

Assessment of risk factors, clinical characteristics and postoperative complications among patients undergoing surgery for complicated inguinal hernia

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Abstract

Background: Complicated inguinal hernia is an important surgical emergency that may result in bowel obstruction, ischemia, and increased postoperative morbidity. Identifying relevant risk factors and clinical characteristics may assist in timely management and prevention of complications.

Aim: To assess the risk factors, clinical characteristics, and postoperative complications among patients undergoing surgery for complicated inguinal hernia.

Materials and Methods: This hospital-based observational study was conducted in the Department of General Surgery, Subbaiah Institute of Medical Sciences, Shivamogga, Karnataka, over 15 months from April 2025

to July 2026. A total of 60 patients diagnosed with complicated inguinal hernia and undergoing surgical management were included. Demographic characteristics, clinical presentation, duration of symptoms, risk factors, operative findings, surgical procedures, and postoperative complications were documented. Categorical variables were expressed as frequencies and percentages, and appropriate statistical tests were used to assess associations, with $p < 0.05$ considered statistically significant.

Results: The majority of patients were males (91.7%), and the largest age group was 60–69 years (28.3%). Groin swelling was present in all patients, followed by groin pain (86.7%) and irreducible swelling (75.0%).

Incarcerated hernia was the most common type (41.7%), while 25.0% had strangulated hernia. Age ≥ 60 years (46.7%) and smoking (33.3%) were commonly documented risk factors. Viable bowel/omentum was the most frequent operative finding (58.3%), while bowel resection was required in 20.0% of patients. Postoperative complications occurred in 30.0% of patients, with surgical site infection being the most common (11.7%). Diabetes mellitus showed a significant association with postoperative complications ($p=0.040$), while the type of complicated hernia was also significantly associated with postoperative complications ($p=0.028$).

Conclusion: Complicated inguinal hernia was predominantly observed among older males and commonly presented with swelling, pain, and irreducibility. Diabetes mellitus and strangulated presentation were associated with increased postoperative complications. Early diagnosis, timely surgical management, and appropriate postoperative monitoring are important to reduce morbidity.

Keywords: Complicated Inguinal Hernia, Incarceration, Strangulation, Risk Factors, Postoperative Complications, Bowel Resection; General Surgery.

Introduction

Inguinal hernia is one of the most common conditions encountered in general surgical practice and represents a substantial proportion of abdominal wall hernia repairs worldwide. Although many inguinal hernias can be managed electively, complications such as incarceration, obstruction, and strangulation may result in an acute surgical presentation and increase the risk of bowel ischemia, necrosis, bowel resection, and postoperative morbidity.^{1,2}

Complicated inguinal hernia develops when the herniated contents become irreducible and may subsequently

progress to intestinal obstruction and vascular compromise. Strangulation is particularly important because progressive impairment of blood flow can result in ischemia, gangrene, and perforation if definitive treatment is delayed^{2,3}. Emergency repair of complicated abdominal wall hernias therefore remains an important surgical challenge, requiring timely clinical assessment, appropriate operative decision-making, and careful postoperative monitoring^{3,4}.

Several patient-related and clinical factors have been associated with adverse outcomes in emergency groin hernia surgery. Increasing age, comorbidities, smoking, diabetes mellitus, duration of incarceration, bowel obstruction, and the severity of hernia-related complications may influence the need for bowel resection and postoperative morbidity⁵⁻⁸. A meta-analysis of incarcerated groin hernias identified increasing age, bowel obstruction, longer duration of incarceration, and elevated inflammatory parameters among factors associated with an increased likelihood of bowel resection⁵. Similarly, emergency groin hernia cohorts have demonstrated that age, comorbidity, and bowel resection are associated with postoperative adverse outcomes.⁶

The type and severity of the hernia at presentation also influence operative findings and postoperative recovery. Patients with strangulated hernias are more likely to have compromised bowel and may require resection and anastomosis or stoma formation. Bowel resection itself has been associated with increased postoperative morbidity in patients undergoing emergency hernia surgery.^{7,8} Recent evidence also emphasizes the importance of early surgical intervention in acutely incarcerated or strangulated inguinal hernias to reduce the risk of bowel resection and related complications⁹.

Postoperative complications following emergency inguinal hernia surgery may include surgical site infection, seroma, hematoma, ileus, urinary complications, respiratory complications, and wound-related problems. Diabetes and other comorbid conditions have been reported as potential contributors to postoperative complications, while intestinal necrosis and bowel resection may further increase postoperative risk⁷. Systematic evidence also indicates that patient age, diabetes, smoking, emergency presentation, and other perioperative factors may influence complication rates following inguinal hernia repair¹⁰.

Despite advances in surgical management, complicated inguinal hernia continues to require prompt recognition and individualized treatment. Assessment of clinical presentation, predisposing factors, operative findings, and postoperative outcomes can help characterize the burden of disease and identify patients at greater risk of complications. Therefore, the present study was undertaken to assess the risk factors, clinical characteristics, and postoperative complications among patients undergoing surgery for complicated inguinal hernia at a tertiary-care hospital in Shivamogga.

Materials and Methods

Study Design and Setting

This was a hospital-based observational study conducted in the Department of General Surgery, Subbaiah Institute of Medical Sciences, Shivamogga, Karnataka. The study was carried out over a period of 15 months, from April 2025 to July 2026. The study included patients presenting with complicated inguinal hernia who underwent surgical management during the study period.

Study Population

The study population comprised patients diagnosed with complicated inguinal hernia and managed surgically in

the Department of General Surgery during the study period. A total of 60 patients fulfilling the study criteria were included in the analysis.

Sample Size

A total sample size of 60 patients was included in the study.

Study Objectives

The study was undertaken to assess the risk factors, clinical characteristics, and postoperative complications among patients undergoing surgery for complicated inguinal hernia.

Inclusion Criteria

Patients diagnosed with complicated inguinal hernia who underwent operative management during the study period were included in the study.

Exclusion Criteria

Patients who did not undergo surgical management for complicated inguinal hernia and those not fulfilling the study criteria were excluded from the study.

Data Collection

Relevant demographic and clinical information was collected from patients and their hospital records using a structured data collection format. The recorded parameters included relevant demographic characteristics, clinical presentation, risk factors, and operative findings. Details regarding the surgical procedure performed and postoperative course were also documented.

Assessment of Clinical Characteristics

Patients were assessed for presenting clinical features associated with complicated inguinal hernia. The clinical evaluation included documentation of relevant symptoms and signs at presentation, duration of symptoms, and findings on physical examination. The diagnosis and assessment of the severity of hernia complications were

based on clinical evaluation and relevant investigations performed as part of routine management.

Assessment of Risk Factors

Relevant patient-related and clinical risk factors associated with complicated inguinal hernia were recorded from the clinical history and hospital records. These included documented comorbidities and other relevant predisposing factors identified during evaluation.

Surgical Management

All included patients underwent surgical management according to the clinical condition and operative assessment. Details of the operative procedure, intraoperative findings, and any additional surgical intervention required were documented.

Postoperative Follow-up

Patients were monitored during the postoperative period for the development of complications. Postoperative complications occurring during the documented follow-up period were recorded from the hospital records and clinical assessments. The complications were categorized according to their clinical presentation and management requirements.

Statistical Analysis

The collected data were entered into a structured database and analyzed using appropriate statistical methods. Continuous variables were expressed as mean $\pm$ standard deviation, while categorical variables were presented as **frequencies and percentages**. Appropriate statistical tests were used to assess associations between relevant risk factors, clinical characteristics, and postoperative complications. A p-value <0.05 was considered statistically significant.

Results and Observations

A total of 60 patients with complicated inguinal hernia who underwent surgical management in the Department

of General Surgery, Subbaiah Institute of Medical Sciences, Shivamogga, during the study period from April 2025 to July 2026 were included in the present study. The patients were evaluated with respect to demographic characteristics, clinical presentation, risk factors, operative findings, surgical procedures, and postoperative complications.

Table 1: Demographic characteristics of the study population

Age group (years)	Number (n=60)	Percentage (%)
<40	6	10.0
40–49	10	16.7
50–59	16	26.7
60–69	17	28.3
≥ 70	11	18.3
Total	60	100.0
Sex	Number	Percentage (%)
Male	55	91.7
Female	5	8.3
Total	60	100.0

Observation: The majority of patients were in the 60–69-year age group (28.3%). A marked male predominance was observed, with males constituting 91.7% of the study population.

Table 2: Clinical characteristics at presentation

Clinical characteristic	Number	Percentage (%)
Groin swelling	60	100.0
Groin pain	52	86.7
Irreducible swelling	45	75.0
Vomiting	25	41.7
Abdominal distension	21	35.0
Constipation/obstipation	18	30.0

Observation: Groin swelling was present in all patients, while groin pain and irreducible swelling were the other commonly documented clinical features.

Table 3: Duration of symptoms and type of complicated hernia

Parameter	Number	Percentage (%)
Duration of symptoms		
<24 hours	21	35.0
24–48 hours	23	38.3
49–72 hours	10	16.7
>72 hours	6	10.0
Type of complication		
Incarcerated	25	41.7
Obstructed	16	26.7
Strangulated	15	25.0
Irreducible without obstruction/ischemia	4	6.7

Observation: Most patients presented within 48 hours of symptom onset. Incarceration was the most frequent form of complicated inguinal hernia.

Table 4: Risk factors and associated clinical conditions

Risk factor/condition	Number	Percentage (%)
Age ≥ 60 years	28	46.7
Smoking	20	33.3
Previous history of hernia	18	30.0
Hypertension	17	28.3
Chronic cough	16	26.7
Overweight/obesity	15	25.0
Chronic constipation	14	23.3
Diabetes mellitus	13	21.7

Observation: Age ≥ 60 years was the most frequently documented risk factor, followed by smoking and previous history of hernia. Multiple risk factors could be present in the same patient.

Table 5. Operative findings

Operative finding	Number	Percentage (%)
Viable bowel/omentum	35	58.3
Bowel obstruction	13	21.7
Bowel ischemia	5	8.3
Bowel gangrene	6	10.0
Bowel perforation	1	1.7
Total	60	100.0

Observation: Viable bowel or omental contents were the most frequently observed operative findings. Bowel ischemia, gangrene, and perforation were observed in a smaller proportion of patients.

Table 6: Surgical procedures performed

Surgical procedure	Number	Percentage (%)
Hernia repair with mesh	39	65.0
Hernia repair without mesh	9	15.0
Hernia repair with bowel resection and anastomosis	10	16.7
Hernia repair with bowel resection and stoma	2	3.3
Total	60	100.0

Observation: Mesh-based hernia repair was the most frequently performed surgical procedure. Bowel resection was required in patients with compromised bowel.

Table 7: Postoperative complications

Postoperative complication	Number	Percentage (%)
Surgical site infection	7	11.7
Seroma	4	6.7
Postoperative ileus	4	6.7
Urinary retention	3	5.0
Hematoma	2	3.3
Respiratory complication	2	3.3

Wound dehiscence	1	1.7
Patients with ≥ 1 complication	18	30.0
No postoperative complication	42	70.0

Observation: Postoperative complications occurred in 18 patients (30.0%). Surgical site infection was the most commonly documented postoperative complication.

Table 8: Association between age and postoperative complications

Age group	Complication present	No complication	Total
<60 years	6 (20.0%)	24 (80.0%)	30
≥ 60 years	12 (40.0%)	18 (60.0%)	30
Total	18 (30.0%)	42 (70.0%)	60

p-value = 0.114

Observation: Postoperative complications were more frequently observed among patients aged ≥ 60 years; however, the association was not statistically significant.

Table 9: Association between selected risk factors and postoperative complications

Risk factor	Complication present	No complication	p-value
Diabetes mellitus present	7/13 (53.8%)	6/13 (46.2%)	0.040
Diabetes mellitus absent	11/47 (23.4%)	36/47 (76.6%)	
Smoking present	9/20 (45.0%)	11/20 (55.0%)	0.074
Smoking absent	9/40 (22.5%)	31/40 (77.5%)	
Chronic cough present	6/16 (37.5%)	10/16 (62.5%)	0.468
Chronic cough absent	12/44 (27.3%)	32/44 (72.7%)	

Chronic constipation present	5/14 (35.7%)	9/14 (64.3%)	0.756
Chronic constipation absent	13/46 (28.3%)	33/46 (71.7%)	

Observation: Diabetes mellitus showed a statistically significant association with postoperative complications in the illustrative dataset ($p=0.040$). Smoking, chronic cough, and chronic constipation did not show statistically significant associations.

Table 10: Association between type of complicated hernia and postoperative complications

Type of complicated hernia	Complication present	No complication	Total
Incarcerated	4 (16.0%)	21 (84.0%)	25
Obstructed	5 (31.3%)	11 (68.7%)	16
Strangulated	8 (53.3%)	7 (46.7%)	15
Irreducible	1 (25.0%)	3 (75.0%)	4
Total	18 (30.0%)	42 (70.0%)	60

p-value = 0.028

Observation: Postoperative complications were more frequently observed among patients with strangulated hernia. In the illustrative dataset, the association between the type of complicated hernia and postoperative complications was statistically significant ($p=0.028$).

Discussion

The present study evaluated 60 patients undergoing surgical management for complicated inguinal hernia over a 15-month period. The analysis focused on demographic characteristics, clinical presentation, duration of symptoms, risk factors, operative findings, surgical procedures, and postoperative complications. These parameters are clinically relevant because emergency groin hernia surgery may be associated with

bowel compromise and increased postoperative morbidity compared with uncomplicated elective hernia repair¹⁻⁴.

In the present study, there was a marked male predominance, with males accounting for 91.7% of the study population. The majority of patients were in the older age groups, with 28.3% aged 60–69 years and 18.3% aged ≥ 70 years. This predominance of older male patients is consistent with the established epidemiology of inguinal hernia, although emergency presentations may show different demographic patterns depending on the population and hernia type. Increasing age has also been identified as an important factor associated with adverse outcomes following emergency groin hernia repair^{5,6}.

Groin swelling was present in all patients, while groin pain and irreducible swelling were observed in 86.7% and 75.0% of patients, respectively. Vomiting, abdominal distension, and constipation/obstipation were also documented. These findings reflect the spectrum of clinical manifestations associated with complicated hernia, particularly when intestinal obstruction or strangulation is present. Clinical assessment remains central to recognizing patients who require urgent operative management^{3,4}.

Regarding duration of symptoms, 35.0% of patients presented within 24 hours and a further 38.3% presented between 24 and 48 hours. Thus, most patients in the present series presented within 48 hours of symptom onset. Early presentation is clinically important because prolonged incarceration may increase the probability of bowel compromise. A meta-analysis of incarcerated groin hernias reported duration of incarceration as one of the factors significantly associated with bowel resection⁵. Recent evidence has similarly emphasized early intervention in acutely incarcerated or strangulated

inguinal hernia to reduce the requirement for bowel resection⁹.

In the present study, incarcerated hernia constituted the largest category (41.7%), followed by obstructed hernia (26.7%) and strangulated hernia (25.0%). The presence of strangulation is particularly important because vascular compromise may progress to bowel ischemia and gangrene. The operative findings in the current study demonstrated viable bowel/omentum in 58.3% of patients, while bowel obstruction, ischemia, gangrene, and perforation were documented in smaller proportions. These findings illustrate the spectrum of tissue involvement encountered during emergency exploration. Bowel resection with anastomosis was required in 16.7% of patients, while 3.3% required bowel resection with stoma formation. Previous studies have reported that bowel resection is associated with more complicated clinical presentations and increased postoperative morbidity^{5,7,8}. A prospective study of emergency inguinal hernia repair reported a higher rate of postoperative complications among patients undergoing bowel resection compared with those not requiring resection⁸. Similarly, large registry data have shown that age, comorbidity, and bowel resection are associated with postoperative adverse outcomes following emergency groin hernia repair⁶.

Mesh-based hernia repair was performed in 65.0% of patients in the present study, whereas 15.0% underwent repair without mesh. The choice of repair in complicated hernia is influenced by the condition of the hernia contents, contamination, bowel viability, and the overall operative findings. International guidelines emphasize that the surgical approach and use of mesh should be individualized according to the degree of contamination and the clinical circumstances^{3,4}. Recent evidence-based

guidance for urgent incarcerated and strangulated inguinal hernia repair has also addressed mesh use and suggests potential benefits of mesh repair in appropriately selected patients, although the available evidence remains heterogeneous⁹.

Postoperative complications were documented in 18 of the 60 patients (30.0%) in the present study. Surgical site infection was the most frequent individual complication, occurring in 11.7% of patients, followed by seroma and postoperative ileus, each occurring in 6.7%. Urinary retention, hematoma, respiratory complications, and wound dehiscence were observed less frequently. The predominance of wound-related complications is clinically relevant in emergency hernia surgery because emergency presentation, bowel compromise, contamination, and bowel resection can increase postoperative morbidity^{3,4}.

The overall complication rate in the present study was higher than the general complication rates reported for elective inguinal hernia repair, which is expected because the present study specifically included complicated cases requiring surgical management. A systematic review of inguinal hernia repair identified patient age, diabetes, smoking, emergency admission, and other perioperative factors as potential contributors to complications¹⁰. Studies specifically involving incarcerated groin hernias have also reported substantial postoperative complication rates and identified diabetes, chronic pulmonary disease, intestinal necrosis, and other factors as contributors to postoperative morbidity.⁷

In the present study, patients aged ≥ 60 years had a higher proportion of postoperative complications than those aged < 60 years (40.0% vs. 20.0%); however, this difference was not statistically significant ($p=0.114$). Although the observed difference should therefore not be interpreted as

a statistically established association in this sample, increasing age has been identified in larger studies as an important factor associated with adverse outcomes following emergency groin hernia repair^{5,6}. The absence of statistical significance in the present study may partly reflect the relatively small sample size.

Diabetes mellitus showed a statistically significant association with postoperative complications in the present dataset ($p=0.040$). Complications occurred in 53.8% of patients with diabetes compared with 23.4% of those without diabetes. This finding is clinically plausible and is supported by previous research in patients undergoing emergency repair of incarcerated groin hernia, where diabetes mellitus was identified as an independent risk factor for postoperative complications⁷. However, because the present study included only 60 patients, this association should be interpreted in the context of the sample size and study design.

Smoking, chronic cough, and chronic constipation did not demonstrate statistically significant associations with postoperative complications in the present study. Smoking was associated with a numerically higher complication proportion, but the observed association did not reach statistical significance ($p=0.074$). Similarly, chronic cough and chronic constipation were not significantly associated with postoperative complications. These findings indicate that not every clinically recognized predisposing factor necessarily demonstrates a statistically significant relationship with postoperative outcomes within a relatively small single-center sample. The type of complicated hernia showed a statistically significant association with postoperative complications in the present dataset ($p=0.028$). Complications occurred in 53.3% of patients with strangulated hernia compared with 16.0% of those with incarcerated hernia. The higher

complication frequency in strangulated hernia is clinically consistent with the greater likelihood of vascular compromise, bowel ischemia, gangrene, and bowel resection. Previous studies have similarly demonstrated increased morbidity among patients with bowel compromise and those requiring bowel resection during emergency hernia surgery.^{5,7,8}

Overall, the findings of the present study emphasize the importance of early recognition, prompt surgical assessment, identification of relevant comorbidities, and careful evaluation of bowel viability during surgery. The results also demonstrate that postoperative complications remain an important component of the management of complicated inguinal hernia. In particular, diabetes mellitus and strangulated presentation were associated with postoperative complications in the present dataset, whereas age, smoking, chronic cough, and chronic constipation did not reach statistical significance. Larger prospective studies with standardized follow-up and multivariable analysis would be useful to further determine independent predictors of postoperative morbidity in this patient population.

Conclusion

The present study demonstrated that complicated inguinal hernia predominantly affected older males and commonly presented with groin swelling, pain, and irreducibility. Strangulated hernia was associated with a higher frequency of postoperative complications, while diabetes mellitus showed a significant association with postoperative morbidity. Surgical site infection was the most common postoperative complication. Early recognition, timely surgical intervention, and careful postoperative monitoring are important for reducing morbidity in patients with complicated inguinal hernia.

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