World Journal of Surgery and Surgical Research

Research Article
Published: 07 Aug, 2025

Comparative Study between N-Butyl Cyanoacrylate *versus* Skin Sutures in Closure of Congenital Inguinal Hernia Incision

Ankit Sachan[1]*, Waseem Ashraf[2], Ritu Patel[3], Shyam Bihari Sharma[4], Praveen Agarwal[1] and Dalvir Singh[2]

[1]*Department of General Surgery, KD Medical College, Mathura, India*

[2]*Urology Unit, Department of General Surgery, KD Medical College, Mathura, India*

[3]*Department of Obstetrics and Gynacology, KD Medical College, Mathura, India*

[4]*Paediatric Surgery Division, Department of General Surgery, KD Medical College, Mathura, India*

Abstract

The closure of surgical wounds plays a pivotal role in ensuring proper healing and reducing postoperative complications. Traditionally, skin sutures have been the standard method for wound closure in inguinal hernia repairs. However, alternative techniques such as the use of tissue adhesives, particularly N-Butyl cyanoacrylate (NBCA), are gaining attention for their potential to improve outcomes. NBCA is a fast-acting adhesive that bonds quickly upon contact with tissue moisture, forming a strong and flexible seal. Compared to sutures, NBCA offers advantages such as shorter application time, improved patient comfort by eliminating suture removal, and a reduced risk of needle-stick injuries. Moreover, studies suggest that tissue adhesives may lead to better cosmetic outcomes with minimal scarring, as the adhesive avoids puncturing the skin like sutures. 2Postoperative scar formation, pain, and infection are key concerns following inguinal hernia repair. Sutures may be associated with greater pain due to tissue tension and irritation caused by suture knots, while NBCA, being non-invasive, can potentially reduce discomfort. Additionally, the adhesive's antimicrobial properties may lower the risk of wound infection, which remains a common complication in surgical wound closure.

OPEN ACCESS

Correspondence:

Ankit Sachan, Department of General Surgery, KD Medical College, Mathura, India,

E-mail: drankitsachan00@gmail.com

Received Date: *14 Jul 2025*

Accepted Date: *01 Aug 2025*

Published Date: *07 Aug 2025*

Citation:

Sachan A, Ashraf W, Patel R, Sharma SB, Agarwal P, Singh D. Comparative Study between N-Butyl Cyanoacrylate versus Skin Sutures in Closure of Congenital Inguinal Hernia Incision. World J Surg Surgical Res. 2025; 8: 1598.

Introduction

Paediatric inguinal hernia repair is one of the most common surgeries performed in children, with various techniques used for wound closure. Traditional skin closure using sutures has long been the standard, but recent advancements in wound closure materials, such as N-Butyl cyanoacrylate, have prompted comparisons regarding their efficacy, cosmetic outcomes, and procedural advantages [1-5]. Cyanoacrylates, are a group of fast-acting adhesives, have been utilized globally since the 1950s for various industrial, household, and medical applications due to their unique properties. In their monomer state, they exist as low-viscosity liquids that instantly polymerize and become adhesive upon contact with ionic substances. Among these, N-butyl cyanoacrylate (NBCA) is frequently employed in medical care, particularly for skin wound closure to promote haemostasis [6]. In the context of inguinal hernia surgery, NBCA can play a role in reducing the need for sutures or staples, particularly in mesh fixation during hernia repair. Its adhesive properties allow for precise application and secure fixation of surgical meshes, potentially reducing postoperative pain and minimizing complications associated with traditional fixation techniques, such as nerve injury or chronic pain. While NBCA-based methods are widely used in other medical fields, its use in hernia repair is still evolving and may offer a valuable alternative for specific patient populations [7]. The term "suture" comes from the Latin word *sutura*, meaning "a sewn seam." Historically, materials like linen, cotton, horsehair, animal tendons, and metal wires were used for wound closure and ligatures. Over time, these have evolved into the sophisticated sutures used today. Surgeons rely on sutures daily, often selecting them based on training or past experiences. However, understanding suture characteristics is essential for minimizing dead space, reducing infection risks, achieving precise tissue approximation, and optimizing scar outcomes [8]. The ideal suture possesses predictable tensile strength relative to its size, excellent handling properties, and secure knot-tying capability. Over time, surgeons develop suture preferences tailored

to their practice, guided by their understanding of tissue healing and the physical and biological properties of suture materials. Factors such as infection, biofilm formation, and antimicrobial resistance also influence their choices. Modern sutures are often enhanced with agents to improve handling, antibacterial effectiveness, and visibility during procedures [9]. Several studies have demonstrated the superior cosmetic outcomes associated with N-Butyl cyanoacrylate compared to traditional sutures. The use of cyanoacrylate resulted in a single linear scar, which was perceived as cosmetically better than the more pronounced, multi-stitch suture scar [10]. It has been seen that approximately 80% of wounds closed with cyanoacrylate were rated as cosmetically good compared to only 6.7% in the suture group [11]. These findings suggest that cyanoacrylate not only improves the aesthetic appearance of the wound but also reduces the likelihood of scar complications, such as keloid formation, which are common with sutures. In terms of wound healing, N-Butyl cyanoacrylate has been shown to be an effective alternative to sutures, with comparable or even better results in some studies. Wound infection rates are generally lower when cyanoacrylate is used for closure. For instance, one study found a lower incidence of wound infection and discharge in the cyanoacrylate group as compared to the suture group. However, other studies noted that while the incidence of wound dehiscence might be slightly higher with cyanoacrylate, the difference is not significant. It is crucial to note that the application of tissue adhesives is associated with a risk of skin irritation or erythema, but this is usually transient and resolves without complications [12]. Another significant advantage of N-Butyl cyanoacrylate is the reduction in operative time. Multiple studies have shown that cyanoacrylate application is quicker than traditional suturing, reducing the total time required for wound closure. This shorter procedure time may also translate into cost savings, particularly in terms of operating room time. However, the material cost for cyanoacrylate is generally higher than that of sutures, though this can be offset by the shorter time spent in the operating room and the reduced need for postoperative care [13]. This study aims to compare NBCA and traditional sutures in the closure of inguinal hernia wounds, focusing on postoperative outcomes such as scar quality, pain intensity, infection rates, and overall patient satisfaction. By evaluating these parameters, the study seeks to determine whether NBCA is a superior alternative for improving patient outcomes in inguinal hernia surgery.

Materials and Methods

The present prospective comparative study enrolled to 90 patients with age below 12 years undergoing inguinal hernia surgery at department of general surgery at our institute KD medical college from January 2023 to December 2024. The study was approved by institutional ethics committee (IEC no. 1689/KDMC). The written Informed consent was taken from each participant. All Paediatric patients with age below 12 years of uncomplicated Inguinal Hernia undergoing open inguinal herniotomy were included in the study. While patients having hernia associated with Connective tissue disorders, skin disease over operating area, patients above 12 years of age and having associated Maldescended testis were excluded from the study. Patients were randomized into two groups: Group A (N-butyl cyanoacrylate) and Group B (sutures). In Group A, after herniotomy, 0.5 ml of N-butyl cyanoacrylate glue was applied to the skin closure site, and the wound edges were held in approximation for 1 minute. In Group B, after herniotomy, the skin was closed using subcuticular continuous sutures with 4-0 or 5-0 Ethilon. Different Questionnaires are shown below which we have used to evaluate each patient.

Visual Analog scale

Pain Assessment: Postoperative pain was evaluated using a Visual Analog Scale (VAS), which is a widely recognized tool for quantifying pain intensity. The VAS ranged from 1 to 7, with 1 representing minimal discomfort and 7 indicating severe pain. The scale was assessed daily from Day 1 to Day 6 after surgery, capturing the patient's pain experience at each time point. Each patient in the study, regardless of treatment group, was asked to self-report their pain level on this scale. The study included two treatment groups: one group received skin sutures for wound closure, and the other group was treated with N-Butyl Cyanoacrylate (NBCA), a tissue adhesive. The VAS scores were recorded for both groups on each postoperative day, allowing for a comparative analysis of pain levels between the two groups over the six-day postoperative period. This method enabled a clear assessment of pain trends and differences related to the type of wound closure employed. Data collected from these daily VAS assessments were analyzed to determine the impact of each treatment on postoperative pain, with particular focus on the duration and severity of pain across the six-day period.

The Vancouver scar scale

Pain Assessment: Pain was assessed using the Vancouver Pain Scale, which ranges from 1 to 10. A score of 1 indicates no pain, while a score of 10 represents the most intense pain imaginable. This scale was used to evaluate pain levels on each postoperative day, from Day 1 to Day 6, to capture daily variations in pain intensity. The Vancouver Pain Scale was applied to two groups: one group underwent wound closure with skin sutures, while the other received N-Butyl Cyanoacrylate (NBCA) as a tissue adhesive. Each patient was asked to rate their pain intensity on the Vancouver Pain Scale at each time point, allowing for a comparison of pain levels between the two groups across the postoperative period. The data collected from these assessments were analyzed to identify any significant differences in pain intensity between the skin sutures and NBCA groups, with a particular focus on how pain varied across the first six days following surgery.

ASEPSIS wound score Questionnaires

Wound infection Assessment: The ASEPSIS (A Serious Prospective Infection Score) wound score was used to evaluate wound healing and detect any complications, such as infection, at a single postoperative assessment. The ASEPSIS score in this study ranged from 1 to 4, where a score of 1 indicates no infection or complications and a score of 4 represents severe infection or complications requiring intervention. The ASEPSIS score was assessed at a single time point, typically during the first postoperative follow-up visit. At this assessment, the wound was closely examined for clinical signs of infection, including redness, swelling, discharge, or other abnormal signs. The score also took into account any additional treatments needed, such as antibiotic use or changes in the wound care regimen. Both groups—skin sutures and N-Butyl Cyanoacrylate (NBCA)—were assessed using this score to compare wound healing outcomes and identify any complications. The results were analyzed to evaluate the effectiveness of each wound closure technique in terms of wound healing and infection control.

Modified Hollander Wound score scale

The Modified Hollander Wound Score was used to evaluate wound healing at a single postoperative time point. This scale ranges

from 1 to 7, where a score of 1 indicates excellent wound healing with no complications, and a score of 7 reflects poor healing with significant complications, such as infection or wound dehiscence. The Modified Hollander Wound Score was assessed during the first postoperative follow-up visit, typically within the first week after surgery. The assessment took into account several factors, including wound appearance (such as redness, swelling, and drainage), the presence of infection, and the overall condition of the wound. This score also considered whether additional medical interventions, such as antibiotics or dressing changes, were required. Both groups—those treated with skin sutures and those treated with N-Butyl Cyanoacrylate (NBCA)—were assessed using this scoring system. The scores for each group were compared to evaluate differences in wound healing outcomes and complications, providing insight into the effectiveness of the two different wound closure techniques.

Sample size

$$N = Z\,\sigma^2 (Z_{\alpha/2} + Z_{\beta})^2$$

$$(\mu_t - \mu_c)^2$$

Where

$Z_{\alpha/2}$= Z Value from standard normal distribution is 1.96 or standard value associated with α

Z_{β} = Z value from the standard normal distribution is (0.840) or standard value associated with β

$(\mu_t - \mu_c)$ = true mean difference

$$N = Z \times (3.13)^2 \times (1.96 + 0.04)^2$$

$$(4.97 - 2.83)^2$$

$$= 186.14$$

$$(2.14)^2$$

$$= 186.14$$

$$4.57$$

$$= 40.73 \approx 41$$

Statistical analysis

All continuous variables are expressed as mean ± SD, and categorical variables are expressed as number (percentages). An independent samples t-test was used to compare two groups for normally distributed continuous variables, while the comparison of categorical variables was performed using the Chi-square test. A p-value of less than 0.05 was considered statistically significant for all test results. All statistical analyses were conducted using IBM SPSS Statistics software, version 26.

Results

A total of 90 participants were included in the study, with a median age of 6 years (ranging from 4 months to 12 years) and a mean age of 5.96 ± 3.2 years. The age distribution revealed that 31.1% of the participants were under 3 years old, 25.6% were between 4 and 6 years, 24.4% were between 7 and 9 years, and 18.9% were between 9 and 12 years. The majority of the participants were below 6 years of age, with the largest proportion belonging to the group aged less than 3 years (Table 1).

The demographic and clinical characteristics of patients in the N-Butyl Cyanoacrylate and skin sutures groups are summarized in the Table 2. The mean age was comparable between the two groups (5.67 ± 3.1 years for N-Butyl Cyanoacrylate *vs.* 6.25 ± 3.3 years for skin sutures, P=0.389). The male-to-female ratio was similar, with males constituting 77.8% in the N-Butyl Cyanoacrylate group and 82.2% in the skin sutures group (P=0.7921). In the study, among patients in the NBCA group, 6 (13.33%) underwent hernioplasty, while 39 (86.66%) underwent herniotomy. In the sutures group, 8 patients (17.78%) underwent hernioplasty, and 37 (82.22%) underwent herniotomy. These findings indicate that herniotomy was the more commonly performed procedure in both groups, with a slightly higher proportion in the NBCA group compared to the sutures group though the difference was statistically insignificant (P value=0.168).

The comparison of operative times between the N-Butyl Cyanoacrylate and skin sutures groups is summarized in the Table 3. The mean time taken for skin closure was significantly shorter in the N-Butyl Cyanoacrylate group (3.22 ± 0.64 minutes) compared to the skin sutures group (7.87 ± 1.16 minutes, P<0.0001). Similarly, the total time of surgery was significantly reduced in the N-Butyl Cyanoacrylate group (64.47 ± 6.64 minutes) compared to the skin sutures group (75 ± 6.12 minutes, P<0.0001). These results highlight the efficiency of N-Butyl Cyanoacrylate in reducing operative times.

Table 4 shows the time taken for skin closure varied significantly between Group A and Group B across all age groups, with Group A consistently demonstrating shorter closure times. In participants under 3 years of age, the mean time was 3.36 ± 0.63 minutes in Group A compared to 8.21 ± 0.58 minutes in Group B (P<0.0001). Similarly, for participants aged 4–6 years, the time was 3.08 ± 0.49 minutes in Group A and 8.1 ± 1.29 minutes in Group B (P < 0.0001). Among the 7–9 years age group, the time was 3.09 ± 0.7 minutes in Group A and 7.55 ± 0.82 minutes in Group B (P < 0.0001). Finally, in the 10–12 years age group, the mean closure time was 3.43 ± 0.79 minutes in Group A compared to 7.5 ± 1.78 minutes in Group B (P<0.0001). These findings indicate that Group A had significantly shorter skin closure times across all age groups.

Table 1: Baseline characteristics of the study population.

Median (min- max)	06 (04 months -12years)
Mean age	5.96 ± 3.2 (years)
< 3 years	28 (31.1%)
4-6 years	23 (25.6%)
7-9 years	22 (24.4%)
9-12 years	17 (18.9%)
Total	90

Table 2: Demographic and clinical characteristics of the study groups.

Variables	Group A (N=45)	Group B (N=45)	P value
Age (years)	5.67±3.1	6.25±3.3	0.389
Male	35 (77.8%)	37 (82.2%)	0.7921
Female	10 (22.2%)	08 (17.8%)	
Hernioplasty	06 (13.33%)	08 (17.78%)	0.168
Herniotomy	39 (86.66%)	37 (82.22%)	

Table 3: Time taken for skin close and surgery time.

Variables	Group A (N=45)	Group B (N=45)	P value
Time taken for skin closure	3.22 ± 0.64	7.87 ± 1.16	<0.0001
Time of surgery in min	67.47 ± 6.64	69.02 ± 6.12	0.253

Table 4: Comparison of skin closure time across the two study groups (in minutes).

Age groups	Group A	Group B	P value
<3 years	3.36 ± 0.63	8.21 ± 0.58	<0.0001
4-6 years	3.08 ± 0.49	8.1 ± 1.29	<0.0001
7-9 years	3.09 ± 0.7	7.55 ± 0.82	<0.0001
10-12 years	3.43 ± 0.79	7.5 ± 1.78	<0.0001

Table 5: Comparison of Post –operative pain score between study groups.

Variables	Group A (N=45)	Group B (N=45)	P value
Day 1	3.71 ± 0.63	5.36 ± 0.68	<0.0001
Day 2	3.78 ± 0.52	5.51 ± 0.89	<0.0001
Day 3	3.27 ± 0.54	4.8 ± 0.76	<0.0001
Day 4	2.8 ± 0.46	4.07 ± 0.62	<0.0001
Day 5	2.22 ± 0.42	3.18 ± 0.58	<0.0001
Day 6	1.36 ± 0.53	2.31 ± 0.56	<0.0001

Table 6: Comparison of Modified Hollander scale Across Different Age Groups in Both Study Cohorts.

Age groups	Group A	Group B	P value
<3 years	3.36 ± 1.01	5.86 ± 0.66	<0.0001
4-6 years	3.08 ± 0.64	5.6 ± 0.7	<0.0001
7-9 years	3.45 ± 0.93	5.73 ± 0.65	<0.0001
10-12 years	2.86 ± 0.9	5.9 ± 0.88	<0.0001

Table 5 presents the postoperative pain scores among the study population across the two study groups from day 1 to day 6. The mean pain score was highest on day 2 (4.64 ± 1.13) and gradually decreased over the following days, reaching 1.83 ± 0.72 by day 6. On day 1, the mean pain score was 4.53 ± 1.05, followed by 4.03 ± 1.01 on day 3, 3.43 ± 0.84 on day 4, and 2.7 ± 0.69 on day 5. This indicates a steady decline in postoperative pain over the six-day period.

The Modified Hollander Score showed significant differences between Group A and Group B across all age groups, with Group A consistently achieving better scores (Table 6). In participants under 3 years of age, the mean score was 3.36 ± 1.01 in Group A compared to 5.86 ± 0.66 in Group B (P<0.0001). For the 4–6 years age group, the scores were 3.08 ± 0.64 in Group A and 5.6 ± 0.7 in Group B (P<0.0001). Among participants aged 7–9 years, the scores were 3.45 ± 0.93 in Group A and 5.73 ± 0.65 in Group B (P<0.0001). Finally, in the 10–12 years age group, Group A scored 2.86 ± 0.9 compared to 5.9 ± 0.88 in Group B (P<0.0001). These results demonstrate that Group A had significantly better Modified Hollander Scores across all age groups (Figures 1 and 2).

Figure 1: Comparison of wound cosmesis in suture and cyanoacrylate closure showing better wound cosmesis in cyanoacrylate closure (second pic).

The comparison of Vancouver Scar Scale scores (Table 7) across different age groups revealed significantly better outcomes in Group A compared to Group B in all age groups. Among participants under 3 years of age, the mean score was 2.93 ± 0.83 in Group A and 8.5 ± 0.52 in Group B (P<0.0001). For the 4–6 years age group, Group A had a mean score of 2.69 ± 0.48, while Group B scored 7.8 ± 1.14 (P<0.0001). In the 7–9 years age group, the scores were 3 ± 0.89 for Group A and 8.36 ± 0.81 for Group B (P<0.0001). Finally, participants aged 10–12 years had mean scores of 2.86 ± 0.9 in Group A and 8.7 ± 0.95 in Group B (P<0.0001). These findings indicate that Group A had significantly lower Vancouver Scar Scale scores, reflecting superior scar outcomes compared to Group B across all age groups.

The ASEPSIS scores showed a significant difference between Group A and Group B across all age groups, with Group A demonstrating better outcomes. For participants under 3 years of age, the mean ASEPSIS score was 0.86 ± 0.66 in Group A compared to 3 ± 0.68 in Group B (P<0.0001). In the 4–6 years age group, Group A scored 0.62 ± 0.51, while Group B scored 2.9 ± 0.74 (P<0.0001). Among participants aged 7–9 years, the scores were 1.18 ± 0.87 for Group A and 3.45 ± 0.82 for Group B (P<0.0001). Lastly, in the 10–12 years age group, Group A had a mean score of 0.86 ± 0.69, compared to 3.5 ± 0.71 in Group B (P<0.0001). These results indicate

Table 7: Comparison of Vancouver scar scale Across Different Age Groups in Both Study Cohorts.

Age groups	Group A	Group B	P value
<3 years	2.93 ± 0.83	8.5 ± 0.52	<0.0001
4-6 years	2.69 ± 0.48	7.8 ± 1.14	<0.0001
7-9 years	3 ± 0.89	8.36 ± 0.81	<0.0001
10-12 years	2.86 ± 0.9	8.7 ± 0.95	<0.0001

Table 8: Comparison of ASEPSIS score Across Different Age Groups in Both Study Cohorts.

Age groups	Group A	Group B	P value
<3 years	0.86 ± 0.66	3 ± 0.68	<0.0001
4-6 years	0.62 ± 0.51	2.9 ± 0.74	<0.0001
7-9 years	1.18 ± 0.87	3.45 ± 0.82	<0.0001
10-12 years	0.86 ± 0.69	3.5 ± 0.71	<0.0001

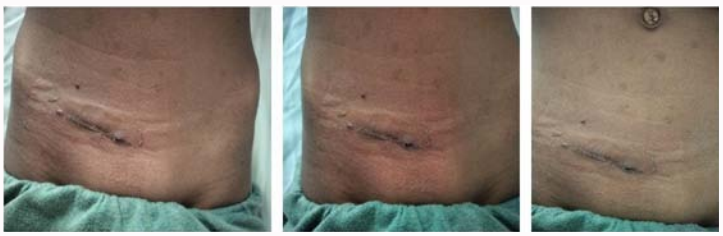

Figure 2: Poor wound cosmesis in suture closure at 1 month, second month and sixth month of surgery.

significantly lower ASEPSIS scores in Group A, suggesting better wound healing outcomes compared to Group B across all age groups.

Discussion

In our prospective study comparing N-butyl cyanoacrylate to conventional skin sutures for paediatric inguinal hernia repair, we observed that N-butyl cyanoacrylate was more effective in reducing wound infection rates, providing better cosmetic outcomes, and minimizing postoperative pain. The study population had a mean age of 5.96 ± 3.2 years, with a male predominance (80%) and 20% female representation. The time required for skin closure was significantly shorter (P<0.0001) with N-butyl cyanoacrylate than with sutures. Patients treated with N-butyl cyanoacrylate reported lower pain scores on the Visual Analog Scale (VAS) compared to those who underwent suturing. Additionally, wound infection, as assessed by the ASEPSIS score, was significantly lower (P < 0.0001) in the cyanoacrylate group. Cosmetic outcomes, evaluated using the Modified Hollander Scale and Vancouver Scar Scale, also favoured N-butyl cyanoacrylate over traditional sutures.

On long-term follow up inguinal hernia repair 31% patients have reported chronic pain and this complication were neglected earlier [14]. In a Danish nationwide study [15] with 1652 patients undergoing surgery for inguinal or femoral hernia repair reported, a high incidence of chronic pain leading to various disability. other study reported 12% incidence of chronic pain among inguinal hernia patients [16]. In the present study, we evaluated the Visual Analog Scale (VAS) scores for pain and Vancouver Scar Scale (VSS) scores across different age groups to assess the effectiveness of NBCA compared to traditional sutures. The VAS scores were significantly lower in the NBCA group (Group A) compared to the suture group (Group B) from day 1 to day 6 (P<0.0001), indicating reduced postoperative pain with NBCA. Similarly, the Vancouver Scar Scale scores showed significantly better outcomes in Group A across all age groups. For participants under 3 years, the mean VSS score was 2.93 ± 0.83 in Group A compared to 8.5 ± 0.52 in Group B (P<0.0001). In the 4–6 years age group, Group A scored 2.69 ± 0.48, while Group B scored 7.8 ± 1.14 (P<0.0001). Among participants aged 7–9 years, the scores were 3 ± 0.89 in Group A and 8.36 ± 0.81 in Group B (P<0.0001), and in the 10–12 years age group, the scores were 2.86 ± 0.9 in Group A compared to 8.7 ± 0.95 in Group B (P<0.0001). These results highlight the dual benefits of NBCA, demonstrating significantly reduced postoperative pain and superior scar outcomes compared to traditional sutures.

A recent study by Benedetto Ielpo et al. [17] compared cyanoacrylate adhesive with traditional skin sutures for TAPP inguinal hernia repair and found significantly less postoperative pain in the adhesive group, as measured by the Visual Analog Scale (VAS), on days 1, 3, and 7. Similarly, a study by Olmi et al. [18] also used the VAS for pain assessment and reported significantly lower pain levels in patients treated with adhesive compared to those with sutures. Additionally, Brown et al. [19] reported, lower VAS scores in the adhesive group during follow-up. Consistent with these findings, our study also showed a significantly (P<0.0001) lower VAS score from day 1 to day 6 in patients treated with N-butyl cyanoacrylate compared to those with skin sutures.

Saxena and Willital [20] extensively utilized cyanoacrylate tissue adhesive for extremity wound closures in pediatric emergencies, highlighting its advantages in managing lacerations without needles or local anesthetic-an important consideration for distressed and frightened children. In our study, mean postoperative pain scores on POD 1 were significantly lower in the tissue adhesive group (3.71) compared to the suturing group (5.36). Similarly, on POD 2 to 6, the tissue adhesive group reported lower.

Study by Chawada et al. [21] reported significantly less complications and infection in patients who were in glue group compared to patients with sutures. In study by Qureshi et al. [22] studies n-Butyl cyanoacrylate adhesive for skin closure of abdominal wounds and reported There were no wound infections and the overall complication rate was 1.2%. All the surgeons involved reported that the adhesive was simple and easy to use. In our study, the N-butyl cyanoacrylate group demonstrated significantly lower ASEPSIS scores compared to the suturing group, these results are in line with other reported study.

Toriumi et al. [23] randomised study in reported, However, at 1 year, the mean visual analog scale cosmetic outcome was enhanced in the octyl-2-cyanoacrylate when compared to the suture group.

Krishnamoorthy et al. [24] study highlights that staples are the fastest method for wound closure, requiring significantly less time compared to glue and sutures. However, skin glue offers superior outcomes, including reduced post-operative pain, improved wound asepsis, better cosmetic results, and cost-effectiveness. The study concludes that tissue glue is a safe, effective, and appealing alternative to traditional wound closure methods in elective surgeries. Bernard et al. [25] study found that the cosmetic outcome of cutaneous excisional surgery wounds closed with standard suturing was found to be superior to that of wounds closed with octyl cyanoacrylate. Previous study by Qinn et al. (1997) [26] found five wounds in the tissue adhesive group were sterile on day 5, whereas all sutured wounds had positive cultures (25% *versus* 0%, p<0.05) and reported wounds closed with sutures had higher infection rates compared with those reported with topical tissue adhesive (Octylcyanoacrylate tissue adhesive). In their another study Quinn JV et al. [27] in a randomized, controlled trial comparing a tissue adhesive with suturing in the repair of pediatric facial lacerations reported also glue is superior and less painful to sutures. Poha et al. [28] conducted a systematic review and meta-analysis comparing the outcomes of glue fixation and suture fixation in patients undergoing open Lichtenstein inguinal hernia repair (IHR).

The analysis revealed that both techniques had comparable rates of early and late recurrence, indicating that glue fixation is as effective as suture fixation in ensuring long-term hernia repair stability. However, glue fixation offered several advantages over suture fixation. It was associated with significantly shorter operative times, likely due to the simplicity and efficiency of applying adhesive compared to suturing. Additionally, glue fixation resulted in a lower incidence of hematoma formation, possibly because it avoids needle-induced trauma to surrounding tissues. On the other hand, the rates of chronic pain and seroma formation did not differ significantly between the two techniques, suggesting that both are similarly effective in minimizing these complications. Overall, the findings highlight glue fixation as a viable alternative to suture fixation, particularly for its time efficiency and reduced risk of hematoma formation. They emphasized the need for additional randomized studies in the future to achieve more accurate and reliable results.

These findings suggest that tissue adhesives have a valuable role

in the closure of certain general surgical wounds, particularly where improved cosmetic outcomes are prioritized. In the present study, we observed significantly better outcomes in patients whose wounds were closed with tissue glue. These outcomes included superior cosmetic results, characterized by minimal scarring and enhanced aesthetic appearance, as well as lower post-operative pain levels. The use of tissue glue not only facilitated improved wound healing but also contributed to greater patient satisfaction due to the reduced visibility of scars and overall comfort during recovery. These findings underscore the advantages of tissue glue as an effective alternative to traditional suture wound closure methods, particularly in cases where cosmesis and patient comfort are key considerations. There very less number of studies that have compared N-butyl cyanoacrylate and sutures in the pediatric population, specifically in cohorts undergoing inguinal hernia repair.

Conclusion

This study demonstrates that N-Butyl Cyanoacrylate (NBCA) is a safe and effective alternative to conventional skin sutures for wound closure in paediatric inguinal hernia repairs. Compared to sutures, NBCA significantly reduced postoperative pain, improved cosmetic outcomes, and lowered wound infection rates, as evidenced by superior Visual Analog Scale (VAS), Modified Hollander, Vancouver Scar Scale, and ASEPSIS scores. Furthermore, NBCA application significantly shortened skin closure and overall operative time. These advantages suggest that NBCA not only enhances patient comfort and satisfaction but may also contribute to improved surgical efficiency. Given its ease of use and favourable outcomes, NBCA should be considered a viable option for wound closure in select paediatric surgical procedures, particularly where cosmetic results and reduced postoperative morbidity are priorities.

References

1. Bal-Ozturk A, Cecen B, Avci-Adali M, Topkaya SN, Alarcin E, Yasayan G, et al. Tissue Adhesives: From Research to Clinical Translation. Nano Today. 2021;36:101049.
2. Cui X, Zhang Y, Wang N, Chen Y, Xu J, Hou J. The outcome of sutured wounds compared with tissue adhesive for paediatric wound closure: A meta-analysis. Int Wound J. 2023 Oct;20(8):3298-306.
3. Mastud K, Lamture Y, Nagtode T, Rewale V. A Comparative Study Between Conventional Sutures, Staples, and Adhesive Glue for Clean Elective Surgical Skin Closure. Cureus. 2022;14(11):e31196.
4. Murphy PS, Evans GR. Advances in wound healing: a review of current wound healing products. Plast Surg Int. 2012:190436.
5. Romero IL, Malta JB, Silva CB, Mimica LM, Soong KH, Hida RY. Antibacterial properties of cyanoacrylate tissue adhesive: Does the polymerization reaction play a role? Indian J Ophthalmol. 2009;57(5):341-4.
6. Takeuchi Y, Morishita H, Sato Y, Hamaguchi S, Sakamoto N, Tokue H, et al. Guidelines for the use of NBCA in vascular embolization devised by the Committee of Practice Guidelines of the Japanese Society of Interventional Radiology (CGJSIR), 2012 edition. Jpn J Radiol. 2014;32(8):500-17.
7. 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.
8. Byrne M, Aly A. The Surgical Suture. Aesthet Surg J. 2019;39(Suppl_2):S67–S72.
9. Manza JT, Maisuria RS, Chaudhari DR, Dave DN, Gajra YB, Patel DP. Comparative study between cyanoacrylate tissue adhesive versus skin sutures in closure of wound in 60 operated cases of open inguinal hernia. Int Surg J. 2018;5(5):1908-13.
10. Medeiros I, Pascoal S, Castro F, Macedo JP, Lopes O, Pereira J. Tissue adhesives for closure of intraoral surgical incisions: A systematic review and meta-analysis. Int Wound J. 2024;21(10):e70047.
11. Sahu S, Mishra S, Lenka S, Banerjee R, Pachisia S, Ghosh S. Comparison between N-butyl cyanoacrylate tissue adhesive and Ethilon nylon sutures in extraoral maxillofacial incisions: A randomized prospective study. J Oral Biol Craniofac Res. 2019;9(3):173-8.
12. Tsai YC, Huang DW, Chou YY, An YC, Cheng YS, Chen PH, Tzeng YS. Comparative Evaluation of Tissue Adhesives and Sutures in the Management of Facial Laceration Wounds in Children. J Pers Med. 2023;13(9):1350.
13. Koonce SL, Eck DL, Shaddix KK, Perdikis G. A prospective randomized controlled trial comparing N-butyl-2 cyanoacrylate (Histoacryl), octyl cyanoacrylate (Dermabond), and subcuticular suture for closure of surgical incisions. Ann Plast Surg. 2015;74(1):107-10.
14. Fränneby U, Sandblom G, Nordin P, Nyrén O, Gunnarsson U. Risk factors for long-term pain after hernia surgery. Ann Surg. 2006;244(2):212-9.
15. Bay-Nielsen M, Perkins FM, Kehlet H. Danish Hernia Database. Pain and functional impairment 1 year after inguinal herniorrhaphy: a nationwide questionnaire study. Ann Surg. 2001;233(1):1-7.
16. Perkins FM, Kehlet H. Chronic pain as an outcome of surgery. A review of predictive factors. Anesthesiology. 2000;93(4):1123-33.
17. Ielpo B, Ferri Valentina, Silva J, Quijano Y, Vicente E, Diago MV, et al. Laparoscopic Transabdominal Preperitoneal (TAPP) Inguinal Hernia Repair Using Fibrin Glue for Fixation of the Mesh and Peritoneum Closure. Surg Laparosc Endosc Percutan Tech. 2020;30(4):e24-e27.
18. Olmi S, Scaini A, Erba L, Bertolini A, Guaglio M, Croce E. Use of fibrin glue (Tissucol) as a hemostatic in laparoscopic conservative treatment of spleen trauma. Surg Endosc. 2007;21(11):2051-4.
19. Brown JK, Campbell BT, Drongowski RA, Alderman AK, Geiger JD, Teitelbaum DH, et al. A prospective, randomized comparison of skin adhesive and subcuticular suture for closure of pediatric hernia incisions: cost and cosmetic considerations. J Pediatr Surg. 2009;44(7):1418-22.
20. Saxena AK, Willital GH. Octylcyanoacrylate tissue adhesive in the repair of pediatric extremity lacerations. Am Surg. 1999;65(5):470-2.
21. Chawada MJ, Hajgude V. Efficacy of cyanoacrylate glue in operative wound closure. Int Surg J. 2016;3(2):792-6.
22. Qureshi A, Drew PJ, Duthie GS, Roberts AC, Monson JR. n-Butyl cyanoacrylate adhesive for skin closure of abdominal wounds: preliminary results. Ann R Coll Surg Engl. 1997;79(6):414.
23. Toriumi DM, O'Grady K, Desai D, Bagal A. Use of octyl-2-cyanoacrylate for skin closure in facial plastic surgery. Plast Reconstr Surg 1998;102(6):2209-19.
24. Krishnamoorthy B, Najam O, Khan UA, Waterworth P, Fildes JE, Yonan N. Randomized prospective study comparing conventional subcuticular skin closure with Dermabond skin glue after saphenous vein harvesting. Ann Thorac Surg. 2009;88(5):1445–9.
25. Bernard L, Doyle J, Friedlander SF, Eichenfield LF, Gibbs NF, Cunningham BB. A prospective comparison of octyl cyanoacrylate tissue adhesive (dermabond) and suture for the closure of excisional wounds in children and adolescents. Arch Dermatol. 2001;137(9):1177-80.
26. Quinn J, Maw J, Ramotar K, Wenckebach G, Wells G. Octylcyanoacrylate tissue adhesive versus suture wound repair in a contaminated wound model. Surgery. 1997;122(1):69-72.
27. Quinn JV, Drzewiecki A, Li MM, Stiell IG, Sutcliffe T, Elmslie TJ, et al. A randomized, controlled trial comparing a tissue adhesive with suturing in

the repair of pediatric facial lacerations. Ann Emerg Med. 1993;22(7):1130-5.

28. 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):1105-20.