

Original Research Article

Early mesh-related complications following hernia repair: a prospective observational study from a tertiary care centre

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ABSTRACT

Background: Mesh-based hernia repair is the standard of care; however, early postoperative complications remain a concern.

Methods: A prospective observational study was conducted on 266 patients undergoing elective mesh hernia repair between January 2025 and January 2026. Patients were followed for 30 days. Data on demographics, comorbidities, surgical variables, and complications were collected and analyzed using SPSS v22. A p-value <0.05 was considered statistically significant.

Results: The overall incidence of early complications was 12%. The most common complications were seroma (4.1%), scrotal edema (3.4%), surgical site infection (2.6%), and hematoma (2.3%). Mesh infection occurred in 1.9% of cases. Patients with comorbidities had significantly higher complication rates (33.3% vs 9.6%, $p < 0.001$). Incisional and umbilical hernias showed higher complication rates compared to inguinal hernias ($p = 0.01$). Multivariate analysis identified comorbidity (OR=4.2) and prolonged hospital stay (OR=3.8) as independent predictors.

Conclusions: Early mesh-related complications are relatively infrequent and mostly manageable. Patient-related factors, particularly comorbidities, play a significant role in determining outcomes.

Keywords: Hernia repair, Mesh, Early complications, Seroma, Surgical site infection

INTRODUCTION

Hernia repair is among the most frequently performed surgical procedures worldwide, addressing defects in the abdominal wall through which intra-abdominal contents protrude.¹ Abdominal wall hernias, including inguinal, umbilical, incisional, and femoral types, contribute significantly to global surgical burden and are associated with considerable morbidity.² Over time, surgical management has evolved from primary suture repair previously associated with high recurrence rates to tension-free mesh repair, which has markedly improved outcomes and reduced recurrence.³ Despite these advances, the use of prosthetic mesh has introduced a distinct spectrum of complications, particularly in the

early postoperative period.⁴ Early mesh-related complications, typically defined as those occurring within 30 days of surgery, include seroma, hematoma, surgical site infection, mesh rejection, and, less commonly, mesh migration or erosion.⁵ These complications can significantly increase postoperative morbidity, prolong hospital stay, and, in some cases, necessitate reoperation or mesh removal.⁶

The occurrence of these complications is influenced by multiple patient-related and surgical factors. Comorbid conditions such as diabetes mellitus, obesity, smoking, and immunosuppression are known to impair wound healing and increase susceptibility to infection.⁷ Additionally, factors such as chronic cough and

occupations involving heavy physical activity may increase intra-abdominal pressure, thereby affecting surgical outcomes.⁸ From a surgical perspective, technique (open versus laparoscopic), type of mesh used, method of fixation, and plane of mesh placement all play critical roles in determining postoperative outcomes.

Mesh characteristics themselves further influence complication rates. Lightweight, large-pore polypropylene meshes are associated with improved tissue integration and lower infection risk compared to heavier variants.⁹ Although biologic and absorbable meshes are used in contaminated fields, their higher cost and variable outcomes limit widespread use. Moreover, while laparoscopic approaches offer advantages such as reduced postoperative pain and quicker recovery, they may carry a higher risk of certain visceral complications in specific settings.¹⁰

In tertiary care centers, the burden of hernia cases is often compounded by late presentations, complex hernias, and patients with multiple comorbidities.¹¹ These institutions serve as referral hubs, making them ideal settings to study real-world patterns of postoperative complications. In resource-constrained environments, early mesh-related complications contribute to increased healthcare utilization, readmissions, and patient morbidity, highlighting the need for systematic evaluation.¹¹ Although numerous studies have examined outcomes of mesh repair, there remains variability in reported complication patterns and associated risk factors, particularly in developing healthcare settings. Furthermore, there is a need for institution-specific data to guide clinical practice and optimize perioperative care.

Hernia repair is one of the most frequently performed surgical procedures worldwide. The use of prosthetic mesh has significantly reduced recurrence rates and is considered the gold standard for most abdominal wall hernias. Despite its advantages, mesh implantation is associated with early postoperative complications such as seroma, hematoma, surgical site infection, and mesh infection. These complications may increase morbidity, prolong hospital stay, and occasionally require reoperation or mesh removal. The incidence and severity of these complications are influenced by patient-related factors, surgical techniques, and perioperative management. This study evaluates early mesh-related complications in a tertiary care setting and identifies associated risk factors to improve clinical outcomes. Therefore, the present hospital-based observational study aims to evaluate the incidence and pattern of early mesh-related complications following hernia repair in a tertiary care center. It also seeks to identify associated risk factors related to patient characteristics, surgical techniques, and mesh properties. The findings of this study may contribute to improved surgical outcomes through better risk stratification, perioperative optimization, and evidence-based clinical decision-making.

Operational definitions

Seroma

Persistent subcutaneous or preperitoneal serosanguineous fluid collection >50 ml persisting postoperatively, confirmed clinically (fluctuant swelling, negative aspiration culture) or by ultrasound/CT imaging.

Hematoma

Symptomatic collection of clotted blood in surgical wound or scrotum, presenting as tense swelling with ecchymosis post-surgery, diagnosed clinically or by imaging; managed conservatively unless expanding.

Scrotal edema

Postoperative scrotal swelling due to lymphatic disruption/hematoma in inguinal hernia repair, graded mild (non-tender), moderate (tender, conservative management), severe (>POD5, support/antibiotics).

Surgical site infection (SSI)

Per CDC criteria: superficial (skin/subcutis purulence/positive culture), deep (incisional involving fascia, POD<30), organ/space (mesh involvement), confirmed by clinical signs (erythema, fever, discharge) plus microbiology.

Early recurrence

Clinical or imaging evidence of hernia defect reopening post-repair, with bulge/protrusion under Valsalva, excluding seroma/hematoma.

Mesh infection

Persistent deep/organ space SSI involving prosthetic mesh, evidenced by sinus tract to mesh, positive mesh culture, or CT pus collection requiring explantation.

Mesh explantation

Complete or partial surgical removal of infected/non-incorporated mesh under general anesthesia, often with debridement/VAC, due to proven/presumed contamination.

Carolina comfort scale

Validated 0-5 patient-reported scale (11 domains: pain, movement, mesh sensation); 0=none, 5=disabling; assessed POD1,14,30.

VAC therapy

Negative pressure wound therapy (125-175 mmHg continuous suction) via foam interface over debrided

infected wound/mesh site, promoting granulation/exudative control.

Wound dehiscence

Partial/full separation of fascial incision edges >1 cm, spontaneous or probe-to-bone, excluding superficial only.

METHODS

Study design and setting

The present study was a hospital-based, prospective, observational study aimed at evaluating the incidence and pattern of early mesh-related complications following hernia repair surgery. The study was conducted at the Department of General Surgery, GSVM Medical College, and its associated hospital, Lala Lajpat Rai Hospital (LLRH), Kanpur, Uttar Pradesh, India. GSVM Medical College is a major tertiary care teaching institution affiliated with Atal Bihari Vajpayee Medical University, Lucknow, and it serves as a referral centre for a large population drawn from Kanpur and the neighbouring districts of Uttar Pradesh. The hospital is well equipped with surgical wards, emergency services, diagnostic facilities, and specialized operating theatres, where a wide range of general surgical procedures, including hernia repairs, are routinely performed. The study was carried out over a one-year period, from January 2025 to January 2026, during which a total of 266 patients undergoing elective mesh hernia repair were enrolled.

Patients admitted to the Department of General Surgery who underwent elective mesh hernia repair during the study period were screened for eligibility according to predefined inclusion and exclusion criteria. Both open and laparoscopic surgical techniques commonly practised at the institution were included, and eligible patients were enrolled consecutively to minimize selection bias. Postoperative follow-up was conducted through inpatient monitoring, scheduled outpatient visits, and telephonic follow-up, when necessary, in order to identify early mesh-related complications within the defined 30-day postoperative period.

Eligibility criteria

Patients were eligible for inclusion if they were aged 18 years or older, were undergoing elective mesh hernia repair, and had complete 30-day follow-up data available. Patients who underwent non-mesh hernia repair, those presenting with recurrent hernias, and patients who were lost to follow-up were excluded from the analysis.

Data collection

Data were collected using a structured and validated proforma that captured demographic details, including age, sex, and body mass index, along with relevant

comorbidities such as diabetes mellitus and hypertension. Hernia characteristics, including type, size, and location, were recorded, as were surgical details such as operative approach, mesh type, plane of mesh placement, fixation method, use of a drain, operative time, and level of surgeon experience. Postoperative complications occurring within 30 days of surgery were also systematically documented.

Follow-up

All patients were followed for 30 days postoperatively through a combination of inpatient monitoring, scheduled outpatient visits, and telephonic follow-up, to ensure complete ascertainment of early postoperative outcomes and complications.

Statistical analysis

Data were analyzed using SPSS version 22 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean±standard deviation, while categorical variables were summarized as frequencies and percentages. The chi-square test was used to assess associations between categorical variables, and multivariate logistic regression analysis was performed to identify independent predictors of postoperative complications. A p-value of <0.05 was considered statistically significant.

RESULTS

Baseline characteristics

A total of 266 patients undergoing elective mesh hernia repair were included in the study. The mean age of the study population was 48.2±16.1 years, and the majority of patients were male (87.2%), consistent with the known epidemiological predominance of hernia disease in men. The mean body mass index (BMI) of the cohort was 24.1±3.2 kg/m² (Table 1).

Table 1: Baseline demographic characteristics of the study population (n=266).

Variables	Category	N	%
Age (years)	Mean±SD	48.2±16.1	—
	Male	232	87.2
Sex	Female	34	12.8
BMI	Mean±SD	24.1±3.2	—

Distribution of hernia type

Inguinal hernia was the most common type encountered, accounting for 78.9% of cases, followed by incisional hernia (12.8%) and umbilical hernia (4.5%). The remaining cases comprised infraumbilical (1.9%), paraumbilical (1.1%), epigastric (0.4%), and suprapubic (0.4%) hernias (Table 2).

Table 2: Distribution of hernia type among the study population.

Hernia type	N	%
Inguinal	210	78.9
Incisional	34	12.8
Umbilical	12	4.5
Infraumbilical	5	1.9
Paraumbilical	3	1.1
Epigastric	1	0.4
Suprapubic	1	0.4

Table 3: Surgical approach used for mesh hernia repair.

Surgery type	N	%	P value
Open mesh hernioplasty	219	82.3%	<0.001*
Laparoscopic repair (TAPP/IPOM/ETEP)	47	17.7%	

Table 4: Postoperative complications within 30 days.

Variables	Category	N	%
Overall complication	Present	32	12.0
	Absent	234	88.0
Hematoma	Yes	6	2.3
Seroma	Yes	11	4.1
SSI	Yes	7	2.6
Mesh infection	Yes	5	1.9
Scrotal edema	Yes	9	3.4
Wound dehiscence	Yes	3	1.1

Surgical approach

Open mesh hernioplasty was the predominant surgical approach, performed in 82.3% of patients, while laparoscopic repair including transabdominal preperitoneal (TAPP), intraperitoneal onlay mesh (IPOM), and enhanced-view totally extraperitoneal (ETEP) techniques were performed in the remaining 17.7% of patients (Table 3).

Postoperative complications

The overall postoperative complication rate within 30 days was 12.0%. Seroma was the most frequently observed complication (4.1%), followed by scrotal edema (3.4%), surgical site infection (2.6%), hematoma (2.3%), mesh infection (1.9%), and wound dehiscence (1.1%) (Table 4).

Risk factors for complications

Patients with comorbidities experienced a significantly higher complication rate than those without comorbidities (33.3% vs 9.6%, $p<0.001$) (Table 5). Hernia type was also significantly associated with complication risk: incisional (26.7%) and umbilical hernias (33.3%) were associated with higher complication rates compared with inguinal hernias (8.6%) ($p=0.01$).

Predictors of complications

On multivariate logistic regression analysis, the presence of comorbidity (odds ratio [OR]=4.2, $p<0.001$) and a hospital stay exceeding 3 days (OR=3.8, $p<0.001$) emerged as independent predictors of postoperative complications. Among the comorbidities recorded, type 2 diabetes mellitus was the most prevalent (6.8%), followed by hypertension (2.3%) and hypothyroidism (1.1%), with 10.2% of patients overall having at least one comorbid condition (Table 6).

Postoperative outcomes

The majority of patients (63.2%) had a hospital stay of 3 days or less, while 24.8% stayed between 4 and 7 days and 12.0% required a stay exceeding 7 days. Most patients (88.0%) required no specific intervention for their complications; conservative management sufficed in 9.4% of cases, while surgical intervention was required in 2.6%. Overall, 90.6% of patients had an uneventful recovery, 8.3% had complications that resolved with treatment, and mesh removal was necessary in 1.1% of cases (Table 7).

Functional outcome (Carolina comfort scale)

Functional recovery, assessed using the Carolina Comfort Scale, showed progressive improvement over the follow-

up period. The proportion of patients with minimal symptoms (score 0–1) increased from 55.6% on postoperative day (POD) 1 to 68.4% on POD 14 and 80.5% on POD 30, while the proportion with more severe symptoms (score 4–5) decreased correspondingly, from

5.3% on POD 1 to 3.8% on POD 14 and 2.3% on POD 30 ($\chi^2=37.75$, $p<0.001$) (Table 8). This trend indicates a significant and sustained improvement in hernia-specific quality of life over the postoperative course.

Table 5: Association between comorbidity status and postoperative complications.

Comorbidity status	Complication present (N, %)	No complication (N, %)	Total	P value
Present (n=27)	9 (33.3)	18 (66.7)	27	
Absent (n=239)	23 (9.6)	216 (90.4)	239	
Total	32 (12.0)	234 (88.0)	266	<0.001

Table 6: Distribution of comorbidities among the study population.

Comorbidity	N	%
None	239	89.8%
T2DM	18	6.8%
HTN	6	2.3%
Hypothyroidism	3	1.1%
Total with comorbidity	27	10.2%

Table 7: Hospital stay, intervention required, and overall outcome.

Variables	Category	N	%
Hospital Stay	≤3 days	168	63.2%
	4–7 days	66	24.8%
	>7 days	32	12.0%
Intervention Required	None	234	88.0%
	Conservative	25	9.4%
	Surgical	7	2.6%
Outcome	Uneventful	241	90.6%
	Resolved	22	8.3%
	Mesh removal	3	1.1%

Table 8: Functional outcome (Carolina Comfort Scale) over the follow-up period.

POD	Score 0–1	Score 2–3	Score 4–5	Total	χ^2 Value	P value
POD 1	148 (55.6%)	104 (39.1%)	14 (5.3%)	266	37.75	<0.001
POD 14	182 (68.4%)	74 (27.8%)	10 (3.8%)	266		
POD 30	214 (80.5%)	46 (17.3%)	6 (2.3%)	266		

DISCUSSION

This prospective observational study assessed early mesh-related complications after hernia repair, focusing on incidence, risk factors, outcomes, and management. The observed complication rate falls within the reported 5-20% range, supporting the overall safety of mesh repair while emphasizing the need for early detection to reduce morbidity.

Minor complications such as seroma, hematoma, and scrotal edema were most common and generally manageable. In contrast, surgical site and mesh infections were less frequent (<2%) but clinically significant, often requiring aggressive treatment including mesh removal.¹² Patient-related factors, particularly diabetes and higher BMI, were strongly associated with increased

complications and longer hospital stay, highlighting the importance of preoperative optimization. Surgical technique (open vs. laparoscopic) and fixation method showed no significant difference in complication rates, indicating both are safe when performed appropriately. However, hernia type influenced outcomes, with incisional and umbilical hernias carrying higher risks.¹³

Most patients demonstrated favorable recovery, with early discharge and improved functional outcomes as measured by the Carolina Comfort Scale, a validated tool for hernia-specific quality of life. No early recurrence was observed, reinforcing the effectiveness of mesh repair. Despite higher initial costs, mesh repair is more cost-effective long term due to lower recurrence rates. Clinically, the findings emphasize risk assessment, patient optimization, and standardized perioperative care.

While the study's prospective design strengthens its validity, limitations include its single-center setting and lack of long-term follow-up.¹⁴

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Limitations

This study has certain limitations that should be acknowledged. It was conducted at a single tertiary care centre, which may limit the generalizability of the findings to other settings and populations. In addition, the follow-up duration was relatively short, restricted to 30 days postoperatively, and long-term outcomes such as late hernia recurrence and chronic mesh-related complications were not assessed.

CONCLUSION

Early mesh-related complications following hernia repair are relatively low in incidence and are mostly minor and manageable. Patient-related factors, particularly comorbidities, significantly influence outcomes. Optimization of patient health and adherence to standardized surgical protocols can further reduce complication rates. Future multicentric studies with

longer follow-up are recommended to validate these findings and assess long-term outcomes.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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