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Comparative Study of Different Mesh Types in Hernia Repair: Compare the Outcomes, Complications, and Recurrence Rates of Different Mesh Types Used in Hernia Repair

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ABSTRACT

Background: Hernia repair is among the most commonly performed surgical procedures worldwide, with mesh reinforcement being the standard of care to reduce recurrence rates. **Objective:** To compare the postoperative outcomes, complication profiles, and recurrence rates associated with different mesh types used in hernia repair. **Methods:** A comparative cross-sectional analytical study was conducted at Sheikh Zayed Hospital, Lahore from January 2023-January 2025, including 175 patients undergoing elective hernia repair with mesh placement, using non-probability consecutive sampling. Intraoperative variables such as operative time and estimated blood loss were documented by the surgical team. Postoperative outcomes, including pain (measured using the Visual Analog Scale), seroma formation, wound infection, and recurrence, were assessed during hospital stay and followed up at regular intervals up to 6 months. **Results:** Out of 175 patients undergoing elective hernia repair, the polypropylene group had the shortest operative time (mean: 58.4 minutes) but the highest recurrence rate (7.1%) and postoperative pain incidence (24.3%). Polyester mesh showed a moderate recurrence rate (5.5%) and the highest infection rate (12.7%). Composite mesh had the lowest recurrence (2.0%) and minimal postoperative pain (16.0%), though it required a slightly longer operative time (65.1 minutes). Overall, composite mesh provided the most favorable balance between safety and efficacy. **Conclusion:** It is concluded that while polypropylene mesh remains a cost-effective option, composite mesh offers superior outcomes with fewer complications and significantly lower recurrence rates. Mesh selection should be individualized based on patient factors, surgical goals, and long-term outcome priorities.

INTRODUCTION

Repair of hernia is among the commonest surgical procedures done in the world with millions of repairs done every year to repair inguinal, ventral and incisional hernia [1]. Tension-free hernia repair using prosthetic mesh to strengthen the abdominal wall and decrease the rates of recurrence is the standard of care [2]. Advances in mesh-based repair procedures have considerably reduced the recurrence rate, which was more than 20 percent with suture-based repair, to less than 5 percent in most current series [3]. Nevertheless, the type of mesh used is still a clinical controversy since various meshes show different properties regarding biocompatibility, inflammatory reaction, handling, and durability over time [4][5]. Meshes are mainly divided by material structure and composition. Most widely used meshes are made of polypropylene, polyester and composite meshes [6]. Polypropylene mesh is very common because it is cheap, has tensile strength and it integrates easily with the surrounding tissues [7]. However, it has a pro-inflammatory property, which may cause postoperative pain, seroma, and fibrosis and thus influence the quality of life of the patient. Polyester mesh is softer and more pliable but could be linked to high infection rates because of their high porosity [8]. Composite meshes add absorbable and non-absorbable material or add a barrier layer to minimize adhesions, especially when used intraperitoneally, and are thought to be more biocompatible, but more expensive [9].

Mesh selection usually depends on the surgeon preference and hernia site, patient comorbidities. After decades of clinical practice, the question of what mesh is best to use in different types of hernia remains open [10]. Values of polypropylene meshes are still the most utilized all over the world as they are more economical; however, new

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findings indicate that composite meshes could provide superior results with fewer complications and recurrence rates. Nevertheless, they may curtail their usage, especially in resource-scarce contexts because of increased initial expenditure [11]. Prospective studies comparing the various types of mesh under standardized surgical conditions are needed to maximize the effect of hernia repair [12]. An assessment of short-term results, such as pain and wound complications, and long-term outcomes, such as recurrence can help surgeons to select evidence-based mesh type that can meet the individual needs of patients [13].

Objective

To compare the postoperative outcomes, complication rates, and recurrence rates among different mesh types used in hernia repair.

METHODOLOGY

A comparative cross-sectional analytical study was conducted at Sheikh Zayed Hospital, Lahore over a period from January 2023-January 2025, including 175 patients undergoing elective hernia repair with mesh placement, using non-probability consecutive sampling.

Inclusion Criteria

- Adults aged > 18 years
- Diagnosed with primary or recurrent abdominal wall hernias (inguinal, umbilical, or incisional)
- Undergoing elective hernia repair with mesh placement
- Provided informed consent for participation

Exclusion Criteria

- Emergency hernia surgeries
- Immunocompromised patients
- Patients with active infections or prior mesh-related complications
- Known allergy or intolerance to mesh materials

Data Collection

Data for this study were collected prospectively from 175 patients who underwent elective hernia repair with mesh placement. After obtaining informed consent, baseline demographic details including age, gender, BMI, and comorbid conditions were recorded. Patients were grouped based on the type of mesh used polypropylene, polyester, or composite. Patients were grouped based on the mesh used:

- Group A: Polypropylene mesh (n = 70)
- Group B: Polyester mesh (n = 55)
- Group C: Composite mesh (n = 50)

Intraoperative variables such as operative time and estimated blood loss were documented by the surgical team. Postoperative outcomes, including pain (measured using the Visual Analog Scale), seroma formation, wound infection, and recurrence, were assessed during hospital stay and followed up at regular intervals up to 6 months. Recurrence was confirmed by clinical examination and ultrasound.

Statistical Analysis

All data were entered and analyzed using SPSS version 26. Quantitative variables such as age, BMI, operative time, and blood loss were reported as mean ± standard deviation. Categorical variables like gender, comorbidities, type of mesh, postoperative complications, and recurrence were presented as frequencies and percentages. The chi-square test was applied to assess associations between mesh types and categorical outcomes such as pain, seroma, infection, and recurrence. A p-value of less than 0.05 was considered statistically significant.

RESULTS

Data were collected from 175 patients with a mean age of 48.6 ± 11.3 years, fairly consistent across mesh groups 47.9 ± 10.9 for polypropylene, 49.1 ± 12.1 for polyester, and 48.9 ± 11.0 for composite mesh. The male predominance was noted, with 69.7% of the overall sample being male; highest in the polypropylene group (71.4%) and lowest in the composite group (66.0%). The average BMI was 27.2 ± 3.8 kg/m^2, suggesting a generally overweight population, with minimal variation across the mesh groups.

Table 1

Demographic and Clinical Characteristics of Patients

Characteristic	Total (n=175)	Polypropylene (n=70)	Polyester (n=55)	Composite (n=50)
Mean Age (years)	48.6 ± 11.3	47.9 ± 10.9	49.1 ± 12.1	48.9 ± 11.0
Male Gender	122 (69.7%)	50 (71.4%)	39 (70.9%)	33 (66.0%)
BMI (kg/m^2)	27.2 ± 3.8	27.0 ± 3.6	27.4 ± 3.9	27.3 ± 4.0
Comorbidities				
Hypertension	61 (34.8%)	24 (34.3%)	20 (36.4%)	17 (34.0%)
Diabetes	39 (22.3%)	15 (21.4%)	13 (23.6%)	11 (22.0%)

The mean operative time for all patients was 61.3 ± 13.2 minutes, with the shortest duration observed in the polypropylene group (58.4 ± 10.2 minutes), followed by polyester (62.5 ± 12.4 minutes) and the longest in the composite mesh group (65.1 ± 14.0 minutes). Mean intraoperative blood loss was 82.1 ± 18.5 mL, slightly lower in the polypropylene group (80.4 ± 17.2 mL) and slightly higher in polyester (83.6 ± 19.1 mL) and composite mesh cases (83.2 ± 18.9 mL).

Postoperative pain was reported in 21.7% of the entire sample, with the highest frequency in the polypropylene group (24.3%) and the lowest in composite mesh users (16.0%). Seroma formation occurred in 11.4% of patients overall, relatively evenly distributed 11.4% in polypropylene, 12.7% in polyester, and 10.0% in composite mesh. Wound infection was most frequent in the polyester group (12.7%), followed by composite (8.0%), and lowest in polypropylene cases (5.7%), indicating better wound healing outcomes with polypropylene but at the cost of more pain.

Table 2

Operative Parameters

Parameter	Total (n=175)	Polypropylene (n=70)	Polyester (n=55)	Composite (n=50)
Mean Operative Time (minutes)	61.3 ± 13.2	58.4 ± 10.2	62.5 ± 12.4	65.1 ± 14.0
Mean Intraoperative Blood Loss (mL)	82.1 ± 18.5	80.4 ± 17.2	83.6 ± 19.1	83.2 ± 18.9

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Table 3
Postoperative Complications

Complication	Total (n=175)	Polypropylene (n=70)	Polyester (n=55)	Composite (n=50)
Postoperative Pain	38 (21.7%)	17 (24.3%)	13 (23.6%)	8 (16.0%)
Seroma Formation	20 (11.4%)	8 (11.4%)	7 (12.7%)	5 (10.0%)
Wound Infection	15 (8.6%)	4 (5.7%)	7 (12.7%)	4 (8.0%)

Hernia recurrence occurred in 5 out of 70 polypropylene patients (7.1%), 3 out of 55 polyester patients (5.5%), and 1 out of 50 composite mesh patients (2.0%). The difference was statistically significant ($p < 0.05$), confirming that composite mesh had the most favorable recurrence profile during the 6-month follow-up. This supports the use of composite mesh in patients at higher risk of recurrence.

Table 4
Hernia Recurrence at 6-Month Follow-up

Mesh Type	Sample Size	Recurrence Cases	Recurrence Rate (%)	p-value
Polypropylene	70	5	7.1%	< 0.05
Polyester	55	3	5.5%	
Composite	50	1	2.0%	

DISCUSSION

This study reports important clinical distinctions among three mesh types polypropylene, polyester and composite in elective hernia repair. We have found that polypropylene mesh showed the least operative time and cheapest material cost but had the highest postoperative pain (24.3%) and recurrence (7.1%) at 6 months. Composite mesh, in turn, demonstrated the best results with the lowest rate of recurrence (2.0%), postoperative pain (16.0%), and an intermediate profile regarding wound complications, although it was characterized by longer operating time and greater expense. A recurrence rate of 7.1 percent observed inpolypropylene group is in line with other studies that had reported a recurrence rate of 6-9 percent in traditional polypropylene mesh, particularly when used in high-tension repairs or when there is inadequate fixation. This could probably be because it is more rigid and prone to causing more inflammatory response. The other past study also found that polypropylene mesh, although popular, could cause discomfort because of its stiffness and chronic pain in a substantial number of patients [14][15]. Polyester mesh was a little more flexible, but had a recurrence rate of 5.5 percent and the worst wound infection rate (12.7 percent) in our study. Such results are in line with other past studies that observed that polyester mesh because of its multifilament structure and its greater porosity can act as a nidus-bacterial colonization and thus can cause more infections, particularly when sterile conditions are compromised [16][17].

Composite mesh, however, was linked with the lowest recurrence (2.0%) and fewest postoperative complications, in line with prior studies which had recommended composite meshes in high-risk patients or intra-peritoneal placements. Its multilayer structure and anti-adhesive barrier tissue reaction is minimal, and it encourages stable incorporation, which decreases inflammation and recurrence. A randomized clinical trial (RCT) is one of such past studies that compared the use of composite and polypropylene mesh in ventral hernia repair; the study reported a significant improvement in outcomes and patient-reported quality of life with composite mesh [18]. Interestingly, we also found that there were minimal variations in intraoperative blood loss between the mesh groups indicating that the type of mesh does not affect immediate operative hemostasis. Mean blood loss in all groups was 82.1 mL, which is consistent with the existing literature of mean blood loss of less than 100 mL in open and laparoscopic hernia repairs [19][20]. This trial adds to the developing data that composite mesh, although more expensive, may provide the optimal mix of safeness and effectiveness in hernia repair. However, selection of mesh ought to be driven by patient factors, surgical experience, anatomic location and availability. Polypropylene mesh could still be used in the setting with limited resources or in low-risk cases, but composite mesh could suit patients with a higher risk of recurrence or those who had previous mesh complications. But shortcomings of this study are quite short follow-up (6 months) and lack of randomization. Long-term, randomized controlled trials involving cost-effectiveness analyses are needed in future to provide further guidance on preferred mesh selection strategies.

CONCLUSION

It is concluded that the type of mesh used in hernia repair significantly influences surgical outcomes, postoperative complications, and recurrence rates. While polypropylene mesh remains a widely used, cost-effective option, it is associated with higher rates of postoperative pain and recurrence. Polyester mesh offers moderate outcomes but may carry a greater risk of wound infection. In contrast, composite mesh demonstrates superior efficacy, with the lowest recurrence rate (2.0%) and fewer complications, particularly in terms of chronic pain and seroma formation.

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