RESEARCH PAPER

Surgical Outcomes of Laparoscopic Mesh, Open Retrorectus Mesh, and Primary Tissue Repair for Ventral and Incisional Abdominal Wall Hernias: A Cross-Sectional Analytical Study

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ABSTRACT

Background: Ventral and incisional hernias vary substantially in location, defect size, patient risk profile, and reconstructive requirements. This study describes size-dependent selection and short-term outcomes of laparoscopic mesh repair, open retrorectus mesh repair, and primary tissue repair in a teaching-hospital cohort.

Methods: This cross-sectional analytical study included 31 patients treated at Subharti Medical College, Meerut, from June 2024 to January 2026. Defects were categorized as small (<2 cm), medium (2–4 cm), or large (>4 to <10 cm). Outcomes included technique distribution, postoperative seroma, mesh infection, haematoma, pain-management requirements, cosmesis, and recurrence during the available follow-up. The association between defect size and repair technique was evaluated using a Fisher–Freeman–Halton exact test.

Results: The mean age was 46.24 ± 10.8 years; 11 patients (35.5%) were male and 20 (64.5%) were female. Seven defects (22.6%) were small, 12 (38.7%) medium, and 12 (38.7%) large. Open retrorectus mesh repair was performed in 22 patients (71.0%), primary tissue repair in 5 (16.1%), and laparoscopic mesh repair in 4 (12.9%). Technique selection differed by defect size (Monte Carlo Fisher–Freeman–Halton $p<0.001$): open retrorectus repair accounted for 10/12 medium and 11/12 large defects; primary tissue repair accounted for 4/7 small defects; and laparoscopic mesh repair was used only for small or medium defects. Four patients (12.9%) had a reported complication: seroma in 2 (6.5%), mesh infection in 1 (3.2%), and haematoma in 1 (3.2%). No recurrence was reported during the documented follow-up.

Conclusion: In this small, non-randomized series, repair selection was strongly related to defect size and clinical complexity. Open retrorectus mesh repair was most frequently used for medium and large defects, whereas primary tissue and laparoscopic approaches were reserved for selected patients. The data support individualized anatomical planning but do not establish comparative superiority among techniques.

Keywords: abdominal wall hernia; ventral hernia; incisional hernia; retrorectus mesh; laparoscopic repair; tissue repair; seroma

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INTRODUCTION

Ventral and incisional hernias are heterogeneous abdominal wall disorders. Their management depends on defect dimensions and location, previous surgery, contamination, tissue quality, obesity, smoking, comorbidity, cost, available expertise, and the patient's functional and cosmetic priorities. Consequently, no single repair is appropriate for every patient. Contemporary reconstruction has shifted from routine suture closure toward anatomically planned mesh reinforcement, with increasing emphasis on mesh position and restoration of the abdominal wall rather than on access route alone [1–5].

Laparoscopic intraperitoneal onlay mesh repair offers smaller skin incisions and may reduce wound morbidity in selected patients, but requires an intraperitoneal prosthesis and fixation and may be limited by adhesions, defect complexity, cost, or the need for skin and scar revision [1,3,6].

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Extraperitoneal minimally invasive approaches, including ventral TAPP and eTEP, seek to combine minimally invasive access with anatomical mesh placement [5–7]. Open retrorectus repair places mesh in a well-vascularized retromuscular plane, separates polypropylene mesh from the viscera, and permits wide reinforcement and concomitant scar revision or abdominoplasty where clinically indicated [2,7,12].

Primary tissue repair avoids prosthetic material but has a restricted role because recurrence is generally higher than after mesh reinforcement, even for some small primary midline hernias [13]. Patient optimization also matters: smoking, obesity, emergency presentation, and increasing defect size are associated with adverse outcomes or recurrence [8–10]. Repair strategy should therefore be interpreted as a clinical selection decision rather than an isolated technical preference.

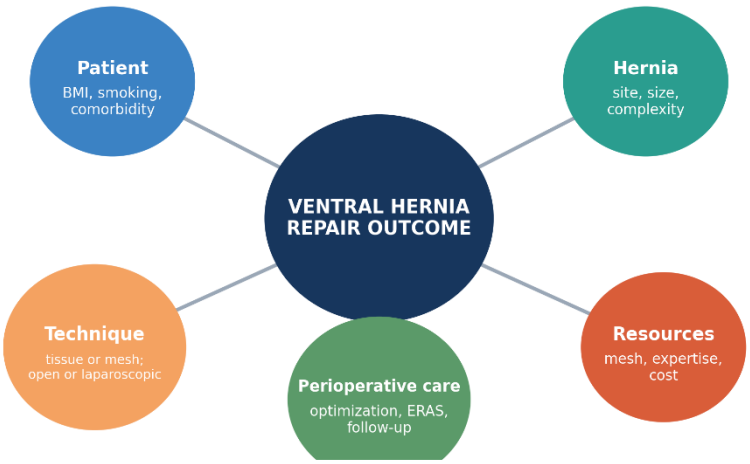

Figure 1. Multiple domains influencing outcome after ventral and incisional hernia repair.

AIM AND OBJECTIVES

The primary objective was to describe the distribution and short-term postoperative outcomes of laparoscopic mesh repair, open retrorectus mesh repair, and primary tissue repair across different ventral and incisional hernia defect sizes. Secondary objectives were to document postoperative complications, recurrence during available follow-up, and the relationship between defect size and selected repair technique.

MATERIALS AND METHODS

Study design and setting

A cross-sectional analytical study was conducted in the Department of Surgery, Subharti Medical College, Meerut, India, between June 2024 and January 2026. Thirty-one patients with ventral or incisional abdominal wall hernia underwent operative repair after clinical assessment and correction of modifiable laboratory abnormalities. Preoperative ultrasonography and/or contrast-enhanced computed tomography was used to define defect size, location, contents, and the anticipated need for abdominal wall reconstruction.

Classification and operative selection

Defects were categorized by maximum documented width as small (<2 cm), medium (2–4 cm), or large (>4 to <10 cm). Repairs were classified into three mutually exclusive groups: laparoscopic mesh repair, open retrorectus mesh hernioplasty, and primary tissue repair. Selection was individualized according to anatomy, adhesions, contamination or enterotomy, need for scar revision or abdominoplasty, patient factors, resources, and surgeon judgement. Primary tissue repair was used mainly for small defects and in one selected large complicated case in which mesh was avoided after intraoperative enterotomy.

Outcome assessment

Recorded outcomes included seroma, haematoma, mesh infection, pain-management requirements, postoperative cosmesis, and recurrence during the documented follow-up. Enhanced Recovery After Surgery principles were applied where feasible. The source dataset did not provide technique-specific complication counts, validated pain or cosmesis scores, or a uniform follow-up duration; these outcomes are therefore reported descriptively and without between-group effect estimates.

Statistical analysis

Categorical variables are reported as number and percentage, and age as mean ± standard deviation. Because several expected cell counts were <5, the association between the 3-level defect-size variable

and the 3-level repair-technique variable was evaluated using a Fisher–Freeman–Halton exact test with a fixed-margin Monte Carlo estimate (500,000 tables; seed 20260902). The estimated two-sided p value was 0.00038 (reported as $p<0.001$). This test demonstrates association, not superiority or causation.

RESULTS

Patient and hernia characteristics

The mean patient age was 46.24 ± 10.8 years. There were 11 males (35.5%) and 20 females (64.5%). Seven patients (22.6%) had small defects, 12 (38.7%) medium defects, and 12 (38.7%) large defects (Figure 2).

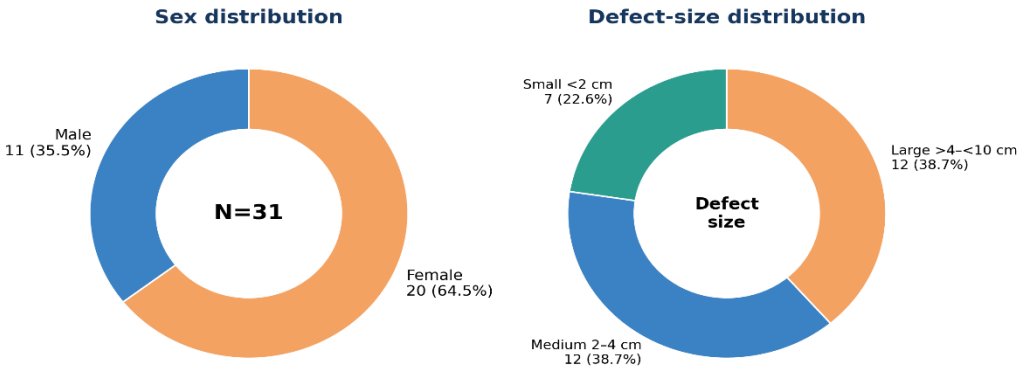

Figure 2. Sex and defect-size distributions. Percentages are calculated using N=31.

Table 1. Distribution of hernia type/location according to defect size.

Hernia type/location	Small <2 cm	Medium 2–4 cm	Large >4–<10 cm	Total
Umbilical	4	4	2	10
Epigastric/supraumbilical	2	4	0	6
Infraumbilical	1	3	2	6
Diastasis recti-associated	0	0	2	2
Lateral stoma-site	0	0	6	6
Spigelian	0	1	0	1
Total	7 (22.6%)	12 (38.7%)	12 (38.7%)	31 (100%)

Repair-technique distribution

Open retrorectus mesh hernioplasty was the predominant approach, used in 22 patients (71.0%). Primary tissue repair was performed in 5 (16.1%), and laparoscopic mesh repair in 4 (12.9%) (Figure 3).

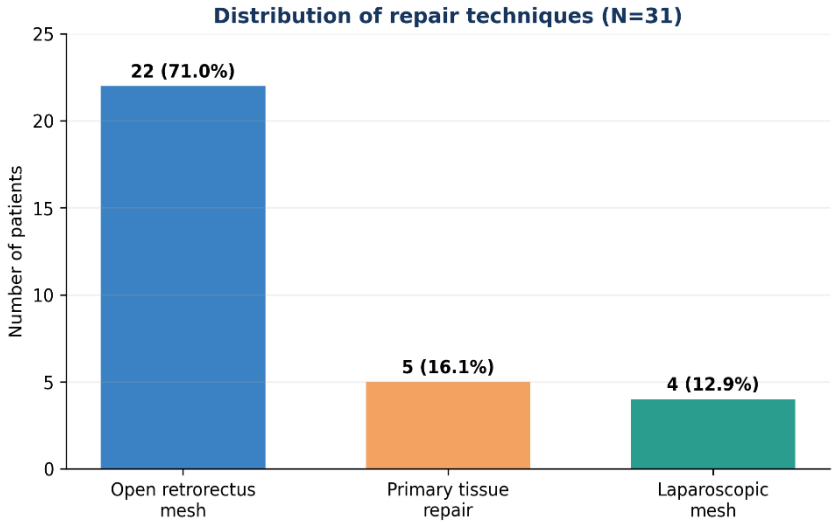

Figure 3. Overall distribution of operative techniques.

Table 2. Repair technique according to defect size.

Repair technique	Small <2 cm	Medium 2–4 cm	Large >4–<10 cm	Total

Repair technique	Small <2 cm	Medium 2–4 cm	Large >4–<10 cm	Total
Laparoscopic mesh	2	2	0	4 (12.9%)
Open retrorectus mesh	1	10	11	22 (71.0%)
Primary tissue repair	4	0	1	5 (16.1%)
Total	7	12	12	31 (100%)

Technique selection differed substantially by defect size (Fisher–Freeman–Halton Monte Carlo p<0.001). Open retrorectus repair was used in 83.3% of medium defects and 91.7% of large defects. Primary tissue repair was used in 57.1% of small defects and in one large complicated defect. Laparoscopic mesh repair was confined to small and medium defects (Figure 4).

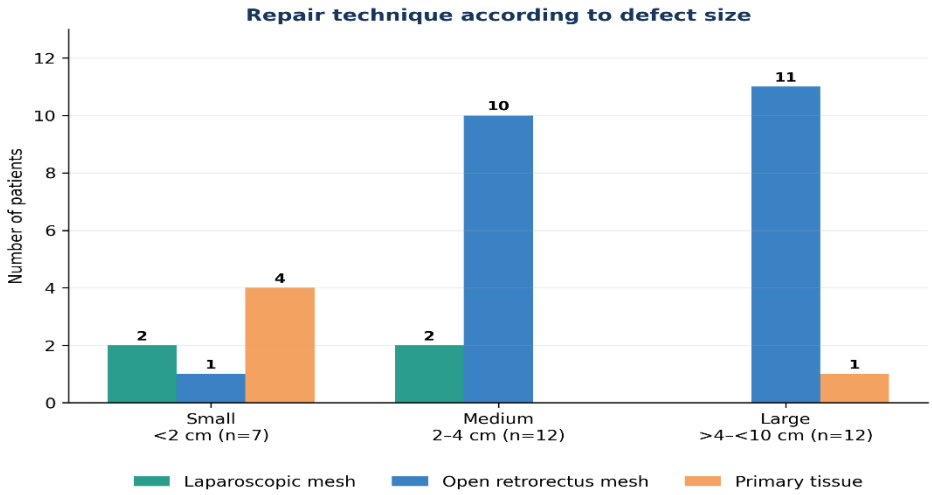

Figure 4. Repair technique stratified by defect size. The p value describes association between size and selected technique.

Postoperative outcomes

Four patients (12.9%) had a reported postoperative complication. Seroma occurred in 2 patients (6.5%), mesh infection in 1 (3.2%), and haematoma in 1 (3.2%). No recurrence was recorded during the available follow-up. Because complication counts were not cross-tabulated by technique and follow-up duration was not standardized in the source data, comparative complication or recurrence rates cannot be estimated.

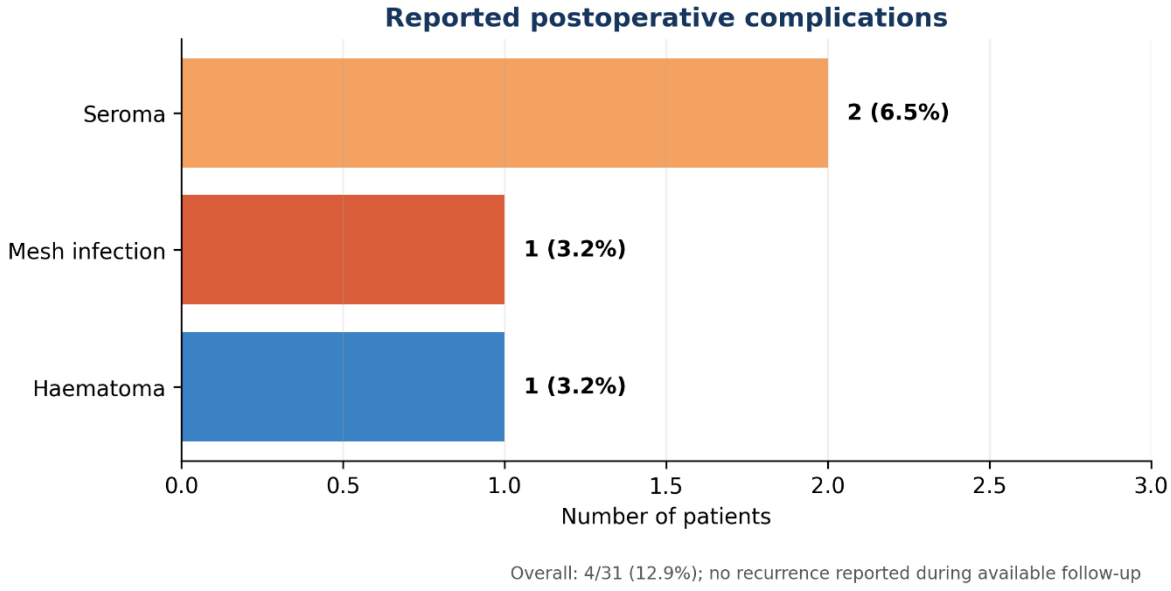

Figure 5. Reported postoperative complications in the complete cohort.

Operative techniques

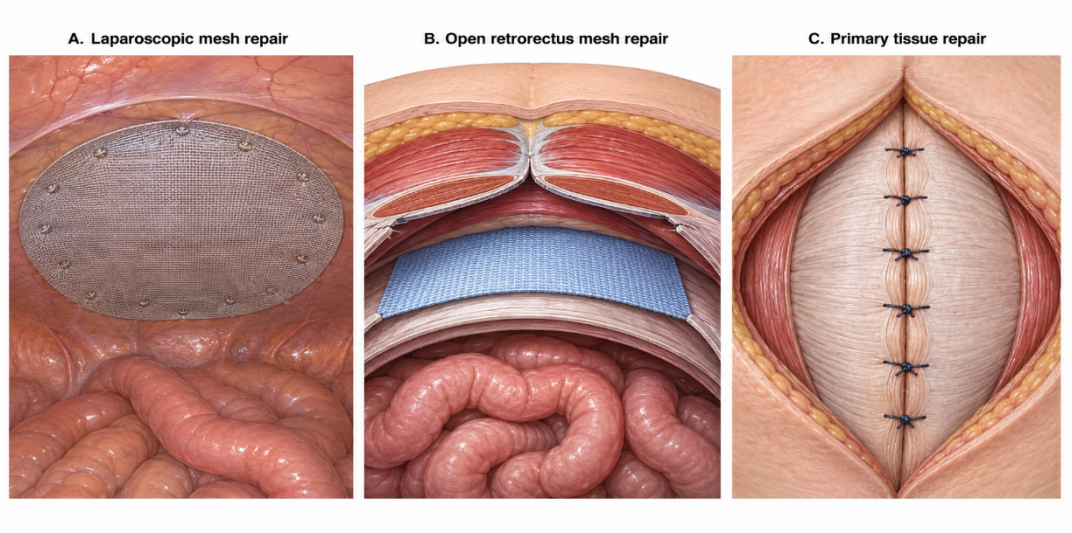

Figure 6. AI-generated schematic comparison of laparoscopic intraperitoneal mesh repair, open retrorectus mesh repair, and primary tissue repair. The image is illustrative and is not an operative photograph.

In laparoscopic mesh repair, an intact composite mesh covers the defect with adequate overlap and is secured under direct visualization. In open retrorectus repair, the mesh is placed posterior to the rectus muscles and anterior to the reconstructed posterior layer, thereby avoiding direct contact between polypropylene mesh and the viscera. In primary tissue repair, selected small defects are closed by approximation of fascial edges without prosthetic reinforcement.

DISCUSSION

This cohort demonstrates a strong size-dependent pattern of operative selection. Open retrorectus mesh repair accounted for more than two-thirds of all procedures and nearly all medium and large defects. Primary tissue repair was concentrated among small defects, while laparoscopic mesh repair was used selectively for small and medium defects. The exact test confirms association between size and technique; however, this reflects clinical selection and must not be interpreted as evidence that one operation is superior.

The predominance of retrorectus repair in medium and large defects is anatomically plausible. The retromuscular plane permits wide mesh coverage in vascularized tissue and separates a macroporous polypropylene prosthesis from the viscera. It also accommodates open reconstruction, scar revision, and removal of redundant skin in selected patients. Contemporary guidelines and observational literature support retromuscular or other extraperitoneal placement for many midline incisional hernias, while the optimal approach remains dependent on patient, hernia, and surgeon factors [2,7,12,16].

Laparoscopic mesh repair was performed in only four patients and not used for a large defect. Potential advantages include smaller skin incisions and avoidance of extensive subcutaneous dissection, but intraperitoneal mesh, fixation-related pain, adhesiolysis, prosthesis cost, and inability to address redundant skin may influence selection [1,3,6,14]. The present study cannot compare cosmetic or pain outcomes because validated scales and technique-specific results were not recorded.

Four of seven small defects were managed by primary tissue repair. Although tissue approximation may be reasonable for carefully selected very small or contaminated defects, mesh reinforcement reduces recurrence in many primary umbilical and epigastric hernias [13]. Accordingly, the present short-term finding of no recorded recurrence should not be used to claim equivalence, particularly without a uniform long-term follow-up schedule.

The overall recorded complication rate was 12.9%, driven by two seromas, one mesh infection, and one haematoma. These events are clinically relevant, but the absence of procedure-specific denominators prevents a valid comparative analysis. Risk modification remains important: smoking and obesity are established contributors to wound complications or recurrence, and increasing defect size is associated with greater procedural complexity [8–11].

LIMITATIONS

The study is limited by its small single-centre sample, non-randomized technique selection, heterogeneity of hernia types, incomplete specification of inclusion and exclusion criteria, absence of standardized pain and cosmetic scores, lack of technique-specific complication data, and unspecified uniform follow-up duration. There was no multivariable adjustment for confounding, and no patient-reported quality-of-life or cost analysis was available. The zero-recurrence observation is therefore descriptive and should not be interpreted as a long-term recurrence estimate.

CONCLUSION

In this 31-patient observational cohort, operative selection was closely related to defect size and clinical complexity. Open retrorectus mesh repair was most commonly selected for medium and large ventral or incisional hernias, whereas primary tissue repair and laparoscopic mesh repair were used in selected small or medium defects. The study supports individualized anatomical planning and risk optimization but does not establish the comparative superiority of any technique. Larger prospective studies with standardized follow-up, validated pain and cosmesis measures, and technique-specific outcomes are required.

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No conflict of interest

No ethical concerns

No financial involvement