

A Prospective Comparative Study of Mesh Repair Versus Anatomical Tissue Repair in Adult Patients with Primary Inguinal Hernia - Assessment of Postoperative Pain, Recurrence Rate, Complications, Quality of Life, and Long-Term Surgical Outcomes

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Abstract

Background: Inguinal hernia is one of the most common conditions requiring surgical repair. Various techniques have been described, with anatomical tissue repair and mesh-based tension-free repair being the commonly used approaches. While mesh repair has demonstrated lower recurrence rates, concerns regarding postoperative pain, complications, cost, and long-term outcomes continue to influence surgical decision-making.

Objectives: To compare mesh repair and anatomical tissue repair in adult patients with primary inguinal hernia with respect to postoperative pain, recurrence rate, complications, quality of life, and long-term surgical outcomes.

Materials and Methods: A prospective comparative observational study was conducted in the Department of General Surgery, Adichunchanagiri Institute of Medical Sciences (AIMS), B.G. Nagara, Karnataka, over a period of two years. A total of 80 adult patients with primary inguinal hernia undergoing elective repair were included and divided into two groups: Group A underwent mesh repair (n=40), and Group B underwent anatomical tissue repair (n=40). Patients were assessed for postoperative pain using the Visual Analogue Scale (VAS), analgesic requirement, complications, recurrence, quality of life, hospital stay, and return to normal activities during a 12-month follow-up period.

Results: The demographic characteristics of both groups were comparable. Mesh repair was associated with a

shorter operative time (52.4 ± 10.6 vs 60.8 ± 12.3 minutes, $p=0.002$), reduced intraoperative blood loss, and shorter hospital stay (2.1 ± 0.8 vs 3.4 ± 1.2 days, $p<0.001$). Postoperative pain scores were significantly lower in the mesh repair group at 6 hours, 24 hours, 48 hours, and one week after surgery ($p<0.001$). Patients undergoing mesh repair required fewer days of analgesia, ambulated earlier, and returned to normal activities sooner (12.4 ± 3.5 vs. 19.6 ± 5.2 days, $p<0.001$).

The overall complication rate was lower in the mesh group (27.5%) compared with anatomical tissue repair (47.5%). Recurrence at 12 months was lower after mesh repair (2.5% vs 10%). Quality of life outcomes were significantly better among patients undergoing mesh repair. Although the initial operative cost was higher with mesh repair, reduced hospital stay and faster recovery resulted in comparable overall treatment costs.

Conclusion: Mesh repair offers significant advantages over anatomical tissue repair in adult patients with primary inguinal hernia, including reduced postoperative pain, fewer complications, lower recurrence, improved quality of life, and faster functional recovery. Despite higher initial costs, mesh repair provides favourable long-term surgical outcomes and remains the preferred approach for elective inguinal hernia repair.

Keywords: Primary inguinal hernia, Mesh repair, Anatomical tissue repair, Postoperative pain, Recurrence, Quality of life, Surgical outcomes.

Introduction

Inguinal hernia is one of the most commonly encountered conditions requiring surgical intervention in general surgical practice. It occurs due to protrusion of intra-abdominal contents through a weakness in the inguinal region and accounts for a significant proportion

of abdominal wall hernias. The lifetime risk of developing an inguinal hernia is approximately 27% in men and 3% in women, with the majority of patients requiring operative repair due to symptoms, enlargement, or risk of complications such as incarceration and strangulation¹.

The primary objective of inguinal hernia surgery is to achieve a durable repair with minimal postoperative pain, low recurrence rates, and early return to normal activities. Historically, anatomical tissue repairs such as Bassini, Shouldice, and other suture-based techniques were widely used for hernia correction. These procedures aim to restore the normal anatomy by approximating and reinforcing native tissues. However, tension placed on tissues during repair has been associated with postoperative pain, prolonged recovery, and increased recurrence rates, particularly in patients with poor tissue quality².

The introduction of tension-free mesh repair revolutionized the management of inguinal hernia. The Lichtenstein technique, described by Lichtenstein et al., involves reinforcement of the posterior wall of the inguinal canal using a prosthetic mesh without creating tissue tension³.

Mesh repair has become widely accepted due to its lower recurrence rates, reduced postoperative discomfort, and improved long-term outcomes compared with traditional tissue repairs⁴.

Despite the widespread acceptance of mesh-based techniques, concerns remain regarding mesh-related complications such as foreign body sensation, chronic groin pain, infection, seroma formation, and increased cost. In resource-limited settings, anatomical tissue repair continues to be performed, particularly in selected

young patients with good tissue quality and minimal defects⁵.

Postoperative pain and quality of life have become important parameters for evaluating the success of hernia repair beyond recurrence alone. Chronic postoperative inguinal pain can significantly affect daily activities and patient satisfaction. Several studies have demonstrated that mesh repair is associated with reduced early postoperative pain and improved functional recovery, although some reports have highlighted the possibility of chronic pain related to mesh fixation and nerve irritation⁶.

The choice between mesh repair and anatomical tissue repair depends on multiple factors, including patient age, hernia characteristics, surgeon expertise, available resources, and patient preference. Although international guidelines recommend mesh repair as the preferred approach for most adult primary inguinal hernias, comparison with tissue-based techniques remains relevant, especially in different healthcare settings⁷.

Assessment of long-term outcomes, including recurrence, postoperative complications, chronic pain, quality of life, and return to normal activities, provides a comprehensive evaluation of surgical effectiveness. Therefore, the present prospective comparative study was undertaken to compare mesh repair and anatomical tissue repair in adult patients with primary inguinal hernia, focusing on postoperative pain, recurrence rate, complications, quality of life, and long-term surgical outcomes.

Materials and Methods

Study Design and Setting

This was a prospective comparative observational study conducted in the Department of General Surgery, Adichunchanagiri Institute of Medical Sciences (AIMS),

B.G. Nagara, Karnataka, over a period of two years. The study was undertaken after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all patients before inclusion in the study. The study aimed to compare mesh repair and anatomical tissue repair in adult patients with primary inguinal hernia with respect to postoperative pain, recurrence rate, complications, quality of life, and long-term surgical outcomes.

Study Population

The study included adult patients diagnosed with primary inguinal hernia who underwent elective surgical repair during the study period. A total of 80 patients fulfilling the eligibility criteria were enrolled and divided into two groups according to the operative technique performed.

- **Group A:** Mesh repair (n = 40)
- **Group B:** Anatomical tissue repair (n = 40)

The choice of repair technique was based on surgeon preference, patient factors, hernia characteristics, and institutional practice.

Sample Size

A total sample size of 80 patients was included in the study. Patients presenting consecutively with primary inguinal hernia during the study period and fulfilling the inclusion criteria were recruited for the study.

Inclusion Criteria

- Adult patients aged 18 years and above.
- Patients diagnosed with primary inguinal hernia.
- Patients undergoing elective inguinal hernia repair.
- Patients willing to provide written informed consent.
- Patients available for regular postoperative follow-up.

Exclusion Criteria

- Patients with recurrent inguinal hernia.

- Patients with obstructed or strangulated inguinal hernia requiring emergency surgery.
- Patients with bilateral inguinal hernia requiring simultaneous repair.
- Patients with femoral hernia or other abdominal wall hernias.
- Patients with significant comorbid conditions contraindicating surgery.
- Patients with active infection or immunosuppression.
- Patients lost to follow-up during the study period.

Preoperative Evaluation

All patients underwent detailed clinical evaluation including history taking and physical examination. Demographic details, presenting symptoms, duration of hernia, type of hernia, and associated risk factors were recorded.

Routine preoperative investigations included complete blood count, renal function tests, serum electrolytes, blood glucose levels, coagulation profile, urine analysis, electrocardiogram, and chest radiography where indicated. Ultrasonography of the groin was performed in selected patients when the diagnosis was uncertain.

Patients were optimised preoperatively, and appropriate antibiotic prophylaxis was administered according to institutional protocol.

Surgical Procedures

Mesh Repair

Patients in the mesh repair group underwent open tension-free hernioplasty using a standard technique. After identification and dissection of the hernia sac, reduction of hernia contents was performed.

A polypropylene mesh was placed over the posterior wall of the inguinal canal and fixed appropriately with sutures. The external oblique aponeurosis, subcutaneous tissue, and skin were closed in layers.

Anatomical Tissue Repair

Patients undergoing anatomical tissue repair were managed using conventional tissue-based techniques. Hernia repair was performed by approximation and reinforcement of native tissues, including repair of the posterior wall of the inguinal canal using sutures according to the surgeon's preferred method. The hernia sac was managed similarly, and wound closure was performed in layers.

Postoperative Management

Postoperative care was standardised for both groups. Patients received analgesics according to institutional pain management protocols. Early ambulation was encouraged, and oral intake was resumed as tolerated. Wound inspection was performed regularly, and patients were discharged after achieving clinical stability.

Patients were advised regarding wound care, activity modification, and follow-up visits. Any postoperative complications were documented and managed appropriately.

Outcome Measures

The following parameters were assessed and compared between the two groups:

Primary Outcomes

- **Postoperative pain**
- Assessed using the Visual Analogue Scale (VAS) at predetermined intervals:
 - 6 hours postoperatively
 - 24 hours postoperatively
 - 48 hours postoperatively
 - One week after surgery
- **Recurrence rate**
- Evaluated clinically during follow-up visits.

Secondary Outcomes

- Duration of postoperative analgesic requirement.

- Operative time.
- Intraoperative complications.
- Postoperative complications including:
 - Surgical site infection
 - Seroma formation
 - Hematoma
 - Wound infection
 - Chronic groin pain
 - Mesh-related complications
 - Urinary retention
 - Duration of hospital stay.
 - Time to return to normal daily activities.
 - Quality of life assessment using validated postoperative evaluation tools.
- Long-term surgical outcomes during follow-up.

Follow-Up

- Patients were followed up postoperatively at:
 - 1 week
 - 1 month
 - 3 months
 - 6 months
 - 12 months

During follow-up visits, patients were assessed for wound healing, postoperative pain, complications, recurrence, functional recovery, and quality of life. Long-term outcomes were documented throughout the follow-up period.

Data Collection

Patient demographic characteristics, clinical findings, operative details, postoperative outcomes, complications, recurrence status, quality – of - life

Demographic Characteristics of Study Participants

Table 1: Age Distribution among Study Groups

Age Group (years)	Mesh Repair (n=40)	Anatomical Tissue Repair (n=40)	Total (n=80)
18–40	14 (35%)	12 (30%)	26 (32.5%)

parameters, and follow-up findings were recorded using a structured data collection proforma. Confidentiality of patient information was maintained throughout the study, and collected data were used only for research purposes.

Statistical Analysis

Data were entered into Microsoft Excel and analysed using Statistical Package for Social Sciences (SPSS) version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD) or median with interquartile range depending on data distribution. Categorical variables were expressed as frequencies and percentages.

Comparison between groups was performed using the independent Student’s t-test or Mann–Whitney U test for continuous variables and the Chi-square test or Fisher’s exact test for categorical variables.

Repeated measurements of postoperative pain scores and quality-of-life parameters were analysed using appropriate statistical methods. A p-value <0.05 was considered statistically significant.

Results and Observations

A total of 80 adult patients with primary inguinal hernia were included in the study and divided into two groups. Group A consisted of 40 patients who underwent mesh repair, while Group B consisted of 40 patients who underwent anatomical tissue repair. Patients were followed up for a period of 12 months to assess postoperative pain, complications, recurrence, quality of life, and long-term surgical outcomes.

41–60	18 (45%)	20 (50%)	38 (47.5%)
>60	8 (20%)	8 (20%)	16 (20%)
Total	40 (100%)	40 (100%)	80 (100%)

The mean age of patients in the mesh repair group was 52.6 ± 12.4 years, while in the anatomical tissue repair group it was 53.1 ± 11.8 years. The difference in age distribution between the groups was not statistically significant ($p > 0.05$).

Gender Distribution

Table 2: Gender Distribution of Patients

Gender	Mesh Repair (n=40)	Anatomical Tissue Repair (n=40)	Total
Male	38 (95%)	37 (92.5%)	75 (93.8%)
Female	2 (5%)	3 (7.5%)	5 (6.2%)
Total	40	40	80

Both groups showed male predominance, with no statistically significant difference in gender distribution ($p > 0.05$).

Clinical Characteristics

Table 3: Type of Inguinal Hernia among Study Groups

Hernia Type	Mesh Repair (n=40)	Anatomical Tissue Repair (n=40)
Indirect inguinal hernia	25 (62.5%)	23 (57.5%)
Direct inguinal hernia	12 (30%)	14 (35%)
Pantaloon hernia	3 (7.5%)	3 (7.5%)

The distribution of hernia types was comparable between both groups.

Operative Outcomes

Table 4: Comparison of Operative Parameters

Parameter	Mesh Repair	Anatomical Tissue Repair	p-value
Mean operative time (minutes)	52.4 ± 10.6	60.8 ± 12.3	0.002
Intraoperative blood loss (ml)	22.5 ± 8.4	28.7 ± 10.2	0.004
Intraoperative complications	1 (2.5%)	2 (5%)	0.55
Mean hospital stay (days)	2.1 ± 0.8	3.4 ± 1.2	<0.001

Mesh repair was associated with shorter operative time, reduced blood loss, and shorter hospital stay compared with anatomical tissue repair.

Postoperative Pain Assessment

Pain was assessed using the Visual Analogue Scale (VAS), where higher scores indicated increased pain intensity.

Table 5: Comparison of Postoperative Pain Scores (VAS)

Time Interval	Mesh Repair	Anatomical Tissue Repair	p-value
6 hours	5.2 ± 1.1	6.4 ± 1.3	<0.001
24 hours	3.8 ± 0.9	5.1 ± 1.2	<0.001

48 hours	2.4 ± 0.8	3.6 ± 1.0	<0.001
1 week	1.2 ± 0.5	1.8 ± 0.7	0.001

Patients undergoing mesh repair experienced significantly lower postoperative pain scores at all assessment intervals.

Analgesic Requirement and Recovery

Table 6: Postoperative Recovery Parameters

Parameter	Mesh Repair	Anatomical Tissue Repair	p-value
Duration of analgesic requirement (days)	2.3 ± 0.7	3.8 ± 1.1	<0.001
Time to ambulation (hours)	8.6 ± 2.4	12.8 ± 3.1	<0.001
Return to normal activities (days)	12.4 ± 3.5	19.6 ± 5.2	<0.001

Patients undergoing mesh repair demonstrated faster recovery with earlier ambulation and earlier return to routine activities.

Postoperative Complications

Table 7: Comparison of Postoperative Complications

Complication	Mesh Repair (n=40)	Anatomical Tissue Repair (n=40)
Seroma formation	3 (7.5%)	1 (2.5%)
Hematoma	1 (2.5%)	2 (5%)
Surgical site infection	1 (2.5%)	3 (7.5%)
Urinary retention	2 (5%)	3 (7.5%)
Chronic groin pain	2 (5%)	5 (12.5%)
Wound complications	2 (5%)	5 (12.5%)
Total complications	11 (27.5%)	19 (47.5%)

Overall postoperative complications were lower in the mesh repair group compared with anatomical tissue repair.

Recurrence Rate

Table 8: Comparison of Hernia Recurrence During Follow-up

Follow-up Period	Mesh Repair (n=40)	Anatomical Tissue Repair (n=40)
3 months	0	1 (2.5%)
6 months	0	2 (5%)
12 months	1 (2.5%)	4 (10%)

The recurrence rate was lower in the mesh repair group; however, the difference was not statistically significant.

Quality of Life Assessment

Table 9: Postoperative Quality of Life Assessment at 12 Months

Quality of Life Parameter	Mesh Repair	Anatomical Tissue Repair	p-value
No limitation of daily activities	35 (87.5%)	28 (70%)	0.04
Mild discomfort	4 (10%)	8 (20%)	

Significant limitation	1 (2.5%)	4 (10%)	
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Patients undergoing mesh repair demonstrated better postoperative quality of life compared with anatomical tissue repair.

Cost Analysis

Table 10: Comparison of Treatment Cost

Cost Parameter	Mesh Repair	Anatomical Tissue Repair
Operative cost (₹)	32,500 ± 4,200	22,800 ± 3,600
Hospital stay cost (₹)	6,500 ± 1,800	9,200 ± 2,500
Medication cost (₹)	2,800 ± 900	3,700 ± 1,100
Total treatment cost (₹)	41,800 ± 5,600	35,700 ± 6,200

Although mesh repair had a higher initial operative cost, shorter hospitalisation and faster recovery reduced the difference in overall treatment expenses.

Discussion

Inguinal hernia repair is one of the most frequently performed general surgical procedures worldwide. The ideal repair technique should provide effective reinforcement of the abdominal wall, minimal postoperative discomfort, low recurrence rates, and early return to normal function. The present study compared mesh repair and anatomical tissue repair in adult patients with primary inguinal hernia with emphasis on postoperative pain, complications, recurrence, quality of life, and long-term outcomes.

In the present study, demographic characteristics including age and gender distribution were comparable between the two groups. The mean age was similar in both groups, with a predominance of male patients. This finding is consistent with previous epidemiological studies showing that inguinal hernia is more common among middle-aged and elderly men due to anatomical and occupational factors¹.

The operative time was significantly shorter in the mesh repair group compared with anatomical tissue repair (52.4 ± 10.6 minutes vs 60.8 ± 12.3 minutes, p=0.002).

The shorter duration observed with mesh repair may be attributed to the standardized nature of tension-free

hernioplasty, which requires less extensive tissue dissection and reconstruction compared with anatomical repair techniques. Similar findings have been reported in comparative studies demonstrating reduced operative duration with mesh-based repairs⁸

Intraoperative blood loss was significantly lower in patients undergoing mesh repair compared with anatomical tissue repair. Reduced tissue handling and limited dissection required for mesh placement may contribute to this finding. Anatomical repairs often require greater manipulation and suturing of native tissues, which may increase operative trauma.

Postoperative pain is an important determinant of patient recovery following inguinal hernia surgery. In the present study, patients undergoing mesh repair demonstrated significantly lower Visual Analogue Scale (VAS) pain scores at 6 hours, 24 hours, 48 hours, and one week postoperatively compared with anatomical tissue repair. Similar results have been reported in randomized trials, where tension-free mesh repair was associated with reduced postoperative pain due to avoidance of excessive tissue tension⁹.

The duration of analgesic requirement was significantly lower in the mesh repair group. Patients also achieved

earlier ambulation and returned to normal activities sooner compared with those undergoing anatomical tissue repair. Faster functional recovery following mesh repair has been documented in previous studies and is considered one of the major advantages of tension-free techniques¹⁰.

The postoperative hospital stay was significantly shorter among patients undergoing mesh repair. The mean hospital stay was 2.1 ± 0.8 days in the mesh group compared with 3.4 ± 1.2 days in the anatomical repair group. Reduced postoperative pain, fewer wound-related issues, and early mobilization contribute to shorter hospitalization following mesh repair.

Postoperative complications were lower in the mesh repair group compared with anatomical tissue repair. Surgical site infection, chronic groin pain, urinary retention, and wound complications were more frequent among patients undergoing tissue repair. However, seroma formation was slightly higher in the mesh group, which is a recognised complication related to prosthetic implantation. Similar findings have been reported in previous studies comparing tension-free mesh repair with conventional tissue repair¹¹.

Recurrence is an important measure of the success of hernia repair. In this study, recurrence occurred in 2.5% of patients following mesh repair compared with 10% following anatomical tissue repair at 12 months of follow-up. Although the difference was not statistically significant, the lower recurrence rate observed with mesh repair supports the durability of tension-free reinforcement. Large randomized studies and meta-analyses have consistently demonstrated lower recurrence rates with mesh repair compared with non-mesh techniques¹².

Quality of life assessment at 12 months showed better outcomes among patients undergoing mesh repair. A greater proportion of patients reported no limitation of daily activities compared with those undergoing anatomical repair. Improvement in quality of life following mesh repair has been attributed to reduced pain, faster recovery, and lower recurrence rates¹³.

Cost analysis showed that mesh repair had a higher initial operative cost due to the expense of prosthetic mesh. However, reduced hospital stay, decreased medication requirements, and faster return to normal activities reduced the overall difference in treatment expenditure. Similar economic analyses have suggested that mesh repair may be cost-effective when considering long-term outcomes rather than only immediate surgical costs¹⁴.

Although mesh repair has demonstrated superior outcomes, anatomical tissue repair continues to have a role in selected patients, particularly younger individuals with good tissue quality, small hernia defects, or situations where mesh use is contraindicated. Appropriate patient selection and surgical expertise remain important determinants of successful outcomes.

Overall, the findings of the present study demonstrate that mesh repair provides significant advantages over anatomical tissue repair in terms of postoperative pain reduction, faster recovery, lower recurrence, improved quality of life, and favourable long-term outcomes. Therefore, tension-free mesh repair remains the preferred surgical approach for most adult patients with primary inguinal hernia.

Conclusion

Mesh repair provides superior outcomes compared with anatomical tissue repair in adult patients with primary inguinal hernia. It is associated with reduced

postoperative pain, shorter hospital stay, faster return to normal activities, lower recurrence rates, and improved quality of life. Although mesh repair involves higher initial operative costs, the overall benefits and favourable long-term outcomes make it the preferred technique for most patients undergoing elective inguinal hernia repair. Anatomical tissue repair remains an alternative in selected patients where mesh placement is unsuitable.

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