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Comparison of postoperative outcomes between tissue glue and suture for mesh fixation in open tension-free inguinal hernia repair: a prospective analytical study

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Introduction: A hernia is an abnormal protrusion of the viscus through the normal or abnormal opening of its containing cavity. Lichtenstein tension-free mesh repair is a commonly performed surgery for hernia. Various studies have revealed atraumatic fixation of the mesh produces less pain without compromising the outcomes.

Methods: This is a prospective analytical study conducted in a tertiary hospital over a year. Eighty patients with primary inguinal hernia undergoing open mesh repair were enrolled and divided into two groups with 40 patients in each group. Mesh fixation was done with N-butyl 2 cyano-acrylate glue in one group, while polypropylene 2-0 suture in the other group. Postoperative pain, the number of dosages of analgesia required, the incidence of hematoma/seroma formation, surgical site infection, and length of hospital stay were compared between the two groups. Data were analyzed using SPSS 25.

Results: Visual analog scores were significantly reduced in the glue group at 12 h and 24 h ($P < 0.05$) with a reduction of the mean number of analgesic doses from 6.42 ± 0.984 in the suture group to 5.95 ± 0.597 in the glue group ($P < 0.05$). The operating time was significantly reduced from 70.03 ± 4.376 minutes in the suture group to 58.43 ± 4.540 min in the glue group ($P < 0.05$), while there was no significant difference in the length of hospital stay. Five percent of cases in the suture group developed seroma while no SSI was reported in this study.

Conclusions: This study demonstrates mesh fixation with cyanoacrylate glue in open hernioplasty for primary groin hernias is associated with reduced immediate postoperative pain, dose of analgesia required, and operating time in comparison to fixation with suture.

Keywords Lichtenstein's hernia repair, mesh fixation, N-butyl 2 cyanoacrylate glue, postoperative pain

Introduction

An abdominal hernia can occur when weak, defective, and injured areas in the abdominal wall allow the protrusion of abdominal organs or part of any organ through the defects. Both endogenous (gene, age, sex) and exogenous (drug, smoking, and trauma) factors are postulated for the abdominal wall hernia development[1]. A study by Abebe and colleagues demonstrated that the pool prevalence of inguinal hernia is 7.7%, being highest in Asia (12.72%) and lowest in America (4.73%). Males (9.61%) have highly outnumbered females (1.31%) in terms of prevalence[2].

Worldwide, 20 million groin hernia repairs are performed annually[3]. Pain after inguinal hernia surgery is found to be

HIGHLIGHTS

- An abdominal hernia can occur when weak, defective, and injured areas in the abdominal wall allow the protrusion of abdominal organs or part of any organ through the defect.
- Approximately 20 million groin hernia repairs are performed worldwide annually, and the incidence of early postoperative pain and chronic persistent inguinal pain following hernia repair surgery is significant in the current scenario.
- In our study, postoperative pain and required doses of analgesics were significantly reduced with mesh fixation with cyanoacrylate glue in comparison to non-absorbable polypropylene suture. The duration of surgery was also significantly reduced.
- Mesh fixation with tissue glue is advantageous in terms of postoperative pain and operation duration with decreased incidence of seroma/hematoma formation compared to sutures.

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debilitating and alters the quality of life in several patients, which has been attributed to the traumatic fixation of the mesh with sutures[4]. Meta-analysis by Chu *et al.*[5] that included 29 466 patients showed that the incidence of chronic pain was 17.01% among the patients undergoing elective tension free hernia repair. The risk factors for chronic persistent inguinal pain are younger age, presence of other postoperative complications, hernial sac defect less than 3 cm, being female, postoperative pain, and preoperative pain. The incidence of persistent pain following hernia repair surgery is significant in the current scenario[5].

Several improvisations have been made to the classical Lichtenstein's hernioplasty technique over the years. Various staplers, tackers, tissue adhesives, self-gripping meshes, and even placing the mesh without fixation have been practiced instead of sutures. However, it has been observed that several patients experience severe pain in the immediate postoperative period and also chronic persisting dragging pain in the inguinal region several months following the surgery. Complications associated with sutured mesh fixation following open groin hernia repair have prompted surgeons to evaluate methods of atraumatic fixation, such as the use of tissue glue. Mesh fixation with glue may decrease the operating time and reduce the frequency of postoperative pain when compared with mesh fixation by suture. Butyl- and octyl-cyanoacrylates demonstrated very good tissue compatibility and are quite cheaper than fibrin glue. They are easily stored even for a long time and can be easily applied[6].

Various studies have revealed that atraumatic fixation of the mesh produced less pain without compromising the outcomes. Hence the study aimed to observe the differences between traumatic and atraumatic mesh fixation in terms of postoperative pain, number of doses of analgesia required postoperatively, hematoma/seroma formation, wound infection, and length of hospital stay postoperatively.

Methodology

This is a prospective observational analytical study conducted in a tertiary hospital over the period of one year between April 2021 and May 2022. Eighty patients above the age of 18 years undergoing elective hernia repair for primary inguinal hernia were enrolled in this study. The patients with recurrent hernia, obstructed or strangulated hernia, and undergoing emergency exploration were excluded from this study. On the basis of the percentage reduction of postoperative pain at 3 months postoperatively following elective inguinal hernia repair that was estimated by Jeyakumar *et al.*[7], the sample size of 80 was calculated for this study. The cases were categorized into two groups via a computer-based randomized sampling method with 40 cases in each group. Every patient in the suture group underwent hernia repair with mesh fixation with polypropylene 2-0 suture, while the cases in the glue group underwent mesh fixation with N-butyl 2 cyno-acrylate glue. However, patient's choice was considered in the study. All the cases underwent hernia repair under spinal anesthesia. Before the surgery, all the patients received a single dose of prophylactic antibiotics as per the institutional protocol. Under standard aseptic precaution, tension-free open hernia repair was performed with a polypropylene mesh of size 6×11 cm. The mesh was placed behind the cord over the flattened fascia transversalis, conjoint tendon and rectus sheath medially. The mesh covered the internal oblique laterally and superiorly above the internal ring. The lower border of the mesh overlapped the inguinal ligament for 1 cm throughout its length under the lower flap of the external oblique aponeurosis. The mesh was fixed at three points that were the pubic tubercle, a reflection of the inguinal ligament and, conjoint tendon in both groups either with suture or glue.

Postoperatively, all patients received Ketorolac 0.5 mg/kg at 8-h intervals. A dose of analgesic was defined as 0.5 mg/kg dosage of Injection Ketorolac or 1 gm Injection Paracetamol administered via the intravenous route. Postoperative pain was assessed using a Visual Analog Score (VAS) at the 12^{th}, 24^{th}, and 48^{th} h. In the presence of pain, an Injection Paracetamol, 1 g, was administered. If pain persisted, pain medications were upgraded to narcotic analgesia. The patients were discharged once the pain is adequately controlled and patients no longer require parenteral analgesics. The incision site was examined for possible seroma or hematoma on 2^{nd} postoperative day. Patients were reassessed on the 7^{th} postoperative day for staples removal and assessment of seroma formation. They were followed up on the 30^{th} and 90^{th} postoperative days to rule out chronic persistent inguinal pain through teleconsultation with telephone call or hospital follow-up. Data were analyzed using SPSS version 25. Mean and standard deviations of the comparison variables that are comparison variables that are age, number of participants in each gender groups, BMI, operating time, visual analog score, number of doses of analgesia and length of hospital stay were calculated and compared between the two groups with independent sample *t*-test. *P* values less than 0.05 were considered statistically significant.

This study has been reported in line with the STROCSS criteria[8].

Results

The demographic variables such as age and sex were similar in the two comparison groups in terms of *P* value. The mean age in the suture group was 55.65 years, while the glue group was 49.42 years. Female patient comprises 2.5% of total cases in either comparison group. The mean BMI was 24.05 and 21.86 kg/m^2 in the suture group and glue group, respectively, as shown in Table 1.

The was a significant reduction in mean operating time from 70 ± 4.376 min in the suture group to 58.43 ± 4.540 min in the glue group ($P < 0.05$). Immediate postoperative pain compared between the two groups using VAS at the 12th and 24th h of surgery were significantly different. The mean pain score at 12 h was 6.95 ± 0.714 in the suture group and 6.43 ± 0.903 in the glue group ($P < 0.05$). The pain score at 24 h was 4.48 ± 0.847 in the suture group and 4.05 ± 0.815 in the glue group ($P < 0.05$) as shown in Table 1. There was no significant reduction in pain score at 48 h, 7^{th} days, 30^{th} days, and 90^{th} days. The number of doses of analgesia was 6.42 ± 0.984 in the suture group and 5.95 ± 0.597 in the glue group ($P < 0.05$). The incidence of seroma and hematoma in the suture group was 5% ($n = 2$), and no evidence of seroma and hematoma was observed in the glue group. Among the two groups, the length of hospital stay was 2.10 ± 0.379 in the suture group and $1.98 \pm .276$ days in the glue group. The difference was statistically insignificant between the two groups.

Table 1

Comparison between mesh fixation with suture vs. glue.

Variables	Suture group (Mean ± SD)	Glue group (Mean ± SD)	*P*
Age (years)	55.65 ± 17.69	49.42 ± 18.02	0.1
Sex			
Male	39	39	1
Female	1	1	
BMI (kg/m^2)	24.05 ± 2.99	21.86 ± 2.11	**0.001**
Operating time (min)	70.03 ± 4.376	58.43 ± 4.540	**< 0.001**
Pain as per VAS			
12th h	6.95 ± 0.714	6.43 ± 0.903	**0.005**
24th h	4.48 ± 0.847	4.05 ± 0.815	**0.025**
48th h	2.68 ± 0.730	2.40 ± 0.709	0.091
7th day	1.63 ± 0.586	1.40 ± 0.591	0.091
30th day	1.00 ± 0.320	0.95 ± 0.389	0.532
90th days	0.63 ± 0.490	0.48 ± 0.506	0.182
No. doses of analgesia	6.42 ± 0.984	5.95 ± 0.597	**0.011**
Seroma/hematoma formation	2(5%)	0	—
Surgical site infection	0	0	—
Length of hospital stay (days)	2.10 ± 0.379	1.98 ± 0.276	0.096

VAS, Visual Analog Score.
Bold values indicate statistically significant ($P < 0.05$).

Discussion

Our study considered 80 cases of primary inguinal hernia undergoing elective open mesh repair under regional anesthesia. The VAS for pain was reduced in the glue group at the 12th and 24th h with significant differences in operation time and number of doses of analgesia required. However, there was no significant difference in the length of hospital stay. The statistical analysis failed to demonstrate any significant difference in the incidence of complications like SSI and hematoma/seroma formation as none of the cases in glue group developed seroma/hematoma and the incidence of SSI was nil in both groups. Furthermore, our study could not establish the difference in chronic persistent inguinal pain and the recurrence rate due to the shorter follow-up duration.

Similar to our study, various other studies indicated benefits with glue fixation in terms of reduced operation duration, postoperative pain, complications and no difference in outcome[9–12]. In a randomized controlled trial, Jeyakumar *et al.*[7] concluded a significant difference in the intraoperative time, with glue taking a significantly lower time than sutures, along with lower immediate and chronic postoperative pain in the glue group. Shukla *et al.*[13] depicted the effectiveness and superiority of glue over suture for mesh fixation in open inguinal hernia repair in terms of reduced immediate and chronic postoperative pain and operative time. In addition, a randomized controlled trial by Tebala *et al.*[6] demonstrated that mesh fixation with glue is a safe procedure and causes less early and late postoperative pain than the classical suture fixation in open mesh repair of groin hernias. The study by Ravishankar *et al.*[14] established cyanoacrylate glue as an effective alternative to conventional sutures for mesh fixation in Lichtenstein tension-free hernia repair as the postoperative complications such as pain and analgesia requirement with an early return to normal activity.

A study by Megahed and colleagues showed a significant decrease in postoperative pain perception at 24 h, 1 week and 1 month in the glue group along with significantly decreased operative time. As regards the postoperative complications, the postoperative hematoma, infection and seroma were lesser in the glue group but the difference was not significant. There was no recurrence in both groups[15]. Intraoperative time duration was significantly reduced with glue as compared to suture and postoperative pain score (mean VAS score) was significantly reduced in glue fixation in a study by Shah *et al.*[16]. In a study by Techapongsatorn *et al.*[17], the effects of glue in hernia recurrence were inconclusive in open and laparoscopy approaches ($P = 0.816$ and 0.946, respectively). However, Fouda and colleagues concluded that there is no significant difference in hernia recurrence and postoperative complication rates between cyanoacrylate and suture mesh fixation[8].

Chronic persistent inguinal pain is a significantly debilitating outcome affecting the daily activities of a patient. A study by Olsson *et al.*[18] concluded that among patients who underwent open anterior mesh repair, persistent inguinal pain was associated with postoperative complications like hematomas (OR = 2.03, CI = 1.30–3.18), surgical site infections (OR = 2.18, CI = 1.27–3.73) and acute postoperative pain (OR = 7.46, CI = 4.02–13.87). Lo *et al.*[19] noticed that the predictive factors for chronic pain were female sex, young age (< 65 years), pain before the operation, and using heavyweight mesh material. On the contrary, Krpatta *et al.*[20] found that there was no significant difference in pain scores in the heavy-weight vs. medium-weight mesh groups at 30 days (46.3 vs. 46.3, $P = 0.89$) and 1 year (30.7 vs. 30.7, $P = 0.59$). A meta-analysis indicated that the incidence of chronic persistent inguinal pain with fibrin glue was lower than that with non-absorbable sutures (relative risk = 0.23)[21]. The results of the existing systematic reviews indicate that glue fixation may be more effective than other techniques in reducing the rate of pain presenting up to 1 year postoperatively without increasing the risk of recurrence[22].

Limitation

This is a single-centered study and the sample size is small. However, the sample size is adequate as per the estimated reduction in postoperative pain at 3 months. Various factors like preservation or sacrifice of ilioinguinal nerve, difficult dissection due to the presence of dense adhesions around the sac, presence of preoperative pain and variation in skills of different surgeons might act as confounders.

Conclusion

Mesh fixation with cyanoacrylate glue in the Lichtenstein repair of inguinal hernia shows advantages over sutures in terms of lower operation time, lower postoperative pain, and postoperative analgesia requirement.

Ethical approval

Ethical approval for this study (Institutional Review Committee Pokhara Academy of Health Sciences Ref:15/078) was provided by the Institutional Review Committee Pokhara Academy of

Health Sciences (IRC/PoAHS), Pokhara, Nepal on 23rd April 2021. All procedures performed in studies involving human participants were in accordance with the ethical standards of IRC/PoAHS and with the 1964 Helsinki's Declaration and its later amendments.

Consent

Informed written consent was obtained from the participants before conducting the study.

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Author contribution

N.R., L.R.: conceptualization, data curation, investigation, methodology, project administration, formal analysis, writing original draft, writing—reviewing and editing. R.S., E.S.: data curation, investigation, methodology, writing original draft, writing—reviewing and editing. N.V.G.: writing original draft, writing—reviewing and editing. All the authors approved of the final version of the manuscript and agreed to be accountable for all aspects of the work ensuring questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflicts of interest disclosure

The authors declare no conflicts of interest.

Research registration unique identifying number (UIN)

Name of the registry: Research registry Research Registration Unique Identifying Number (UIN): researchregistry10333 Hyperlink to the registration: https://researchregistry.knack.com/research-registry#userresearchregistry/registerresearchdetails/6652133c92a3f402761cf536/.

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Data availability statement

The data are available through the corresponding author upon reasonable request.

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