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Comparative study of polyester vs polypropylene mesh in laparoscopic inguinal hernia repair

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I. INTRODUCTION

Every surgical technique needs to be studied, its merits and demerits assessed; so that the patients in future may undergo only the best of the procedures. The surgical treatment of inguinal hernias has evolved through several stages to reach a modern and successful era. An Ideal Hernia repair should be Tension free, with no potential damage to vital structures, no long term pain and no recurrence.[1]

Laparoscopic approaches are nowadays well-established procedures for managing an inguinal hernia.[2] In the laparoscopic procedure, tension free repair is achieved by placement of a mesh to cover the entire groin area.[3] The total extraperitoneal approach is the method of choice in the laparoscopic repair of the inguinal hernia.[4,5]

Prosthetic material used in hernia repair causes inflammatory reactions.[6,7] The aim of the mesh used in hernia repair should be to reinforce the abdominal wall without reducing the mobility by excessive scarring.[8,9] There are mainly three groups of material: polypropylene, polyester and polytetrafluoroethylene. Still there is no consensus which material has the best biocompatibility in humans. Light weight meshes seem to have some advantages, but studies shows that mesh construction and composition (pore size and filament structure) appeared to be more important determinants of foreign body reaction.[10,11]

Mainly polypropylene meshes are used for hernia repair from years but it has complications such as post-operative pain, discomfort and foreign body awareness. Polyester mesh (Figure 1), popularized by Stoppa, has been widely used in Europe for the repair of inguinal hernias.[12,13] Polyester is a hydrophilic material and thus encourages early biologic fixation and collagen ingrowth into surrounding tissue. Polyester has also been used as an implanted material in humans for decades in the form of vascular grafts with good safety record.[14]

METHODS

This study was done at Department of General Surgery at Sri Krishna Medical College and Hospital, between August 2021 to July 2022 with a follow up period of 6 months. It was conducted on 60 patients admitted with the diagnosis of inguinal hernia. The study was approved by the Institutional Research and Ethical Committee.

Inclusion criteria

- All patients with age 18years and more
- With unilateral or bilateral simple uncomplicated inguinal hernia.

Exclusion criteria

- Patients with complicated hernia
- Or patients unfit for general anaesthesia
- And those not giving consent for the study.

The patients were subjected to either TEP hernioplasty using Polyester mesh or TEP hernioplasty using Polypropylene mesh randomly by odd and even type of simple randomization (odd = intervention, Even = control) for inguinal hernia repair after taking written consent to participate in the study. Purpose of the study and the methods of treatment were carefully explained to the patients individually. All patients were admitted and after clinical and physical examination all basic routine investigations were done and planned for surgery.

Operative technique

A standard surgical technique

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(Laparoscopic TEP hernioplasty) was used for all patients. In a supine position, an infraumbilical incision made and carried down until the extraperitoneal space was identified. Balloon dissection was used to create an extraperitoneal space, which was then maintained by insufflation with CO2. Then, additional 2 (5-mm) ports placed in the midline and dissection started by first identifying the pubic tubercle and dissecting laterally.

The inguinal hernia sac was identified and dissected free from the cord structure. Then, a polyester or polypropylene mesh of 15*10cm size (according to group) was placed in position around the cord and projected to the midline. A tacking device was used to secure the mesh to the pubic tubercle, Cooper's ligament, and anterior abdominal wall. Careful examination for haemostasis was done. The sheath was closed with Portt Vicryl No. 1 and skin with Ethilon 3-0(RC) (Figure 1).

Figure 1: Polyester mesh.

Post-operative care and follow-up

Post operatively the patients were kept nil by mouth and till then they were given supportive maintenance intravenous fluids. Foley's catheter was removed once the patient becomes ambulatory, usually on the first postoperative day. Patients were advised and encouraged to ambulate and start their activities of daily life as early as possible.

Prophylactic antibiotics were given for duration of 5 to 7days, of which parenteral antibiotics were given for first 24hours. Analgesics were given for a period of 3 to 5 days, on first post-operative day intravenous analgesics was given then shifted on to oral tablets. Patients were observed for any complications like hematoma, seroma, wound infection and also assessed for postoperative pain and its severity. Time for return to daily activity and postoperative duration of hospital stay was also documented. Patients were also observed for chronic pain and recurrence up to 6months. The patients were followed up at one month, three month and six months intervals for any complications like seroma, mesh sepsis, post OP pain and feeling of lump.

Patients were assessed for postoperative pain using Visual Analogue Scale on day 1, day 3 and on day 7. Pain was evaluated by a score of 0 (no pain) to 10 (worst pain possible). Patients were discharged once free of complications and once they resumed their activities of daily normal life. Patients were discharged within 48hours. Sutures were removed on the 8^{th} to 10^{th} postoperative day.

Statistical analysis

Data analysis was performed using MedCalc version 17.9.5 software. Categorical variables were analyzed with chi-squared test and continuous variables were analyzed with 't' test. Values were reported as mean±standard deviation. P value of less than 0.05 was considered significant.

II. RESULTS

Total 60 patients of inguinal hernia were admitted and divided into two groups randomly by odd and even type of simple randomization in TEP hernioplasty using Polypropylene mesh group (PPL) and TEP hernioplasty using Polyester mesh group (PE). Adequacy of randomization was evident from similarity in patient characteristics in both the groups.

Table 1: Comparison of outcomes in PE group and PPL group.

Outcomes	PE group (n=30)	PPL group (n=30)	P value
Post-op pain scores (VAS)			
Day 1	2.6±1.32	3.5±2.5	P<0.05
Day 3	1.9±1.30	2.23±1.47	P<0.05
Day 7	0.30±1.25	0.70±1.20	P< 0.05

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Duration of hospital stay (days)	2.55±1.8	3.40±2.5	P<0.05
Duration of return to the daily activities (days)	6.35±0.42	7.10±2.15	P<0.05

The mean pain scores in PPL group were seen consistently higher compared to PE group on post- operative day 1, day 3 and day 7. The difference is statistically significant (Table 1).

The duration of hospital stay was seen to be longer in PPL group, with 3 patients having a 5 or more than 5 days hospital stay, whereas no patient had such a longer stay in the PE group. P value for duration of Postoperative Hospital stay is 0.05 which is considered statistically significant (Table 1).

The duration of return to the daily activities was seen to be longer in PPL group. On statistical calculation the P Value is 0.05, which is considered statistically significant (Table 1).

P value for early post-operative complications is 0.40 which is considered statistically not significant. Seroma was seen in 2 patients in PE group and 4 patients in PPL group. Hematoma was seen in 1 patient in PE group and 2 patients in PPL group. Wound infection was not seen in either group (Table 2).

Table 2: Comparison of Early complications in PE group and PPL group.

Early complications	PE group		PPL group		P value
	N	%	N	%	
Any complication	4	5 %	8	20%	0.40
Seroma	2	5%	4	15%	
Hematoma	1	0	2	5%	
Wound infection	1	0	2	0	

Post-operative complications like seroma, mesh sepsis, post-op pain and feeling of lump on follow up at 1 month, 3 months and 6 months didn't show any statistically significant difference.

Table 3: Comparison of incidence of chronic pain in PE group and PPL group.

Chronic pain	3 months	6 months
PE group	2	0
PPL group	6	2 (10%)
P value	0.0051	0.01

Chronic pain was seen in 2 patient in PE group and in 4 patients in PPL group on follow up at 3 months. And on follow up at 6 months chronic pain was seen in 2 patients in PPL group while no patient had similar complaint in PE group, which is considered statistically significant (Table 3 and Figure 2).

No recurrence in inguinal hernia was seen in patients of both groups during the 6 months follow up period.

III. DISCUSSION

Laparoscopic repair of inguinal hernia, which was designed to reduce the surgical stress and complications associated with large incisions, has been shown to improve short-term outcomes without compromising long-term results.[2] The use of mesh has now become the standard of care in repair of inguinal hernia because mesh implantation is known to reduce recurrence by 50%.[11] In a randomized trial for open inguinal hernia repair, comparing conventional polypropylene mesh with a modified mesh made of polypropylene and polyglactin, it was determined that the use of less foreign material of a more pliant nature reduced

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foreign body sensation after 6 months to less than half of the incidence reported using polypropylene mesh.[13]

Table 4: Comparison of post-op pain, duration of post-operative hospital stay, time taken to return to daily activities and early complications with other studies.

Post-OP pain (VAS scores)	Polyester mesh	Polypropylene mesh	P value
Present study	3	3.5	0.0011
Langenbach et al[16]	2.5±0.8	3.8±1.0	<0.001
Pradeep et al[18]	2.2±1	2.1±0.8	0.6
Morrison et al[19]	0.37	-	-
Duration of post-operative hospital stay (days)			
Present study	2.25±1.1	3.20±2.46	0.0043
Mughal MA et al[17]	2.8±0.89	2.37±0.81	0.05
Return to daily activities (days)			
Present study	7.25±1.42	8.10±3.30	0.044
Shah B et al[15]	7.45	10.57	0.11
EARLY complications			
Present study	5%	20%	0.40
Langenbach et al[16]	10%	9%	1.0
Morrison et al[19]	2%	-	-
Dmitry et al[20]	1%	1%	-

Table 5: Comparison of incidence of chronic pain, recurrence and feeling of lump with other studies.

hronic pain	Polyester mesh	Polypropylene mesh	P value
Present study	6 %	25%	0.005
Shah B et al[15]	5.7%	18.7%	0.05
Dmitry et al[20]	3%	10%	-
Recurrence			
Present study	0%	0%	-
Bhavin et al[15]	2.9%	9.3%	0.26
Langenbach et al[16]	1%	1%	-
Morrison et al[19]	0.71%	-	-
Dmitry et al[20]	3%	9%	-
Feeling of lump			
Present study	5%	20%	0.005
Shah B et al[15]	5.7%	18.7%	0.02

It is described that polypropylene meshes, as a hydrophobic material, cause some degree of contraction and scar formation in the long-term follow-up and increase subjective foreign body feeling from contracture and scarring.[15,16] Polyester seems not to suffer from these limitations because it is described as hydrophilic. Other advantages are the softness of polyester, making placement easier and its lack of tendency to stick to fat.

Meanwhile, present study yielded comparable results to those of Shah BC et al, Langenbach et al, and Mughal MA et al, who mentioned that TEP hernioplasty using Polyester mesh statistically significantly reduced postoperative pain, Duration of post-operative hospital stay**,** incidence of chronic pain and feeling of lump.[15-17] This difference may be attributed to the strong foreign body fibrous reactions at the mesh placement sites after inguinal hernia repair with polypropylene mesh. This causes nerve entrapment leading to chronic pain. The polypropylene mesh also induces a profound inflammatory reaction, leading to a firm scar plate that reduces elasticity of the abdominal wall (Table 4 and 5).

In the present study, no patients of both groups had recurrence within 6 months of follow up. Present study results comparable to those of Shah BC et al, and Langenbach et al.[15,16] As it's a short period of follow up longer duration and

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multicentric studies are required for further evaluation.

In present study, seroma was seen in 1 patient in PE group and 3 patients in PPL group. This was managed by daily dressing. No one needed surgical intervention. There was also a case of Hematoma noted in PPL group. This was overcome by aspiration, tight dressing and antibiotics. Hematoma was not seen in PE group. Similar such findings were found in other studies, but none were found to be statistically significant.

The small number of patients and short follow-up period were our limitations. Also, the patients were operated and studied by different surgical teams and study was done in single hospital. The long-term results and recurrence rate should be evaluated in multicentric large randomized control trial studies for better outcome assessment. Also, cost is a concern with the newer technology, but it was provided for free of cost to the patients undergoing laparoscopic TEP hernioplasty at our institute.

IV. CONCLUSION

Laparoscopic TEP hernioplasty using polyester mesh has better outcome in terms of post-operative pain, hospital stay, early return to daily activity, chronic pain and feeling of lump but more number of randomized control trials and multicenter trials need to be undertaken to study the pros and cons of polyester mesh in future.

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