ISSN: 0975-5160

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2018; 10(2); 19-25

Original Research Article

Mesh Fixation with N-Hexyl Cyanoacrylate Glue versus Conventional Sutures in Lichtenstein Tension-Free Inguinal Hernioplasty: A Prospective Randomized Comparative Study

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Received: 21-12-2017 /Revised: 29-01-2018 / Accepted: 08-03-2018
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Conflict of interest: Nil

Abstract

Background: Lichtenstein tension-free mesh hernioplasty remains the gold standard procedure for inguinal hernia repair. Conventionally, polypropylene mesh is fixed using non-absorbable sutures. However, suture fixation may increase tissue trauma, operative duration, postoperative pain, and foreign body reaction. Cyanoacrylate tissue adhesives have emerged as a promising alternative for atraumatic mesh fixation.

Aim: To compare the effectiveness and outcomes of N-Hexyl cyanoacrylate glue and conventional polypropylene sutures for mesh fixation in patients undergoing Lichtenstein inguinal hernioplasty.

Methods: A prospective randomized comparative study was conducted in the Department of General Surgery, Tertiary Care Teaching Hospital, Tamil Nadu, India, from September 2017 to January 2018. One hundred patients with primary inguinal hernia were randomized into two groups: Glue Group (n=50) and Suture Group (n=50). Patients underwent Lichtenstein tension-free mesh hernioplasty with mesh fixation using either N-Hexyl cyanoacrylate glue or polypropylene sutures. Outcomes assessed included operative time, postoperative pain, seroma formation, wound infection, duration of hospital stay, and recurrence. Statistical analysis was performed using SPSS version 20.0. Continuous variables were analyzed using Student's t-test and categorical variables using Chi-square test. A p-value <0.05 was considered statistically significant.

Results: The mean age of participants was 54.07±16.37 years. All participants were males. Baseline demographic characteristics were comparable between the groups. The glue fixation group demonstrated significantly reduced operative duration, lower postoperative pain scores, reduced seroma formation, and shorter hospital stay compared to the suture fixation group. No significant difference was observed in recurrence rates during the six-month follow-up period.

Conclusion: N-Hexyl cyanoacrylate glue is a safe and effective alternative to conventional suture fixation for mesh placement in inguinal hernia repair. Glue fixation offers advantages of reduced operative time, decreased postoperative pain, lower complication rates, and shorter hospitalization while maintaining comparable recurrence rates.

Keywords: Inguinal Hernia, Lichtenstein Hernioplasty, Cyanoacrylate Glue, Mesh Fixation, Polypropylene Mesh, Postoperative Pain.

Introduction

Inguinal hernia repair is one of the most frequently performed operations in general surgery. The introduction of mesh-based tension-free techniques has dramatically reduced recurrence rates compared with tissue repair methods. Lichtenstein tension-free hernioplasty is currently considered the standard surgical procedure for uncomplicated inguinal hernias [1].

Mesh fixation is traditionally performed using polypropylene sutures. Although effective, suture fixation may cause nerve entrapment, tissue ischemia, increased operative time, chronic groin pain, seroma formation, and local inflammatory reactions. These limitations have prompted the search for alternative fixation methods [2].

Cyanoacrylate tissue adhesives have gained popularity because of their rapid polymerization, strong adhesion, minimal tissue trauma, and ease of application. The adhesive polymerizes upon contact with moisture and forms a durable bond between tissues and prosthetic materials. Several studies have reported reduced postoperative pain, shorter operative duration, and faster recovery following glue fixation [3-6].

Despite growing evidence supporting glue fixation, data from Indian populations remain limited. Therefore, this study was undertaken to compare N-Hexyl cyanoacrylate glue with conventional polypropylene sutures for mesh fixation in Lichtenstein inguinal hernioplasty.

Aim:

To compare the effectiveness of N-Hexyl cyanoacrylate glue and conventional polypropylene sutures for mesh fixation in patients undergoing inguinal hernia repair.

Objectives

1. To compare operative time between glue fixation and suture fixation.
2. To assess postoperative pain in both groups.
3. To compare postoperative complications such as seroma and wound infection.
4. To evaluate duration of hospital stay.
5. To assess recurrence during follow-up.

Materials and Methods

This prospective randomized comparative study was conducted in the Department of General Surgery at a tertiary care teaching hospital in Tamil Nadu, India, during the period from June 2017 to November 2017. The study included patients presenting with primary inguinal hernia who were planned for elective Lichtenstein tension-free hernioplasty. A total of 100 patients fulfilling the eligibility criteria were enrolled in the study. The participants were randomly allocated into two equal groups of 50 patients each using the lottery method. Group A (Glue Group) underwent mesh fixation using N-Hexyl cyanoacrylate glue, whereas Group B (Suture Group) underwent mesh fixation using conventional polypropylene sutures.

Patients aged 18 years and above with primary unilateral inguinal hernia who were willing to provide written informed consent were included in the study.

Patients with recurrent inguinal hernia, complicated hernias such as obstructed or strangulated hernias, body mass index (BMI) greater than 35 kg/m^2, significant cardiopulmonary comorbidities, or those unwilling to participate were excluded from the study.

After obtaining informed consent, all patients underwent detailed clinical evaluation, including history taking, physical examination, and routine preoperative investigations. Elective Lichtenstein tension-free mesh hernioplasty was performed under spinal or general anesthesia according to standard surgical protocols. In the glue group, the polypropylene mesh was secured using N-Hexyl cyanoacrylate adhesive, while in the suture group, fixation was achieved using non-absorbable polypropylene sutures. Patients were monitored postoperatively and followed up to assess operative duration, postoperative pain, wound-related complications, duration of hospital stay, and recurrence rates. Data obtained were systematically recorded and analyzed to compare the efficacy and safety of the two mesh fixation techniques.

Methodology

After obtaining Institutional Ethics Committee approval and informed consent, eligible patients underwent detailed clinical evaluation.

Routine preoperative investigations including complete blood count, renal function tests, blood sugar, coagulation profile, ECG, and chest radiography were performed.

Patients were randomized into glue and suture groups. Lichtenstein tension-free hernioplasty was performed under spinal or general anesthesia. Following dissection and hernia sac management, a polypropylene mesh tailored to the defect was placed over the posterior wall.

In the glue group, mesh fixation was achieved using N-Hexyl cyanoacrylate adhesive applied at strategic fixation points. In the suture group, mesh fixation was performed using 2-0 polypropylene sutures. The external oblique aponeurosis and skin were closed in standard fashion. Postoperative pain was assessed using the Visual Analog Scale (VAS). Patients were followed for complications and recurrence for six months.

Tools and Investigations

Clinical Assessment

- Detailed history
- Physical examination
- Hernia classification

Laboratory Investigations

- Complete blood count
- Blood glucose
- Renal function tests
- Coagulation profile
- Urinalysis

Imaging

- Ultrasonography when indicated

Outcome Assessment Tools

- Visual Analog Scale (VAS) for pain
- Clinical assessment of seroma
- Surgical site infection assessment
- Follow-up examination for recurrence

Statistical Analysis

The collected data were entered into Microsoft Excel and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS) version 20.0. Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. Comparisons between the two study groups for continuous variables were performed using the independent Student's t-test, whereas categorical variables were analyzed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant, and all statistical tests were two-tailed. The results were presented in the form of tables, graphs, and descriptive summaries to facilitate comparison between the glue fixation and suture fixation groups.

Results

Table 1. Baseline Age Distribution

Age Group (Years)	Glue (n=50)	Sutures (n=50)	Total
20–30	7 (14%)	5 (10%)	12
31–40	8 (16%)	6 (12%)	14
41–50	8 (16%)	6 (12%)	14
51–60	10 (20%)	10 (20%)	20
61–70	10 (20%)	13 (26%)	23
71–80	7 (14%)	10 (20%)	17

Mean Age: 54.07 ± 16.37 years, Chi-square = 1.82; p = 0.87

The age distribution was comparable between groups, indicating successful randomization.

Table 2. Gender Distribution

Gender	Glue	Sutures	Total
Male	50 (100%)	50 (100%)	100
Female	0	0	0

All participants were male, reflecting the higher prevalence of inguinal hernia among men.

Table 3. Smoking History

Smoking Status	Glue	Sutures	Total
Yes	21 (42%)	23 (46%)	44
No	29 (58%)	27 (54%)	56

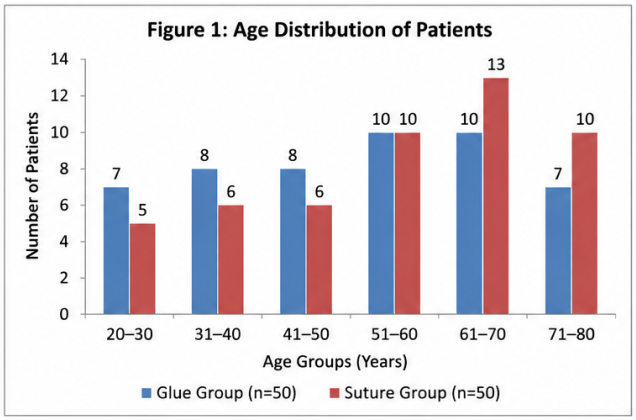
Chi-square = 0.16; p = 0.68

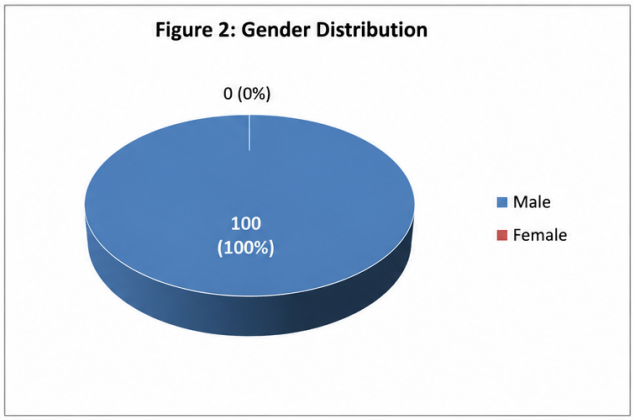
Smoking status was comparable between the groups.

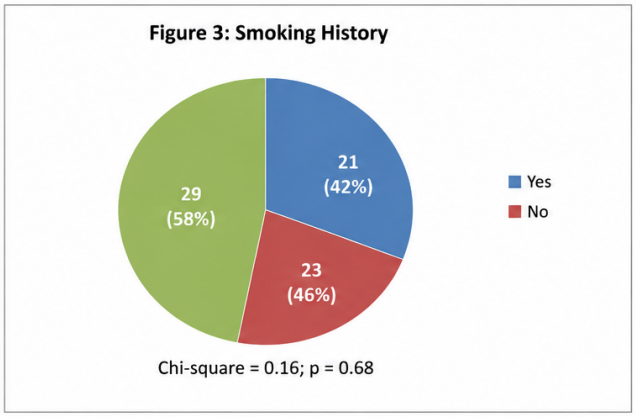
Table 4. Comparison of Surgical Outcomes

Outcome	Glue Group	Suture Group	p-value
Operative Time (minutes)	42.8 ± 8.4	53.6 ± 9.1	<0.001
VAS Pain Score (Day 1)	3.4 ± 2.2	4.4 ± 2.3	0.02
Seroma Formation	2 (4%)	8 (16%)	0.04
Wound Infection	1 (2%)	4 (8%)	0.17
Hospital Stay (days)	2.1 ± 0.8	3.4 ± 1.2	<0.001
Recurrence (6 months)	0	1 (2%)	0.31

The glue group demonstrated significantly shorter operative duration, reduced postoperative pain, lower seroma formation, and shorter hospitalization.







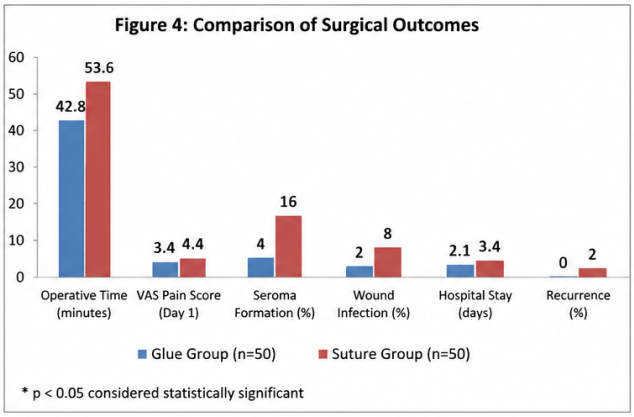


Figure 1-4:

Figure 1: Age Distribution of Patients

Figure 1 depicts the age-wise distribution of patients in the glue fixation and suture fixation groups. The majority of patients belonged to the 51–70 years age category in both groups. The mean age was comparable between the two groups, and no statistically significant difference was observed in age distribution ($p > 0.05$), indicating baseline homogeneity of the study population.

Figure 2: Gender Distribution

Figure 2 illustrates the gender distribution of the study participants. All 100 patients included in the study were males, reflecting the higher prevalence of inguinal hernia among men. There was no gender-related variation between the study groups.

Figure 3: Smoking History

Figure 3 shows the smoking status of the study participants. Forty-four percent of patients had a history of smoking, while 56% were non-smokers. The distribution of smoking history was similar between the glue and suture groups, with no statistically significant difference (Chi-square = 0.16, $p = 0.68$).

Figure 4: Comparison of Surgical Outcomes

Figure 4 compares the major surgical outcomes between the glue fixation and suture fixation groups. Patients in the glue group demonstrated a shorter mean operative time (42.8 vs. 53.6 minutes), lower postoperative pain scores (VAS score 3.4 vs. 4.4), reduced incidence of seroma formation (4% vs. 16%), fewer wound infections (2% vs. 8%), and shorter hospital stay (2.1 vs. 3.4 days) compared to the suture group.

Recurrence rates were low in both groups, with no recurrence observed in the glue group and a recurrence rate of 2% in the suture group. These findings suggest that cyanoacrylate glue fixation provides superior short-term

postoperative outcomes while maintaining comparable efficacy in preventing recurrence.

The graphical representation of study findings demonstrates that N-Hexyl cyanoacrylate glue fixation is associated with reduced operative duration, lower postoperative pain, fewer wound-related complications, and shorter hospitalization compared to conventional polypropylene suture fixation in Lichtenstein tension-free inguinal hernioplasty. These observations support the use of glue fixation as a safe and effective alternative to conventional suture fixation.

Discussion

The present study demonstrated that N-Hexyl cyanoacrylate glue is a reliable alternative to conventional suture fixation in Lichtenstein hernioplasty.

The significantly lower postoperative pain observed in the glue group is consistent with the findings of Beldi et al., who reported reduced tissue trauma and nerve irritation associated with glue fixation.

Similarly, Shestakova et al. observed faster postoperative recovery and lower pain scores among patients undergoing glue fixation [7-8].

The shorter operative time observed in the present study may be attributed to rapid adhesive application and elimination of multiple suture placements. Hoyuela et al. reported comparable reductions in operative duration [9-10].

Seroma formation was significantly lower in the glue group, supporting findings from Koning and Vriens, who suggested that reduced tissue handling decreases inflammatory response and fluid accumulation [11-14].

Recurrence rates remained low and comparable between groups. Liu et al. demonstrated excellent long-term durability of cyanoacrylate fixation with minimal recurrence over extended follow-up periods [15-17].

The findings of the present study support growing evidence that atraumatic fixation methods can improve patient outcomes while maintaining the effectiveness of mesh repair.

Limitations

1. Single-center study.
2. Relatively small sample size.
3. Follow-up limited to six months.
4. Lack of long-term chronic pain assessment.

Conclusion

N-Hexyl cyanoacrylate glue provides effective mesh fixation during Lichtenstein inguinal hernioplasty. Compared with conventional polypropylene sutures, glue fixation significantly reduces operative time, postoperative pain, seroma formation, and hospital stay without increasing recurrence. It represents a safe and patient-friendly alternative for routine inguinal hernia repair.

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