

DETERMINANTS OF MORTALITY AND DISEASE SEVERITY IN EMERGENCY VENTRAL HERNIA REPAIR: A PROSPECTIVE STUDY FROM A TERTIARY CARE CENTRE

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DOI: <https://doi.org/10.63001/tbs.2026.v21.i02.pp502-510>

Abstract

Received on:
25-03-2026

Accepted on:
14-04-2026

Published on:
24-04-2026

Background:

Emergency ventral hernia repair carries significantly higher morbidity and mortality than elective surgery, largely due to delayed presentation and bowel compromise. However, prospective data identifying determinants of mortality and operative decision-making in such settings remain limited.

Materials and Methods:

This prospective observational study included 50 patients undergoing emergency surgery for complicated ventral hernia (2024–2026). Clinical, intraoperative, and postoperative variables were analysed. Logistic regression identified independent predictors of mortality.

Results:

Most patients were aged 51–70 years (62%). Strangulation occurred in 38%, and bowel resection was required in 34%. Postoperative complications occurred in 58%, with overall mortality of 22%. All deaths occurred in patients with strangulation requiring bowel resection and postoperative sepsis. Mortality among resection cases was 64.7%. Strangulation (OR 6.8, $p = 0.002$), bowel resection (OR 9.4, $p < 0.001$), and age >60 years (OR 2.6, $p = 0.04$) were independent predictors of mortality. Type of repair was not associated with complications ($p = 0.66$).

Conclusion:

Mortality in emergency ventral hernia is primarily driven by disease severity at presentation rather than operative technique. The progression from delayed presentation to strangulation and bowel resection represents a critical pathway leading to adverse outcomes. Early elective repair and timely intervention are essential to reduce mortality.

INTRODUCTION (Reviewer-targeted framing added)

Ventral hernia is a common surgical condition that may present electively or as an emergency when complications such as obstruction, strangulation, or perforation occur. Emergency repair is associated with significantly higher morbidity and mortality compared to elective surgery.¹

The increased risk in emergency cases is largely attributed to delayed presentation, bowel compromise, contamination, and limited preoperative optimization.² Patients often present with advanced disease, systemic sepsis, and reduced physiological reserve, particularly in resource-constrained settings.^{3,4}

Strangulation represents a critical turning point in disease severity, leading to bowel ischemia and necrosis, often necessitating resection and significantly increasing mortality.^{5–8}

The choice of repair technique remains controversial in emergency settings. While anatomical repair has traditionally been preferred in contaminated cases, recent evidence supports the selective use of synthetic mesh without increased infection risk.^{9–13}

Although previous studies have described emergency ventral hernia outcomes, most are retrospective and descriptive. There remains limited prospective evidence evaluating determinants of mortality, disease severity pathways, and operative decision-making in tertiary care settings.

Furthermore, the relationship between delayed presentation, strangulation, bowel resection, and mortality has not been sufficiently characterized as a unified clinical pathway.

This study aims to:

- Identify predictors of mortality
- Evaluate operative outcomes
- Analyse the disease progression pathway leading to adverse outcomes

RESULTS

A total of 50 patients underwent emergency surgery for ventral hernia during the study period.

Patient characteristics and presentation

Most patients were aged 51–70 years (62%), with a mean age of 56.8 ± 10.4 years. There was a slight male predominance (52%). Incisional hernia was the most common type (52%).

Intestinal obstruction was the most frequent mode of presentation (48%), followed by strangulation (30%) and irreducibility (22%) (Table 1).

Intraoperative findings and disease severity

Bowel obstruction was present in 68% of patients, and strangulation in 38%. Bowel resection was required in 34% of cases (Table 2).

A strong association was observed between strangulation and bowel resection ($p < 0.001$), with resection performed almost exclusively in strangulated hernias (Table 4, Figure 1).

This demonstrates a clear escalation in disease severity from strangulation to bowel compromise requiring resection.

Surgical management

Mesh repair was performed in 62% of patients, while anatomical repair was performed in 38%, primarily in contaminated cases (Table 2).

There was no statistically significant association between type of repair and postoperative complications ($p = 0.66$) (Table 6), indicating that selective use of mesh did not increase complication risk.

Postoperative outcomes

Postoperative complications occurred in 58% of patients. Surgical site infection was the most common complication (32%), followed by sepsis (24%) and seroma (12%) (Table 3).

Mean hospital stay was 11.6 ± 4.8 days and was significantly longer in patients undergoing bowel resection (17.2 ± 2.8 vs 8.6 ± 2.1 days, $p < 0.001$) (Table 7), reflecting increased disease severity.

Mortality and its determinants

Overall mortality was 22% ($n = 11$). All deaths occurred in patients with strangulation who underwent bowel resection and developed postoperative sepsis.

Mortality was confined to patients with advanced disease (Table 8, Figure 3).

Mortality increased markedly:

- From 0% in non-strangulated cases
- To 57.9% in strangulated cases
- To 64.7% in patients requiring bowel resection

Patients aged >60 years had higher mortality compared to younger patients (38.1% vs 10.3%).

Logistic regression analysis identified strangulation (OR 6.8, $p = 0.002$), bowel resection (OR 9.4, $p < 0.001$), and age >60 years (OR 2.6, $p = 0.04$) as independent predictors of mortality, while type of repair was not associated with mortality (Table 5, Figure 2).

Mortality demonstrated a clear severity-dependent escalation, with bowel resection representing the strongest determinant.

DISCUSSION

Emergency ventral hernia repair remains a high-risk surgical condition associated with significantly increased morbidity and mortality compared to elective repair.^{1,2} This prospective study provides clinically relevant insights into determinants of adverse outcomes, demonstrating that strangulation, bowel resection, and advanced age are independent predictors of mortality.

Importantly, the present study demonstrates that mortality is not uniformly distributed but is concentrated in a clearly identifiable high-risk subgroup characterized by strangulation and bowel resection. This supports a severity-dependent disease pathway linking delayed presentation to adverse outcomes.

A key finding of this study is the identification of a progressive disease severity pathway, in which delayed presentation leads to strangulation, subsequently necessitating bowel resection, and culminating in increased postoperative sepsis and mortality. This sequence is consistent with established pathophysiological mechanisms, where prolonged incarceration results in vascular compromise, bowel ischemia, and eventual necrosis.⁵⁻⁸

The strong association observed between strangulation and bowel resection in this study reinforces the critical role of early surgical intervention. Similar findings have been reported by Bessa SS et al. and Nieuwenhuizen J et al., who demonstrated that delayed presentation significantly increases the likelihood of bowel ischemia and resection.^{6,7} In addition, Kaoutzanis C et al. reported that bowel resection is associated with increased postoperative complications, prolonged hospital stay, and higher mortality, which aligns with the findings of the present study.⁸

The mortality rate observed in this study (22%) and particularly among patients undergoing bowel resection (64.7%) reflects the severity of disease at presentation rather than operative factors alone. Patients requiring resection often presented with advanced disease, including bowel necrosis, contamination, and systemic sepsis. Previous studies have similarly demonstrated that mortality in emergency ventral hernia is strongly associated with bowel compromise and sepsis rather than the surgical procedure itself.^{2,9}

The stratified analysis further demonstrated a marked escalation in mortality from 0% in non-strangulated cases to 57.9% in strangulated cases and 64.7% in patients requiring bowel resection, highlighting bowel resection as a surrogate marker of advanced disease and systemic compromise.

These findings emphasize that mortality should be interpreted within the context of disease severity and delayed presentation, rather than as a reflection of surgical quality.

Advanced age was identified as an independent predictor of mortality, consistent with previous studies demonstrating that elderly patients have reduced physiological reserve and higher perioperative risk.^{3,19} The increased vulnerability of this population highlights the importance of early elective intervention and risk stratification in older patients.

Although this study did not include a direct comparison with elective ventral hernia repair, existing literature consistently demonstrates significantly lower morbidity and mortality in elective cases.^{2,19} The findings of this study therefore reinforce the importance of early elective repair to prevent progression to emergency presentation and its associated complications.

The role of laparoscopic repair in emergency ventral hernia remains limited. While minimally invasive approaches are increasingly used in elective settings, emergency cases are often unsuitable due to bowel distension, contamination, and hemodynamic instability.⁹ Open surgery therefore continues to be the standard approach in most emergency scenarios.

The choice of repair technique in emergency ventral hernia remains a subject of debate. In the present study, mesh repair was not associated with increased postoperative complications, supporting its selective use in appropriately chosen cases. This finding is consistent with studies by Carbonell AM et al. and Pandey H et al., which demonstrated that synthetic mesh can be safely used in contaminated or emergency settings without significantly increasing infection rates.^{11,12} Furthermore, Rosen MJ et al. showed that synthetic mesh

offers superior durability without increased infection compared to biologic mesh.¹³ These findings suggest that postoperative outcomes are influenced more by contamination and patient factors than by mesh use itself.¹⁴

The high rate of postoperative complications observed in this study, particularly surgical site infection and sepsis, reflects the complex interplay between contamination, bowel compromise, and patient-related factors. Similar patterns have been described in previous studies, where emergency hernia repair is associated with significantly higher complication rates compared to elective surgery.^{2,4}

From a systems perspective, the findings of this study highlight delayed presentation as a key upstream determinant of adverse outcomes. In developing healthcare settings, factors such as limited access to elective surgical care, delayed referral, and health-seeking behavior contribute to the increased burden of emergency presentations.^{3,4} These systemic factors play a crucial role in disease progression and must be addressed to reduce morbidity and mortality.

The identification of a clearly defined high-risk subgroup in this study further allows for clinical risk stratification, enabling targeted perioperative management and early sepsis control in patients with strangulation and bowel resection.

Overall, this study contributes to existing literature by providing prospective evidence that integrates clinical, operative, and outcome variables into a coherent disease severity model. The identification of strangulation and bowel resection as

critical determinants of mortality, along with the demonstration of safe mesh use, provides clinically actionable insights for improving surgical outcomes in emergency ventral hernia.

LIMITATIONS

The study is limited by small sample size and single-centre design. Severity of strangulation was not quantitatively graded. Long-term outcomes were not assessed. Larger multicentre studies are required.

CONCLUSION

Emergency ventral hernia repair is a high-risk condition in which mortality is primarily driven by delayed presentation and bowel compromise. Strangulation and bowel resection represent critical determinants of mortality and define a high-risk subgroup requiring aggressive management. Selective use of mesh is safe when appropriately indicated. Early elective repair and timely intervention are essential to prevent progression to severe disease and reduce mortality.

Acknowledgment

The authors would like to thank the Department of General Surgery, Sree Balaji Medical College and Hospital, for their support in conducting this study. We also express our sincere gratitude to all the patients who participated in this study.

Ethical Considerations

This study was conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Ethical approval was obtained from the Institutional Human Ethics Committee (IHEC) of Sree Balaji Medical College and Hospital, Chennai

(Ref No: 002/SBMCH/IHEC/2024/2234;
Date: 25 June 2024).

Conflict of Interest

The authors declare that they have no conflicts of interest.

Funding

The authors received no funding for this study.

Data availability statement

The datasets generated and/or analysed during the current study are available from the corresponding author on reasonable request, subject to institutional ethical guidelines.

Clinical Trial Registration

This study is an observational analytical study and not a clinical trial. Therefore, it was not registered in a clinical trial registry.

Author Contributions

All authors contributed to the study conception and design. Data collection, analysis, and manuscript preparation were performed collaboratively. All authors reviewed and approved the final manuscript.

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TABLES AND FIGURES

Table 1. Patient characteristics and presentation

Variable	Category	n (%)
Age (years)	31–40	6 (12%)
	41–50	8 (16%)
	51–60	15 (30%)
	61–70	16 (32%)
	>70	5 (10%)
Gender	Male	26 (52%)
	Female	24 (48%)
Type of hernia	Incisional	26 (52%)
	Umbilical	10 (20%)
	Paraumbilical	8 (16%)
	Epigastric	5 (10%)
	Spigelian	1 (2%)
Presentation	Obstruction	24 (48%)
	Strangulation	15 (30%)
	Irreducible	11 (22%)

Table 2. Intraoperative findings and management

Variable	n (%)
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Bowel obstruction	34 (68)
Strangulation	19 (38)
Bowel resection	17 (34)
Mesh repair	31 (62)
Anatomical repair	19 (38)

Table 3. Postoperative complications

Outcome	n (%)
Surgical site infection	16 (32)
Sepsis	12 (24)
Seroma	6 (12)
No complications	21 (42)

Table 4. Strangulation and bowel resection

Strangulation	Resection	No resection
Present	17	2
Absent	0	31

p < 0.001

Table 5. Predictors of mortality

Variable	Odds Ratio	p-value
Strangulation	6.8	0.002
Bowel resection	9.4	<0.001
Age >60 years	2.6	0.04
Type of repair	0.9	0.72

Table 6. Repair type and complications

Repair Type	Complications	No complications
Mesh repair	18	13
Anatomic al repair	11	8

p = 0.66

Table 7. Hospital stay

Group	Mean (days)
Bowel resection	17.2 ± 2.8
No resection	8.6 ± 2.1

p < 0.001

Table 8. Mortality stratified by determinants

Variable	Category	Total	Deaths	Mortality (%)
Overall	All	50	11	22
Strangulation	Present	19	11	57.9
	Absent	31	0	0
Bowel resection	Yes	17	11	64.7
	No	33	0	0
Age	>60 years	21	8	38.1
	≤60 years	29	3	10.3

Figure 1 Intraoperative findings

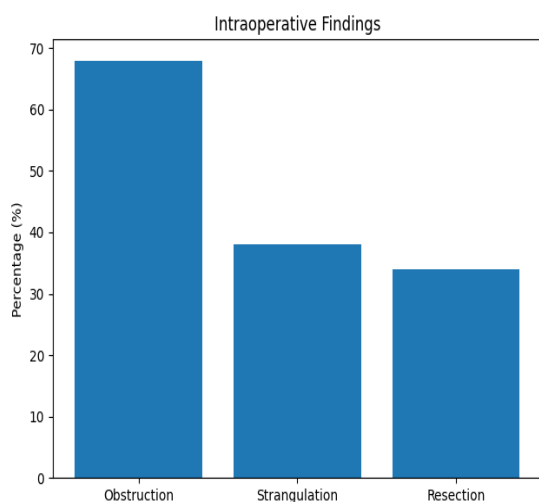


Figure 2 Predictors of mortality (Forest plot)

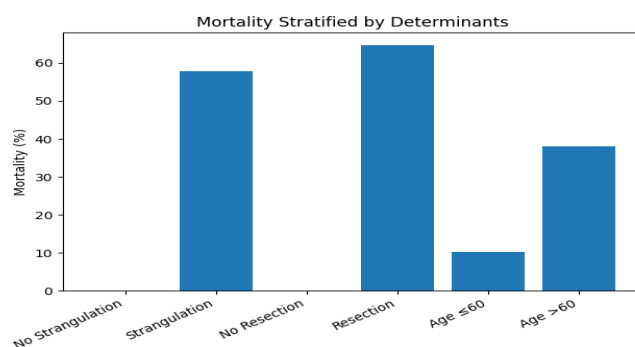
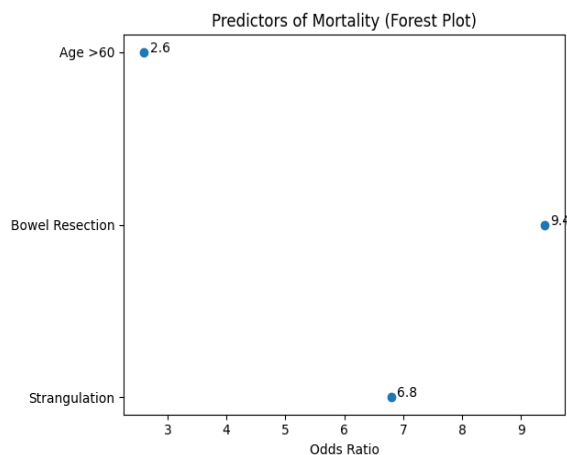


Figure 3 Mortality stratified by determinants