

Original research article**The safety, efficacy, functional outcome, and cosmesis of isoamyl 2-cyanoacrylate in circumcision****¹Dr. A.S Sushrith Urs, ²Dr. Syed Zahid Raza, ³Dr. Amar M, ⁴Dr. Pratap Balakrishna, ⁵Dr. Vasanth Shenoy**^{1,3} Post Graduate, Department of General Surgery, Dr. B. R. Ambedkar Medical College, Bangalore, Karnataka, India² Assistant Professor, Department of Urology, Dr. B. R. Ambedkar Medical College, Bangalore, Karnataka, India^{4,5} Professor, Department of General Surgery, Dr. B. R. Ambedkar Medical College, Bangalore, Karnataka, India**Corresponding Author:**

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Abstract

Circumcision is a commonly performed surgery. Surgeons have become increasingly interested in the use of adhesive bonds. Recent advances have been made in the use of tissue glue in circumcision. In this study, we used Isoamyl 2 cyanoacrylate for closing circumcision wounds and we have reported our experience. This was a prospective non-comparative observational study involving 40 patients where 2-octyl cyanoacrylate was used as a tissue adhesive for wound closure after formal circumcision at surgery department. A total of 40 patients were enrolled in our study. In this study, the mean time taken for skin closure by Isoamyl-2-cyanoacrylate is much faster in last year of study. There is significant less pain. Bleeding and excessive swelling was seen in 1 patient each. 3 patients had serous exudates, 2 patients had erythema, 1 patient had purulent discharge and 4 patients had minor wound separation. The wound cosmesis score on 3rd month is optimal except in 2 patients of wound separation, and perfect score was seen in all patients by the end of 6th month. Hence use of adhesive glue, isoamyl-2- cyanoacrylate can be considered as an alternative to sutures for skin closure after circumcision.

Key words: Isoamyl-2-cyanoacrylate, adhesive circumcision, adhesive glue skin closure**Introduction**

Circumcision is a commonly performed surgery all over the world by general surgeons, urologists, paediatric surgeons, physicians, family physicians, midwives and even quacks ^[1]. It is one of the oldest operations documented nearly 2500 BC and has many controversies associated with it ^[2, 3]. The fold of skin (foreskin) covering the glans is removed during the circumcision procedure to a point near the coronal sulcus. Currently one-sixth of the world's male population is circumcised, mostly on religious grounds ^[4]. The incidence of circumcision in the general population is 33% ^[5]. The complication rate after circumcision is 0.2% to 6% ^[6, 7]. Haemorrhage and infection are the most common complications, followed by wound separation, recurrent phimosis, preputial adhesions, and unsatisfactory cosmesis due to scar formation.

Circumcision can be undertaken using tools like Mogen clamp, Plastibell and Gomco clamp. There are foreskin preserving procedures as well as radical circumcision techniques. For the technique to be successful it should be easy to perform, address the problem of haemorrhage, avoid the need for interventional postoperative care and give a good cosmetic and functional result. In the modern time with the advent of elective surgery, more energy has been directed for achieving an efficient and uncomplicated healing of the deliberately inflicted wound. The oldest problem of perfect wound closure still persists. Recently, alternative wound closure methods have been studied to decrease the complication rate and repair time and to improve the cosmetic outcome.

Tissue adhesives like cyanoacrylate have recently invoked a lot of interest in the field of wound healing. The tissue glue is, in theory bacteriostatic and has been used to achieve haemostasis.

A randomised study comparing glue with sutures in circumcision concluded that glue application is a feasible alternative but offers no extra advantage when compared with suturing ^[8]. There have been efforts to do sutureless circumcision by many. By undertaking this study we observed the efficacy of isoamyl-2-cyanoacrylate glue for skin approximation after circumcision.

Methodology**Study Design**

Prospective and observational study.

Duration of study

1 year 6 months

Inclusion criteria

- Acquired phimosis
- Balanitis xerotica obliterans,
- Previous history of paraphimosis
- Religious and cultural reasons

Exclusion criteria

- Newborns excluded
- Infants with hypospadiasis
- Patients with bleeding diathesis

The following investigations were done for all patients who underwent circumcision

- CBC
- ESR
- HIV I & II
- HbSAg
- Coagulation profile
- RBS
- ECG (only for elderly patients)

Study Procedure

All the patients were personally subjected to detailed history regarding name, age, occupation, socioeconomic status and general physical examination. Patients with phimosis and active infection like balanoposthitis were administered antibiotics and circumcision was done on a later date. Patients with diabetes mellitus were evaluated and if not under control, appropriate glycemic control was achieved and were later posted for circumcision (since balanoposthitis is sometimes first presentation of DM patients) All patients were given a single dose of IV antibiotic prior to the procedure. The procedure was done under dorsal penile block for all patients aged above 10 years of age. Patients under the age of 10 years were put under general anesthesia and then circumcision was carried out.

Dorsal slit followed by free hand cutting with sharp scissors method of circumcision was employed in all patients. Bipolar cautery was used at bleeding points especially superficial dorsal vein of penis and frenular artery. Iso amyl cyanoacrylate was the glue used. Two tooth forceps were used to hold two edges of skin and a drop of glue was poured and the edges were approximated swiftly. If the glue was accidentally dropped on glans or shaft of penis it was wiped off immediately with either dry gauze or gauze dipped in acetone solution.



Fig 1: Use of bipolar cautery for hemostasis

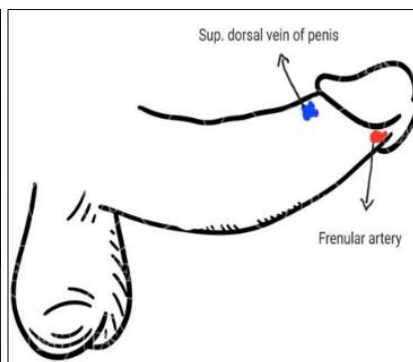


Fig 2: Usual cauterization points for hemostasis

For dressing a thin line of antibiotic ointment was applied on a gauze and the same was wrapped around the operated site after adhesive film was completely solid/polymerized (approximately 5 minutes after application). All patients were examined approximately 30 min after the procedure to check for any

bleeding. All the patients were given analgesic aceclofenac and paracetamol according to pain. All patients were discharged in the evening after examination and followed up on 1st, 3rd, 7th, 15th, 30th, 3rd and 6th month. Bathing on the operative site was permitted after the 3rd day onwards.

Results

For comparison patients were categorised into 3 groups based upon the time period when surgery was done.

Table 1: Time taken for skin approximation

Group	No. of patients	Max time (sec)	Min time(sec)	Avg time(sec)
Jan 21-June 21	16	148	68	104.6
July 21-Dec 21	13	96	71	83.5
Jan 22-June 22	11	92	58	70.45
Total	40			

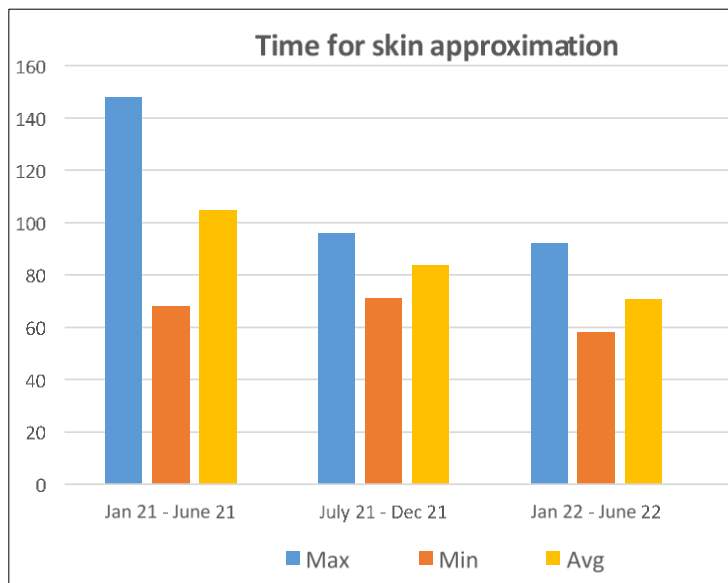


Fig 3: Time taken for skin approximation

From the above table it is evident that as procedures progressed the time taken for glue approximation got reduced. The mean time taken for skin closure in adhesive glue is much faster in last year of the study.

Post-operative wound complications

- Bleeding:** Bleeding was seen in 1 out of 40 patients. A total of 2.5% of patients had bleeding
- Excessive swelling:** Swelling was seen in 1 out of 40 patients, i.e. 2.5%
- Wound infection:** Using ASEPSIS score

Table 2: Wound ASEPSIS Score

Interval (days)	No complications	Serous exudates	Erythema	Purulent discharge	Wound separation	Total
1	38	2	0	0	0	40
3	36	1	2	1	0	40
7	36	0	0	0	4	40
15	40	0	0	0	0	40

It is evident from the table that 2 patients had seroma on day 1 and on day 3, 1 patient had seroma. Total of 3 patients had seroma amounting to 7.5% of total study population. 2 patients had erythema on day 3, amounting to 5% of study population. 1 patient had purulent discharge on day 3, i.e 2.5% of study population. 4 patients had wound separation on day 7, amounting to 10% of study population.



Fig 4: Excessive swelling with erythema seen on post op day 3

Post op pain was calculated using Visual analogue pain scale. The average score in the predetermined time intervals were calculated and tabulated below.

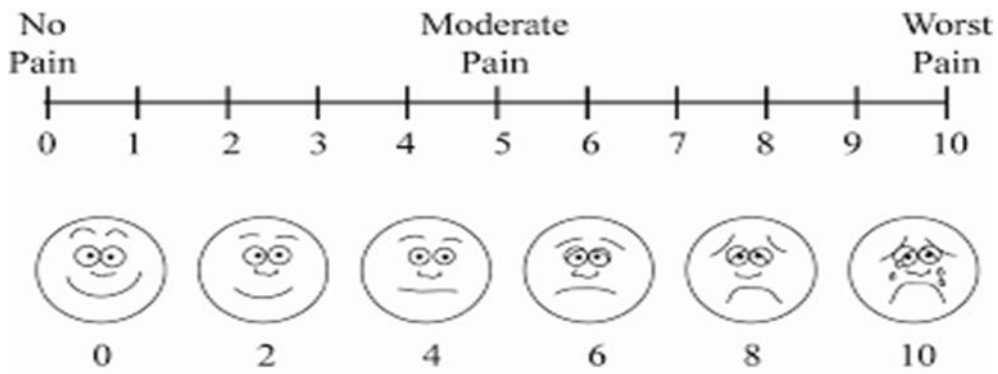


Fig 5: Visual analogue pain scale

Table 3: Post-operative pain score

Time interval	Average VAS
12th hour	2.5
24hrs	1.07
72hrs	0.32

Cosmetic score was calculated using Modified Hollander Scale and the results were observed as follows.

ID	Step-off of borders (Edges not on the same plane)	Contour irregularities (Wrinkled skin near the wound)	Margin separation (Gap between the sides)	Edge inversion (Wound not properly everted)	Excessive distortion (Swelling or infection)	Patient satisfaction score (1-10)	Operator satisfaction score (1-10)
A							
B							
C							
D							
E							

Is the overall appearance? Acceptable Not acceptable

Fig 6: Modified Hollander Scale

Table 4: Wound Cosmesis Score

Time	Score 0	Score 1	Score 2	Score 3	Score 4	Score 5	Score 6
1 week	27 patients	6 patients	4 patients	2 patients	1 patient	Nil	Nil
1 st month	35 patients	4 patients	1 patients	Nil	Nil	Nil	Nil
3 rd month	36 patients	2 patients	Nil	Nil	Nil	Nil	Nil
6 th month	35 patients	Nil	Nil	Nil	Nil	Nil	Nil

By the end of 3 months we had lost 2 patients to follow up and by end of 6 months, another 3 patients were lost to follow up



Fig 7: Pediatric circumcision immediate post op Fig 8: Pediatric circumcision after 3 months



Fig 9: Adult circumcision after 6 months

Discussion

In our study time taken for skin approximation using glue post free hand cutting has been taken into consideration. From the results we can summarise that due to learning curve initially time taken for glue approximation was well over 2 minutes but as the cases progressed wound closure could be achieved in less than one minute specifically for pediatric patients and less than 2 minutes for adults.

In the case of skin adaptation using glue, most authors assume that the learning curve will be steep at first. As reported by Elmore *et al.*^[9] in his work that for the first 150 cases an average of 3 minutes was required for the skin adaptation with glue but for subsequent 120 cases an average of 90 seconds per readaptation of Wound edges were recorded.

Parmar and Solanki^[10] shared comparable experiences in a prospective comparative clinical preliminary study. They reported that the operation time by glue was longer in the first year and shorter in the final year due to the learning curve of the surgeons.

D'Arcy and Jaffry^[11] reported a shorter learning curve. They published a study on the Duration of one year with a patient collective of 100 cases that the first 25 cases using the Glue Technique took an average of 5 minutes and there after for remaining 75 cases and average of 2 minutes.

Cheng and Saing⁸ state that the operation time with the method of readaptation the wound edges takes 3 minutes longer with glue than with sutures.

The most common short-term postoperative complications of circumcisions that may occur are swelling, pain, and postoperative bleeding. It can also have late complications such as wound infections and micturition disorders.

In our study 1 patient had post op bleeding which comprises of 2.5% of study population. The patient did not require revision and bleeding suspended on application of compression followed by pressure bandage. When we look at literature, a prospective randomized study from the USA analyzed by Elemen^[12] and colleagues, detailing the frequency of intraoperative and postoperative bleeding in glue and suture groups ruled in favor of the glue technique. Also the meta-analysis of Martin^[13] and colleagues confirmed that there was less bleeding and hematomas with the use of skin glue.

A probable explanation for less incidence of post op bleeding can be attributed to our technique of dorsal cut followed by free hand cutting using scissors. Prior to dorsal cut, artery forceps were applied at the place of incision and skin was crushed with forceps and locked in place for a minute to minimize bleeding.

1 patient had excessive swelling in our study that comprises of 2.5% of study population. Excessive swelling was defined as swelling involving more than half of the penile shaft. 2 patients had erythema that comprises of 5% of study population. Both the group of patients recovered after a course of antihistaminics.

Cases of allergic reactions using skin glue have been reported in the literature. In the study by D'Arcy and Jaffry^[11] a patient after application of Dermabond TM (2-octyl cyanoacrylate), skin adhesive caused an allergic reaction during a circumcision in immediate postoperative period with symptoms such as swelling, erythema and pruritus. After a course of oral antihistamine, he recovered without consequences.

Kelly^[14] and colleagues also report an allergic reaction in terms of contact dermatitis through the use of 2-octyl cyanoacrylate after a circumcision. This is also been treated with an antihistamine.

For parameters apart from the above a wound asepsis score model was used where serous and purulent exudates, erythema and separation of deeper tissues were considered. 3 patients had seroma amounting to 7.5% and 1 patient had purulent discharge, i.e 2.5%. Both the groups were treated with 5 day course of amoxicillin-clavulanic acid and the complications resolved without further intervention.

In a study by Hiren Vaidya *et al.*,^[15] in glue group comprising of 55 patients, 3 people had seroma i.e 5.45% comparable to our study. In a study by Tiwari *et al.*,^[16] in glue group comprising of 44 patients, 3 people had seroma i.e 6.8% comparable to our study.

Minor wound separation/dehiscence was seen in 4 out 40 patients, i.e 10% of study population. This was seen in adult population and dehiscence due to erection can be a possible explanation for higher rates of dehiscence in our study. The raw area healed by itself without any surgical intervention.

This can be compared to studies in literature by Tiwari *et al.*,^[16] (6.8% dehiscence) and Sharma¹(13.3% dehiscence). Similar to our study no surgical interventions were seen and the wound site healed by itself.

The postoperative pain was assessed using Visual Analogue pain scale. Around 12hrs post circumcision, patients were enquired about pain and majority of the patients reported mild to no pain. Very few patients complained of moderate pain and were advised analgesics. None of the patients reported severe pain.

In the study by Tiwari *et al.*,^[16] the subjective pain perception using the VAS; a significant difference in the comparison group could not be proven (Tiwari *et al.*, 2011).

Majority of the procedures were performed under block anesthesia in the form of a penile root block or a caudal block. Due to this effective postoperative analgesia is achieved. In our study cosmetic assessment was done objectively using a Modified Hollander Cosmetic Scale. Majority of the patients had a Score of 0 or nil which implies best outcome. By the end of 3rd month 2 patients were lost to follow up and except 2 patients who had a score of 1 due to earlier wound dehiscence rest of the patients had a score of 0. At the end of 6

months all patients had score of 0 except for the patients lost to follow up, i.e. a total of 5 patients. Many patients and parents were satisfied with the cosmetic appearance of the wound by end of 3rd and 6th month.

Our results can be comparable with Hiren Parmar^[10] study, who concluded that cosmesis with glue was better. In a study conducted by Hiren Vaidya^[15] *et al.*, glue group was found to have better cosmesis compared to suture group, however it wasn't statistically significant.

Conclusion

In conclusion, it can be said that the method of skin adaptation using glue can be considered instead of sutures with regard to the cosmetic result, skin approximation time, postoperative pain is superior and the complication rate are comparable to that of suture.

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