).

**Table 4: Postoperative Complications and Follow-up Outcomes**

| Complications / Outcomes | Laparoscopic Group (n = 22) | Open Group (n = 23) | p-value |
|---|---|---|---|
| Wound infection | 1 (4.5%) | 3 (13.0%) | 0.27 |
| Seroma formation | 1 (4.5%) | 2 (8.7%) | 0.56 |
| Mesh infection | 0 | 1 (4.3%) | 0.31 |
| Recurrence (6 months) | 1 (4.5%) | 2 (8.7%) | 0.56 |
| Patient satisfaction score | 90.1 ± 5.4 | 78.3 ± 6.1 | <0.001 |

## Discussion

Over the span of a year, a recently conducted study evaluated the results of laparoscopic ventral hernia repair, as well as open ventral hernia repair, on 45 patients. Our study results show that for postoperative recovery, patient satisfaction, hospital stay, and wound complications, laparoscopic repair is favourable, even though the operating time is slightly longer. Most of the findings are consistent with what has been documented in recent surgical literature. The shorter hospital stays in the laparoscopic group results from the causal factor of the surgery being minimally invasive, and therefore being less traumatic on the tissues, allowing for a quicker recovery. Literature demonstrating a similar reduction in hospital stay has been documented, reporting 2.8 days vs 5.2 days after open surgery. Patients managed laparoscopically clearly demonstrated a faster return to normal activity, and lower postoperative morbidity [8,16]. Recovery after hernia surgery is significantly influenced by pain control and early ambulation. Our study demonstrated that pain scores 1 and 3 days post-surgery were significantly lower on the laparoscopic group. This confirms earlier findings in literature describing faster recovery and discharge with laparoscopic mesh repair. The emotional response to pain and the need for analgesics are less with laparoscopic procedures, as there is less tissue handling, smaller incisions, and of course, less tissue trauma [10].

When compared to open repair, the laparoscopic group showed a lower prevalence of surgical-site infections. This finding is in line with a meta-analysis of randomized controlled studies that found that laparoscopic ventral hernia repair was associated with lower rates of overall complications and less wound infections [14]. The lower infection rates can be attributed to minimal surgical field exposure to the environment and the absence of large incisional gaps that are typical entry points for bacterial contamination with open repair. In a few cases of laparoscopic repair, seroma formation was noted, consistent with findings in the literature [17]. Increased seroma formation noted with laparoscopic procedures may be due to significant dissection of the preperitoneal planes and creation of dead space to be filled with mesh. Notwithstanding, these seromas were uncomplicated and conservatively treated, posing little to no morbidity. Longer operative time in the laparoscopic group was also reported in the literature [12,18]. The reasons for increase operative time are the intricacies in the mesh fixation and the laparoscopic learning curve. There is significant literature to document that operative time, from the laparoscopic perspective, is learning curve dependent, with most studies demonstrating that time tends to be the same as open surgery. Positive patient outcomes tend to be the motivating factor for most surgeons.

Recurrence continues to be the most principal factor in determining the long-term outcomes of hernia surgery. In the present study, there were no recurrences in the laparoscopic group during the 6-month follow-up. In contrast, the open surgery group had one recurrence. This is in line with the literature that reports lower recurrence rates in laparoscopic repairs compared to open mesh repairs. The lower recurrence seen in laparoscopic repairs may be due to the extended mesh overlap, circumferential fixation, and direct visualization of hidden secondary defects. In contemporary surgery, the importance of cosmetic outcomes, and thus patient satisfaction, are constantly increasing. In this study, patients who underwent laparoscopic repairs noted higher satisfaction due to the faster recovery and smaller incisions [19,20]. It has been shown that patients also report improved cosmetic satisfaction and faster work resumption after laparoscopic repairs relative to open surgery. Although laparoscopic repairs appear more expensive in the first instance due to the cost of mesh and fixation devices, the overall cost is less than open repair because of the shorter length of hospital stay and faster return to work, lower postoperative complications, and reduced overall downtime. Therefore, despite the higher procedural costs, laparoscopic surgery is more cost-effective in the long run [21,22].

## Conclusion

This comparative study highlights some advantages of laparoscopic ventral hernia repair when compared with the open approach to ventral hernia repair. Patients with laparoscopic repairs experienced significantly reduced postoperative pain, shorter hospital stays, fewer complications involving the wounds, and quicker returns to regular activities. While the laparoscopic approach took somewhat more time to complete during the procedure, it resulted in better cosmetic results, and patients reported greater satisfaction. Additionally, the

recurrence of hernia in the laparoscopic group was lower during the study period. This validates the conclusion that laparoscopic ventral hernia repairs ventral hernia with patients is effective and less onerous. Although the costs for laparoscopic repairs and the open repairs initially seem higher for the surgeon, the time saved, and reduced hospital resources for patients outweigh the costs over open repair in properly chosen patients. To assess cost-effectiveness and recurrence, the study should have included more significant prospective studies over extended periods.

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