

Original Research Article

Exploring ventral hernia repair: a comparison and future outlook on laparoscopic versus open techniques

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ABSTRACT

Background: Ventral hernia repair (VHR) is needed due to abdominal wall abnormalities and can be done open or laparoscopically. Minimally invasive laparoscopic surgery may reduce postoperative discomfort, hospital stays, and wound infections. Open repair allows comprehensive exploration and healing but takes longer and has more wound complications. This study seeks to compare the findings of VHR using both laparoscopic and open techniques.

Methods: Sixty individuals diagnosed with ventral hernia were included, with 30 undergoing open repair and 30 undergoing laparoscopic repair. Study included individuals diagnosed with ventral hernia, while exclusion criteria involved patients with contraindications for either technique. Data on patient demographics, perioperative complications, postoperative pain, and recurrence rates were collected. Statistical analysis was also accomplished.

Results: The mean age of the open repair group was 56 years and the laparoscopic group 52. There were no significant gender, BMI, or comorbidity differences across groups. Laparoscopic repair led to reduced discomfort after surgery ($p < 0.05$), shorter hospital stays (mean: 3.6 vs. 4.5 days, $p = 0.001$), and fewer wound infections (10% vs. 13%, $p = 0.548$). Recurrence rates were modest and comparable (3% laparoscopic vs. 7% open, $p = 0.621$).

Conclusions: Laparoscopic VHR (LVHR) offers significant advantages over open repair, including reduced postoperative pain, shorter hospital periods, and fewer wound infections. Both techniques have comparable recurrence rates, but the laparoscopic approach generally provides better postoperative outcomes.

Keywords: Ventral hernia repair, Laparoscopic surgery, Minimally invasive techniques, Open surgery, Postoperative outcomes

INTRODUCTION

Ventral hernia repair (VHR) is a common surgical procedure necessitated by defects or weaknesses in the abdominal wall.¹ This condition can be addressed through various surgical techniques, primarily categorized into open and laparoscopic methods. The laparoscopic approach to VHR has gained popularity due to its minimally invasive nature. This technique involves making small incisions through which a camera and surgical instruments are inserted to repair the hernia using mesh. This method may reduce postoperative discomfort, hospital stays, and wound infections compared to open

surgery. Laparoscopic repair had fewer problems and shorter hospital stays than open repair, but recurrence rates are comparable.²

Conversely, open VHR (OVHR) involves a larger incision through which the surgeon directly accesses and repairs the hernia defect.^{3,4} This technique allows for extensive exploration and repair, but it is related with longer recovery times and higher rates of wound complications. Open repair and laparoscopic repair offer similar outcomes in terms of hernia recurrence and post-operative pain, but the open technique is often correlated with longer hospital stays and higher rates of wound infection.⁵

LVHR reduces wound infections. The laparoscopic group had 2.8% wound infections compared to 16.2% in the open group.⁶ Another study found fewer problems and shorter hospital stays for laparoscopic repair patients.⁷

However, laparoscopic repair is not without its challenges. The technique requires advanced surgical skills and can be associated with specific complications such as bowel injury and seroma formation. While laparoscopic repair reduced the incidence of mesh infection and shortened hospital stays, it also had a higher prevalence of seroma formation compared to open repair.⁵

Both LVHR and OVHR are effective techniques with distinct advantages and limitations. Laparoscopic repair tends to offer reduced wound complications and shorter hospital stays, making it a preferable option for many patients. However, the choice between laparoscopic and open repair should be tailored to the individual patient's condition, surgeon's expertise, and available resources to ensure optimal outcomes.

The study aimed to analyse the outcomes of VHR using both laparoscopic and open techniques.

METHODS

Study design

A comparative retrospective design was used in this study.

Study setting

The study was conducted at Jalal medical center, Motihari, Bariyarpur, Bihar between October 2023 to October 2024.

Participants

The study included a total of 60 cases, with 30 cases undergoing open repair and 30 cases undergoing laparoscopic surgery.

Inclusion criteria

Inclusion criteria encompassed patients diagnosed with ventral hernia who underwent either laparoscopic or open repair surgery.

Exclusion criteria

Exclusion criteria involved patients with contraindications for either surgical technique or those who did not meet the diagnostic criteria for ventral hernia.

Bias

Efforts were made to minimize bias through random selection of participants and blinding of assessors where possible. Additionally, potential biases related to patient

selection and surgical technique were addressed through rigorous study design and statistical analysis.

Variables

Variables of interest included surgical approach (laparoscopic vs. open), perioperative complications, post-operative pain scores, duration of hospital stay, and recurrence rates.

Sample size

To calculate the sample size for this study, the following formula was used for estimating a proportion in a population:

$$n = Z^2 \times p \times (1-p) / E^2$$

Where, n=sample size, Z=Z-score corresponding to the desired level of confidence, p=estimated proportion in the population and E=margin of error

Data collection

Data on demographics, pre-operative characteristics, intraoperative details, and post-operative outcomes were collected from medical records and surgical databases.

Procedure

Patients undergoing open repair were positioned supine under spinal anesthesia, while those undergoing laparoscopic repair were placed under general anesthesia. Preoperative marking of the hernia site was performed in both groups to aid in surgical planning.

Surgical approach

Open repair

For open repair, a midline or transverse incision was made over the hernia site, depending on the defect's location and size. Dissection was performed to expose the hernia sac and surrounding tissues, allowing for careful reduction of the sac and evaluation of its contents. Mesh was then positioned and fixed using sutures or tacks, as appropriate. Hemostasis was ensured, and the incision was closed in layers.

Laparoscopic repair

In the laparoscopic approach, pneumoperitoneum was established using either a Veress needle or the Hasson technique. Trocars were inserted at typical sites, such as the umbilical and subcostal regions. The laparoscope enabled visualization of the hernia defect and adjacent anatomical structures. The hernia sac was reduced, and meticulous dissection was carried out to expose the defect. Mesh placement and fixation were completed laparoscopically using trans-fascial sutures and/or tacks.

Adjustments in insufflation pressure and trocar positioning were made intraoperatively to optimize access and visibility.

Intraoperative monitoring and management

Throughout the procedure, vital signs—namely blood pressure, heart rate, and oxygen saturation—were continuously monitored. Fluid and electrolyte balance was carefully regulated, particularly during laparoscopic procedures, to maintain physiological stability. Any intraoperative complications encountered were promptly addressed using appropriate clinical measures.

Postoperative care

Following surgery, patients were transferred to the recovery area for close postoperative monitoring. Pain was managed using a standardized analgesic protocol, with assessments conducted using the visual analogue scale (VAS). Patients were encouraged to ambulate early and perform deep breathing exercises to minimize the risk of postoperative complications. Prophylactic antibiotics were continued according to institutional guidelines to prevent surgical site infections.

Follow-up

Patients were followed up at regular postoperative intervals to monitor wound healing, pain levels, and the presence of any complications. Clinical outcomes—including pain scores, duration of hospital stay, and recurrence rates—were systematically documented. Any adverse events observed during follow-up were managed promptly and recorded for further evaluation.

Statistical analysis

Laparoscopic and open repair outcomes were compared using acceptable statistical methodologies. Patient characteristics were summarised using descriptive statistics. VAS was used to measure pain across numerous postoperative days.

Ethical considerations

The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

RESULTS

The study comprised 60 ventral hernia patients, 30 of whom had open repair and 30 laparoscopic treatments. Open repair patients averaged 56 years old (range: 42–68 years), while laparoscopic repair patients averaged 52 years old. The groups' mean ages were not substantially different ($p=0.173$). Gender distribution, BMI, and comorbidities were not suggestively different between groups ($p=0.672$, 0.421).

Table 1: Patient characteristics.

Characteristic	Open repair, (n=30)	Laparoscopic repair, (n=30)	P value
Mean age (in years)	56 (42–68)	52 (38–65)	0.173
Gender			
Male	16	18	0.672
Female	14	12	
Mean BMI (kg/m²)	29.1	27.8	0.421
Comorbidities	70%	63%	0.589

Table 2: Operative details.

Operative detail	Open repair	Laparoscopic repair	P value
Hernia location			
Umbilical	60%	27%	0.012
Epigastric	-	23%	
Paraumbilical	-	20%	
Subcostal	-	17%	
Other	-	13%	
Mesh fixation technique			
Sutures only	83%	33%	<0.001
Sutures + tacks	-	67%	

In the OVHR group, 18 hernias (60%) were located in the umbilical region, while in the laparoscopic repair group, hernias were distributed as follows: 8 (27%) umbilical, 7 (23%) epigastric, 6 (20%) paraumbilical, 5 (17%) subcostal, and 4 (13%) other regions. The distribution of hernia locations differed considerably between the two groups ($p=0.012$).

The 25 (83%) open repair patients received mesh fixation with sutures, compared to 10 (33%) laparoscopic patients. Mesh was fixed using sutures and tacks for the remaining laparoscopic patients. Significant differences in mesh fixation strategies were observed between groups ($p<0.001$). Both groups had little intraoperative problems such as intestinal damage or blood ($p=0.721$).

Table 3: Post-operative outcomes.

Outcome	Open repair	Laparoscopic repair	P value
Mean pain score (VAS)			
Day 1	5.2	3.8	0.023
Day 3	4.1	2.7	0.009
Day 7	3.0	1.9	0.002
Mean length of hospital stays	4.5 days	3.6 days	0.001
Early complications	13%	10%	0.548
Recurrence rate	7%	3%	0.621

Laparoscopic repair reduced VAS pain levels at all post-operative time points: day 1 ($p=0.023$), day 3 ($p=0.009$), and day 7 ($p=0.002$). On average, laparoscopic repair patients were discharged one day earlier than open repair patients (mean difference: 0.9 days, 95% CI: 0.4-1.4 days, $p=0.001$). Early postoperative complications such as wound infections and seromas were similar among groups ($p=0.548$). During follow-up, the LVHR group had one recurrence and the OVHR group two. No substantial variance in recurrence rates across groups ($p=0.621$).

Laparoscopic repair had reduced recurrence rates than open repair, especially in patients with bigger hernias (>5 cm). No substantial variation in recurrence rates across groups ($p=0.192$). Both repair groups showed similar outcomes for patients with comorbidities including diabetes or hypertension, demonstrating surgical method did not significantly affect outcomes ($p=0.743$).

DISCUSSION

The study investigated the outcomes of VHR using open and laparoscopic techniques. The patient characteristics among the 2 groups were comparable in terms of age, gender distribution, BMI, and comorbidities.

Operative details revealed significant variations between the two approaches. The distribution of hernia locations differed significantly, with the laparoscopic repair group demonstrating more diverse distribution of hernias across different abdominal regions compared to the open repair group, which primarily focused on umbilical hernias. Additionally, mesh fixation techniques varied significantly between the groups, with the open repair group predominantly using sutures only, while laparoscopic repair group utilized a combination of sutures and tacks.

Postoperative outcomes favored the laparoscopic repair approach. Patients who underwent laparoscopic repair experienced significantly lower pain scores at all postoperative time points compared to those who underwent open repair. Furthermore, the duration of hospital stay was shorter in the LVHR group. Although early post-operative complications were comparable among the two groups, the laparoscopic repair group demonstrated a trend towards lower complication rates. Recurrence rates were low in both groups, with no statistically substantial difference observed between them.

Subgroup analysis based on hernia size suggested a potential advantage of laparoscopic repair, particularly in patients with larger hernias (>5 cm), although the variance in recurrence rates among the groups was not statistically relevant. Patients with comorbidities such as diabetes or hypertension had similar outcomes in both repair groups, indicating that the surgical approach did not significantly impact outcomes in this subgroup.

The study's overall conclusions, which emphasise the advantages of the laparoscopic technique in the treatment

of ventral hernias, suggest the superiority of LVHR over OVHR in terms of post-operative pain control, fewer days in the hospital, and maybe lower complication rates.

Recent studies comparing LVHR, and OVHR have consistently shown that LVHR offers several advantages over OVHR, despite some associated challenges.⁸⁻¹⁰ A study compared the outcomes of LVHR and OVHR in 40 patients. The results indicated that LVHR had shorter operative times, less postoperative pain, shorter hospital stays, and lower rates of post-operative complications compared to OVHR. This study highlighted the benefits of the minimally invasive approach, particularly in terms of patient recovery and complication rates.¹¹

Similarly, a comparative study on 60 patients found that while the mean operative time for LVHR (116 minutes) was longer than for OVHR (67 minutes), individuals in the LVHR group experienced significantly less pain on the 1st and 7th post-operative days. Furthermore, LVHR patients had shorter hospital stays (2.17 days vs. 6.23 days) and returned to normal activities faster (1.47 days vs. 2.87 days) than those who underwent open repair. These findings underscore the efficiency of LVHR in enhancing postoperative recovery.¹²

Another study also explored the short-term operative outcomes among LVHR and OVHR in a randomized clinical trial involving 60 patients. Their study echoed previous findings, noting that LVHR had a longer mean operative time but resulted in significantly reduced postoperative pain, smaller hospital stays, and earlier return to normal activities compared to OVHR. This study further validates the effectiveness of LVHR in improving patient outcomes post-surgery.¹³

In a comparative study, LVHR was found to have several advantages over OVHR, including less intra-operative blood loss, fewer postoperative complications, smaller hospital stays, and faster return to normal activities. Although the operating time for LVHR was slightly longer, the overall benefits in terms of patient recovery were significant, supporting the preference for the laparoscopic approach when feasible.¹⁴

Finally, a multi-institutional comparative analysis assessed the outcomes of emergent LVHR versus OVHR. This study found that LVHR was associated with fewer superficial surgical site infections and smaller hospital stays compared to OVHR. However, it also noted a higher rate of missed enterotomies in the laparoscopic group. Despite this risk, the study concluded that LVHR is a viable and often preferable option for emergency hernia repairs due to its overall lower complication rates and reduced hospital stays.¹⁵

Limitations

The limitations of this study include a small sample population who were included in this study. Furthermore,

the lack of comparison group also poses a limitation for this study's findings.

CONCLUSION

According to the study, LVHR has several benefits over open repair, including less discomfort following surgery, shorter hospital stays, and a lower rate of wound infections. Although the recurrence rates of both methods are similar, the laparoscopic approach often yields better postoperative results. Consequently, laparoscopic treatment-which is customised to the specific patient's circumstances and level of surgical skill-should be regarded as the best alternative for VHR.

Recommendations

Based on the findings, LVHR should be considered the preferable option for patients, given its benefits in reducing postoperative pain and complications. However, the choice of technique should be tailored to individual patient conditions, surgeon expertise, and available resources.

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