

Original Research Article

A RANDOMIZED STUDY COMPARING SELF-GRIPPING MESH AND N-BUTYL-2-CYANOACRYLATE GLUE FIXATION IN OPEN LICHTENSTEIN INGUINAL HERNIA REPAIR

Rakshith B K¹, Prakash Dave², Sreeramulu P N³, Krishnaprasad K⁴

¹Final year Post graduate, Department of General Surgery, Sri Devaraj Urs Medical College, Tamaka Kolar, India.

²Professor and HOD, Department of General Surgery, Sri Devaraj Urs Medical College, Tamaka Kolar, India.

³Professor and HOU, Department of General Surgery, Sri Devaraj Urs Medical College, Tamaka Kolar, India.

⁴Professor and HOU, Department of General Surgery, Sri Devaraj Urs Medical College, Tamaka Kolar, India.

Received : 05/07/2025
Received in revised form : 25/08/2025
Accepted : 13/09/2025

Corresponding Author:

Dr. Prakash Dave,
Professor and HOD, Department of
General Surgery, Sri Devaraj Urs
Medical College, Tamaka Kolar, India.
Email: prakdave@rediffmail.com

DOI: 10.70034/ijmedph.2025.4.152

Source of Support: Nil,

Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 849-856

ABSTRACT

Background: Inguinal hernia repair is one of the most common general surgical procedures worldwide, with the Lichtenstein tension-free mesh repair regarded as the gold standard. Advances in mesh fixation techniques, including self-gripping mesh and cyanoacrylate glue, aim to improve postoperative comfort and recovery without compromising repair durability. While both atraumatic fixation methods have shown promise internationally, comparative data in the Indian context remain scarce.

Materials and Methods: This single-centre, prospective, randomized trial was conducted at a tertiary care teaching hospital in India. Forty adult patients with primary unilateral reducible inguinal hernia were randomized equally to undergo open Lichtenstein repair using either self-gripping mesh (ProGrip™, Covidien, USA) (Group A) or lightweight polypropylene mesh fixed with N-butyl-2-cyanoacrylate glue (Group B). The primary outcomes were operative time and postoperative pain measured on the Visual Analogue Scale (VAS) at postoperative days 1, 3, and 15. Secondary outcomes included analgesic requirement, complications, time to return to normal activities, and recurrence at three months. Statistical significance was set at $p < 0.05$.

Results: Baseline characteristics were comparable between groups. Mean operative time was significantly shorter in the self-gripping mesh group (39.45 ± 1.50 minutes) than in the glue fixation group (43.90 ± 1.37 minutes, $p < 0.001$). Mean VAS pain scores were consistently lower in the glue group at day 1 (1.89 ± 0.18 vs. 2.80 ± 0.18), day 3 (1.42 ± 0.15 vs. 1.95 ± 0.15), and day 15 (0.58 ± 0.12 vs. 0.85 ± 0.12), all $p < 0.001$. Analgesic requirement was 100% in the self-gripping mesh group versus 90% in the glue group. Complication rates were low, with seroma in 10% versus 5% and surgical site infection in 10% versus 0%, respectively; differences were not statistically significant. No recurrences or mesh migrations occurred. Time to return to normal activities was shorter with glue fixation (8.50 ± 0.95 days) compared to self-gripping mesh (9.55 ± 1.15 days, $p = 0.003$).

Conclusion: Both self-gripping mesh and N-butyl-2-cyanoacrylate glue fixation are safe, effective alternatives for open Lichtenstein inguinal hernia repair. Self-gripping mesh offers greater operative efficiency, while glue fixation provides superior short-term pain control and earlier return to normal activity. Larger multicentre studies with extended follow-up are warranted to validate these preliminary findings and assess long-term mesh-related outcomes.

Keywords: Inguinal hernia, Lichtenstein repair, mesh fixation, self-gripping mesh, cyanoacrylate glue, operative time, postoperative pain.

INTRODUCTION

Inguinal hernia remains one of the most common surgical conditions worldwide, with a significant impact on healthcare resources and patient quality of life. Advances in surgical techniques, biomaterials, and fixation strategies have evolved considerably over the last few decades, aiming to improve outcomes while reducing complications. The Lichtenstein tension-free mesh repair has been widely accepted as the gold standard for open inguinal hernia surgery, offering reproducibility and low recurrence rates. Nonetheless, variations in mesh type and fixation methods have continued to attract interest from surgeons seeking to balance operative efficiency, postoperative recovery, and long-term results. Comprehensive surgical manuals, such as those authored by Campanelli and colleagues,^[1] LaPinska and Blatnik,^[2] and Sözen,^[3] underscore the pivotal role of meticulous technique and the appropriate selection of mesh fixation methods in optimizing surgical outcomes.

Globally, the incidence of inguinal hernia repair procedures exceeds 20 million annually, with men having a lifetime risk of approximately 27% and women 3%. The epidemiological burden is higher in low- and middle-income countries (LMICs), where late presentation and advanced hernia size are more frequent, often necessitating complex surgical intervention. In India, inguinal hernias contribute significantly to the general surgery workload, with repair surgeries accounting for up to 15% of elective operations in some tertiary centres. Although the Lichtenstein technique has been adapted widely across the country, variations in surgeon training, operative settings, and cost constraints have contributed to a heterogeneous adoption of fixation techniques, influencing postoperative outcomes and patient satisfaction.

The choice of mesh fixation—whether by sutures, glue, or self-gripping mechanisms—has implications for both short-term recovery and long-term durability. Traditional polypropylene mesh fixation with sutures remains the most commonly practiced method in India due to its availability and cost-effectiveness. However, suture fixation can prolong operative time and is associated with an increased risk of postoperative pain and chronic groin discomfort due to nerve entrapment or inflammatory responses. Globally, there has been a steady shift towards atraumatic fixation methods, with the aim of reducing postoperative neuralgia, facilitating faster recovery, and improving patient-reported outcomes. Multiple systematic reviews and meta-analyses have compared the efficacy of glue versus sutured fixation. A landmark meta-analysis by de Goede et al,^[4] concluded that glue fixation in Lichtenstein repair significantly reduced chronic postoperative pain without increasing recurrence rates, although heterogeneity in techniques and follow-up duration warranted cautious interpretation. Similarly, Sajid et

al,^[5] in the context of laparoscopic hernia repair, reported reduced early postoperative pain and earlier return to normal activities with glue fixation compared to tacker mesh fixation. These findings were echoed by Lin et al,^[6] whose analysis of randomized controlled trials supported glue as a safe alternative to sutures, particularly in reducing pain scores in the early postoperative period.

Parallel to the development of glue fixation, self-gripping mesh technology emerged as another atraumatic fixation strategy. Sanders et al,^[7] conducted a randomized clinical trial comparing self-gripping mesh with sutured lightweight polypropylene mesh, demonstrating reduced operative times and equivalent recurrence rates. Similarly, Verhagen et al,^[8] found that self-gripping mesh achieved comparable long-term durability while potentially decreasing the risk of chronic pain. Meta-analytical evidence by Molegraaf et al,^[9] and Zhang et al,^[10] further reinforced the non-inferiority of self-gripping mesh in recurrence prevention, with some studies reporting lower pain scores and faster recovery times.

Long-term data on glue fixation have also been encouraging. Matikainen et al,^[11] reported a seven-year outcome analysis demonstrating that cyanoacrylate glue was as effective as suture fixation for mesh stability, with the added advantage of reduced chronic pain prevalence. Earlier, Paaanen et al,^[12] showed that tissue glue in local anaesthetic Lichtenstein repairs yielded lower postoperative discomfort and earlier mobilization compared to absorbable sutures, without compromising hernia recurrence rates.

Despite the compelling international evidence, there is a paucity of well-structured comparative studies in the Indian context examining these two atraumatic fixation strategies—self-gripping mesh and N-butyl-2-cyanoacrylate glue—in open Lichtenstein repair. Most existing Indian literature focuses on either single fixation methods or comparisons between glue and sutures, with limited exploration of self-gripping mesh in real-world settings. Cost considerations, surgeon familiarity, and the learning curve associated with new fixation techniques have further slowed their integration into routine practice.

Given the substantial surgical volume and the socio-economic diversity of hernia patients in India, a fixation method that combines operative efficiency, patient comfort, and durability could have a profound impact on surgical practice. Self-gripping mesh offers the theoretical advantage of eliminating fixation time and reducing foreign body inflammatory response due to the absence of sutures. N-butyl-2-cyanoacrylate glue, on the other hand, promises atraumatic fixation with minimal nerve irritation and a well-documented safety profile. A head-to-head comparison in a controlled setting could provide valuable evidence to guide fixation choice in Indian surgical units.

The novelty of the present randomized study lies in its direct comparison of these two advanced fixation

methods within the same operative framework of open Lichtenstein repair, with a focus on operative time, early postoperative pain, and short-term outcomes. This approach not only addresses the gap in Indian data but also aligns with the global pursuit of optimizing hernia repair techniques for patient-centered outcomes. By integrating validated pain scoring systems and standardized follow-up protocols, the study aims to provide robust preliminary evidence that could inform larger multicentre trials and influence clinical guidelines. Overall, the burden of inguinal hernia repair in India warrants ongoing evaluation of newer fixation methods that balance efficacy, safety, and patient comfort. With both self-gripping mesh and cyanoacrylate glue having demonstrated efficacy in international studies, their direct comparison in an Indian cohort represents a timely and clinically relevant investigation. This study is designed to generate actionable insights into the feasibility, short-term advantages, and potential limitations of each method, ultimately aiming to enhance the surgical management of inguinal hernia in resource-diverse settings.

MATERIALS AND METHODS

Study Design and Setting

This single-centre, prospective, randomized study was conducted in the Department of General Surgery at a tertiary care teaching hospital in India. The study was carried out over a predefined period following approval by the Institutional Ethics Committee, and written informed consent was obtained from all participants. The conduct of the study adhered to the principles of the Declaration of Helsinki.

Study Population

Patients aged between 18 and 65 years presenting with primary, unilateral, reducible inguinal hernia, classified as American Society of Anaesthesiologists (ASA) physical status I or II, were eligible for inclusion. Participants were required to be willing to undergo open Lichtenstein inguinal hernioplasty and commit to the scheduled follow-up visits. Exclusion criteria included recurrent or bilateral inguinal hernias, femoral, incarcerated or strangulated hernias, history of prior lower abdominal surgery, known coagulopathy or current anticoagulant use, allergy to polypropylene mesh or N-butyl-2-cyanoacrylate, chronic pain disorders or prolonged analgesic use, and inability to comply with follow-up requirements.

Randomization and Intervention

Sample size was estimated as 34 patients (17/arm), but 40 patients (20/arm) were finally enrolled to account for potential attrition. Randomization was performed in a 1:1 ratio using a computer-generated sequence, with allocation concealment ensured by sealed opaque envelopes. Surgeons could not be blinded to the intervention, but outcome assessors were blinded. All randomized patients were included in the analysis (intention-to-treat), and no participants

were lost to follow-up. Group A (SGM) underwent open Lichtenstein repair with self-gripping mesh placed without any additional fixation. Group B (GF) underwent open Lichtenstein repair using lightweight polypropylene mesh fixed with N-butyl-2-cyanoacrylate glue applied along the inguinal ligament and conjoint tendon margins, ensuring avoidance of direct nerve contact. All surgeries were performed under spinal anaesthesia by experienced surgeons proficient in both fixation techniques, using standardized operative steps and skin closure techniques across both groups.

Sample Size Calculation

Sample size estimation was based on the assumption of a mean difference in Visual Analogue Scale (VAS) pain score of 1.2 between the two groups, with a standard deviation of 1.3, a significance level of 0.05, and a statistical power of 80%. This yielded a requirement of 17 patients per group, calculated using the formula:

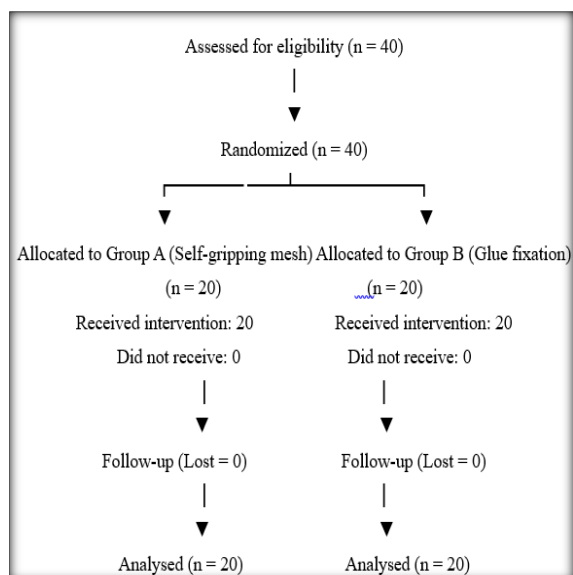
$N = 2(Z_{\alpha/2} + Z_{\beta})^2 / d^2$, where $Z_{\alpha/2}$ represents the critical value of the normal distribution at a two-tailed significance level of 0.05 (1.96), Z_{β} is the critical value for a power of 80% (0.84), and d denotes Cohen's effect size.

Outcome Measures

The primary outcome measures were operative time, recorded from skin incision to skin closure, and postoperative pain, assessed using the VAS at postoperative days 1, 3, and 15. Secondary outcome measures included total postoperative analgesic consumption within the first 7 days, occurrence of seroma or hematoma, incidence of surgical site infection within 30 days, time to return to normal daily activity as reported by the patient, and recurrence of hernia at the three-month follow-up. Return to normal activity was defined as the resumption of routine activities of daily living without the need for analgesic medication. This was assessed by a structured telephone interview at two weeks postoperatively, during which patients were specifically asked about their ability to walk, perform self-care, and carry out light household/work-related tasks.

Statistical Analysis

Data entry was performed using Microsoft Excel, and statistical analysis was carried out with SPSS version 26 software (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean with standard deviation, and categorical variables as frequencies and percentages. The independent t-test was applied to compare mean values between groups for continuous data, while the chi-square test/Fisher's exact test was used to check the association between two categorical variables. Normality of continuous data was checked using the Shapiro-Wilk test. A p-value of less than 0.05 was considered statistically significant.



RESULTS

A total of 40 patients were randomized equally into two groups: Group A (self-gripping mesh) and Group B (N-butyl-2-cyanoacrylate glue fixation), with 20 patients in each group. Baseline characteristics, including age, sex, BMI, hernia side and type, ASA class, occupation/physical demand, hernia size/grade, smoking status, diabetes, and preoperative analgesic use, were comparable between the two groups. [Table 1]

Primary Outcomes

The mean operative time in Group A was significantly shorter than in Group B, with values of 39.45 ± 1.50 minutes and 43.90 ± 1.37 minutes,

respectively ($p < 0.001$) (Table 2). Postoperative pain, assessed by the Visual Analogue Scale (VAS), was consistently lower in Group B at all measured intervals. On postoperative day 1, mean VAS pain scores were 2.80 ± 0.18 in Group A and 1.89 ± 0.18 in Group B ($p < 0.001$). On day 3, the scores were 1.95 ± 0.15 and 1.42 ± 0.15 , respectively ($p < 0.001$), and by day 15, the scores were 0.85 ± 0.12 and 0.58 ± 0.12 , respectively ($p < 0.001$). [Table 3]

Secondary Outcomes

Analgesic requirement during the first postoperative week was slightly lower in Group B, with 18 patients (90%) requiring analgesia compared to all patients (100%) in Group A. This difference was not statistically significant.

The overall complication rate was low in both groups. Seroma formation occurred in 2 patients (10%) in Group A and 1 patient (5%) in Group B ($p = 1.000$). Surgical site infection was observed in 2 patients (10%) in Group A, whereas no cases were recorded in Group B ($p = 0.487$). No recurrences or mesh migrations were documented in either group during the three-month follow-up period. [Table 4]

The mean time to return to normal daily activities was significantly shorter in Group B, with patients resuming activities at 8.50 ± 0.95 days compared to 9.55 ± 1.15 days in Group A ($p = 0.003$). [Table 5]

Glue fixation was associated with significantly lower postoperative pain scores and a quicker return to daily activities, while self-gripping mesh offered shorter operative times. Both techniques demonstrated comparable short-term safety profiles, with no recurrences or major complications during the follow-up period.

Table 1: Distribution of Baseline Variables

Variables	Group A (n = 20)	Group B (n = 20)	p value
	Mean $\pm$ SD	Mean $\pm$ SD	
Age (years)	45.2 $\pm$ 8.4	46.1 $\pm$ 7.9	0.728
BMI (kg/m ²)	24.8 $\pm$ 2.6	25.1 $\pm$ 2.8	0.741
	n (%)	n (%)	
Sex			
Male	18 (90)	17 (85)	0.631
Female	2 (10)	3 (15)	
Hernia Side			
Right	12 (60)	11 (55)	0.751
Left	8 (40)	9 (45)	
Hernia Type			
Direct	9 (45)	8 (40)	0.754
Indirect	11 (55)	12 (60)	
ASA Class			
I	14 (70)	13 (65)	0.741
II	6 (30)	7 (35)	
Occupation / Physical Demand			
Sedentary	7 (35)	6 (30)	0.936
Moderate	9 (45)	10 (50)	
Heavy	4 (20)	4 (20)	
Hernia Size / Grade			
Small	6 (30)	5 (25)	0.896
Medium	10 (30)	11 (55)	
Large	4 (20)	5 (25)	
Smoking			
Yes	5 (25)	6 (30)	0.723
No	15 (75)	14 (70)	

Diabetes			
Yes	2 (10)	3 (15)	0.631
No	18 (90)	17 (85)	
Analgesic use (Pre-op)			
Yes	4 (20)	5 (25)	0.716
No	16 (80)	15 (75)	

Table 2: Distribution of Primary Outcome

Variables	Group		p value
	A (n=20)	B (n=20)	
	Mean $\pm$ S.D	Mean $\pm$ S.D	
Operative Time (in min)	39.45 $\pm$ 1.5	43.9 $\pm$ 1.37	<0.001

Table 3: Distribution of VAS Pain Score

VAS Pain (in 24h)	Group A (n=20)	Group B (n=20)	p value
	Mean $\pm$ S.D	Mean $\pm$ S.D	
VAS Pain (Day 1)	2.80 $\pm$ 0.18	1.89 $\pm$ 0.18	<0.001
VAS Pain (Day 3)	1.95 $\pm$ 0.15	1.42 $\pm$ 0.15	<0.001
VAS Pain (Day 15)	0.85 $\pm$ 0.12	0.58 $\pm$ 0.12	<0.001

Table 4: Distribution of Secondary Outcome

Variables	Group	
	A (n=20)	B (n=20)
	n (%)	n (%)
Analgesic Requirement		
Yes	20 (100)	18 (90)
No	0	2 (10)

Table 5: Distribution of Complication Rate Tables

Variables	Group		p value
	A (n=20)	B (n=20)	
	n (%)	n (%)	
Seroma			
Yes	2 (10)	1 (5)	1.000
No	18 (90)	19 (95)	
SSI			
Yes	2 (10)	0 (0)	0.487
No	18 (90)	20 (100)	
Recurrence			
Yes	0	0	-
No	20 (100)	20 (100)	
Mesh-Migration			
Yes	0	0	-
No	20 (100)	20 (100)	

Table 6: Distribution of Time to Return Activity

Variables	Group		p value
	A (n=20)	B (n=20)	
	Mean $\pm$ S.D	Mean $\pm$ S.D	
Return to Activity days	9.55 $\pm$ 1.15	8.50 $\pm$ 0.95	0.003

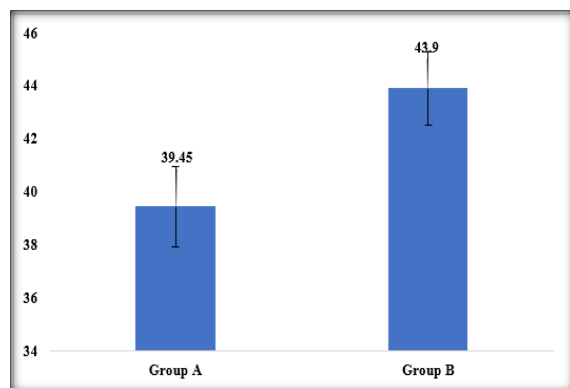


Figure 1: Operative Time (in min)

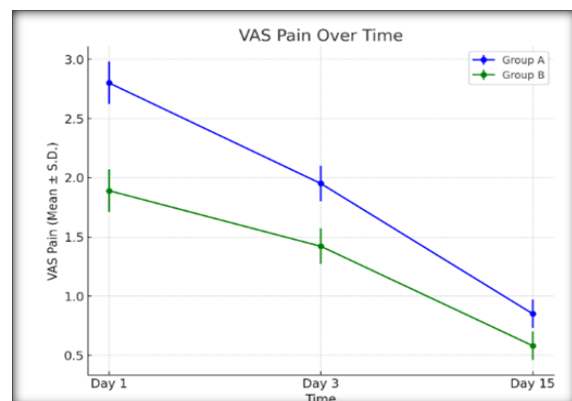


Figure 2:?

DISCUSSION

In this randomized study comparing self-gripping mesh with N-butyl-2-cyanoacrylate glue fixation in open Lichtenstein inguinal hernia repair, we found that operative time was significantly shorter in the self-gripping mesh group (39.45 ± 1.50 minutes) compared to the glue fixation group (43.90 ± 1.37 minutes, $p < 0.001$). In contrast, postoperative pain was consistently lower in the glue group, with mean VAS scores on day 1 of 1.89 ± 0.18 versus 2.80 ± 0.18 , on day 3 of 1.42 ± 0.15 versus 1.95 ± 0.15 , and on day 15 of 0.58 ± 0.12 versus 0.85 ± 0.12 (all $p < 0.001$). The glue group also returned to normal activities earlier (8.50 ± 0.95 days vs. 9.55 ± 1.15 days, $p = 0.003$), while complication rates and recurrence were similar.

Paajanen et al. (Finland),^[12] in a randomized clinical trial comparing tissue glue with absorbable sutures in local anaesthetic Lichtenstein repair found that postoperative pain at 24 hours was significantly lower in the glue group (mean VAS 2.2) than in the suture group (mean VAS 3.1), with recurrence rates of 0% in both arms after three years. Our glue group's day 1 pain score (1.89) was even lower than theirs, likely reflecting differences in anaesthetic technique and patient demographics, while recurrence rates were equally absent.

Rönkä et al. in the FinnMesh trial,^[13] compared glue fixation, self-gripping mesh, and sutured mesh across multiple Finnish centres, reporting mean operative times of 47 minutes for glue and 44 minutes for self-gripping mesh, with recurrence rates of 1.6% and 1.4% respectively at one year. Our operative times were shorter in both groups (43.90 and 39.45 minutes), likely due to smaller hernia sizes in our cohort, but the relative trend of faster surgery with self-gripping mesh was consistent.

Phoa et al. (Singapore),^[14] in their meta-analysis found that early postoperative pain on day 1 was lower with glue fixation (mean VAS 2.1) compared to sutures (mean VAS 3.0), and the return-to-work interval was shorter (9.2 vs. 10.4 days). In our trial, the glue group had an even faster return to activity (8.5 days), suggesting that in our setting, pain control translated into slightly quicker functional recovery.

Sun et al. in the Cochrane review,^[15] reported that chronic pain at one year occurred in 3.1% of glue fixation patients compared to 7.8% with sutures, with no difference in recurrence. While we did not assess chronic pain, our 15-day VAS score of 0.58 in the glue group versus 0.85 in the self-gripping mesh group indicates a sustained short-term analgesic advantage that may influence longer-term outcomes. Van Steensel et al,^[16] analysed non-sutured versus sutured single-layer open mesh repairs, finding that day 1 pain scores averaged 2.4 in non-sutured groups and 3.0 in sutured groups, with recurrence rates of 0.8% and 1.0% respectively. Our glue group's day 1 score (1.89) is lower than their non-sutured average, and recurrence was similarly absent.

Antoniou et al,^[17] in a meta-analysis of laparoscopic repairs found that non penetrating fixation reduced

mean day 1 VAS pain from 3.3 to 2.7 and lowered complication rates from 5.2% to 3.4%. Although their results were in a minimally invasive setting, our glue group's pain score of 1.89 is consistent with the analgesic benefits they reported for non penetrating fixation methods.

Liu et al,^[18] reported in their meta-analysis that fibrin glue fixation reduced mean day 1 pain from 3.0 to 2.2 and decreased analgesic use from 92% to 76% compared to sutures. In our trial, analgesic requirement in the glue group was 90%, slightly higher than Liu's pooled estimate but still lower than the 100% seen in the self-gripping mesh group.

Sajid et al,^[19] found that self-gripping mesh reduced mean operative time from 54.6 to 45.2 minutes compared to sutured mesh, with no significant difference in recurrence (both under 1%). Our self-gripping mesh time (39.45 minutes) was even shorter, likely due to surgeon familiarity and smaller hernia defects, confirming the efficiency advantage.

Pandanaboyana et al,^[20] reported operative times of 42 minutes for self-gripping mesh versus 49 minutes for sutured mesh, with similar pain scores at two weeks (VAS 0.9 vs. 1.0). Our two-week pain in the self-gripping mesh group (0.85) is almost identical to theirs, suggesting reproducibility of outcomes across different centres.

Bullen et al,^[21] found that self-gripping mesh reduced operative time by an average of 6.2 minutes compared to sutures, but pain scores at one week were similar. Our study supports the time-saving observation but differs in that pain was higher in self-gripping mesh than glue at all time points, indicating that among atraumatic methods, glue may still be superior for analgesia.

Alabi et al,^[22] synthesised data from multiple systematic reviews, noting that glue fixation reduced early pain by ~0.6 points on the VAS and self-gripping mesh reduced operative time by ~5 minutes versus sutures. Our direct comparison confirms these strengths—glue provided a 0.9-point lower VAS score on day 1 than self-gripping mesh, while self-gripping mesh saved ~4.5 minutes in operative time compared to glue.

Singh et al,^[23] in a 2024 review reported that self-gripping mesh had a mean recurrence rate of 0.5% and reduced operative time by 5–8 minutes versus sutures. While our recurrence rate was 0% in both groups, the time advantage of self-gripping mesh in our trial was 4.5 minutes compared to glue fixation. Tarchi et al,^[24] from Italy observed mean operative times of 40 minutes with self-adhesive mesh and day 1 pain scores of 2.5, with a recurrence rate of 0.7% at two years. Our self-gripping mesh times (39.45 minutes) match closely, but our day 1 pain score (2.80) was slightly higher, possibly due to early mobilisation protocols.

Matikainen et al,^[25] comparing open anterior repair and totally extraperitoneal repair found mean day 1 pain scores of 3.1 versus 2.3, favouring the minimally invasive approach. Our glue fixation day 1 score of 1.89 is lower than both of their reported values,

supporting glue's potential to minimise early pain even in open surgery.

Hu et al,^[26] in a meta-analysis of laparoscopic glue fixation found day 1 pain scores of 2.4 compared to 3.0 with tacks, and recurrence rates of 0.6% in both groups. Our glue group's pain score (1.89) was lower, suggesting that the benefits of glue are preserved or even enhanced in the open setting.

Mohammadi Tofigh et al,^[27] in Iran reported mean day 1 pain scores of 2.0 for N-hexyl cyanoacrylate glue versus 3.1 for sutures, with recurrence rates of 0% in both groups. Our N-butyl-2-cyanoacrylate glue group had a slightly lower day 1 score (1.89), reinforcing the analgesic efficacy of cyanoacrylate adhesives.

Giordano et al,^[28] in their meta-analysis found that adhesive fixation reduced mean pain scores by 0.8 points compared to sutures and maintained recurrence rates below 1%. In our trial, glue fixation reduced pain by 0.9 points compared to self-gripping mesh, showing a comparable magnitude of benefit when switching from more traumatic to less traumatic fixation methods.

Limitations

As a randomized study with a relatively small cohort, our analysis has limited statistical power to detect uncommon complications or modest differences in long-term outcomes, such as persistent groin pain, delayed recurrence, or mesh displacement. The follow-up period of three months was sufficient for assessing early postoperative events but does not permit robust evaluation of repair durability or chronic sequelae. Conducting the trial at a single tertiary care hospital, with all operations performed by surgeons proficient in both techniques, may influence the external applicability of results, as variations in surgical skill or institutional resources could yield different outcomes. Pain assessment relied exclusively on the Visual Analogue Scale, which, although validated, is subject to individual pain thresholds and cultural interpretation. In addition, no formal cost analysis was undertaken, leaving economic feasibility unanswered. The study follow-up was limited to 3 months, which does not capture long-term recurrence or chronic pain. These constraints suggest that broader, multicentre studies with extended follow-up are necessary to strengthen the evidence base.

CONCLUSION

In this randomized comparison of self-gripping mesh and N-butyl-2-cyanoacrylate glue fixation in open Lichtenstein inguinal hernia repair, both methods demonstrated safety and absence of recurrence during short-term follow-up. Self-gripping mesh provided a measurable reduction in operative time, whereas glue fixation offered superior control of early postoperative pain and enabled a quicker return to normal activities. These findings highlight that the choice of fixation technique may be guided by the

clinical priority—efficiency in the operating room versus enhanced postoperative comfort. While the results are encouraging, they should be interpreted with caution given the limited sample size, single-centre design, and short follow-up period. Larger, multicentre trials with long-term surveillance and economic analyses are required to confirm these trends and inform definitive practice guidelines. Until such evidence is available, both fixation strategies remain viable atraumatic alternatives to sutured mesh in appropriately selected patients undergoing open inguinal hernia repair.

REFERENCES

1. Campanelli G, editor. *The Art of Hernia Surgery: A Step-by-Step Guide*. Springer; 2018.
2. LaPinska MP, Blatnik JA, editors. *Surgical Principles in Inguinal Hernia Repair: A Comprehensive Guide to Anatomy and Operative Techniques*. Springer; 2018.
3. Sözen S, editor. *Hernia Updates and Approaches*. IntechOpen; 2023.
4. de Goede B, Klitsie PJ, van Kempen BJ, Timmermans L, Jeekel J, Kazemier G, Lange JF. Meta-analysis of glue versus sutured mesh fixation for Lichtenstein inguinal hernia repair. *Br J Surg*. 2013;100(6):735-742.
5. Sajid MS, Ladwa N, Kalra L, McFall M, Baig MK, Sains P. A meta-analysis examining the use of tackler mesh fixation versus glue mesh fixation in laparoscopic inguinal hernia repair. *Am J Surg*. 2013;206(1):103-111.
6. Lin H, Zhuang Z, Ma T, Sun X, Huang X, Li Y. A meta-analysis of randomized control trials assessing mesh fixation with glue versus suture in Lichtenstein inguinal hernia repair. *Medicine (Baltimore)*. 2018;97(14):e0227.
7. Sanders DL, Nienhuijs S, Ziprin P, Miserez M, Gingell-Littlejohn M, Smeds S. Randomized clinical trial comparing self-gripping mesh with suture fixation of lightweight polypropylene mesh in open inguinal hernia repair. *Br J Surg*. 2014;101(11):1373-1382.
8. Verhagen T, Zwaans WAR, Loos MJA, Charbon JA, Scheltinga MRM, Roumen RMH. Randomized clinical trial comparing self-gripping mesh with a standard polypropylene mesh for open inguinal hernia repair. *Br J Surg*. 2016;103(7):812-818.
9. Molegraaf M, Kaufmann R, Lange J. Comparison of self-gripping mesh and sutured mesh in open inguinal hernia repair: A meta-analysis of long-term results. *Surgery*. 2018;163(2):351-360.
10. Zhang C, Li F, Zhang H, Zhong W, Shi D, Zhao Y. Self-gripping versus sutured mesh for inguinal hernia repair: a systematic review and meta-analysis of current literature. *J Surg Res*. 2013;185(2):653-660.
11. Matikainen M, Kössi J, Silvasti S, Hulmi T, Paajanen H. Randomized Clinical Trial Comparing Cyanoacrylate Glue Versus Suture Fixation in Lichtenstein Hernia Repair: 7-Year Outcome Analysis. *World J Surg*. 2017;41(1):108-113.
12. Paajanen H, Kössi J, Silvasti S, Hulmi T, Hakala T. Randomized clinical trial of tissue glue versus absorbable sutures for mesh fixation in local anaesthetic Lichtenstein hernia repair. *Br J Surg*. 2011;98(9):1245-1251.
13. Rönkä K, Vironen J, Kössi J, Hulmi T, Silvasti S, Hakala T, Ilves I, Song I, Hertsi M, Juvonen P, Paajanen H. Randomized Multicenter Trial Comparing Glue Fixation, Self-gripping Mesh, and Suture Fixation of Mesh in Lichtenstein Hernia Repair (FinnMesh Study). *Ann Surg*. 2015;262(5):714-720.
14. Phoa S, Chan KS, Lim SH, Oo AM, Shelat VG. Comparison of glue versus suture mesh fixation for primary open inguinal hernia mesh repair by Lichtenstein technique: a systematic review and meta-analysis. *Hernia*. 2022;26(4):1105-1120.
15. Sun P, Cheng X, Deng S, Hu Q, Sun Y, Zheng Q. Mesh fixation with glue versus suture for chronic pain and recurrence in Lichtenstein inguinal hernioplasty. *Cochrane Database Syst Rev*. 2017;2(2):CD010814.

16. van Steensel S, van Vugt LK, Al Omar AK, Mommers EHH, Breukink SO, Stassen LPS, Winkens B, Bouvy ND. Meta-analysis of postoperative pain using non-sutured or sutured single-layer open mesh repair for inguinal hernia. *BJS Open*. 2019;3(3):260-273.
17. Antoniou SA, Köhler G, Antoniou GA, Muysoms FE, Pointner R, Granderath FA. Meta-analysis of randomized trials comparing nonpenetrating vs mechanical mesh fixation in laparoscopic inguinal hernia repair. *Am J Surg*. 2016;211(1):239-249.e2.
18. Liu H, Zheng X, Gu Y, Guo S. A meta-analysis examining the use of fibrin glue mesh fixation versus suture mesh fixation in open inguinal hernia repair. *Dig Surg*. 2014;31(6):444-451.
19. Sajid MS, Farag S, Singh KK, Miles WF. Systematic review and meta-analysis of published randomized controlled trials comparing the role of self-gripping mesh against suture mesh fixation in patients undergoing open inguinal hernia repair. *Updates Surg*. 2014;66(3):189-196.
20. Pandanaboyana S, Mittapalli D, Rao A, Prasad R, Ahmad N. Meta-analysis of self-gripping mesh (Progrid) versus sutured mesh in open inguinal hernia repair. *Surgeon*. 2014;12(2):87-93.
21. Bullen NL, Hajibandeh S, Hajibandeh S, Smart NJ, Antoniou SA. Suture fixation versus self-gripping mesh for open inguinal hernia repair: a systematic review with meta-analysis and trial sequential analysis. *Surg Endosc*. 2021;35(6):2480-2492.
22. Alabi A, Haladu N, Scott NW, Imamura M, Ahmed I, Ramsay G, Brazzelli M. Mesh fixation techniques for inguinal hernia repair: an overview of systematic reviews of randomised controlled trials. *Hernia*. 2022;26(4):973-987.
23. Singh A, Subramanian A, Toh WH, Bhaskaran P, Fatima A, Sajid MS. Comprehensive systematic review on the self-gripping mesh vs sutured mesh in inguinal hernia repair. *Surg Open Sci*. 2024; 17:58-64.
24. Tarchi P, Cosola D, Germani P, Troian M, De Manzini N. Self-adhesive mesh for Lichtenstein inguinal hernia repair. Experience of a single center. *Minerva Chir*. 2014;69(3):167-176.
25. Matikainen M, Vironen JH, Silvasti S, Ilves I, Kössi J, Kivivuori A, Paajanen H. A randomized clinical trial comparing early patient-reported pain after open anterior mesh repair versus totally extraperitoneal repair of inguinal hernia. *Br J Surg*. 2018;105(7):814-821.
26. Hu N, Xie H, Wang DC, Lei YH, Wei J, Yu M, Li YJ. Efficacy and safety of glue mesh fixation for laparoscopic inguinal hernia: A meta-analysis of randomized controlled trials. *Asian J Surg*. 2023;46(9):3417-3425.
27. Mohammadi Tofigh A, Karimian Ghadim M, Bohlooli M. Comparing suture with N-Hexyl Cyanoacrylate glue for mesh fixation in inguinal hernia repair, a randomised clinical trial. *Am J Surg*. 2021;222(1):203-207.
28. Giordano C, Rosellini E, Cascone MG, Di Puccio F. In vivo comparison of mesh fixation solutions in open and laparoscopic procedures for inguinal hernia repair: A meta-analysis. *Heliyon*. 2024;10(7):e28711.