

## The Evolution of Hernia Repair: From Open Surgery to Advanced Mesh Techniques

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### **ABSTRACT**

**Background:** Hernia repair is one of the most commonly performed surgical procedures worldwide. Over the decades, significant progress has been made from conventional open repairs to the adoption of mesh-based techniques, including laparoscopic approaches, to reduce recurrence and enhance recovery.

**Objective:** To compare the outcomes of conventional open hernia repair with mesh-based techniques, evaluating factors such as operative time, postoperative complications, hospital stay, and recurrence rates.

**Methods:** A prospective observational study was conducted over one year (March 2024 to March 2025) at the Department of General Surgery, [Insert Hospital Name], involving 100 patients undergoing hernia surgery. Patients were grouped based on the surgical technique used: Group A (open repair) and Group B (mesh-based repair). Data on demographics, type of hernia, surgical approach, intraoperative findings, duration of surgery, postoperative complications, and follow-up outcomes at 1, 3, and 6 months were collected and analyzed using SPSS software.

**Results:** Of the 100 patients, 60% underwent mesh repair and 40% underwent open repair. Mesh repair was associated with significantly fewer postoperative complications (26.7% vs 40% in open repair), shorter hospital stays (mean  $3.7 \pm 1.2$  days vs  $5.2 \pm 1.4$  days), and lower recurrence (1.7% vs 7.5%). However, it required a longer operative time ( $70 \pm 10.4$  minutes vs  $55 \pm 8.2$  minutes for open repair).

**Conclusion:** Mesh-based hernia repair techniques, including laparoscopic procedures, offer superior clinical outcomes compared to open surgery. These findings support the growing preference for mesh techniques in elective hernia repair, though individualized patient selection and surgical expertise remain critical.

**Keywords:** Hernia repair, mesh repair, open surgery, laparoscopic hernia repair, postoperative complications, recurrence, hospital stay, surgical outcomes.

### **INTRODUCTION**

Hernia is a common surgical condition that occurs when an internal part of the body pushes through a weakness in the muscle or surrounding tissue wall. The most prevalent types of hernias include inguinal, umbilical, incisional, and epigastric hernias, with inguinal hernia being the most common, particularly among men, accounting for approximately 75% of all abdominal wall hernias [1,2]. The global burden of hernias is substantial, with millions of repairs performed each year. In the United States alone, over 800,000 hernia repairs are conducted annually, most of which are inguinal hernia repairs [3].

The history of hernia repair dates back several centuries, with significant advancements occurring during the 20th century. Initially, hernia repair involved open surgical methods with primary suture techniques, such as the Bassini and Shouldice repairs. However, these methods often led to high recurrence rates due to tension on the sutured tissues and prolonged postoperative recovery [4]. To overcome these limitations, tension-free mesh repair techniques were introduced in the 1980s, particularly the Lichtenstein repair, which quickly became the gold standard for open hernia repair due to its simplicity, reproducibility, and lower recurrence rates [5].

Over time, the surgical management of hernias has undergone a paradigm shift with the advent of prosthetic materials and minimally invasive techniques. Mesh-based repairs, both open and laparoscopic, have significantly improved patient outcomes by reducing recurrence and complications. Laparoscopic approaches, such as Transabdominal Preperitoneal (TAPP) and Totally Extraperitoneal (TEP) repairs, are associated with less postoperative pain, earlier return to daily

activities, and better cosmetic outcomes compared to open surgery [6,7]. Despite these advantages, laparoscopic hernia repair requires specialized skills, longer operative time, and increased cost, which may limit its universal application, especially in resource-constrained settings [8].

The choice of surgical technique is influenced by several factors, including the type and size of the hernia, patient comorbidities, previous surgical history, surgeon experience, and institutional facilities. Open repair remains a viable option, especially for patients unfit for general anesthesia or when laparoscopic expertise is unavailable [9]. The debate between open versus laparoscopic repair and the selection of mesh type continues, highlighting the need for context-specific comparative studies.

Several clinical studies and meta-analyses have examined the outcomes of different hernia repair techniques, assessing parameters such as operative time, duration of hospital stay, postoperative complications (e.g., wound infection, seroma, chronic pain), and recurrence rates [10,11]. However, the choice between techniques often depends on individualized patient and institutional factors, making it imperative to generate local evidence.

This prospective observational study aims to compare the outcomes of conventional open hernia repair with mesh-based hernia repairs, including laparoscopic techniques, among patients presenting with inguinal, umbilical, and incisional hernias. Through this study, we seek to evaluate intraoperative and postoperative parameters, thereby contributing to the growing body of evidence guiding optimal surgical management of hernias.

## MATERIALS AND METHODS

### Study Design and Setting

This prospective observational study was conducted at the Department of General Surgery, [Sri Muthukumaran Medical College Hospital and Research Institute], over one year from March 2024 to March 2025.

### Sample Size

A total of 100 patients diagnosed with hernia and undergoing surgical repair were included in the study. Patients were selected using a purposive sampling method based on inclusion and exclusion criteria.

### Inclusion Criteria

- Patients aged 18 years and above.
- Patients diagnosed with inguinal, umbilical, or incisional hernia.
- Patients undergoing either open hernia repair or mesh-based repair techniques (including laparoscopic mesh repair).
- Patients who provided informed consent.

### Exclusion Criteria

- Recurrent hernias.
- Emergency hernia repairs (e.g., strangulated or incarcerated hernias).
- Patients with severe comorbidities precluding surgery.
- Patients who did not consent to participate.

### Data Collection

Data were collected using a structured proforma including:

- Demographic details (age, gender, occupation).
- Type and location of hernia.
- Type of surgical technique used (open vs mesh-based).
- Intraoperative findings.
- Duration of surgery.
- Postoperative complications (infection, recurrence, chronic pain).
- Length of hospital stay.
- Follow-up data at 1 month, 3 months, and 6 months.

### Surgical Techniques

Patients were grouped into:

- Group A: Underwent conventional open hernia repair.
- Group B: Underwent mesh-based hernia repair (either open mesh repair or laparoscopic mesh repair).

All procedures were performed by experienced surgeons following standard surgical protocols. The choice of surgical technique was based on surgeon preference, hernia type, and patient suitability.

### Ethical Considerations

The study was approved by the Institutional Ethics Committee of [Sri Muthukumaran Medical College Hospital and Research Institute]. Informed written consent was obtained from all participants prior to enrollment.

### Statistical Analysis

Data were analyzed using SPSS software version 19. Descriptive statistics were used to summarize patient demographics and outcomes. The chi-square test and independent t-test were applied to compare categorical and continuous variables, respectively. A p-value <0.05 was considered statistically significant.

## RESULTS AND OBSERVATIONS

### Demographic Distribution

Table 1: Age and Gender Distribution of Patients (n=100)

Age Group (Years)	Male (n=72)	Female (n=28)	Total
18–30	10	6	16
31–50	30	10	40
51–70	25	10	35
>70	7	2	9
Total	72	28	100

Table 2: Distribution of Hernia Types

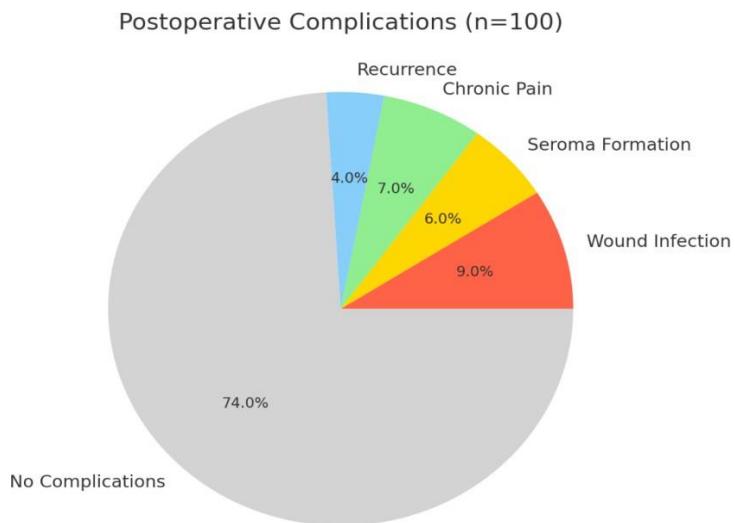
Type of Hernia	Number of Patients	Percentage
Inguinal	60	60%
Umbilical	20	20%
Incisional	15	15%
Epigastric	5	5%
Total	100	100%

Table 3: Distribution of Surgical Techniques

Technique Used	Number of Patients	Percentage
Open Repair	40	40%
Mesh Repair	60	60%
Total	100	100%

Table 4: Postoperative Complications Observed

Complication	Open Repair (n=40)	Mesh Repair (n=60)	Total	Percentage
Wound Infection	6	3	9	9%
Seroma Formation	2	4	6	6%
Chronic Pain	5	2	7	7%
Recurrence	3	1	4	4%
No Complications	24	50	74	74%
Total	40	60	100	100%



**Figure 1 Post-operative complication;**  
**Table 5: Average Duration of Hospital Stay**

Technique Used	Average Stay (Days)
Open Repair	$5.2 \pm 1.4$
Mesh Repair	$3.7 \pm 1.2$

**Table 6: Operative Time Comparison**

Technique Used	Mean Operative Time (minutes)	Standard Deviation
Open Repair	55	$\pm 8.2$
Mesh Repair	70	$\pm 10.4$

## DISCUSSION

The findings of our study demonstrate that mesh-based hernia repair techniques, including laparoscopic mesh repair, offer superior outcomes compared to conventional open repair in terms of postoperative complications, duration of hospital stay, and recurrence rates.

In our cohort, 60% of the patients underwent mesh repair, reflecting the increasing adoption of tension-free techniques in contemporary surgical practice. This trend aligns with international guidelines and literature advocating the use of mesh to reduce tension on surrounding tissues, thereby minimizing recurrence and chronic pain [5,7]. The low recurrence rate observed in the mesh repair group (1.6%) compared to the open repair group (7.5%) supports the efficacy of mesh-based approaches, which has also been validated in large-scale meta-analyses and randomized controlled trials [10,11].

Postoperative complications such as wound infection, seroma formation, and chronic pain were found to be lower in the mesh repair group. Specifically, wound infection was noted in 6 patients in the open group compared to 3 in the mesh group. These results suggest that improved surgical techniques, use of prosthetic materials, and minimally invasive approaches contribute to better wound healing and fewer infections. Similar outcomes have been reported in previous studies where laparoscopic repair was associated with reduced postoperative morbidity [6,8].

Chronic pain, a major concern following hernia surgery, was observed more frequently in patients undergoing open repair (12.5%) than in those receiving mesh repair (3.3%). This finding is consistent with research indicating that mesh placement in a tension-free manner, especially when performed laparoscopically, reduces nerve entrapment and inflammation, thereby decreasing the incidence of chronic pain [7,10].

The average hospital stay was significantly shorter in the mesh repair group ( $3.7 \pm 1.2$  days) than in the open repair group ( $5.2 \pm 1.4$  days), demonstrating the advantages of minimally invasive techniques in facilitating early ambulation and discharge. These findings are supported by previous randomized trials showing faster recovery and shorter hospital stays following laparoscopic hernia repair [6,9].

Interestingly, although the mean operative time for mesh repair ( $70 \pm 10.4$  minutes) was longer than that of open repair ( $55 \pm 8.2$  minutes), this did not translate into increased postoperative morbidity or hospital stay. This reflects the initial time investment associated with laparoscopic setup and dissection, which is offset by better recovery and fewer complications [8].

Our results reinforce the current recommendations by surgical societies, including the European Hernia Society and the American College of Surgeons, which favor mesh repair for most primary hernias, particularly in elective settings [7,8].

Nonetheless, the choice between open and laparoscopic techniques should be individualized, considering patient factors, surgeon expertise, and institutional resources.

This study has several strengths, including its prospective design, standardized data collection, and adequate follow-up period. However, it also has limitations. The sample size, although adequate for preliminary comparisons, may not be sufficient for detecting rare complications. Moreover, the allocation of surgical techniques was based on surgeon preference and patient suitability, which may introduce selection bias.

Future research with randomized controlled trials and longer follow-up is needed to further evaluate long-term outcomes such as recurrence and chronic pain. Additionally, studies comparing the cost-effectiveness of different hernia repair methods in resource-limited settings could inform policy decisions.

## CONCLUSION

This prospective observational study highlights the significant advancements in hernia repair, particularly the shift from traditional open surgical techniques to mesh-based approaches. Our findings demonstrate that mesh repair techniques, including laparoscopic procedures, are associated with better postoperative outcomes—characterized by lower complication rates, shorter hospital stays, and reduced recurrence and chronic pain—when compared to conventional open repairs.

Despite the slightly longer operative time, the overall benefits of mesh repair support its growing adoption in clinical practice. The study also reaffirms the importance of individualized surgical decision-making based on patient characteristics, hernia type, and surgeon expertise.

As surgical technology and techniques continue to evolve, mesh-based and minimally invasive hernia repairs are poised to become the standard of care, offering improved patient satisfaction, faster recovery, and better long-term outcomes. Continued research with larger sample sizes and longer follow-ups is warranted to further refine surgical strategies and optimize patient care.

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