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Original Research Article

A comparative study of polypropylene self-adhesive mesh (ProGrip) versus polypropylene mesh suture fixation in inguinal hernia repair

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ABSTRACT

Background: Self-gripping mesh may simplify fixation during open inguinal hernia repair, potentially improving operative efficiency and postoperative recovery. Conventional suture fixation may contribute to postoperative tissue irritation. This study compared self-gripping polypropylene mesh with conventional sutured polypropylene mesh.
Methods: This prospective, hospital-based study included 60 adults undergoing elective open Lichtenstein hernioplasty at GMERS Medical College, Vadodara. Participants were allocated by computer-generated block randomization to self-gripping ProGrip mesh (n=30) or conventional sutured mesh (n=30). Operative duration, postoperative visual analogue scale (VAS) pain scores, hospital stay, return to normal activities, complications, and recurrence were evaluated over three months.
Results: Mean operative duration was shorter with self-gripping mesh (56.40±8.70 versus 68.90±10.20 minutes; p<0.001). At 24 hours, mean VAS pain scores were lower (4.83±1.29 versus 6.23±1.04; p<0.001), with significant differences persisting through one month but not at three months (p=0.486). Pain reduction was also significant at 48 hours (3.93 versus 5.00; p<0.001), 14 days (2.60 versus 3.40; p=0.010), and one month (0.70 versus 1.30; p=0.011). Return to normal activities was faster (1.30±0.47 versus 3.50±0.63 days; p<0.001), and seroma was less frequent (6.7% versus 30.0%; p=0.020). However, hospital stay was slightly longer (2.23±0.43 versus 1.93±0.69 days; p=0.048). Surgical-site infection, scrotal swelling, and recurrence did not differ significantly. No recurrence occurred with self-gripping mesh, compared with one recurrence in the conventional mesh group during follow-up.
Conclusions: Self-gripping polypropylene mesh reduced operative time, early pain, and seroma formation and facilitated earlier return to activities. Longer follow-up and larger studies are necessary to assess sustained benefits and recurrence.

Keywords: Hernia, Inguinal, Herniorrhaphy, Surgical mesh, Postoperative pain, Treatment outcome

INTRODUCTION

Inguinal hernia repair is among the most frequently performed general surgical procedures worldwide, with more than 20 million groin hernia operations undertaken annually. Although surgical repair is generally effective, postoperative pain, wound complications, delayed functional recovery, and recurrence remain important determinants of patient satisfaction and treatment outcomes.[1] Contemporary groin hernia guidelines emphasize individualized surgical management, aiming to achieve durable repair while minimizing morbidity and disruption to daily activities.[1,2]

Open Lichtenstein tension-free hernioplasty remains an established option for adult inguinal hernia repair, particularly where laparoendoscopic techniques are unsuitable or unavailable. The procedure reinforces the posterior inguinal wall using prosthetic mesh, conventionally secured to surrounding tissues with nonabsorbable sutures. This approach is reproducible and provides reliable anatomical reinforcement. However, penetrating fixation may contribute to local tissue trauma,

inflammatory responses, or nerve irritation, potentially influencing postoperative discomfort and chronic groin pain.[2,3] Because pain following hernia surgery can restrict mobilization, prolong recovery, and impair quality of life, refinement of mesh fixation has become an important component of contemporary surgical practice.

Self-gripping polypropylene meshes, including ProGrip, were developed to reduce dependence on conventional suture fixation. Their resorbable polylactic acid microgrips provide immediate adherence to the underlying tissues, permitting mesh placement with few or no additional anchoring sutures. By simplifying fixation, this technique may shorten operative duration and reduce tissue penetration without compromising reinforcement of the inguinal floor.[3,4] Nevertheless, theoretical advantages do not necessarily translate into improved patient-reported outcomes, and the possibility of postoperative complications or recurrence remains clinically relevant. This balance is especially relevant in high-volume general surgical settings worldwide.

Randomized studies have demonstrated shorter operative times with self-gripping mesh, although improvements in postoperative pain have varied across assessment periods.[3,4] A systematic review and trial sequential analysis encompassing 14 randomized trials found that ProGrip reduced operative time but did not significantly improve chronic pain or recurrence compared with sutured mesh.[5] More recently, a comprehensive review of 17 randomized trials involving 3,863 patients similarly reported shorter operations without significant differences in chronic groin pain, overall postoperative complications, or recurrence.[6] These findings suggest that the clinical value of self-gripping fixation should be assessed across multiple recovery domains rather than operative efficiency alone.

Early pain intensity, wound infection, seroma formation, scrotal swelling, length of hospital stays, and return to normal activities are relevant measures of recovery after open repair. Differences in these outcomes may influence perioperative care and the experience of patients undergoing elective hernioplasty. Furthermore, recurrence remains a critical safety outcome, although short follow-up periods can identify only early failures. Against this background, the present study compared open inguinal hernia repair using self-gripping polypropylene mesh with conventional sutured polypropylene mesh, evaluating operative time, postoperative pain, hospital stay, functional recovery, complications, and recurrence during three months of follow-up.

METHODS

Study design and setting

A hospital-based prospective analytical study was conducted in the Department of General Surgery, GMERS Medical College and General Hospital, Gotri, Vadodara, Gujarat, India, over a period of two years. The study was undertaken to compare the clinical outcomes of open inguinal hernia repair using self-gripping polypropylene mesh (ProGrip) with those of conventional polypropylene mesh fixed with sutures.

Study population and eligibility criteria

A total of 60 patients undergoing elective open inguinal hernia repair were included in the study. Patients aged more than 18 years and less than 65 years, diagnosed with inguinal hernia, and willing to provide written informed consent were considered eligible for inclusion.

Patients with recurrent inguinal hernia, femoral hernia, complicated hernia (irreducible, obstructed, strangulated, or incarcerated), hernia associated with hydrocele, and pregnant women were excluded.

All potentially eligible patients presenting during the study period were assessed according to the predefined inclusion and exclusion criteria. After written informed consent was obtained, detailed clinical histories were recorded, and general and local examinations were performed. Baseline demographic and clinical characteristics, including age, body mass index (BMI), American Society of Anesthesiologists (ASA) physical status, presenting symptoms, duration of symptoms, and hernia laterality, were documented using a predesigned case record form.

Sample size calculation and randomization

The sample size was estimated based on the postoperative visual analogue scale (VAS) scores reported by Gunasekaran et al.[7] A comparison of two independent means was considered, with an anticipated mean difference of 0.93, pooled standard deviation of 1.3, statistical power of 80%, and a two-sided significance level of 5%. A final sample of 60 patients was included, with 30 patients allocated to each treatment group.

Participants were allocated into two groups using block randomization based on a computer-generated random number table.

Group A (n=30)

Open Lichtenstein inguinal hernia repair using self-gripping polypropylene mesh (ProGrip).

Group B (n=30)

Open Lichtenstein inguinal hernia repair using conventional polypropylene mesh with suture fixation.

Surgical procedure

All patients underwent standard preoperative evaluation, including routine investigations and assessment of anesthetic fitness. Prophylactic antibiotics were

administered according to institutional protocols. All procedures were performed electively under spinal or general anesthesia, depending on patient-related factors and anesthesiologist preference.

A standard open Lichtenstein tension-free technique was employed in both groups. Following surgical preparation and draping, an oblique inguinal incision was made approximately 1-2 cm above and parallel to the inguinal ligament. The subcutaneous tissues were dissected, the external oblique aponeurosis was opened, and the spermatic cord and hernial sac were identified. In indirect hernias, the sac was dissected, its contents were reduced, and high ligation was performed using absorbable sutures. In direct hernias, the sac was inverted and plicated when required. Adequate hemostasis was ensured before mesh placement.

In group A, a self-gripping polypropylene mesh (ProGrip) containing resorbable polylactic acid microgrips was positioned over the posterior wall of the inguinal canal. The mesh was tailored to provide adequate medial and lateral overlap, and its lateral tails were positioned around the spermatic cord. Fixation was achieved through gentle application of pressure, allowing the microgrips to adhere to the underlying tissues. Additional sutures were generally avoided, although a single anchoring suture was permitted at the surgeon's discretion when required.

In group B, a conventional polypropylene mesh was positioned over the posterior inguinal wall and secured using nonabsorbable polypropylene sutures. Fixation was performed along the pubic tubercle, inguinal ligament, and conjoint tendon or internal oblique aponeurosis, with appropriate precautions taken to avoid nerve entrapment.

Following mesh placement, the spermatic cord was repositioned, and the external oblique aponeurosis, subcutaneous tissues, and skin were closed in anatomical layers.

Outcome measures and follow-up

The principal outcomes assessed were operative duration, postoperative pain, hernia recurrence, and procedure-related complications. Additional outcomes included length of hospital stay and time required to return to normal activities.

Operative duration was defined as the interval between skin incision and completion of skin closure and was recorded in minutes.

Postoperative pain was assessed using the VAS at 24 hours, 48 hours, 14 days, 1 month, and 3 months following surgery. Pain scores were recorded at each assessment, and between-group comparisons were performed at the corresponding time points. Postoperative analgesic requirements were also documented.

Postoperative complications were assessed through clinical examination during hospitalization and subsequent follow-up visits. Patients were evaluated for seroma formation, hematoma, surgical-site infection, scrotal swelling, and other procedure-related complications. Seroma and hematoma were identified through inspection and palpation, whereas wound infection was assessed on the basis of local inflammatory signs, discharge, or the requirement for additional treatment.

Length of hospital stay was recorded in days from surgery until discharge. The time required to return to normal activities was also documented in days.

Hernia recurrence was assessed during postoperative follow-up through clinical examination of the operated groin in standing and supine positions, with and without the Valsalva maneuver.

Patients were followed up during the postoperative period, including scheduled assessments at approximately 1 month and 3 months. The occurrence of postoperative complications and recurrence was documented during the follow-up period.

Statistical analysis

The collected data were entered into Microsoft Excel and analyzed using IBM statistical package for the social sciences (SPSS), version 20.0. Categorical variables were expressed as frequencies and percentages, whereas continuous variables were presented as mean ± standard deviation (SD).

Comparisons of categorical variables between the two study groups were performed using the chi-square test. Continuous variables, including operative duration, postoperative VAS scores, hospital stay, and time to return to normal activities, were compared using the independent-samples student's t-test. A p value of less than 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the institutional ethics committee of GMERS Medical College and General Hospital, Gotri, Vadodara, before commencement of the study. Written informed consent was obtained from all participants before enrollment. Patient confidentiality and anonymity were maintained throughout data collection, analysis, and reporting.

RESULTS

A total of 60 patients undergoing elective open inguinal hernia repair were included in the study, with 30 patients (50.0%) allocated to the self-gripping polypropylene mesh group (group A) and 30 patients (50.0%) to the conventional sutured polypropylene mesh group (group B). He majority of participants belonged to the 40-49-year

age group, accounting for 53.3% of patients in each group. Regarding body mass index (BMI), 53.3% of patients in group A were overweight, whereas 56.7% of patients in group B had a normal BMI. Most participants were classified as American Society of Anesthesiologists (ASA) physical status I or II. ASA I status was observed in 56.7% of group A and 40.0% of group B. Inguinal swelling was the predominant presenting symptom in both groups (83.3% and 86.7%, respectively). Symptom duration was most commonly 3-4 years in group A (40.0%) and 1-2 years in group B (43.3%). Right- and left-sided hernias were distributed almost equally between the groups. The baseline demographic and clinical characteristics of the study participants are presented in (Table 1).

The mean operative duration was significantly shorter in group A compared with group B (56.40±8.70 versus 68.90±10.20 minutes; p<0.001), representing a mean reduction of 12.50 minutes with self-gripping mesh fixation. Postoperative pain scores, assessed using the VAS, were consistently lower in group A throughout the follow-up period. At 24 hours, the mean VAS score was significantly lower in group A than in group B (4.83±1.29 versus 6.23±1.04; p<0.001). A similar difference was observed at 48 hours (3.93±1.14 versus 5.00±1.20; p<0.001). At 14 days, the mean VAS score remained significantly lower in group A (2.60±0.96 versus 3.40±1.34; p=0.010). At 1 month, a significant difference in pain scores persisted between the groups (0.70±0.70 versus 1.30±1.03; p=0.011). However, by 3 months, postoperative pain had decreased substantially in both groups, and the difference was no longer statistically significant (0.30±0.50 versus 0.40±0.60; p=0.486). These findings demonstrated a progressive reduction in postoperative pain in both groups, with lower pain scores observed following self-gripping mesh repair during the earlier postoperative assessments (Table 2).

The mean duration of hospital stay was significantly longer in group A compared with group B (2.23±0.43 versus 1.93±0.69 days; p=0.048), with a mean difference of 0.30 days. In contrast, the mean time required to return to normal activities was significantly shorter in group A than in group B (1.30±0.47 versus 3.50±0.63 days; p<0.001). Patients undergoing repair with self-gripping mesh returned to normal activities approximately 2.20 days earlier than those undergoing conventional sutured mesh fixation (Table 2).

Table 1: Baseline demographic and clinical characteristics of the study participants.

Characteristics	Self-gripping mesh (group A, n=30)	Sutured mesh (group B, n=30)
Age (years), N (%)		
18-29	3 (10.0)	3 (10.0)
30-39	8 (26.7)	7 (23.3)
40-49	16 (53.3)	16 (53.3)
50-65	3 (10.0)	4 (13.3)
Body mass index (kg/m²), N (%)		
18.5-24.9	13 (43.3)	17 (56.7)
25.0-29.9	16 (53.3)	13 (43.3)
≥30.0	1 (3.3)	0 (0.0)
ASA physical status, N (%)		
ASA I	17 (56.7)	12 (40.0)
ASA II	13 (43.3)	18 (60.0)
Primary presenting symptom, N (%)		
Inguinal pain	5 (16.7)	4 (13.3)
Inguinal swelling	25 (83.3)	26 (86.7)
Duration of symptoms (years), N (%)		
1-2	9 (30.0)	13 (43.3)
3-4	12 (40.0)	8 (26.7)
≥5	9 (30.0)	9 (30.0)
Laterality of inguinal hernia, N (%)		
Right	14 (46.7)	16 (53.3)
Left	16 (53.3)	14 (46.7)

Table 2: Comparison of operative duration, postoperative pain, hospital stay, and functional recovery between the study groups.

Outcome	Self-gripping mesh (n=30)	Sutured mesh (n=30)	Mean difference (95% CI)	P value
Operative duration (min)	56.40±8.70	68.90±10.20	-12.50 (-17.40 to -7.60)	<0.001
Postoperative VAS score				
At 24 hours	4.83±1.29	6.23±1.04	-1.40 (-2.01 to -0.79)	<0.001
At 48 hours	3.93±1.14	5.00±1.20	-1.07 (-1.68 to -0.47)	<0.001
At 14 days	2.60± 0.96	3.40±1.34	-0.80 (-1.40 to -0.20)	0.010
At 1 month	0.70±0.70	1.30±1.03	-0.60 (-1.06 to -0.15)	0.011
At 3 months	0.30±0.50	0.40±0.60	-0.10 (-0.39 to 0.19)	0.486
Length of hospital stay (days)	2.23±0.43	1.93±0.69	0.30 (0.003 to 0.597)	0.048
Time to return to normal activities (days)	1.30±0.47	3.50±0.63	-2.20 (-2.49 to -1.91)	<0.001

Postoperative complications were assessed during the three-month follow-up period. Seroma formation was observed in 2 patients (6.7%) in group A compared with 9 patients (30.0%) in group B, representing a statistically

significant difference (p=0.020). Surgical-site infection was documented in 1 patient (3.3%) in group A and 5 patients (16.7%) in group B. Although the frequency of infection was numerically lower in group A, the difference was not statistically significant (p=0.195). Similarly, postoperative scrotal swelling was reported in 7 patients (23.3%) in group A and 9 patients (30.0%) in group B, without a statistically significant difference (p=0.559). At the three-month follow-up, no hernia recurrence was observed in group A, whereas recurrence was documented in 1 patient (3.3%) in group B. The difference in recurrence rates was not statistically significant (p=1.000). The comparative frequencies of postoperative complications and hernia recurrence are presented in (Table 3).

Table 3: Comparison of postoperative complications and hernia recurrence at 3 months between the study groups.

Postoperative outcome	Self-gripping mesh (n=30), N (%)	Sutured mesh (n=30), N (%)	P value
Seroma formation	2 (6.7)	9 (30.0)	0.020
Surgical-site infection	1 (3.3)	5 (16.7)	0.195
Scrotal swelling	7 (23.3)	9 (30.0)	0.559
Hernia recurrence	0 (0.0)	1 (3.3)	1.000

DISCUSSION

The present study compared self-gripping polypropylene mesh with conventional sutured polypropylene mesh in 60 patients undergoing open inguinal hernia repair. Baseline characteristics were broadly similar across groups, supporting interpretation of the observed postoperative differences. The most prominent finding was a shorter mean operative duration with self-gripping mesh (56.4 versus 68.9 minutes), corresponding to a 12.5-minute reduction. This agrees with earlier meta-analysis by Li et al, which demonstrated shorter operative times without consistent advantages in long-term outcomes.[8] Avoidance of multiple fixation sutures plausibly explains this improvement, although operative efficiency may also reflect surgeon familiarity and technical variability.

Postoperative pain was lower with self-gripping mesh at 24 hours, 48 hours, 14 days, and one month. At 24 hours, mean visual analogue scores were 4.83 and 6.23, respectively. Sanders et al similarly reported reduced early pain after self-gripping repair, whereas Gunasekaran et al observed a favorable but statistically nonsignificant immediate pain pattern.[7,9] Pandanaboyana et al and Quyn et al identified less persistent pain and activity limitation with self-adhesive fixation.[10,11] Nevertheless, these findings should not imply that eliminating sutures consistently prevents chronic pain. Nikkolo et al found no significant reduction in pain at six months, emphasizing the multifactorial nature of postoperative discomfort, including dissection, neural injury, and inflammatory responses.[12]

By three months, mean pain scores had fallen to 0.30 and 0.40 in the self-gripping and sutured groups, respectively, without a significant difference. This convergence resembles findings from the three-year randomized follow-up by Zwaans et al in which persistent pain was low in both arms.[13] Nikkolo et al also reported no statistically significant difference in activity-related pain at three years.[14] Accordingly, the present data suggest better early symptom control rather than demonstrable prevention of established chronic postoperative groin pain, which requires longer and more detailed assessment.

Return to normal activities occurred earlier after self-gripping repair (1.30 versus 3.50 days), potentially reflecting less immediate pain and easier mobilization. However, hospital stay was unexpectedly longer in the same group (2.23 versus 1.93 days). The apparent inconsistency warrants clarification of how functional recovery was defined and measured; earlier activity cannot automatically be equated with earlier discharge. Ismail et al found broadly comparable longer-term clinical outcomes across fixation techniques.[15] Similarly, Thölix et al, comparing two self-fixating mesh types, highlighted variability in pain-related recovery that may depend on the implant and assessment interval.[16]

Seroma occurred significantly less frequently with self-gripping mesh (6.7% versus 30.0%), whereas surgical-site infection and scrotal swelling showed nonsignificant numerical differences. These observations contrast with the network meta-analysis by Rausa et al, which found no clear complication advantage of self-gripping fixation over alternatives.[17] The small event counts here make chance variation and differences in clinical ascertainment important considerations. Recurrence was observed in no self-gripping recipients and one sutured-mesh recipient; this isolated event cannot establish superior durability. A recent meta-analysis with GRADE assessment by Jiang et al similarly found no significant overall difference in recurrence, seroma, or hospital stay and rated evidence for operative time and early pain as low certainty.[18]

Analgesic consumption was included in the planned assessments but was not quantified in the reported results. Consequently, differences in prescribing, dosing, or rescue analgesia could have influenced the between-group pain scores and require careful, transparent clarification before publication.

Interpretation is constrained by the single-center design, limited sample size, and three-month follow-up. Repeated pain comparisons were unadjusted, and insufficient information on analgesic use and postoperative care limits causal interpretation. Nevertheless, the observed improvements in operating time and early pain provide clinically relevant signals that should be evaluated

alongside material costs, patient-centered recovery, and longer-term safety.

CONCLUSION

ProGrip demonstrated significantly shorter operative time, lower early postoperative pain scores, reduced seroma formation, and faster return to normal activities compared with conventional sutured polypropylene mesh in open inguinal hernia repair. However, hospital stay was slightly longer in the self-gripping mesh group, while surgical-site infection, scrotal swelling, and recurrence rates showed no statistically significant differences. These findings suggest that self-gripping mesh may offer advantages in operative efficiency and early postoperative recovery, although larger studies with longer follow-up are required to establish its long-term benefits and safety.

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