

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

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### Abstract:

**Background:** In general surgery practice, ventral hernias—which include incisional, umbilical, and para-umbilical defects—represent a significant burden. Laparoscopic Ventral Hernia Repair (LVHR) has becoming more popular due to its less invasive nature; however open mesh repair has traditionally been the norm. There is still a dearth of information comparing these methods in semi-urban Indian contexts, nevertheless.

**Objective:** This study's main goal was to assess and contrast the short-term results of laparoscopic and open ventral hernia repair (OVHR). The study specifically sought to evaluate the length of hospital stay, intraoperative blood loss, postoperative pain intensity, operative time, and the frequency of early postoperative problems such as seroma and surgical site infection (SSI).

**Methods:** Over the course of 11 months, the Department of Surgery at Jawahar Lal Nehru Medical College and Hospital (JLNMCH), Bhagalpur, carried out a prospective comparative study. A total of 75 patients with simple ventral hernias were recruited and divided into two groups: Group A received LVHR (n = 35) and Group B received OVHR (n = 40).

**Results:** The LVHR group's mean operating time ( $95.4 \pm 15.2$  minutes) was substantially longer than the OVHR group's ( $72.6 \pm 12.8$  minutes) ( $p < 0.05$ ). On the other hand, Group A had a shorter mean hospital stay (2.8 days vs. 5.4 days;  $p < 0.001$ ) and considerably lower postoperative pain scores at 24 hours (VAS: 3.2 vs. 6.1). Compared to 2.8% in the laparoscopic group, 12.5% of the open group experienced surgical site infections.

**Conclusion:** An efficient and safe substitute for open treatment is laparoscopic ventral hernia repair. It is a feasible alternative even in settings with limited resources since, despite the longer operating time, it gives clear benefits in terms of decreased postoperative discomfort, lower wound morbidity, and faster hospital discharge.

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### Introduction

A ventral hernia is a disorder that significantly impairs a patient's quality of life. It is characterized by the protrusion of abdominal viscera through the anterior abdominal wall fascia. A variety of deformities, such as incisional, umbilical, para-umbilical, and epigastric hernias, are included in this disorder. Among these, incisional hernias, which occur in 10–20% of all laparotomy cases, continue to be a significant concern in contemporary abdominal surgery [1]. Over the past century, the treatment of congenital deformities has changed significantly, moving from anatomical closure to prosthetic reinforcement.

**Historical Context and Evolution:** In the past, simple stitch repair (primary tissue closure) was the

main technique used to treat ventral hernias. Long-term follow-up data, however, showed unacceptably high recurrence rates, which were frequently linked to wound failure due to stress at the suture line [2]. The "tension-free" repair concept was introduced as a result of the initial repair's failure, which caused a paradigm change. Hernia surgery was transformed by the use of prosthetic mesh, which bridges the defect instead of tightly shutting it. Open mesh repair required significant soft tissue dissection, but it decreased recurrence. The search for less invasive options has been prompted by the constant correlation between this intensive tissue manipulation and high rates of wound-related morbidity, such as seroma development and surgical site infections (SSI) [3].

**The Laparoscopic Shift:** The introduction of minimally invasive methods has altered the field of hernia surgery. Laparoscopic Ventral Hernia Repair (LVHR) using the Intraperitoneal Onlay Mesh (IPOM) approach has become a strong rival to open surgery since it was first reported by LeBlanc and Booth in 1993 [3]. There are a number of theoretical and practical benefits to the laparoscopic approach. The surgeon can use the intra-abdominal pressure to keep the mesh in place by inserting it intraperitoneally. Additionally, laparoscopy offers a comprehensive view of the abdominal cavity, making it possible to detect occult satellite problems that an open investigation could overlook [4].

**Rationale for the Study:** Even though laparoscopy has been shown to be beneficial in affluent countries, there are particular obstacles to its acceptance in underdeveloped nations. Patient demographics in semi-urban Indian communities, like those in the Bhagalpur catchment region, frequently exhibit delayed presentation and clear socioeconomic limitations [5]. Additionally, the expense of composite mesh is still a barrier in these contexts, according to expert consensus [6]. There is a dearth of prospective studies from eastern India that assess whether the therapeutic advantages of LVHR justify the greater resource use in a government teaching hospital context, despite the abundance of comparative data in Western literature. In order to prospectively assess and compare the intraoperative features and early postoperative results of LVHR with OVHR, this study was conducted at Jawahar Lal Nehru Medical College in Bhagalpur.

### Material and Methods

**Study Design and Setting:** The Department of General Surgery at Jawahar Lal Nehru Medical College and Hospital (JLNMCH), Bhagalpur, Bihar, was the site of this prospective comparative study. For a sizable population that is primarily rural and semi-urban, the facility acts as a tertiary care referral center. Eleven months were spent on the study. The institutional review board granted ethical clearance before the study started.

**Study Population:** Seventy-five patients with a clinical diagnosis of ventral hernia who came to the surgical outpatient department (OPD) made up the study cohort. The hiring procedure was intended to be both inclusive and tightly regulated to guarantee uniformity. The nature of both surgical methods was thoroughly explained to the patients. A mix of patient preference, financial viability, and surgeon discretion was used to decide the final allocation to either the Laparoscopic (Group A) or Open (Group B) arm.

To guarantee the participants' safety, we set stringent inclusion conditions. Patients with primary ventral or incisional hernias that ranged in size from 2 to 10 cm and were between the ages of 18 and 70 were included. On the other hand, we routinely eliminated patients who presented with severe coagulopathy, decompensated liver disease, strangulated or obstructed hernias, or those judged unfit for general anesthesia in order to prevent confounding factors related to complex pathology [7].

**Surgical Technique:** Laparoscopic Repair (LVHR) is Group A. This set of patients underwent surgery while under general anesthesia. A Veress needle or open Hassan method was used to create pneumoperitoneum. After a diagnostic laparoscopy to evaluate the defect, the bowel was carefully separated from the abdominal wall by adhesiolysis using harmonic shears or electrocautery, being extremely careful to prevent thermal damage to the intestine [8]. A dual-sided composite mesh was added once the flaw was fixed. To reduce the chance of recurrence, the mesh was sized to guarantee a large overlap of at least 5 cm beyond the defect borders in all directions [9]. A "double crown" technique—trans-fascial sutures at the cardinal points and a circumferential sequence of tackers—was used to establish fixation.

Group B: OVHR (Open Repair) Under general or spinal anesthesia, patients in the open repair group had surgery. Onlay mesh repairs or Mayo's repairs were used for umbilical or minor paraumbilical hernias. Either an Onlay method or a Sublay (Retromuscular/Rives-Stopppa) placement was used for incisional hernias [10]. Non-absorbable sutures were used to secure the polypropylene mesh. To avoid fluid buildup, negative suction drains were frequently positioned in the subcutaneous or retro-muscular region.

**Outcome Measures and Data Collection:** The process of gathering data was thorough and prospective. The estimated blood loss and the duration of the procedure were among the intraoperative characteristics noted. One of the main goals was to measure discomfort after surgery. We used the Visual Analog Scale (VAS), a validated instrument that asks patients to rate their level of pain on a scale of 0 to 10. Evaluations took place 12, 24, and 48 hours after the procedure. The duration of hospital stay (LOS) and the time it took to restart a liquid diet were additional recovery indicators. Seroma and surgical site infection (SSI) were given particular focus in the thorough monitoring of wound complications.

**Statistical Analysis:** SPSS software was used to compile and evaluate the gathered data. The Student's t-test was used to compare quantitative data (age, operative time) that were reported as

Mean ± Standard Deviation (SD). The Chi-square test was used to assess categorical variables. Statistical significance was defined as a p-value of less than 0.05.

**Results**

**Demographic Profile:** A total of 75 patients were successfully recruited for the study, and they were

divided into two groups: 40 patients underwent open ventral hernia repair (Group B) and 35 patients underwent laparoscopic ventral hernia repair (Group A). Effective randomization was confirmed by an examination of the baseline parameters, which showed a homogeneous distribution between the two arms.

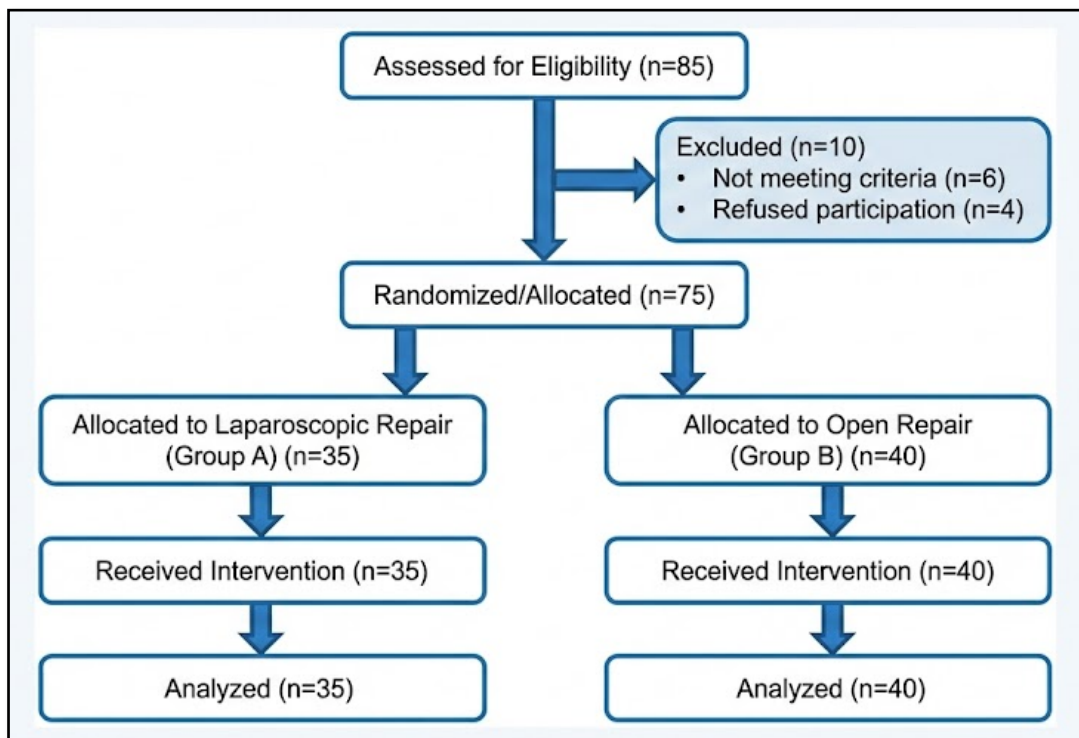
**Table 1: Demographic Baseline Characteristics**

Parameter	Group A (Laparoscopic) (n=35)	Group B (Open) (n=40)	P-value
Mean Age (Years)	44.5 ± 10.2	46.8 ± 11.5	0.38 (NS)
Gender (M: F)	12 : 23	15 : 25	0.81 (NS)
Mean BMI (kg/m <sup>2</sup> )	28.4 ± 3.1	27.9 ± 3.5	0.52 (NS)
<b>Hernia Type</b>			
- Incisional	10 (28.6%)	14 (35.0%)	0.55 (NS)
- Para-umbilical	18 (51.4%)	18 (45.0%)	0.58 (NS)
- Epigastric	7 (20.0%)	8 (20.0%)	1.00 (NS)
Mean Defect Size (cm)	4.2 ± 1.5	4.5 ± 1.8	0.45 (NS)

NS = Not Significant; Values are Mean ± SD or Number (%).

The mean age, gender distribution, BMI, and hernia features were statistically similar in both groups

(p > 0.05), as Table 1 illustrates. This demographic comparability guarantees that surgical technique, not patient selection bias, is responsible for any observed variations in clinical outcomes.



**Figure 1: CONSORT flow diagram of patient recruitment and allocation**

**Intraoperative Outcomes:** The intraoperative measures comparing the two methods showed a clear disparity. The Laparoscopic group's mean operating time was determined to be 95.4 ± 15.2 minutes, which was substantially greater than the Open group's 72.6 ± 12.8 minutes (p < 0.05). The logistical setup time needed for the insufflator and video equipment, as well as the precise nature

of laparoscopic adhesiolysis, were the main causes of this lengthening of the laparoscopic method. On the other hand, the laparoscopic method showed a definite benefit in terms of blood loss. Because of the exact hemostasis that comes with the laparoscopic procedure, Group A's estimated blood loss was much less than Group B's.

**Postoperative Pain and Recovery:** The area where the two approaches differed the most was in postoperative pain control. Patients in Group A consistently reported reduced pain levels at all observed intervals when the Visual Analog Scale

(VAS) scores were analyzed. Patients in the laparoscopic group were able to walk and tolerate oral fluids much earlier as a direct result of this pain decrease. As a result, the average length of hospital stay was significantly decreased.

**Table 2: Comparison of Perioperative and Recovery Outcomes**

Parameter	Group A (Lap) Mean $\pm$ SD	Group B (Open) Mean $\pm$ SD	P-value
Operative Time (min)	95.4 $\pm$ 15.2	72.6 $\pm$ 12.8	< 0.05
Blood Loss (ml)	20.5 $\pm$ 10.0	65.4 $\pm$ 25.0	< 0.001
VAS Score (12 Hours)	5.2 $\pm$ 1.1	7.8 $\pm$ 1.2	< 0.001
VAS Score (24 Hours)	3.2 $\pm$ 0.9	6.1 $\pm$ 1.4	< 0.001
VAS Score (48 Hours)	1.8 $\pm$ 0.7	4.2 $\pm$ 1.1	< 0.001
Hospital Stay (Days)	2.8 $\pm$ 1.1	5.4 $\pm$ 1.8	< 0.001

**Complications:** Due in large part to a significant decrease in wound-related problems, the overall complication profile favored the laparoscopic method. Five patients (12.5%) in the Open group experienced surgical site infections (SSIs), which included one deep infection that required drainage

and four superficial infections. On the other hand, in the laparoscopic group, just one patient (2.8%) experienced a port-site infection. Although not statistically significant, seroma development was greater in the open group.

**Table 3: Postoperative Complications**

Complication	Group A (Lap) (n=35)	Group B (Open) (n=40)	p-value
Seroma	2 (5.7%)	4 (10.0%)	> 0.05
Surgical Site Infection (SSI)	1 (2.8%)	5 (12.5%)	< 0.05
Prolonged Ileus	1 (2.8%)	3 (7.5%)	> 0.05
Chronic Pain (>3 months)	1 (2.8%)	4 (10.0%)	> 0.05
Recurrence (at 6 months)	0	0	–
<b>Total Morbidity</b>	<b>5 (14.3%)</b>	<b>16 (40.0%)</b>	<b>&lt; 0.05</b>

Note: Some patients may have had more than one complication.

The Open Repair group had a considerably greater overall morbidity rate (40.0%) than the Laparoscopic Repair group (14.3%), as shown in Table 3. This was mainly because the Open cohort had a higher prevalence of wound infections and persistent discomfort.

### Discussion

From straightforward stitch closure to intricate abdominal wall reconstructions, the treatment of ventral hernias has changed throughout time. The increasing consensus that laparoscopic surgery provides better short-term morbidity profiles than open repair is supported by our prospective investigation at JLNMCB, Bhagalpur [11].

**Operative Time and Learning Curve:** According to our research, LVHR took an average of 23 minutes longer than open repair. This result is in line with other research, such as that of Pereira et al., who found a comparable discrepancy [12]. The placement of camera equipment and careful adhesiolysis are responsible for the extra time. However, research shows that as the surgical team gets over the learning curve, this time gap tends to

reduce, with operating times stabilizing after about 20 instances [13].

**Postoperative Pain and Analgesia:** One of the main factors influencing patient discharge is postoperative discomfort. In the laparoscopic group, we found a statistically significant decrease in VAS values. This validates Zhang et al.'s meta-analysis, which found that LVHR leads to reduced pain and a quicker return to activity [14]. Significant tissue damage and inflammatory release are caused by the open approach. Although focal pain may result from trans-fascial sutures in LVHR, our data indicates that the avoidance of extensive incisions outweighs this, which is in line with findings by Chelala et al. [15].

**Wound Morbidity: The Strongest Argument for Laparoscopy:** The decrease in SSI in the laparoscopic group (2.8% vs. 12.5%) was possibly the most significant finding. Because of the enormous surface area of dissection, open healing is linked to wound problems. The mesh is placed far away from the skin flora during laparoscopic repair. This is consistent with the findings of Itani et al.'s multicenter experiment, which revealed noticeably reduced incidence of wound infection with LVHR [16].

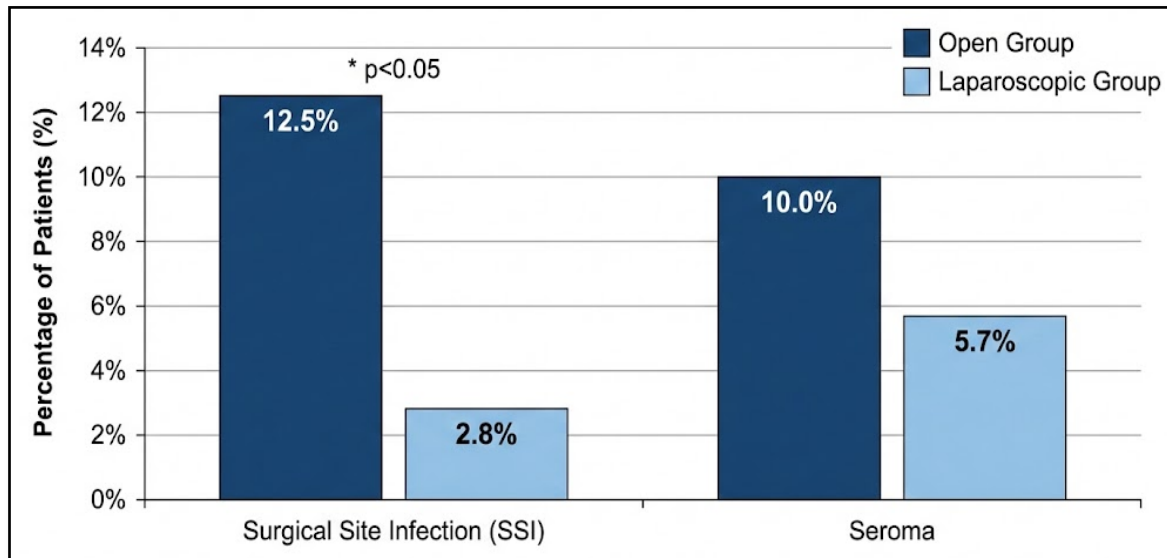


Figure 2: Comparison of wound complication rates (SSI and Seroma) between groups

**Seroma Formation:** The genesis of seromas is still up for dispute. The laparoscopic group had a lower incidence (5.7%) than the open group (10%), according to our study. Because the hernia sac is frequently left in situ, LVHR may theoretically put patients at risk for seroma [17]. Nevertheless, a large potential area for fluid buildup is created after open surgery due to the significant elevation of subcutaneous flaps.

**Limitations:** Although this study offers useful prospective data, there are a number of drawbacks. First, the evaluation of long-term recurrence or late problems like mesh erosion, which usually appear after two years, is not possible due to the 11-month duration and capped 6-month follow-up [18]. Second, the 75-patient sample size is statistically insufficient to identify uncommon adverse outcomes like enterotomy or vascular damage, even though it is adequate for examining typical morbidities. Third, there was a possibility of socioeconomic selection bias because the study was not entirely randomized; allocation depended in part on the patient's capacity to purchase the particular composite mesh. Additionally, observer bias regarding subjective outcomes like VAS pain scores may have been introduced due to the unavoidable absence of blinding caused by the clear differences in surgical incisions. Additionally, we may have missed subtle functional recovery indicators since we only used generic pain ratings instead than hernia-specific quality-of-life tools like the Carolinas Comfort Scale. Lastly, because this was a teaching institution, the learning curve of surgeons with different levels of expertise was incorporated in the operational timeframes, which probably caused the laparoscopic group's recorded duration to be disproportionately longer than that of the normal open procedure.

### Conclusion

The clinical effectiveness and safety of laparoscopic ventral hernia repair (LVHR) over open ventral hernia repair (OVHR) are strongly supported by this prospective comparative study carried out at Jawahar Lal Nehru Medical College and Hospital in Bhagalpur. We have conclusively shown, based on the analysis of 75 patients, that although the laparoscopic technique requires a significantly longer operating time (averaging 95.4 minutes vs. 72.6 minutes for open surgery), this intraoperative time investment provides significant postoperative benefits. The most important discovery is that LVHR has a better safety profile when it comes to wound morbidity; the procedure dramatically decreased the prevalence of surgical site infections to just 2.8% as opposed to a concerning 12.5% in the open group. Avoiding large incisions and extensive subcutaneous dissection is a significant advantage in our particular semi-urban setting, where maintaining postoperative hygiene can be difficult and humidity exacerbates wound problems.

The study also reveals an important operational advantage: compared to their open surgery peers, patients in the laparoscopic arm were discharged on average 2.6 days earlier and reported far less discomfort. In addition to helping the patient return to economic production more quickly, this expedited recovery trajectory efficiently maximizes hospital resource usage by raising bed turnover rates. It is crucial to recognize that these therapeutic advantages are accompanied by increased consumable costs associated with specific composite tackers and meshes. Therefore, if budgetary restrictions are reasonable, we conclude that LVHR should be established as the

preferred surgical choice for simple ventral hernias in patients fit for general anesthesia. For patients with certain contraindications or financial constraints, open repair is still an essential and dependable option, guaranteeing that all demographic groups receive quality surgical care.

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