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ORIGINAL RESEARCH

Evaluation of Cyanoacrylate Glue for Pediatric Surgical Incision Closure: An Observational Study

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ABSTRACT

Background: Effective wound closure is a critical consideration in paediatric surgical procedures, as it facilitates rapid healing, minimizes infection risk, and achieves satisfactory cosmetic outcomes.Cyanoacrylate (CA) tissue adhesives offer an alternative approachto traditional closure methods such as sutures and staples by demonstrating efficacy, reduced infection rates, and improved cosmetic results. **Methodology:** This is a prospective observational study was conducted over 18 months i.e. from December, 2022 till May, 2024, which included75 paediatric patients undergoing elective surgical procedures. Inclusion criteria covered children under 14 years of age undergoing elective surgery, while exclusion criteria excluded specific conditions. Data collection involved a structured proforma. Statistical analysis employed various measures, including Chi-square test. **Results:** This study evaluated use of CA glue in surgical incision closure in 75 paediatric patients. The patient population spanned a range of age groups, with the majority aged between 1 year to 5 years andthe mean patient age was 3.07 years. The gender distribution skewed predominantly male at 80% compared to 20% female. The most common surgical procedures were herniotomy, orchidopexy and laparotomy. Incision locations were primarily right inguinal crease, left inguinal crease and right abdominal transverse.Outcomes Post-operative complications were evaluated on days 3, 5, and 10. Cosmetic outcomes were favourable, with 94.7% of patients demonstrating thin scars and 5.3% broad scars. The mean time for incision closure with CA glue was 45.13 seconds, and the mean hospital stay was 5.14 days. **Conclusion:** Overall, the study shows that CA glue effectively manages paediatric surgical incisions, promoting optimal wound healing, minimizing complications, and ensuring favourable cosmetic outcomes.

Keywords: Cyanoacrylate glue, Paediatric surgery, Hernia repair**,** Orchidopexy, Laparotomy.

INTRODUCTION

The management of surgical incisions in paediatric patients requires special consideration due to factors such as skin sensitivity, compliance issues, and the need for minimal disruption to normal activities. Advances in wound closure techniques have expanded beyond traditional suturing and now includes options like adhesive glues, skin staplers, and adhesive tapes which aim to achieve optimal outcomes such as good tissue approximation and cosmetically acceptable scars.

Tissue adhesives are equally effective as conventional suturing and provide additional benefits of ease of application, no prior need of anaesthesia or sedation, especially in children and without the need for additional suture removal procedures (1). Adhesive glues, such as cyanoacrylates e.g. Trueseal, **(Figure 1)** offer advantages such as improved cosmesis, reduced postoperative pain and significant reduction in percutaneous trauma from suture needles hence, lower wound infection rates, and potentially shorter hospital stays.(2)

The thought of needles, sutures, or staples can be more distressing to a child than the actual injury. Therefore, the ideal method of wound closure in paediatric patients should be painless, quick, easy to perform, safe, and result in minimal scarring with few complications.(3)

Since the 2004 Cochrane Database Report (4), CA adhesives have gained widespread global acceptance. The report suggested that surgeons should consider tissue glue as a viable alternative to

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traditional sutures due to its comparable effectiveness in preventing infection and leakage.

This study aims to systematically observe and document key outcomes, including wound healing, complication rates, patient comfort, and cosmetic results. The findings could inform clinical practice guidelines, enhance patient care, and contribute to the growing evidence supporting the use of CA glue in this field.

MATERIALS AND METHODS

Study Design

This observational cross – sectional study was done to evaluate the role of CA glue in the closure of surgical incisions in paediatric group patients who presented to our hospital for the duration of 18 months i.e. from December, 2022 – May, 2024.

Inclusion criteria

1. Age of the patients less than 14 years.
2. Patients admitted for various elective surgeries like herniotomy/hernioplasty,laparotomy, appendectomy, cyst excision, orchidopexy.

Exclusion Criteria

1. Patients operated in emergency.
2. Patients with diabetes Type 1, autoimmune disease and any other chronic illness.
3. Patients with age more than 14 years.
4. Patients with infected wound.

Sample Size

The sample size was calculated using the formula $n=z^2\alpha$ x P x (Q)/d^2. Utilizing assumptions with a likelihood value (P) of 0.05, margin of error (d) of 0.05, and a standard normal variate (z) of 1.96. After doing all the calculations, sample size came out to be 73. So minimum of 75patients were taken up for the observational study.

Sampling technique

The sampling technique used was non-probabilistic sampling method of purposive sampling where all the patients attending to the Department of Paediatric surgery (OPD and IPD), of our hospital for a period of (18 months), for elective surgery, were screened as per inclusion and exclusion criteria and subsequently included or excluded from the study.

Data collection

Data collection for this study was conducted by the observer, using a designated study proforma. Prior to participation, informed consent was obtained in their local vernacular language through a pre-approved proforma sanctioned by our ethical committee. Participants were explicitly granted the freedom to withdraw from the study at any stage.

Methods

This observational study was executed within the Department of Paediatric surgery at our hospital, involving 75 patients undergoing elective surgery who met the predetermined inclusion criteria. Prior to the commencement of the study, informed written consent was meticulously obtained, and ethical approval from the institutional review committee was secured.

In this study, CA glue was used for skin closure in patients undergoing various elective surgeries like herniotomy/ hernioplasty, orchidopexy, cyst excision, laparotomy and appendectomy. The various outcomes like benefits over conventional suturing, incidence of wound dehiscence, cosmetic outcome, economical benefits and hospital stay duration were meticulously observed and evaluated in detail. For this purpose patients were comprehensively followed up in their post-operative period and variables like – post operative complications, quality of scar, incision length and duration of hospital stay were observed and evaluated.

Statistical analysis

The statistical analysis encompassed a detailed evaluation of the data, employing various measures to elucidate the characteristics of the study cohort. Descriptive statistics, including range, mean ± standard deviation (± SD), frequencies and percentages (demographic variables), were meticulously calculated as deemed appropriate for each variable. To calculate the association between factors, Chi-square (χ^2) test was applied. Unpairedt-test was used to compare the results of procedure findings.

RESULTS

This was an 18-month observational study i.e. from December, 2022 till May, 2024 conducted at our hospital. It included 75 paediatric patients scheduled for elective surgeries. Participants were selected based on pre-defined inclusion and exclusion criteria, and informed written consent was obtained.

The data indicates that the mean age of the population was 3.07 years, with a significant concentration in the age group of >1 year to 5 years, which comprised 32% of the sample. This was followed by the 6-12 months age group at 28%, and the >5 years age group at 25.3%. The youngest cohort, those under 6 months, accounted for 14.7% of the sample. Additionally, there was a notable gender disparity, with 80% of the patients being male and only 20% female. **(Table-I)**

Study revealed that herniotomy was the most frequently performed procedure, comprising 54.7% of cases, followed by orchidopexy at 20% and laparotomy at 18.7%. Appendectomy and pyloromyotomy were less prevalent, each accounting for 2.7% of cases. Duodenostomy emerged as the least common procedure, representing 1.3% of the total. The most common

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type of incision emerged out was the Right inguinal crease, accounting for 40% of the cases, followed by the Left inguinal crease incision, representing 34.7% of the cases. Right abdominal transverse incisions accounted for 22.7% of the cases, while the Lanz incision was the least common, accounting for 2.7% of the cases. The incision length was in range of 3.50cm – 5.00cm with a mean length of 4.36cm. This indicates that the surgical procedures performed were relatively consistent in terms of incision length. **(Table-II)**

Our study also documented the post-operative complications. On Day-3 there was low incidence of wound

erythema (6.7%), minimal presence of serous discharge (2.7%) and the absence of seropurulent discharge and wound dehiscence. On Day-5, the incidence of wound erythema and serous discharge was (5.3%). Careful observation revealed presence of seropurulent discharge in (2.7%) of cases and wound dehiscence in (1.3%) of cases. On Day-10, the incidence of wound erythema and serous discharge remained constant at (5.3%), however seropurulent discharge was noted in 4.0% of the cases and wound dehiscence in 5.3% of the cases. **(Table-III)**

A comparison was made between different post-operative complications on given days. Wound Erythema was present in 6.7% of the cases on Day 3, reducing slightly to 5.3% on Days 5 and 10 ($p = 0.921$). Serous Discharge was present in 2.7% of cases on Day 3, increasing to 5.3% on Days 5 and 10 ($p = 0.657$). Seropurulent Discharge was absent on Day 3, but it was noted in 2.7% cases on Day 5, and 4.0% cases on Day 10 ($p = 0.649$). No cases of wound dehiscence were reported on Day 3, however by Day 5, it was present in 1.3% of cases which rose to 5.3% by Day 10 ($p=0.172$). **(Table-IV)**

In the present study, the incidence of secondary suturing, which is often required when primary wound healing is insufficient or complicationsarise, was as low as 5.3% with a substantial amount of cases i.e. 94.7% not requiring secondary suturing. A note of the quality of the scar was also made, in which 94.7% cases exhibited thin scars post-surgery, indicating effectiveness of the CA glue. There were only 5.3% of the cases which showed broad scars.

The mean time taken for closure was 45.13seconds, with closure time ranging from 30 to 60 seconds, which indicates quicker closure resulting in reduced overall operative time. The mean hospital stay duration was 5.14 days, ranging from 2- 17 days, suggesting a relatively shorter hospital stay.

Table -I - Age distribution and Gender distribution.

Age	No. of subjects	Percentage
<6Months	11	14.7%
6-12Months	21	28.0%
>1yearTo5Year	24	32.0%
>5Year	19	25.3%
Total	75	100.0%
Sex	**No. of subjects**	**Percentage**
Female	15	20.0%
Male	60	80.0%
Total	75	100.0%

Table-II – Frequency of procedures performed, Types of incisions and Length of incision.

Operative procedure	No. of subjects	Percentage
Herniotomy	41	54.7%
Orchidopexy	15	20.0%
Laparotomy	14	18.7%
Appendicectomy	2	2.7%
Pyloromyotomy	2	2.7%
Duodenostomy	1	1.3%
Total	75	100.0%
Typeofincision	**No. of subjects**	**Percentage**
Right Inguinal Crease	30	40.0%
Left Inguinal Crease	26	34.7%
Right Abdominal Transverse Incision	17	22.7%
Lanz Incision	2	2.7%
Total	75	100%

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	No. of cases	Minimum	Maximum	Mean	Standard Deviation
Length of incision(cm)	75	3.50cm	5.00cm	4.36cm	0.37

Table-III – Comparison of different Post-operative complications on Day 3, Day 5 and Day 10.

PostOp Examination Day3	No. of subjects	Percentage
Wound Erythema	5	6.7%
Serous Discharge	2	2.7%
Seropurulent Discharge	0	0.0%
Wound dehiscence	0	0%
PostOp Examination Day5	**No. of subjects**	**Percentage**
Wound Erythema	4	5.3%
Serous Discharge	4	5.3%
Seropurulent Discharge	2	2.7%
Wound dehiscence	1	1.3%
PostOp Examination Day10	**Frequency**	**Percentage**
Wound Erythema	4	5.3%
Serous Discharge	4	5.3%
Seropurulent Discharge	3	4.0%
Wound dehiscence	4	5.3%

Table-IV – P-values of Post-operative complications occurring on various Days.

Wound erythema	Post-op Day 3		Post-op Day 5		Post-op Day 10		P value
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Absent	70	93.3%	71	94.7%	71	94.7%	
Present	5	6.7%	4	5.3%	4	5.3%	0.921
Total	75	100%	75	100%	75	100%	

Serous discharge	Post-op Day 3		Post-op Day 5		Post-op Day 10		P value
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Absent	73	97.3%	71	94.7%	71	94.7%	
Present	2	2.7%	4	5.3%	4	5.3%	0.657
Total	75	100%	75	100%	75	100%	

Seropurulent discharge	Post-op Day 3		Post-op Day 5		Post-op Day 10		P value
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Absent	75	100%	73	97.3%	72	96.0%	
Present	-	-	2	2.7%	3	4.0%	0.649
Total	75	100%	75	100%	75	100%	

Wound dehiscence	Post-op Day 3		Post-op Day 5		Post-op Day 10		P value
	No. of cases	Percentage	No. of cases	Percentage	No. of cases	Percentage	
Absent	75	100%	74	98.7%	71	94.7%	
Present	-	-	1	1.3%	4	5.3%	0.172
Total	75	100%	75	100%	75	100%	

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Figure 1 – Cyanoacrylate glue

Figure 2 – Application of CA glue

Figure 3 – A case of post- operative wound dehiscence requiring secondary suturing.

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Figure 4 – Post-op examination of Herniotomy wound on Day 10 indicating cosmetically favourable wound healing.

DISCUSSION

Surgical procedures in children pose unique challenges, particularly regarding wound closure and postoperative care. An ideal approach for paediatric patients should prioritize painlessness and ease of application **(Figure 2)**, safety, and minimal scarring to ensure optimal outcomes with fewer complications.

In present study, use of CA glue was observed in 75 patients and the age distributionindicated majority of patients in the >1 year to 5 year age group with a mean age of 3.07 years**.** Devrukhkar et al. (3) conducted a study to evaluate the tissue adhesive, observing a mean age of 6.35 ± 1.36 years.Our study revealed a significant gender disparity, with (80%) of the patients being male and (20%) female, a result consistent with study of Devrukhkar et al.(3) which also reported 5 (71.43%) boys and 2 (28.57%) girls in their study. This notable male predominance may indicate higher rates of surgical conditions or interventions among male pediatric patients.

Several studies, including those by Arafa et al., Haroon et al., and Voznesensky et al. (5–7), have highlighted cyanoacrylate (CA) glue fixation as a reliable, safe, and effective method for hernia repair and mesh fixation.

A study by Qureshi et al. (8) reported a partial wound dehiscence rate of 2 out of 102 cases following both general and laparoscopic surgeries, suggesting that proper drying of the skin edges before the application of CA adhesive. These findings align with the results of our study, in which wound dehiscence occurred in 5 out of 75 cases **(Figure 3)**. This underscores that careful management and vigilance are required to address potential issues such as wound dehiscence.

A study byGörgülü et al.(9) indicates the efficiency of CA glue after laser circumcisions, reporting minimal complications with 0% rates of hematoma and bleeding, in contrast with standard treatment showing hematoma and bleeding rates of 1.4% and 2.2%, respectively and presence of circumcision site dehiscence in 0.8% of cases. Our study also demonstrates the glue's effectiveness in achieving primary wound closure with majority of patients (94.7%) exhibiting thin scars, indicating that CA glue is highly effective in promoting cosmetically favourable wound healing **(Figure 4)**.

These results align with the finding of studies by Devrukhkar et al. and Vishwanathan et al.(3,10) whoreported aesthetically highly satisfactory post-operative scar marks at3months as compared to the 1-month scar mark on the Visual Analogue Cosmesis Scale with the scar being thin and supple.

The mean length of incision was 4.36cm and the mean time taken for closure was 45.13 seconds in our study which was consistent with studiyconducted by Bhati G. and Dagla R.(11) who reported 1.10 min as average time for wound closure. A similar study conducted by Ayyilidiz and his co-authors(12) also suggested quick drying of CA adhesive with time ranging from 2.0 to 50.0 seconds in urological procedures performed by them. Average hospital stay duration varied from 2 to 17 days, with a mean of 5.14 days which was also consistent with study of Bhati G. and Dagla R.(11) who reported mean of 2.72 days of hospital stay. Elemen et al.(13) also suggested use of 2-octyl-CA in their study which was better than conventional suturing.

A study by Koli et al.(14) highlighted the advantages offered by the use of CA tissue adhesives, in lowering chances of wound infections and eliminating the risk of fecal incontinence while promoting rapid healing and being superior to other sealants like fibrin glue.

A retrospective study held by Lee et al. (15) concluded that using surgical skin adhesive bond reduces the rate of SSIs and lowers the total cost of wound care, making it a safe and effective alternative.

The study conducted by Chawada et al. (16) evaluated 100 patients undergoing elective surgical procedures which demonstrated advantages of CA glue such as lower infection rates, better cosmetic outcomes, ease of application, painless removal, lack of skin reactions, and high patient acceptability.

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CONCLUSION

Overall, the study shows that CA glue effectively manages paediatric surgical incisions, promoting optimal wound healing, minimizing complications, and ensuring favourable cosmetic outcomes. Its application is linked to efficient closure times and shorter hospital stays, making it a valuable asset in paediatric surgical care. Continuous monitoring and individualized care are crucial for maintaining these positive results and addressing any complications promptly.

REFERENCES

1. Aravind K, Sunil CG, Chandrasekar S, Shidlingappa SS, Kamat V, Kulkarni M, et al. Cyanoacrylate vs. sutures in clean and clean-contaminated surgical wounds – a randomised control study. InnovSurg Sci. 2024;9(1):47–54.
2. Leggat PA, Smith DR, Kedjarune U. SURGICAL APPLICATIONS OF CYANOACRYLATE ADHESIVES: A REVIEW OF TOXICITY. ANZ J Surg. 2007;77(4):209–13.
3. Devrukhkar VN, Hegde RJ, Khare SS, Saraf TA. Evaluation of isoamyl 2- cyanoacrylate tissue adhesive in management of pediatric lacerations: An alternative to suturing. Ann Maxillofac Surg. 2015;Jan-Jun;5(1):49-54.
4. Coulthard P, editor. Tissue adhesives for closure of surgical incisions. In: Cochrane Database of Systematic Reviews [Internet]. Chichester, UK: John Wiley & Sons, Ltd; 2010 [cited 2024 Sep 17]. Available from: https://doi.wiley.com/10.1002/14651858.CD004287.pub3
5. Arafa AS, Khairy MM, Rushdy T, Gomaa MA. Cyanoacrylate glue mesh fixation versus suture mesh fixation in Lichtenstein inguinal hernia repair. Egypt J Surg. 2019;Jul–Sept;38(3):471-477.
6. Haroon M, Morarasu S, Morarasu BC, Al-Sahaf O, Eguare E. Assessment of feasibility and safety of cyanoacrylate glue versus absorbable tacks for inguinal hernia mesh fixation. A prospective comparative study. WideochirInne Tech Maloinwazyjne. 2023;Mar;18(1):90-98.
7. Voznesensky M, Mutter C, Hayn M, Kinkead T, Jumper B. Pediatricsutureless circumcision: an effective and cost efficient alternative. Can J Urol. 2015;22(5):7995–9.
8. Qureshi A, Drew PJ, Duthie GS, Roberts AC, Monson J. n-Butyl cyanoacrylate adhesive for skin closure of abdominal wounds: Preliminary results. Ann R CollSurg Engl. 1997;79:414–5.
9. Gorgulu T, Olgun A, Torun M, Kargi E. A fast, easy circumcision procedure combining a CO2 laser and cyanoacrylate adhesive: a non-randomized comparative trial. IntBraz J Urol. 2016;Jan-Feb;42(1):113-7.
10. Vishwanathan H, Hamilton DW, Ibrahim E, Youssef H, Pahor AL. Superglue in otology. Surgeon. Internet;2007;5(1):10–2.
11. G B, R D. A comparative study of non-suture closure of surgical incision using cyanoacrylate versus conventional method. Indian J Appl Res. 2018;Aug;8(8):337-9.
12. Ayyıldız SN, Ayyıldız A. Cyanoacrylic tissue glues: Biochemical properties and their usage in urology. Turk J Urol. 2017;Mar;43(1):14-24:14–24.
13. Elemen L, Seyidov TH, Tugay M. The advantages of cyanoacrylate wound closure in circumcision. PediatrSurg Int. 2011;27:879–83.
14. Koli D, Kumar P, PandaV. Evaluation of the role of cyanoacrylate glue in the management of fistula-in-ano.Int Surg. Vol. J7. 2020. p. 721–4.
15. Lee CS, Han K SR, BH B, JH K, W L, IK L, et al. Surgical skin adhesive bond is safe and feasible wound closure method to reduce surgical site infection following minimally invasive colorectal cancer surgery. Ann Surg Treat Res. 2020;Sep;99(3):146-152.
16. Chawada M, Hajgude V. Efficacy of cyanoacrylate glue in operative wound closure.