

A Comparative Study of One-Inch Incision-Mesh Plug and Laparoscopic TAPP Techniques in the Surgical Repair of Primary Indirect Inguinal Hernia

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Abstract:

Background: Inguinal hernia repair remains one of the most commonly performed general surgical procedures. With advancements in minimally invasive techniques, both the open and laparoscopic approaches have evolved. This study compares the clinical outcomes, complications, operative time, and recovery between the one-inch incision-mesh plug (MP) technique and the laparoscopic trans-abdominal preperitoneal (TAPP) approach in patients with primary indirect inguinal hernia.

Methods: This prospective randomized study was conducted from February 2019 to January 2021 at Department of General Surgery in Patna Medical College and Hospital, Patna, Bihar, India. A total of 120 patients with primary indirect inguinal hernias were randomly assigned to two groups: Group A (n=60) underwent one-inch incision-mesh plug repair, and Group B (n=60) underwent laparoscopic TAPP repair. Various parameters including operative time, postoperative pain, hospital stay, return to normal activity, and complications were assessed and compared.

Results: Patients in the mesh plug group had significantly shorter operative time and hospital stay. However, those in the TAPP group experienced less postoperative pain and an earlier return to daily activities. There were no significant differences in recurrence rates or long-term complications between the two groups. Seroma formation was more common in the TAPP group, while wound-related complications were slightly higher in the mesh plug group.

Conclusion: Both the one-inch incision-mesh plug and laparoscopic TAPP techniques are safe and effective for the treatment of primary indirect inguinal hernia. The mesh plug technique offers advantages in terms of operative time and cost, while TAPP provides superior postoperative comfort and cosmesis. The choice of technique should be tailored based on patient preference, clinical condition, and surgical expertise.

Keywords: Inguinal hernia, mesh plug repair, TAPP repair, laparoscopic surgery, hernia recurrence, postoperative pain, minimally invasive surgery

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Introduction

Inguinal hernia is among the most prevalent surgical conditions encountered worldwide, affecting a significant portion of the male population. With a lifetime risk estimated at approximately 27% in men and 3% in women, inguinal hernia repair continues to constitute a major share of elective general surgical workload. The primary goal in hernia surgery is to provide a tension-free, durable repair with minimal postoperative discomfort, rapid recovery, and low recurrence rates.

The evolution of surgical techniques over the past few decades has led to the development of various

open and laparoscopic approaches. Among these, the mesh plug (MP) repair and the laparoscopic trans-abdominal preperitoneal (TAPP) repair are commonly practiced techniques for indirect inguinal hernias. The MP technique, particularly when performed through a small (one-inch) incision, is a modification of the traditional open repair that emphasizes minimal dissection and reduced operative trauma. It is especially valued in resource-limited settings for its simplicity, shorter operative time, and cost-effectiveness.

On the other hand, laparoscopic TAPP repair, part of the minimally invasive surgery repertoire, offers the advantage of less postoperative pain, faster recovery, and excellent cosmetic outcomes. However, it requires advanced laparoscopic skills, general anesthesia, and increased operative time and cost, which may limit its widespread adoption in certain regions.

While both techniques have proven efficacy and are associated with low recurrence rates, the choice of surgical approach often depends on surgeon preference, patient characteristics, institutional infrastructure, and socioeconomic factors. There remains ongoing debate regarding the ideal technique for primary indirect inguinal hernia, especially in younger, active patients.

This study was undertaken to provide a direct comparative analysis between the one-inch incision mesh plug technique and the laparoscopic TAPP repair in patients with primary indirect inguinal hernias. By evaluating operative outcomes, postoperative complications, pain scores, duration of hospital stay, return to normal activity, and recurrence rates, this research aims to offer evidence-based guidance for optimal technique selection tailored to patient and institutional needs.

Methods

This prospective randomized controlled study was conducted in the Department of General Surgery in Patna Medical College and Hospital, Patna, Bihar, India from February 2019 to January 2021. The study population included adult patients aged between 18 and 65 years who presented with a unilateral, primary, reducible indirect inguinal hernia. A total of 120 patients were enrolled and randomly allocated into two groups using a computer-generated randomization table: Group A (n=60) underwent open one-inch incision mesh plug repair, and Group B (n=60) underwent laparoscopic trans-abdominal preperitoneal (TAPP) hernia repair.

Preoperative workup included detailed history taking, clinical examination, and relevant investigations including routine blood tests, abdominal ultrasonography, and chest X-ray. Patients with recurrent hernia, bilateral hernia, irreducible or strangulated hernia, previous lower abdominal surgeries, or those unfit for general anesthesia were excluded from the study.

All surgeries were performed by experienced surgeons proficient in both techniques to minimize operator bias. The mesh plug repair was performed under spinal anesthesia using a one-inch inguinal skin crease incision. After dissection of the hernia sac, a polypropylene mesh plug was inserted into the defect and secured in place, followed by reinforcement with a flat onlay mesh. Wound closure was done in layers.

For the TAPP procedure, patients underwent general anesthesia. Pneumoperitoneum was created, and standard three-port laparoscopic access was obtained. The peritoneum was incised and reflected to expose the myopectineal orifice. The hernia sac was reduced, and a large polypropylene mesh was placed in the preperitoneal space, covering all potential hernia sites. The peritoneum was then sutured to restore its integrity.

Intraoperative parameters including operative time and intraoperative complications were recorded. Postoperative parameters assessed were pain scores (using the Visual Analog Scale), time to ambulation, duration of hospital stay, postoperative complications such as seroma, hematoma, wound infection, urinary retention, and recurrence during the follow-up period. Patients were followed up at 1 week, 1 month, 3 months, 6 months, and 1 year postoperatively.

Data were analyzed using appropriate statistical tools. Categorical variables were compared using the Chi-square test or Fisher's exact test, and continuous variables were analyzed using the Student's t-test. A p-value of <0.05 was considered statistically significant.

Results

This study analyzed and compared the clinical outcomes of 120 patients with primary indirect inguinal hernia who underwent either one-inch incision mesh plug (MP) repair (Group A) or laparoscopic TAPP repair (Group B). The two groups were similar in baseline characteristics. Differences emerged in terms of operative time, postoperative pain, hospital stay, complications, and recovery parameters, offering insights into the benefits and limitations of each technique.

Table 1: Demographic Profile of Patients in Both Groups

Parameter	Group A (Mesh Plug)	Group B (TAPP)	p-value
Mean Age (years)	42.8 ± 11.6	41.2 ± 12.3	0.48
Male (%)	56 (93.3%)	54 (90.0%)	0.52
Female (%)	4 (6.7%)	6 (10.0%)	

Table 2: Comparison of Operative Time

Group	Mean Operative Time (minutes)	Standard Deviation	p-value
Mesh Plug	36.2	±7.5	<0.001
TAPP	61.4	±9.1	

Table 3: Postoperative Pain Scores (VAS) at 6, 24, and 48 Hours

Time (post-op)	Group A (MP)	Group B (TAPP)	p-value
6 hours	6.4 ± 1.2	4.8 ± 1.1	<0.001
24 hours	4.9 ± 1.1	3.2 ± 0.9	<0.001
48 hours	3.1 ± 1.0	2.0 ± 0.8	<0.001

Table 4: Time to Ambulation and Return to Work

Parameter	Group A (MP)	Group B (TAPP)	p-value
Time to ambulation (hrs)	22.5 ± 6.2	14.3 ± 4.9	<0.001
Return to work (days)	9.4 ± 2.6	5.8 ± 1.9	<0.001

Table 5: Duration of Hospital Stay

Group	Mean Hospital Stay (days)	Standard Deviation	p-value
Mesh Plug	1.4 ± 0.5		<0.001
TAPP	2.1 ± 0.6		

Table 6: Postoperative Seroma Formation

Group	Seroma Cases (n)	Percentage (%)	p-value
Mesh Plug	2	3.3%	0.04
TAPP	7	11.7%	

Table 7: Wound Infection Rate

Group	Infection Cases (n)	Percentage (%)	p-value
Mesh Plug	5	8.3%	0.02
TAPP	1	1.7%	

Table 8: Hernia Recurrence During Follow-up

Group	Recurrence (n)	Percentage (%)	p-value
Mesh Plug	1	1.7%	0.56
TAPP	0	0%	

Table 9: Cost Analysis (Total Hospital Expenditure)

Group	Average Cost (INR)	Range (INR)	p-value
Mesh Plug	₹9,200 ± 1,100	₹7,800 – ₹11,500	<0.001
TAPP	₹16,800 ± 2,000	₹13,200 – ₹20,000	

Table 10: Patient Satisfaction with Cosmetic Outcome

Group	Mean Score (1–5)	Standard Deviation	p-value
Mesh Plug	3.2	±0.8	<0.001
TAPP	4.5	±0.6	

Discussion

This randomized controlled study compared the clinical outcomes of one-inch incision mesh plug (MP) repair and laparoscopic transabdominal preperitoneal (TAPP) repair in the surgical management of primary indirect inguinal hernias. The findings reveal significant differences in several key postoperative parameters, including operative time, pain levels, recovery duration, complication rates, and patient satisfaction.

The demographic profile between the two groups was similar in terms of age and sex distribution, minimizing confounding variables. The mean age in both groups hovered around the early 40s, reflecting the common presentation of inguinal hernias in a working-age male population. The male predominance in both groups aligns with global epidemiological patterns, as indirect inguinal hernias are far more prevalent in men due to the anatomy of the inguinal canal.

Operative time was significantly shorter in the mesh plug group (mean 36.2 minutes) compared to the

TAPP group (mean 61.4 minutes), a finding consistent with existing literature. This may be attributed to the simplicity and direct anatomical access afforded by the open technique, whereas TAPP involves more technical steps, including peritoneal dissection, mesh placement, and suturing. Despite a longer operative time, TAPP yielded superior outcomes in terms of postoperative pain, mobility, and patient satisfaction, emphasizing the trade-off between procedural complexity and patient comfort.

Postoperative pain assessment revealed consistently lower visual analog scores (VAS) in the TAPP group at 6, 24, and 48 hours post-surgery. These findings highlight the less traumatic nature of laparoscopic access and reduced tissue manipulation. Faster ambulation and earlier return to work observed in the TAPP group further reinforce its minimally invasive advantages. These functional outcomes are clinically significant, particularly in a working population where early recovery translates to reduced absenteeism and economic burden.

Interestingly, the mean hospital stay was shorter in the mesh plug group (1.4 days) compared to TAPP (2.1 days), likely due to the simpler anesthesia and postoperative observation requirements. However, despite the marginally longer stay, TAPP patients reported greater overall satisfaction, especially regarding cosmetic outcomes. Smaller port-site incisions and minimal scarring in laparoscopic procedures contribute to higher satisfaction scores, as noted in our study.

In terms of complications, seroma formation was more frequent in the TAPP group. This is in line with other reports attributing it to the creation of large preperitoneal spaces. Conversely, wound infections were more common in the mesh plug group, likely due to the external incision and open field exposure, highlighting a potential trade-off between access route and infection risk. Both groups had low and comparable recurrence rates (1.7% in MP vs. 0% in TAPP), reaffirming the long-term efficacy of both procedures when performed correctly.

A crucial aspect for consideration in resource-limited settings is cost. The mesh plug technique proved significantly more economical than TAPP, due to the lower cost of equipment, lack of need for general anesthesia, and shorter operating time. This positions mesh plug repair as a viable option in rural or economically constrained environments, especially when advanced laparoscopic facilities are unavailable.

Patient satisfaction regarding aesthetics was notably higher in the TAPP group. With increasing emphasis on cosmetic outcomes in modern surgical practice, this aspect cannot be overlooked. Despite the slightly higher complication and cost profile, the

TAPP approach offers advantages in terms of patient-centered metrics like pain control, scar appearance, and quicker functional recovery.

Overall, both techniques are safe and effective, with distinct advantages. Mesh plug repair remains a practical, efficient, and cost-effective option, particularly in low-resource settings or where laparoscopic expertise is unavailable. TAPP repair, while technically demanding and more expensive, provides excellent outcomes in terms of pain, mobility, and cosmetic results, making it a favorable choice for patients who prioritize these aspects and in facilities equipped with laparoscopic infrastructure.

Future research should explore long-term recurrence rates beyond one year, patient quality of life scores, and multicenter trials to validate findings across different practice settings. Cost-effectiveness studies factoring in total societal costs, including return-to-work duration, may also provide a broader perspective on the comparative value of each approach.

Conclusion

This randomized controlled study demonstrates that both one-inch incision mesh plug (MP) repair and laparoscopic transabdominal preperitoneal (TAPP) repair are effective surgical options for the treatment of primary indirect inguinal hernia. Each approach offers distinct advantages that cater to different clinical, economic, and patient-centered priorities.

The mesh plug technique was found to be significantly quicker to perform and more cost-effective, making it an ideal choice in resource-limited settings and for patients where financial constraints are a major concern. It also facilitates shorter hospital stays, which can reduce the overall burden on hospital infrastructure. However, it was associated with slightly higher postoperative pain scores and more visible scarring, factors that may impact patient comfort and satisfaction.

On the other hand, laparoscopic TAPP repair, though more expensive and technically demanding with a longer operative duration, clearly outperformed mesh plug repair in terms of postoperative pain, earlier mobilization, faster return to work, lower incidence of wound infections, and superior cosmetic results. These factors collectively translated into higher overall patient satisfaction.

While complication and recurrence rates remained low and statistically similar in both groups, the TAPP group had a slightly higher incidence of postoperative seroma, which did not significantly impact the long-term outcome or patient recovery.

In summary, mesh plug repair is a suitable and efficient option for high-volume, low-resource settings, whereas TAPP should be considered the

preferred technique in centers with adequate laparoscopic infrastructure and among patients prioritizing reduced pain and superior cosmetic outcomes. The choice of surgical approach should therefore be tailored to individual patient profiles, surgeon expertise, and institutional capabilities.

Further multicentric studies with longer follow-up periods are warranted to assess long-term recurrence, chronic pain, and quality of life outcomes across both techniques.

References