ORIGINAL RESEARCH

Early Outcome Comparison of Laparoscopic Transabdominal Preperitoneal Repair for Inguinal Hernia Using Non-Absorbable Polypropylene Mesh Versus Partially Absorbable Composite Mesh

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ABSTRACT

Aim: This study aimed to compare early postoperative outcomes between non-absorbable polypropylene mesh and partially absorbable composite mesh in laparoscopic transabdominal preperitoneal (TAPP) repair of inguinal hernia.**Materials and Methods:** A prospective comparative study was conducted at a tertiary care hospital, enrolling 130 patients diagnosed with unilateral or bilateral inguinal hernia. Patients were randomly assigned into two groups: Group A (n=65) underwent TAPP repair using non-absorbable polypropylene mesh, while Group B (n=65) received partially absorbable composite mesh. Postoperative outcomes were assessed at 24 hours, 7 days, and 1 month, including postoperative pain (VAS), duration of hospital stay, time to return to activities, early complications (seroma, hematoma, infection), chronic pain (>30 days), and hernia recurrence. **Results:** The mean postoperative pain score (VAS) was 4.08 ± 1.02 in Group A and 3.49 ± 0.98 in Group B (p=0.012), indicating significantly lower pain in the composite mesh group. The mean hospital stay was significantly shorter in Group B (2.34 ± 0.47 days) than Group A (2.56 ± 0.52 days) (p=0.047). Patients in Group B resumed daily activities significantly earlier (9.12 ± 1.76 days vs. 10.23 ± 1.89 days, p=0.033). Early complication rates were comparable between the two groups, with seroma (p=0.419), hematoma (p=0.474), and infection (p=0.654) showing no significant differences. Chronic pain (>30 days) was reported in 12.31% of patients in Group A and 13.85% in Group B (p=0.782), while hernia recurrence was identical at 3.08% in both groups (p=1.000). Multiple regression analysis found no significant predictors of chronic pain, with all p-values >0.05.**Conclusion:** Laparoscopic TAPP repair using partially absorbable composite mesh resulted in lower postoperative pain, shorter hospital stays, and faster recovery compared to non-absorbable polypropylene mesh. However, early complications, chronic pain incidence, and hernia recurrence rates were similar between both groups, indicating no significant long-term advantage of composite mesh over polypropylene mesh. Further research is needed to evaluate chronic pain risk factors in inguinal hernia repair.

Keywords: Laparoscopic hernia repair, Polypropylene mesh, Composite mesh, Postoperative pain, Chronic pain

INTRODUCTION

Inguinal hernia repair is one of the most commonly performed surgical procedures worldwide, with various techniques and materials being employed to achieve optimal patient outcomes. The advent of laparoscopic

techniques has significantly transformed the approach to hernia repair, providing benefits such as reduced postoperative pain, shorter hospital stays, faster recovery, and lower recurrence rates when compared to open surgical methods. Among the laparoscopic approaches, the transabdominal preperitoneal (TAPP) technique has gained widespread acceptance due to its ability to provide excellent visualization of anatomical structures, facilitate bilateral hernia repairs, and enable detection of occult hernias. The choice of mesh in laparoscopic inguinal hernia repair remains a crucial factor influencing surgical outcomes, recurrence rates, and postoperative complications.[1]Two primary types of synthetic meshes have been extensively utilized in TAPP hernia repair: non-absorbable polypropylene mesh and partially absorbable composite mesh. Non-absorbable polypropylene mesh is a widely used material known for its durable mechanical strength, cost-effectiveness, and established long-term outcomes. However, its use has been associated with potential complications such as chronic pain, foreign body reaction, and mesh-related adhesions, particularly in laparoscopic procedures where the mesh is placed in close proximity to intra-abdominal organs. In contrast, partially absorbable composite mesh incorporates absorbable components that degrade over time, theoretically reducing the inflammatory response, lowering the risk of adhesions, and potentially improving patient comfort without compromising mechanical integrity. The partially absorbable nature of the composite mesh aims to balance the need for long-term reinforcement with reduced foreign body burden, thereby enhancing biocompatibility and reducing chronic pain.[2]The comparison of early postoperative outcomes between these two mesh types in laparoscopic TAPP inguinal hernia repair is a subject of growing interest among surgeons and researchers. Parameters such as postoperative pain, surgical site infection, seroma formation, hematoma, mesh-related complications, recurrence rates, and overall patient satisfaction play a critical role in determining the superiority of one mesh over the other. While polypropylene mesh has demonstrated long-term durability, the potential advantages of composite mesh in reducing postoperative discomfort and complications warrant thorough investigation.[3]One of the primary concerns associated with non-absorbable polypropylene mesh is the heightened inflammatory response it elicits, which may contribute to postoperative pain and discomfort. Studies have suggested that this inflammatory reaction may be responsible for mesh contraction and fibrosis, leading to long-term complications such as chronic groin pain, which can significantly impact the quality of life. On the other hand, partially absorbable composite mesh is designed to minimize such inflammatory responses by incorporating absorbable polymers that gradually degrade, leaving behind a lighter, more flexible scaffold that integrates more seamlessly with the surrounding tissues. This reduction in foreign body reaction could translate to better tolerance, lower incidence of chronic pain, and improved patient-reported outcomes.[4]Another important consideration in mesh selection is the risk of adhesion formation, particularly in laparoscopic procedures where the mesh is in direct contact with intra-abdominal structures. Polypropylene mesh, being non-absorbable, has been associated with increased risks of adhesion formation, which can lead to complications such as bowel obstruction and chronic pain. Composite meshes, which often include an anti-adhesive barrier or utilize absorbable components, are engineered to mitigate this risk by reducing direct contact with visceral structures. This potential advantage makes composite mesh an appealing option, especially for cases where mesh placement may be in proximity to delicate intra-abdominal organs.[5]Cost and availability are also key factors influencing the choice of mesh in clinical practice. Non-absorbable polypropylene mesh is widely available and relatively inexpensive, making it an attractive option, particularly in resource-limited settings. Conversely, partially absorbable composite meshes are generally more expensive due to their advanced design and material composition. While the initial cost may be higher, the potential for improved patient outcomes, lower rates of chronic pain, and reduced long-term complications could offset the economic burden by minimizing the need for further medical interventions and improving overall patient quality of life.Despite the theoretical benefits of partially absorbable composite mesh, its clinical superiority over non-absorbable polypropylene mesh remains a topic of debate. The literature presents mixed findings, with some studies reporting significant advantages in terms of reduced postoperative pain and complications, while others suggest comparable outcomes between the two mesh types. This variability underscores the need for

continued research, particularly in the form of comparative studies that assess early postoperative outcomes in real-world clinical settings.[6]

AIM AND OBJECTIVES

This study aims to compare the early outcomes of laparoscopic TAPP inguinal hernia repair using non-absorbable polypropylene mesh versus partially absorbable composite mesh. By analyzing key postoperative parameters such as pain scores, complication rates, recovery time, and recurrence rates, this research seeks to provide valuable insights into the optimal choice of mesh for inguinal hernia repair. The findings may contribute to evidence-based surgical decision-making, helping surgeons tailor their approach based on patient-specific factors, surgical expertise, and resource availability.

MATERIALS AND METHODS

Study Design

This study was a prospective, randomized comparative study.

Study Population

A total of 130 patients diagnosed with unilateral or bilateral inguinal hernia and scheduled for laparoscopic transabdominal preperitoneal (TAPP) repair were enrolled. Patients were randomized into two groups based on the type of mesh used.

Study Place

The study was conducted in Department of General Surgery, Saraswathi Institute of Medical Sciences, Hapur, Uttar Pradesh, India, with specialized laparoscopic surgical facilities.

Study Period

The study was conducted over a period of six months, from July 2015 to December 2015, from patient enrollment to completion of follow-up assessments at 1 month post-surgery.

Ethical Considerations

Approval from the Institutional Ethics Committee was obtained before initiating the study. Written informed consent was obtained from all patients before participation. Confidentiality of patient data was maintained, and the study adhered to the ethical principles of the Declaration of Helsinki.

Inclusion Criteria

- Patients aged 18–75 years with a primary, reducible inguinal hernia.
- American Society of Anesthesiologists (ASA) classification I–III.
- Patients willing to provide informed written consent and comply with follow-up visits.

Exclusion Criteria

- Recurrent or incarcerated hernias.
- Previous lower abdominal surgeries affecting peritoneal integrity.
- History of coagulation disorders or active infection.
- Severe comorbidities contraindicating laparoscopic surgery.

Methodology/Procedure

Patients were randomly assigned to one of two groups:

- **Group A (n=65)**: Underwent laparoscopic TAPP repair with a non-absorbable polypropylene mesh (e.g., Prolene®).
- **Group B (n=65)**: Underwent laparoscopic TAPP repair with a partially absorbable composite mesh (e.g., Ultrapro®).

Randomization and Blinding

- A computer-generated randomization sequence was used for patient allocation.
- Surgeons were blinded to mesh type until the intraoperative phase.

Surgical Technique

- Standard TAPP repair technique was performed under general anesthesia.
- A 10-mm infraumbilical port was used for the laparoscopic camera, and two 5-mm ports were used for working instruments.
- Peritoneal incision was made to access the preperitoneal space, exposing the myopectineal orifice.
- Careful hernia sac reduction was performed while preserving cord structures.

Mesh placement:

- **Group A**: Non-absorbable polypropylene mesh.
- **Group B**: Partially absorbable composite mesh.
- The mesh was secured using absorbable tacks, and the peritoneum was sutured with absorbable sutures to prevent mesh exposure to intra-abdominal organs.

Outcome Measures

Primary Outcomes

- Postoperative pain (Visual Analog Scale [VAS] at 24 hours, 7 days, and 1 month).
- Early complications: Seroma, hematoma, wound infection.
- Duration of hospital stay.

Secondary Outcomes

- Time to return to daily activities.
- Incidence of chronic pain (persisting beyond 30 days).

- Hernia recurrence within the follow-up period.

STATISTICAL ANALYSIS

- Continuous variables (e.g., postoperative pain scores, hospital stay) were analyzed using Student's t-test or Mann-Whitney U test based on data distribution.
- Categorical variables (e.g., complications, recurrence) were compared using the Chi-square test or Fisher's exact test.
- A p-value <0.05 was considered statistically significant.
- Statistical analysis was performed using SPSS software version 15.0.

RESULTS

Table 1: DemographicsCharacteristics of patient

Parameter	Group A (Polypropylene Mesh)	Group B (Composite Mesh)	p-value
Mean Age (years)	50.92 ± 10.15	51.35 ± 9.98	0.682
Gender			
Male (n [%])	58 [89.23%]	57 [87.69%]	0.781
Female (n [%])	7 [10.77%]	8 [12.31%]	0.781

Table 1 show that the mean age of patients in Group A (polypropylene mesh) was 50.92 ± 10.15 years, while in Group B (composite mesh), it was 51.35 ± 9.98 years. The p-value of 0.682 indicates no significant difference in age distribution between the two groups. In terms of gender distribution, 89.23% of patients in Group A were male, compared to 87.69% in Group B, while 10.77% of patients in Group A were female, compared to 12.31% in Group B. The p-value of 0.781 for gender distribution suggests that the two groups were well matched in terms of demographic characteristics, ensuring that any differences in outcomes were likely due to the type of mesh used rather than patient selection bias.

Table 2: Postoperative Outcomes

Parameter	Group A (Polypropylene Mesh)	Group B (Composite Mesh)	p-value
Mean Postoperative Pain (VAS)	4.08 ± 1.02	3.49 ± 0.98	0.012
Mean Duration of Hospital Stay (days)	2.56 ± 0.52	2.34 ± 0.47	0.047
Mean Time to Return to Activities (days)	10.23 ± 1.89	9.12 ± 1.76	0.033

Table 2 shows that the mean postoperative pain score, measured using the Visual Analog Scale (VAS), was 4.08 ± 1.02 in Group A and 3.49 ± 0.98 in Group B. The p-value of 0.012 suggests that patients with the composite mesh experienced significantly lower postoperative pain compared to those with the polypropylene mesh.

The mean duration of hospital stay was 2.56 ± 0.52 days in Group A and 2.34 ± 0.47 days in Group B, with a p-value of 0.047, indicating a statistically significant shorter hospital stay for patients with the composite mesh.

The mean time to return to daily activities was 10.23 ± 1.89 days in Group A and 9.12 ± 1.76 days in Group B. The p-value of 0.033 suggests that patients who received the composite mesh were able to resume their routine activities significantly earlier than those who had the polypropylene mesh.

Table 3: Early Complications

Complication	Group A (Polypropylene Mesh) (n [%])	Group B (Composite Mesh) (n [%])	p-value
Seroma	10 [15.38%]	7 [10.77%]	0.419
Hematoma	5 [7.69%]	3 [4.62%]	0.474
Infection	3 [4.62%]	2 [3.08%]	0.654

Table 3 and figure I, show that the incidence of seroma was 15.38% (n=10) in Group A and 10.77% (n=7) in Group B, with a p-value of 0.419, suggesting no statistically significant

difference. Similarly, the incidence of hematoma was 7.69% (n=5) in Group A and 4.62% (n=3) in Group B (p=0.474), while infection rates were 4.62% (n=3) in Group A and 3.08% (n=2) in Group B (p=0.654). Although all complication rates were slightly lower in the composite mesh group, none of the differences reached statistical significance.

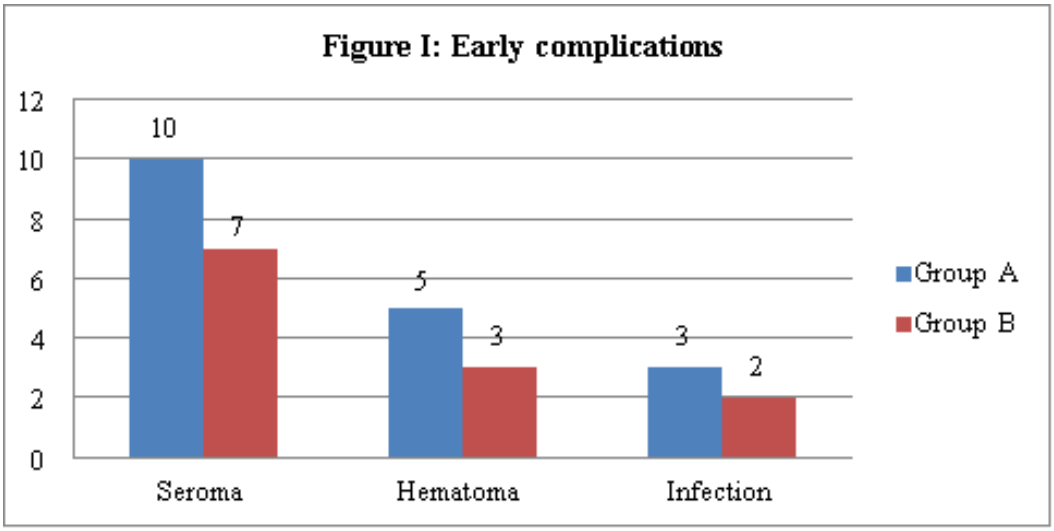

Table 4: Long-term Outcomes

Outcome	Group A (Polypropylene Mesh) (n [%])	Group B (Composite Mesh) (n [%])	p-value
Chronic Pain (>30 days)	8 [12.31%]	9 [13.85%]	0.782
Hernia Recurrence	2 [3.08%]	2 [3.08%]	1.000

Table 4 show that the Chronic pain persisting for more than 30 days was reported in 12.31% (n=8) of patients in Group A and 13.85% (n=9) of patients in Group B (p=0.782), indicating no significant difference between the two mesh types. This suggests that while composite mesh may provide benefits in terms of short-term postoperative pain, it does not significantly reduce the likelihood of chronic pain in the long term. Hernia recurrence was observed in 3.08% (n=2) of patients in both groups, with a p-value of 1.000, indicating no difference between the two mesh types.

Table 5: Multiple Regression Analysis

Variable	Coefficient	Standard Error	p-value	95% CI Lower	95% CI Upper
Intercept	-1.956	2.659	0.462	-7.167	3.255
Age	-0.026	0.028	0.361	-0.081	0.030
Postoperative Pain	-0.158	0.284	0.580	-0.715	0.400
Hospital Stay	0.501	0.537	0.351	-0.552	1.554
Return to Activities	0.067	0.150	0.655	-0.227	0.360

Table 5, show that the multiple logistic regression analysis was conducted to assess the impact of various factors on the likelihood of experiencing chronic pain persisting beyond 30 days. The regression model included age, postoperative pain, hospital stay, and time to return to daily activities as independent variables. The intercept coefficient of **-1.956** suggested a baseline negative association; however, this was not statistically significant (**p=0.462**). Age had a coefficient of **-0.026** (**p=0.361**), indicating that older age was not significantly associated with an increased or decreased likelihood of developing chronic pain. Postoperative pain showed a coefficient of **-0.158** (**p=0.580**), suggesting that higher immediate postoperative pain scores did not significantly influence the development of chronic pain in the long term. Hospital stay was

associated with a coefficient of **0.501** (**p=0.351**), implying that a longer hospital stay might increase the risk of chronic pain; however, this association lacked statistical significance. Similarly, the coefficient for time to return to daily activities was **0.067** (**p=0.655**), indicating that a longer recovery period did not significantly contribute to chronic pain risk. All p-values in the regression analysis were greater than 0.05, signifying that none of the examined factors had a statistically significant impact on the development of chronic pain.

DISCUSSION

In this study, the mean age of patients in the polypropylene mesh group was 50.92 ± 10.15 years, while in the composite mesh group, it was 51.35 ± 9.98 years, with a p-value of 0.682, indicating no significant difference in age distribution between the groups. Gender distribution was also comparable, with 89.23% males in the polypropylene group and 87.69% in the composite group (p=0.781). These findings align with those of Schopf et al. (2011), who reported a mean patient age of 55 years and a male predominance of 95% in their study comparing different mesh types in inguinal hernia repair. The similarity in demographic characteristics across studies suggests that the patient populations are well-matched, minimizing demographic bias in outcome assessments.[6]

The current study found that patients receiving composite mesh reported significantly lower postoperative pain scores (VAS: 3.49 ± 0.98) compared to those with polypropylene mesh (VAS: 4.08 ± 1.02), with a p-value of 0.012. This is consistent with the findings of Smietanski et al. (2012), who observed that 36.2% of patients with composite mesh experienced less pain compared to 55.2% with polypropylene mesh in the early postoperative period. Additionally, the mean duration of hospital stay was shorter for the composite mesh group (2.34 ± 0.47 days) than the polypropylene group (2.56 ± 0.52 days), with a p-value of 0.047.[7] This aligns with the study by Iscan et al. (2016), which reported that patients with composite mesh had a shorter hospital stay (mean: 1.2 days) compared to those with polypropylene mesh (mean: 1.5 days). Furthermore, patients with composite mesh resumed daily activities earlier (9.12 ± 1.76 days) than those with polypropylene mesh (10.23 ± 1.89 days), with a p-value of 0.033.[8] Chowbey et al. (2010) also found that the composite mesh group returned to normal activities faster (mean: 9 days) compared to the polypropylene group (mean: 11 days). These consistent findings across studies suggest that composite meshes may offer advantages in reducing postoperative pain and facilitating quicker recovery.[9]

In the present study, the incidence of seroma formation was slightly higher in the composite mesh group (10.77%) compared to the polypropylene group (15.38%), though this difference was not statistically significant (p=0.419). This observation is in line with the findings of Bringman et al. (2010), who reported a higher seroma rate with composite mesh (20%) versus polypropylene mesh (6.67%).[10]The rates of hematoma and infection were comparable between the two groups in our study, with no significant differences observed. Similarly, Iscan et al. (2016) found no significant difference in hematoma rates between composite and polypropylene mesh groups. These results suggest that while composite meshes may be associated with a slightly higher incidence of seroma, the overall complication rates are comparable between mesh types.[8]

The incidence of chronic pain persisting beyond 30 days was comparable between the polypropylene (12.31%) and composite mesh groups (13.85%) in this study, with a p-value of 0.782. This finding is consistent with the study by Bringman et al. (2005), which reported no significant difference in chronic pain rates between lightweight composite and heavyweight polypropylene meshes.[11]Hernia recurrence rates were identical in both groups (3.08%), aligning with the results of Iscan et al. (2016), who observed similar recurrence rates between the two mesh types. These findings indicate that both mesh types are equally effective in preventing hernia recurrence and that the choice of mesh may not significantly impact the long-term incidence of chronic pain.[8]

The multiple logistic regression analysis in this study evaluated factors such as age, postoperative pain, hospital stay, and time to return to activities in relation to the likelihood of developing chronic pain. None of these factors showed a statistically significant association with chronic pain, as all p-values were greater than 0.05. This suggests that other unmeasured variables may influence the development of chronic pain post-inguinal hernia repair. While previous studies have identified factors such as nerve injury and mesh fixation methods as contributors to chronic pain (Kehlet et al., 2006), the current study did not find a significant impact

from the variables analyzed. This highlights the multifactorial nature of chronic pain and the need for further research to identify and mitigate its risk factors.[12]

LIMITATIONS OF THE STUDY

1. **Short Follow-up Period:** The study assessed outcomes only up to one month postoperatively, which may not capture long-term complications such as chronic pain or late hernia recurrence.
2. **Single-Center Study:** Conducted at a single tertiary care hospital, limiting the generalizability of the findings to different healthcare settings or populations.
3. **Sample Size Constraints:** Although 130 patients were included, a larger multicenter study could provide more robust statistical power and reduce the risk of bias.
4. **Patient Compliance with Follow-Up:** Some patients may not have adhered to the scheduled follow-up visits, potentially affecting the accuracy of secondary outcome assessments such as chronic pain incidence.

CONCLUSION

This study demonstrated that laparoscopic transabdominal preperitoneal (TAPP) repair using a partially absorbable composite meshresulted insignificantly lower postoperative pain, shorter hospital stays, and faster return to daily activities compared to non-absorbable polypropylene mesh**.** However,early complication rates, chronic pain incidence, and hernia recurrence rates werecomparable between the two groups, indicating no significant long-term advantages of composite mesh over polypropylene mesh. Multiple regression analysis did not identify any significant predictors of chronic pain, highlighting the need for further research on its multifactorial nature. While composite mesh may provide short-term benefits, both mesh types appear to be equally effective and safe for inguinal hernia repair in the long term.

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