

ORIGINAL RESEARCH

Risk Factors of Postoperative Complications After Emergency Inguinal Hernia Surgery

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ABSTRACT

Background: Complications after inguinal or femoral hernia repair are relatively common. Complications that occur in the perioperative period were wound seroma/hematoma, urinary retention, and superficial incisional surgical site infection, while complications that occur later following hernia repair include persistent groin pain, sexual dysfunction, deep incisional/mesh infection, recurrent hernia, and mesh migration and erosion

Aim & Objective: This study aimed to explore the risk factors of postoperative complications for adult patients with Incarcerated groin hernia (IGH).

Material & Methods: this was a retrospective study carried out in the department of the surgery in a tertiary care hospital, central India. Patients undergoing emergency hernia repair for Incarcerated groin hernia (IGH) during the study period were included in our study. Socio-demographic data were collected from all the patients. Postoperative complications, such as surgical site infection, seroma, hernia recurrence and mortality, were investigated, with risk factors for such complications were analyzed.

Results: Sixty-four patients were included, with 51 males and 13 females (mean age 65.1, range 25–98 years). Ten patients (15.6%) underwent resection of necrotic bowel and anastomosis. 43 patients (67.2%) received open tension-free herniorrhaphy with polypropylene mesh, whereas the rest (32.8%) received herniorrhaphy without mesh. The overall postoperative complication rate was 40.6% (26/64), with an incisional complication rate of 31.2% (20/64) and an infection rate of 6.2% (4/64). At a median follow-up of 32 months, hernia recurrence and mortality were recorded in five cases each (7.8%). Mesh repair was associated with decreased recurrence rate compared with non-mesh repair (2.3% vs. 19.0%, $p = 0.019$). Diabetes mellitus (OR 8.611, 95%CI 1.292–57.405; $p = 0.026$) was an independent risk factor of postoperative complications, together with chronic obstructive pulmonary disease (COPD; OR 14.365, 95%CI 1.652–127.767, $p = 0.016$), intestinal necrosis (OR 14.260, 95%CI 1.079–188.460, $p = 0.044$), and general anesthesia (OR 14.543, 95%CI 1.682–125.711, $p = 0.015$) as risk for incisional complications after surgery.

Conclusion: Diabetes mellitus was an independent risk factor of postoperative complications for IGH, along with COPD, intestinal necrosis and general anesthesia associated with incisional complications. The use of polypropylene mesh did not increase infection or recurrence rate in this cohort.

Keywords: Incarcerated groin hernia (IGH), Risk factors, Complications, herniorrhaphy

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Introduction

Incarcerated abdominal wall hernia, defined as the inability to reduce the hernia content from abdominal wall, is a common surgical emergency, which accounts for 5–15% of abdominal hernias. Incarcerated groin hernia (IGH) is one of the most frequently encountered types, accounting for 50–80% of incarcerated abdominal hernias. About 15% of IGH patients require bowel resection due to progressive bowel necrosis [1-2]. The incidence of

postoperative complications in emergency repair of IGH is 21–39%, along with a mortality rate of 4–5% [3-4]. Early recognition of risk factors for postoperative complications and rapid effective interventions for potential complications are of great clinical significance.

The application of synthetic mesh in emergency surgery for IGH remains controversial, especially when the presence of bowel necrosis, contaminated or infected surgical field is clinically validated [5]. Recently, several studies have revealed that synthetic

mesh could be safely and effectively used in patients with incarcerated or strangulated inguinal hernia, which significantly reduced the risk of hernia recurrence but did not increase the opportunity of surgical site infection (SSI) [6–8]. Nevertheless, most of those studies are retrospective analyses, and the level of evidence-based surgical practice is not high enough. As a result, more evidence-based clinical data are necessary to confirm the safety and effectiveness of using synthetic mesh in repairing IGH. The purpose of this study was to investigate risk factors of postoperative complications for patients with IGH.

Materials & Methods

This is a retrospective study carried out in the department of surgery, in a tertiary care hospital, central India. All consecutive adult patients who had confirmed Incarcerated groin hernia (IGH) diagnosis and underwent emergency herniorrhaphy in our center were retrospectively reviewed. All data were retracted from medical records and our database. Clinical data, including demographic characteristics (gender, age, concomitant disease, etc.) and basic information of IGH were collected from the medical records and database meanwhile. Next, data related to postoperative complications were extracted and double checked by both researchers. Surgical wound classification was consistent with the Centers for Disease Control and Prevention (CDC) wound classification, as well as the diagnostic criteria of SSI [9].

The non-absorbable mesh was commonly applied in open inguinal herniorrhaphy, which reduced incidence of chronic groin pain as well as other groin symptoms [12].

Perioperative Management: Immediately after admission, antibiotic prophylaxis and fluid resuscitation were initiated against underlying infection and water–electrolyte imbalance. The emergency operation was basically decided by the main surgeons, according to their clinical judgment and preference.

During surgery, incarcerated hernia was repaired with various techniques. Briefly, as for IGH without ischemic necrosis of the hernia content, a simple reduction of the hernia content was applied, followed by a high ligation of hernia sac at the level of internal inguinal ring. After that, PP mesh was used to achieve tension-free repair when the Lichtenstein procedure was considered for inguinal hernia, with non-mesh tissue repair performed when Bassini or Shouldice procedure was considered [10]. The mesh-plug repair was employed for femoral hernia, with non-mesh tissue repair performed when the McVay procedure was preferred [11].

After discharge, patients were scheduled to regular out-patient visits at least for a 1-year follow-up period. During these visits, physical examination,

abdominal ultrasound, particularly CT scans were performed to determine hernia recurrence and other long-term complications.

Statistical Analysis: All data were analyzed statistically by using SPSS version 20. A p -value < 0.05 considered as statistically significant.

Results

Within the study period, a total of 64 patients were included, with 51 males (79.7%) and 13 females (20.3%), and an average age of 65.1 (range 25–98) years. The baseline characteristics of all subjects are summarized in Table 1. It showed that male was more involved than female, almost reaching up to 80% of cases. Besides, 57.8% of all patients were older than 65 years, and 62.5% of them had various concomitant diseases when admitting to our center. The median duration of groin hernia for this cohort was 60 (range 1–70) months. The median time interval until diagnosis of IGH was 24 (range 2–168) hours. The median size of hernia sac was 7 (range 3–18) cm in diameter. IGH occurred more frequently in the right-sided groin than in the left-sided groin [62.5% vs. 37.5%].

Surgical Data: Open tension-free herniorrhaphy was performed in 43 cases (67.2%), with non-mesh herniorrhaphy applied in the rest of 21 cases (32.8%). The detailed surgical information is shown in Table 2. Briefly, the median operation time was 95 (range 50–180) min. Bowel resection and anastomosis was performed in ten cases (15.6%).

Postoperative complications and long-term outcomes: The overall postoperative complication rate was 40.6% (26/64), and the incisional complication rate was 31.2% (20/64). Local wound complications were much more commonly observed than other complications (Table 3). At the end time of follow-up, 57 of the 64 patients (89.1%) had complete follow-up records, with a median follow-up period of 32 (range, 31.6–43.8) months. Briefly, two patients (3.1%) lost contact with us, and five patients (7.8%) died. Of the five dead cases, two died of heart disease, two of multiple organ failure and one of respiratory failure. Hernia-related death was not observed, but hernia recurrence after initial herniorrhaphy was recorded in five cases (7.8%).

Mesh versus non-mesh repair: To evaluate the safety and efficacy of mesh repair for IGH treatment, all patients were divided into two groups: 43 cases (67.2%) and 21 cases (32.8%) in the mesh and non-mesh repair groups, respectively (Table 4). The average operation time in the mesh group was much shorter than that in the non-mesh group (87.4 min vs. 125.5 min, $p < 0.001$). Importantly, the incidence of overall postoperative complication (27.9% vs. 66.7%, $p = 0.005$), incisional seroma (20.9% vs. 47.6%, $p = 0.028$) and scrotal swelling (13.9% vs. 66.7%, $p = 0.001$), and median postoperative length of stay (5 vs. 8 days, $p = 0.026$) were markedly decreased in the

mesh repair group compared with the non-mesh repair group. Besides, the hernia recurrence rate was also significantly reduced (2.3% vs. 19.1%, $p = 0.019$), with a comparable mortality rate observed between both groups (7.0% vs. 9.5%, $p = 0.721$).

Risk factors of Postoperative complications: The concomitant basic disease ($p = 0.049$), diabetes mellitus (DM, $p = 0.001$), chronic heart disease (CHD, $p = 0.019$), history of abdominal wall hernia ($p = 0.024$), bowel necrosis ($p = 0.011$), general

anesthesia ($p = 0.009$), and mesh repair ($p = 0.003$) were risk factors of postoperative complications for IGH patients (Table 5). Specifically, concomitant basic disease ($p = 0.002$), DM ($p < 0.001$), hypertension ($p = 0.047$), CHD ($p = 0.010$), chronic obstructive pulmonary disease (COPD, $p = 0.001$), bowel necrosis ($p = 0.001$), general anesthesia ($p = 0.016$), and mesh repair ($p = 0.028$) were risk factors for postoperative incisional complications

Table1: Baseline characteristics of patients within incarcerated groin hernia

Variables	Total (N=64)	Mesh group (N=43)	Non-mesh group (N=21)	P value
Gender (male),n(%)	51 (79.7)	36 (83.7)	15 (71.4)	0.324
Age(years), mean±SD	65.1±17.1	62.5±17.9	70.5±14.1	0.078
≥65years,n(%)	37 (57.8)	21 (48.8)	16 (76.2)	0.058
Comorbidities, n(%)	40 (62.5)	23 (53.5)	17 (81.0)	0.053
Diabetes mellitus	12 (18.8)	6 (14.0)	6 (28.6)	0.185
Hypertension	33 (51.6)	18 (41.9)	15 (71.4)	0.035*
Heart diseases	15 (23.4)	9 (20.9)	6 (28.6)	0.540
COPD	14 (21.9)	7 (16.3)	7 (33.3)	0.196
Chronic renal failure	2 (3.1)	1 (2.3)	1 (4.8)	1.000
Duration of hernia(years), M(95% CI)	5.0 (5.4-12.0)	5 (3.4-6.0)	7 (2.3-10.0)	0.891
Duration of incarceration (h),M(95%CI)	24.0 (32.4-52.5)	23 (13.0-48.0)	25 (14.7-48.0)	0.365
Maximum diameter of hernia sac(cm) M(95%CI)	7 (6.9-8.8)	6 (5.8-8.0)	8 (5.8-13.3)	0.117
Classification of groin hernia, n(%)				
Indirect hernia	47 (73.4)	34 (79.1)	13 (61.9)	
Direct hernia	5 (7.8)	5 (11.6)	0	
Femoral hernia	11 (17.2)	4 (9.3)	7 (33.3)	
Saddle-bag hernia	1 (1.6)	0	1 (4.8)	
Recurrent hernia, n(%)	3 (4.7)	3 (7.0)	0	
Scrotal hernia, n(%)	43 (84.3)	30 (83.3)	13 (86.7)	
Hernialocation (right sided), n(%)	40 (62.5)	23 (53.5)	17 (81.0)	0.053

SD standard deviation, M median, CI confidence interval, *statistically significant

Table2: Perioperative data of patients within incarcerated groin hernia

Variables	Value
ASA grades, n(%)	
Grade I	23 (35.9)
Grade II	28 (43.8)
Grade III	13 (20.3)
Anesthetic methods, n(%)	
Local	4 (6.2)
Spinal	32 (50.0)
General	28 (43.8)
Operation time(min),M(95%CI)	95 (91.9-107.8)
Open tension-free herniorrhaphy, n(%)	
Lichtenstein	26 (40.6)
Mesh-plug repair	10 (15.6)

Preperitoneal herniorrhaphy	7 (10.9)
Traditional herniorrhaphy, <i>n</i> (%)	21 (32.8)
High ligation of hernia sac	4 (6.2)
Laparotomy plus high ligation	2 (3.1)
Bassini method	8 (1.25)
Mc Vay method	6 (9.37)
Shouldice method	1 (1.56)
Postoperative LOS(days), <i>M</i> (95%)	5.0 (5.3–7.9)
Enterectomy, <i>n</i> (%)	10 (15.6)
Small intestine	9 (14.06)
Caecum	1 (1.56)

ASA American society of anesthesia score, LOS length of stay

Table 3: Postoperative complications and follow-up results

Variables	Value
Postoperative complications, <i>n</i> (%)	26 (40.6)
Incisional complications	20 (31.2)
Seroma	19 (29.7)
Incisional infection	4 (6.2)
Scrotal swelling	13 (27.1)
Retention of urine	6 (9.4)
Intra-abdominal infection	1 (1.5)
Acute heart failure/ arrhythmia	2 (3.1)
Pulmonary infection	1 (1.5)
Mesh infection	1(2.3%)
Mesh extraction	0 (0)
Hernia recurrence, <i>n</i> (%)	5 (7.8)
Hernia unrelated death, <i>n</i> (%)	5 (7.8)

Table4: Risk factors of postoperative complications for incarcerated groin hernia

Variables	Postoperative complications		
	Control(N=38)	Event(N=26)	pvalue
Gender(male/female),	31 /7	20/6	0.649
Age (≥ 65 years), <i>n</i> (%)	19 (50.0)	18 (69.2)	0.126
Comorbid disease, <i>N</i> (%)	20 (52.6)	20 (76.9)	0.049*
Diabetes mellitus	2 (5.3)	10 (38.5)	0.001*
Hypertension	17 (44.7)	16 (61.5)	0.187
Heart disease	5 (13.2)	10 (38.5)	0.019*
COPD	6 (15.8)	8 (30.8)	0.155
Chronic kidney disease	1 (2.6)	1 (3.8)	1.000
Duration of hernia(yrs), <i>M</i> (95%CI)	5 (3.0–6.5)	5.5 (2.0–10.0)	0.431
Duration of in carceration (h), <i>M</i> (95%CI)	23 (12.0–48.0)	36 (18.0–80.0)	0.115
History of abdominal hernia, <i>n</i> (%)	0	4 (15.4)	0.024*
Maximum diameter of hernia sac(cm), <i>M</i> (95%CI)	6 (5.0–8.0)	8 (5.0–10.0)	0.123
Intestinal necrosis, <i>n</i> (%)	2 (5.3)	8 (30.8)	0.011*
Intestinal perforation, <i>n</i> (%)	0	2 (7.7)	0.161
Intestinal obstruction, <i>n</i> (%)	11 (28.9)	11 (42.3)	0.269
Hernia location (right- sided), <i>n</i> (%)	23 (60.5)	17 (65.4)	0.693
ASA grades (I/II/III), <i>n</i> (%)	16 (42.1) / 17 (44.7) / 5 (13.2)	7 (26.9)/11 (42.3)/8 (30.8)	0.186
Anesthetic methods (local/spinal /general), <i>n</i> (%)	2(5.3)/25 (65.8) / 11 (28.9)	2 (7.7)/7 (26.9) /17 (65.4)	0.009*
Mesh repair (yes), <i>n</i> (%)	31 (81.6)	12 (46.2)	0.003*

Operation time (min), mean±SD	96.3±26.3	105.1±36.1	0.300
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M median value, *CI* confidential intervals, *SD* standard deviation, *ASA* American society of anesthesia score *statistically +significant

Discussion

IGH in adult often involves bowel obstruction and potential necrosis, and it needs an emergency surgery to avoid death-related complications [13–15]. It is known that most of IGHs have the following characteristics: elder age, weakness due to concomitant disease, a long history of hernia with a large sac, and delayed diagnosis and treatment. Those features often lead to bowel necrosis or perforation, even severe complications such as diffuse peritonitis and sepsis, which are associated with increased rates of post-operative morbidity and mortality [16, 17]. A previous retrospective study indicates that long history of hernia, prolonged length of stay, severe concomitant diseases and high American Society of Anesthesia (ASA) grade were significant factors linked to unfavorable outcome of IGH [18].

Many studies have shown that the presence of concomitant diseases, such as DM, cardiovascular disorders, COPD and kidney disease, prolonged the length of stay and increased morbidity and mortality in IGH patients [16–19]. It is speculated that significant concomitant diseases greatly depressed oxygenation of surgical field, subsequently attenuated wound healing process and increased risk of wound complications after surgery [20, 21]. In our study, DM was found to be an independent risk factor of postoperative complications, together with COPD, bowel necrosis and general anesthesia as independent risk factors for incisional complications. Our findings were in accordance with other studies [22-24].

Previous studies have reported that general or spinal anesthesia could increase the incidence of postoperative complications compared to local anesthesia [3, 8]. It is believed that local anesthesia has fewer adverse effects on respiratory function and provides better postoperative pain control in comparison with general anesthesia [25]. The application of synthetic mesh was limited in incarcerated hernia, especially suspicious of strangulated hernia [13, 26]. The conventional view suggested that using synthetic mesh would increase the chance of SSI and mesh-related complications [23, 27]. However, traditional tissue herniorrhaphy resulted in a high recurrence rate, and the requirement of additional repairing operation undoubtedly increased medical costs and frustrated patients. Recent studies have shown that it is safe and effective to use a prosthetic mesh in the emergency repair of incarcerated or strangulated hernia [28, 29]. In the current study, the overall incidence of postoperative complications in patients undergoing mesh repair was markedly lower than that in patients undergoing non-mesh repair as well as the incidence of incisional seroma and hernia recurrence [30].

Clinical utility of PP mesh can be considered when a hernia sac has been properly managed without residual contamination, and tension-free herniorrhaphy with such mesh has been confirmed to reduce recurrence and SSI rates [10, 31].

As is well known, enterectomy is one of the worst complications of IGH, remaining an important risk factor of postoperative morbidity and mortality. Under those conditions, use of biological mesh would be an alternative option, and several studies have shown its efficacy on potentially contaminated or infected herniorrhaphy [32].

In this study, the overall postoperative complication rate was 40.6%, with 31.2% and 6.2% for incisional complication rate and wound infection rate, respectively. Within the follow-up period, hernia recurrence and death were recorded in 7.8% of included patients each. Importantly, tension-free herniorrhaphy with PP mesh was performed in 67.2% of included subjects, and it was insignificantly associated with post-operative complications.

Conclusion

This study confirmed that DM was an independent risk factor of postoperative complications after emergency surgery for IGH, alongside with DM, COPD, intestinal necrosis and general anesthesia considered as risk factors for specific incisional complications. Mesh repair with various tension-free techniques could be safely and effectively performed for IGH patients, with better long-term outcomes obtained compared with non-mesh tissue repair.

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