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Original Research Article

Mesh-related Complications in Inguinal Hernia Surgery: A Prospective Cohort Study

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Abstract

Background: Inguinal hernia repair is one of the most commonly performed surgical procedures worldwide, with mesh-based techniques becoming the gold standard. However, mesh-related complications remain a significant concern affecting patient outcomes and quality of life. This study aimed to evaluate the incidence, types, and risk factors associated with mesh-related complications following inguinal hernia repair.

Methods: This prospective cohort study was conducted at a tertiary care hospital. A total of 486 patients who underwent mesh-based inguinal hernia repair were enrolled and followed for 12 months postoperatively. Demographic data, surgical parameters, and complication rates were recorded and analyzed using appropriate statistical tests.

Results: The overall mesh-related complication rate was 12.8% (n=62). Chronic groin pain was the most common complication (6.4%), followed by seroma formation (3.1%), surgical site infection (2.1%), and mesh migration (1.2%). Multivariate analysis revealed that age >60 years (OR=2.34, 95% CI: 1.42-3.86, p=0.001), body mass index >30 kg/m² (OR=2.89, 95% CI: 1.67-4.99, p<0.001), and diabetes mellitus (OR=1.98, 95% CI: 1.21-3.24, p=0.006) were independent predictors of mesh-related complications. Laparoscopic repair demonstrated significantly lower complication rates compared to open repair (8.7% vs. 15.9%, p=0.018).

Conclusion: Mesh-related complications following inguinal hernia repair occur in a notable proportion of patients. Identification of modifiable risk factors and appropriate surgical technique selection may help minimize these complications and improve patient outcomes.

Keywords: Inguinal hernia, mesh repair, surgical complications, chronic pain, hernioplasty, prospective cohort.

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Introduction

Inguinal hernia represents one of the most prevalent surgical conditions, affecting approximately 27% of men and 3% of women during their lifetime [1]. Globally, more than 20 million inguinal hernia repairs are performed annually, making it among the most frequently conducted surgical procedures [2]. The introduction of prosthetic mesh in hernia repair has revolutionized surgical outcomes, significantly reducing recurrence rates from approximately 15% with primary suture repair to less than 2% with mesh-based techniques [3].

The Lichtenstein tension-free mesh repair, introduced in 1989, has become the gold standard for open inguinal hernia repair [4]. Subsequently, laparoscopic approaches, including transabdominal preperitoneal (TAPP) and totally extraperitoneal (TEP) techniques, have gained widespread acceptance, offering advantages such as reduced postoperative pain and faster recovery [5]. Despite these advancements, mesh-related complications continue to pose significant challenges to surgeons and patients alike. Chronic postoperative inguinal pain (CPIP) affects 10-12% of patients following mesh hernioplasty and represents the most debilitating complication [6]. Other mesh-related complications include seroma formation, surgical site infection, mesh shrinkage, migration, and erosion into adjacent structures [7]. These complications can significantly impact patients' quality of life and may necessitate mesh removal in severe cases [8].

Recent studies have focused on identifying risk factors associated with mesh-related complications. Younger age, preoperative pain, early postoperative pain intensity, and recurrent hernia repair have

been identified as predictors of chronic pain [9]. Additionally, patient-related factors such as obesity, diabetes mellitus, and smoking have been associated with increased infection rates and wound complications [10]. The type of mesh material and its characteristics, including weight, pore size, and composition, have also been investigated in relation to complication rates [11]. Lightweight macroporous meshes have demonstrated improved biocompatibility and potentially reduced chronic pain compared to heavyweight meshes [12]. However, conflicting evidence exists regarding the superiority of different mesh types in preventing complications. Despite extensive research, there remains a gap in comprehensive prospective data examining the full spectrum of mesh-related complications and their associated risk factors in diverse patient populations. Most existing studies have focused on single complications or retrospective analyses, limiting their clinical applicability [13].

The aim of this study was to prospectively evaluate the incidence, types, and risk factors associated with mesh-related complications in patients undergoing inguinal hernia repair at a tertiary care center, with particular emphasis on identifying modifiable factors that may guide clinical decision-making.

Materials and Methods

Study Design and Setting: This prospective cohort study was conducted at the Department of General Surgery.

Sample Size Calculation: Based on previous literature reporting a mesh-related complication rate of approximately 12%, with an absolute precision of 3% and 95% confidence interval, the minimum required sample size was calculated as 451 patients. Accounting for a 10% dropout rate, we aimed to recruit 500 patients.

Inclusion and Exclusion Criteria: Inclusion criteria comprised adult patients (≥18 years) with primary or recurrent inguinal hernia undergoing elective mesh-based repair (open or laparoscopic). Exclusion criteria included emergency surgery for incarcerated or strangulated hernia, previous mesh implantation at the same site, known allergy to mesh materials, immunocompromised status, and inability to provide informed consent or comply with follow-up requirements.

Surgical Techniques: Open repairs were performed using the Lichtenstein tension-free technique with polypropylene mesh (7.5 × 15 cm). Laparoscopic repairs were performed using either TAPP or TEP approach based on surgeon preference and patient characteristics. Lightweight polypropylene mesh (10 × 15 cm) was used for laparoscopic procedures. All surgeries were performed by experienced surgeons with more than 50 hernia repairs annually.

Data Collection: Demographic data including age, sex, body mass index (BMI), smoking status, comorbidities (diabetes mellitus, hypertension, chronic obstructive pulmonary disease), and American Society of Anesthesiologists (ASA) classification were recorded. Hernia characteristics (laterality, type, size, primary vs. recurrent) and surgical parameters (operative time, type of anesthesia, surgeon experience) were documented.

Follow-up Protocol: Patients were followed at 1 week, 1 month, 3 months, 6 months, and 12 months postoperatively. At each visit, clinical examination was performed to assess wound healing, seroma formation, and hernia recurrence. Pain assessment was conducted using the Visual Analog Scale (VAS) and Numeric Rating Scale (NRS). Chronic groin pain was defined as pain persisting beyond 3 months postoperatively.

Outcome Measures: The primary outcome was the incidence of any mesh-related complication within 12 months. Secondary outcomes included individual complication rates, time to complication onset, risk factor identification, and comparison between surgical techniques.

Statistical Analysis: Data were analyzed using SPSS version 26.0 (IBM Corporation, Armonk, NY). Continuous variables were expressed as mean ± standard deviation (SD) or median (interquartile range) as appropriate.

Categorical variables were presented as frequencies and percentages. Comparisons between groups were performed using Student's t-test or Mann-Whitney U test for continuous variables and Chi-square test or Fisher's exact test for categorical variables. Multivariate logistic regression analysis was conducted to identify independent predictors of complications. A p-value <0.05 was considered statistically significant.

Results

Patient Characteristics: Of the 500 patients initially enrolled, 486 completed the 12-month follow-up and were included in the final analysis. Fourteen patients were excluded due to loss to follow-up (n=10) or death from unrelated causes (n=4). The mean age was 52.4 ± 14.8 years, with 451 (92.8%) male patients. The mean BMI was 26.8 ± 4.2 kg/m². Baseline patient characteristics are presented in Table 1.

Table 1: Baseline Patient Characteristics (N=486)

Variable	Total (N=486)	Open Repair (n=275)	Laparoscopic Repair (n=211)	p-value
Age, years (mean ± SD)	52.4 ± 14.8	54.2 ± 15.3	50.1 ± 13.9	0.003
Male sex, n (%)	451 (92.8)	256 (93.1)	195 (92.4)	0.781
BMI, kg/m² (mean ± SD)	26.8 ± 4.2	27.1 ± 4.4	26.4 ± 3.9	0.067
BMI >30 kg/m², n (%)	98 (20.2)	59 (21.5)	39 (18.5)	0.417
Current smoker, n (%)	142 (29.2)	84 (30.5)	58 (27.5)	0.459
Diabetes mellitus, n (%)	78 (16.0)	48 (17.5)	30 (14.2)	0.329
Hypertension, n (%)	134 (27.6)	82 (29.8)	52 (24.6)	0.202
ASA I-II, n (%)	412 (84.8)	228 (82.9)	184 (87.2)	0.188
Primary hernia, n (%)	438 (90.1)	245 (89.1)	193 (91.5)	0.377
Bilateral hernia, n (%)	67 (13.8)	32 (11.6)	35 (16.6)	0.108
Operative time, min (mean ± SD)	58.4 ± 18.6	52.3 ± 14.2	66.4 ± 21.3	<0.001

Complication Rates: The overall mesh-related complication rate was 12.8% (n=62) at 12-month follow-up. Chronic groin pain was the most frequent complication, occurring in 31 patients (6.4%), followed by seroma formation in 15 patients (3.1%), surgical site infection in 10 patients (2.1%), and mesh migration in 6 patients (1.2%). Detailed complication rates are shown in Table 2.

Table 2: Mesh-related Complications at 12-Month Follow-up

Complication	Total n (%)	Open Repair n (%)	Laparoscopic Repair n (%)	p-value
Any complication	62 (12.8)	44 (15.9)	18 (8.7)	0.018
Chronic groin pain	31 (6.4)	24 (8.7)	7 (3.3)	0.014
Seroma formation	15 (3.1)	10 (3.6)	5 (2.4)	0.420
Surgical site infection	10 (2.1)	8 (2.9)	2 (0.9)	0.126
Mesh migration	6 (1.2)	2 (0.7)	4 (1.9)	0.249
Hernia recurrence	8 (1.6)	5 (1.8)	3 (1.4)	0.735
Mesh removal required	4 (0.8)	3 (1.1)	1 (0.5)	0.461

Risk Factor Analysis: Multivariate logistic regression analysis identified several independent predictors of mesh-related complications. Age >60 years (OR=2.34, 95% CI: 1.42-3.86, p=0.001), BMI >30 kg/m² (OR=2.89, 95% CI: 1.67-4.99, p<0.001), diabetes mellitus (OR=1.98, 95% CI: 1.21-3.24, p=0.006), and recurrent hernia (OR=2.12, 95% CI: 1.18-3.81, p=0.012) were significantly associated with increased complication risk. Laparoscopic approach was protective against complications (OR=0.51, 95% CI: 0.29-0.89, p=0.018). Results are presented in Table 3.

Table 3: Multivariate Logistic Regression Analysis for Risk Factors

Variable	Odds Ratio	95% CI	p-value
Age >60 years	2.34	1.42-3.86	0.001
BMI >30 kg/m²	2.89	1.67-4.99	<0.001
Current smoking	1.54	0.92-2.58	0.098
Diabetes mellitus	1.98	1.21-3.24	0.006
Recurrent hernia	2.12	1.18-3.81	0.012
Bilateral hernia	1.43	0.78-2.62	0.246
Laparoscopic approach	0.51	0.29-0.89	0.018
Operative time >60 min	1.28	0.74-2.21	0.378

The mean VAS pain score at 12 months was significantly higher in patients with chronic groin pain (4.2 ± 1.8) compared to those without complications (0.8 ± 0.6, p<0.001). Median time to onset of chronic pain was 4 months (IQR: 3-6 months).

Discussion

This prospective cohort study provides comprehensive data on mesh-related complications following inguinal hernia repair, revealing an overall complication rate of 12.8% at 12-month follow-up. These findings are consistent with previously reported rates in the literature and

highlight the ongoing challenge of mesh-related morbidity [14].

Chronic groin pain emerged as the most prevalent complication in our cohort, affecting 6.4% of patients. This rate falls within the lower range of published estimates, which vary from 6% to 29% depending on definitions and assessment methods [15]. The international guidelines on groin hernia management emphasize the importance of standardized pain assessment and appropriate surgical technique to minimize this complication [16].

Our finding that laparoscopic repair was associated with significantly lower complication rates (8.7% vs. 15.9%, p=0.018) supports existing evidence favoring minimally invasive approaches. A large meta-analysis comparing laparoscopic and open inguinal hernia repair demonstrated similar benefits of laparoscopic techniques regarding chronic pain and early recovery [17]. However, it is important to note that laparoscopic surgery requires specialized training and resources, which may limit its applicability in certain settings.

The identification of obesity (BMI >30 kg/m²) as the strongest predictor of mesh-related complications (OR=2.89) aligns with previous studies demonstrating increased surgical site complications in obese patients [18]. Adipose tissue may impair wound healing, increase inflammatory responses, and contribute to mesh-related fibrosis and discomfort. These findings emphasize the importance of preoperative optimization and weight management counseling.

Diabetes mellitus was independently associated with mesh-related complications (OR=1.98), consistent with literature reporting increased infection rates and impaired wound healing in diabetic patients undergoing hernia surgery [19]. Optimization of glycemic control before elective surgery is crucial in this population.

The association between advanced age and complications may reflect cumulative comorbidities, altered tissue healing capacity, and age-related changes in collagen metabolism [20]. Careful patient selection and perioperative optimization are essential in elderly patients undergoing hernia repair.

Seroma formation occurred in 3.1% of patients, which is lower than some reported rates. This may be attributed to standardized surgical technique, including careful hemostasis and appropriate mesh fixation [21]. Surgical site infection occurred in 2.1% of patients, similar to rates reported in other studies and within acceptable limits for clean surgical procedures.

Mesh migration, though rare (1.2%), represents a serious complication potentially requiring reoperation. Recent advances in mesh design and fixation techniques may help reduce this complication [22]. In our study, four patients required mesh removal due to intractable pain or infection, highlighting the importance of appropriate patient counseling regarding potential outcomes.

Study limitations include the single-center design, which may limit generalizability. Additionally, the relatively short follow-up period may not capture all late-onset complications such as mesh shrinkage. Future multicenter studies with longer follow-up are warranted.

Conclusion

This prospective cohort study demonstrates that mesh-related complications following inguinal hernia repair occur in approximately one in eight patients, with chronic groin pain being the most common manifestation. Obesity, diabetes mellitus, advanced age, and recurrent hernia are significant risk factors, while laparoscopic repair appears protective. These findings underscore the importance of careful patient selection, preoperative optimization of modifiable risk factors, and appropriate surgical technique selection. Standardized postoperative surveillance protocols should be implemented to ensure early detection and management of complications. Future research should focus on developing risk stratification tools and investigating novel mesh materials to further reduce complication rates.

References

1. Köckerling F, Simons MP. Current concepts of inguinal hernia repair. Visc Med. 2018;34(2):145-150. doi: 10.1159/000487278. PMID: 29888245.
2. Kingsnorth A, LeBlanc K. Hernias: inguinal and incisional. Lancet. 2003;362(9395):1561-1571. doi: 10.1016/S0140-6736(03)14746-0. PMID: 14615114.
3. Amid PK. Lichtenstein tension-free hernioplasty: its inception, evolution, and principles. Hernia. 2004;8(1):1-7. doi: 10.100 7/s10029-003-0160-y. PMID: 14505237.
4. Lichtenstein IL, Shulman AG, Amid PK, Montllor MM. The tension-free hernioplasty. Am J Surg. 1989;157(2):188-193. doi: 10.1016/0002-9610(89)90526-6. PMID: 2916733.
5. Wake BL, McCormack K, Fraser C, Vale L, Perez J, Grant AM. Transabdominal pre-peritoneal (TAPP) vs totally extraperitoneal (TEP) laparoscopic techniques for inguinal hernia repair. Cochrane Database Syst Rev.

2005;(1):CD004703. doi: 10.1002/14651858.CD004703.pub2. PMID: 15674961.
6. Aasvang E, Kehlet H. Chronic postoperative pain: the case of inguinal herniorrhaphy. Br J Anaesth. 2005;95(1):69-76. doi: 10.1093/bja/aei019. PMID: 15531621.
7. Coda A, Lamberti R, Martorana S. Classification of prosthetic materials and mesh-related complications. Hernia. 2012;16(1):9-20. doi: 10.1007/s10029-011-0868-z. PMID: 21822933.
8. Amid PK. Radiologic images of meshoma: a new phenomenon causing chronic pain after prosthetic repair of abdominal wall hernias. Arch Surg. 2004;139(12):1297-1298. doi: 10.1001/archsurg.139.12.1297. PMID: 15611452.
9. Nienhuijs S, Staal E, Strobbe L, Rosman C, Groenewoud H, Bleichrodt R. Chronic pain after mesh repair of inguinal hernia: a systematic review. Am J Surg. 2007;194(3):394-400. doi: 10.1016/j.amjsurg.2007.02.012. PMID: 17693290.
10. Berger RL, Li LT, Hicks SC, Davila JA, Kao LS, Liang MK. Development and validation of a risk-stratification score for surgical site occurrence and surgical site infection after open ventral hernia repair. J Am Coll Surg. 2013;217(6):974-982. doi: 10.1016/j.jamcollsurg.2013.08.003. PMID: 24051068.
11. Klinge U, Klosterhalfen B, Birkenhauer V, Junge K, Conze J, Schumpelick V. Impact of polymer pore size on the interface scar formation in a rat model. J Surg Res. 2002;103(2):208-214. doi: 10.1006/jsre.2002.6358. PMID: 11922736.
12. O'Dwyer PJ, Kingsnorth AN, Molloy RG, Small PK, Lammers B, Horeyseck G. Randomized clinical trial assessing impact of a lightweight or heavyweight mesh on chronic pain after inguinal hernia repair. Br J Surg. 2005;92(2):166-170. doi: 10.1002/bjs.4833. PMID: 15584057.
13. Grant AM, Scott NW, O'Dwyer PJ; MRC Laparoscopic Groin Hernia Trial Group. Five-year follow-up of a randomized trial to assess pain and numbness after laparoscopic or open repair of groin hernia. Br J Surg. 2004;91(12):1570-1574. doi: 10.1002/bjs.4799. PMID: 15515112.
14. Simons MP, Aufenacker T, Bay-Nielsen M, et al. European Hernia Society guidelines on the treatment of inguinal hernia in adult patients. Hernia. 2009;13(4):343-403. doi: 10.1007/s10029-009-0529-7. PMID: 19636493.
15. Poobalan AS, Bruce J, Smith WC, King PM, Krukowski ZH, Chambers WA. A review of chronic pain after inguinal herniorrhaphy. Clin J Pain. 2003;19(1):48-54. doi: 10.1097/00002508-200301000-00006. PMID: 12514456.
16. HerniaSurge Group. International guidelines for groin hernia management. Hernia. 2018;22(1):1-165. doi: 10.1007/s10029-017-1668-x. PMID: 29330835.
17. McCormack K, Scott NW, Go PM, Ross S, Grant AM; EU Hernia Trialists Collaboration. Laparoscopic techniques versus open techniques for inguinal hernia repair. Cochrane Database Syst Rev. 2003;(1):CD001785. doi: 10.1002/14651858.CD001785. PMID: 12535413.
18. Rosemar A, Angerås U, Rosengren A. Body mass index and groin hernia: a 34-year follow-up study in Swedish men. Ann Surg. 2008;247(6):1064-1068. doi: 10.1097/SLA.v0b013e31816b4399. PMID: 18520237.
19. Mavros MN, Athanasiou S, Alexiou VG, Mitsikostas PK, Peppas G, Falagas ME. Risk factors for mesh-related infections after hernia repair surgery: a meta-analysis of cohort studies. World J Surg. 2011;35(11):2389-2398. doi: 10.1007/s00268-011-1266-5. PMID: 21913134.
20. Nilsson H, Stylianidis G, Haapamäki M, Nilsson E, Nordin P. Mortality after groin hernia surgery. Ann Surg. 2007;245(4):656-660. doi: 10.1097/01.sla.0000251364.32698.4b. PMID: 17414617.
21. Bittner R, Schwarz J. Inguinal hernia repair: current surgical techniques. Langenbecks Arch Surg. 2012;397(2):271-282. doi: 10.1007/s00423-011-0875-7. PMID: 22116525.
22. Köhler G, Luketina RR, Emmanuel K. Sutured repair of primary small umbilical and epigastric hernias: concomitant rectus diastasis is a significant risk factor for recurrence. World J Surg. 2015;39(1):121-126. doi: 10.1007/s00268-014-2765-y. PMID: 25217109.