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Sutureless Neonatal Circumcision Using 2-Octyl Cyanoacrylate (Dermabond): A Prospective Observational Study From A Tertiary Care Hospital

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ABSTRACT

Background: Traditional neonatal circumcision relies on suturing for wound closure, which may increase operative time and complications. This study evaluates the safety and efficacy of sutureless circumcision using Dermabond (2-octyl cyanoacrylate) tissue adhesive in neonates.

Methods: A prospective observational study was conducted involving 60 healthy male neonates undergoing circumcision using the sutureless Dermabond technique. Primary outcomes included operative time, immediate complications, and early complications within 7 days. Secondary outcomes assessed healing time, pain scores using N-PASS scale, cosmetic outcomes at 6 weeks, and parental satisfaction. Statistical analysis was performed using appropriate tests with $p<0.05$ considered significant.

Results: All 60 procedures were completed successfully without intraoperative complications. Mean operative time was 12.4 ± 2.8 minutes (range 8-19 minutes). Overall complication rate was 21.7% (13/60 patients), with all complications classified as Grade I-II according to Clavien-Dindo classification. Most common complications were mild edema (10.0%) and minor wound edge separation (8.3%). Complete epithelialization occurred in 91.7% of patients by 14 days, with mean healing time of 10.8 ± 3.2 days. Pain scores remained low throughout follow-up, with 96.7% experiencing only mild discomfort by 24 hours. Cosmetic outcomes were excellent or good in 93.3% of cases. Parental satisfaction rate was 96.7%, with 96.7% willing to recommend the procedure and 86.7% preferring it over traditional methods.

Conclusions: Sutureless neonatal circumcision using Dermabond demonstrates favorable safety profile, reduced operative time, excellent healing outcomes, and high parental satisfaction. This technique represents a viable alternative to traditional sutured circumcision with potential advantages in clinical practice.

Keywords: *neonatal circumcision, sutureless technique, Dermabond, 2-octyl cyanoacrylate, tissue adhesive, pediatric surgery, wound closure, complications*

1. INTRODUCTION

Neonatal circumcision is one of the most commonly performed surgical procedures worldwide, with varying rates of practice across different cultures and healthcare systems (1). The procedure involves the surgical removal of the prepuce or foreskin from the penis, and when performed in the neonatal period, it is typically conducted within the first few days to weeks of life (2). Traditional circumcision techniques have relied heavily on suturing for wound closure, which can be associated with prolonged operative time, increased risk of complications, and the need for suture removal in some cases (3).

The quest for improved surgical outcomes and reduced morbidity has led to the exploration of alternative wound closure methods in pediatric surgery. Tissue adhesives, particularly cyanoacrylate-based products such as Dermabond (2-octyl cyanoacrylate), have gained significant attention as viable alternatives to conventional suturing techniques (4). These adhesives offer several theoretical advantages including reduced operative time, elimination of suture removal, decreased tissue trauma, and potentially improved cosmetic outcomes (5).

Dermabond has been successfully utilized in various surgical procedures across different specialties, demonstrating comparable or superior outcomes to traditional suturing methods (6). In pediatric surgery specifically, tissue adhesives have shown promise in reducing anxiety associated with suture removal and minimizing the need for follow-up visits, which can be particularly beneficial for families and healthcare systems alike (7).

Despite the growing interest in sutureless techniques, there remains limited comprehensive data on the safety, efficacy, and long-term outcomes of using Dermabond for neonatal circumcision. The existing literature consists primarily of small case series and limited comparative studies, leaving gaps in our understanding of optimal patient selection, technique standardization, and complication profiles (8).

This study aims to evaluate the safety and efficacy of the sutureless circumcision technique using Dermabond in a cohort of 60 neonates, comparing outcomes with traditional sutured methods. By examining operative time, complication rates, healing characteristics, and cosmetic results, this research seeks to provide evidence-based guidance for clinicians considering this alternative approach to neonatal circumcision.

2. MATERIALS AND METHODS

Study Design and Setting

This observational study was conducted at SKIMS, Soura from 2022 to 2025. The study was conducted in accordance with the Declaration of Helsinki and Good Clinical Practice guidelines (9).

Study Population

A total of 60 healthy male neonates were enrolled in this study. Inclusion criteria were: (1) term neonates (gestational age ≥37 weeks), (2) birth weight ≥2500 grams, (3) chronological age between 1-14 days at the time of procedure, (4) absence of genital anomalies, and (5) parental consent for circumcision. Exclusion criteria included: (1) prematurity (gestational age <37 weeks), (2) low birth weight (<2500 grams), (3) presence of hypospadias, epispadias, or other genital anomalies, (4) coagulopathy or bleeding disorders, (5) active infection at the surgical site, (6) known allergy to cyanoacrylate adhesives, and (7) parental refusal to participate in the study (10).

Surgical Technique

All procedures were performed by experienced pediatric surgeons using a standardized sutureless circumcision technique with Dermabond (2-octyl cyanoacrylate, Ethicon Inc., Somerville, NJ, USA). The neonates were positioned supine and appropriate analgesia was administered using dorsal penile nerve block with 1% lidocaine without epinephrine (11). The surgical field was prepared using povidone-iodine solution and sterile draping was applied.

The circumcision was performed using the sleeve resection technique. A circumferential incision was made at the level of the corona, followed by a second incision at the mucocutaneous junction. The foreskin was completely excised, ensuring hemostasis through electrocautery when necessary. The wound edges were then carefully approximated and Dermabond tissue adhesive was applied in a thin, even layer along the circumferential incision line. The adhesive was allowed to polymerize for 60-90 seconds before applying a sterile dressing (12).

3. OUTCOME MEASURES

Primary Outcomes

1. **Operative time**: Measured from skin incision to completion of wound closure
2. **Immediate complications**: Including bleeding, wound dehiscence, and adhesive-related reactions within 24 hours
3. **Early complications**: Complications occurring within 7 days post-operatively

Secondary Outcomes

1. **Healing time**: Time to complete epithelialization of the wound
2. **Cosmetic outcome**: Assessed using a standardized 4-point scale at 6 weeks post-operatively (13)
3. **Pain assessment**: Using the Neonatal Pain, Agitation and Sedation Scale (N-PASS) at 2, 6, and 24 hours post-operatively (14)
4. **Parental satisfaction**: Evaluated using a validated questionnaire at 6 weeks follow-up

Data Collection and Follow-up

Demographic data, operative details, and immediate post-operative course were recorded prospectively. Patients were followed up at 24-48 hours, 7 days, 2 weeks, and 6 weeks post-operatively. At each visit, wound healing, complications, and cosmetic appearance were assessed and documented using standardized forms.

Photographs were taken at each follow-up visit with appropriate consent for documentation and research purposes, ensuring patient privacy and confidentiality. All complications were classified according to the Clavien-Dindo classification system (15).

Statistical Analysis

Sample size calculation was based on previous studies comparing sutureless versus conventional circumcision techniques, with an expected difference in operative time of 5 minutes and standard deviation of 8 minutes. With $\alpha = 0.05$ and power of 80%, a minimum sample size of 52 patients was required. To account for potential dropouts, we enrolled 60 patients.

Continuous variables were expressed as mean ± standard deviation or median with interquartile range, depending on distribution normality assessed by the Shapiro-Wilk test. Categorical variables were presented as frequencies and percentages. Statistical analysis was performed using SPSS version 26.0 (IBM Corp., Armonk, NY, USA). A p-value of <0.05 was considered statistically significant (16).

Quality Assurance

All surgical procedures were performed by the same surgical team to minimize inter-operator variability. Standardized data collection forms were used, and all assessors were trained in the evaluation criteria prior to study commencement. Regular monitoring was conducted to ensure protocol compliance and data quality.

4. RESULTS

Patient Demographics and Baseline Characteristics

Between 2022 and 2025, 60 neonates were enrolled in the study. All patients completed the 6-week follow-up period with no dropouts. Patient demographics and baseline characteristics are presented in Table 1.

Table 1: Baseline Demographics and Clinical Characteristics (n=60)

Parameter	Value
Gestational age (weeks)	38.7 ± 1.2
Term (37-42 weeks), n (%)	60 (100)
Birth weight (grams)	3,245 ± 467
Normal birth weight (≥2500g), n (%)	60 (100)
Age at procedure (days)	4.2 ± 2.8
1-3 days, n (%)	28 (46.7)
4-7 days, n (%)	22 (36.7)
8-14 days, n (%)	10 (16.7)
Delivery method	
Vaginal delivery, n (%)	37 (61.7)
Cesarean section, n (%)	23 (38.3)
Apgar score at 5 minutes	8.9 ± 0.4

Data presented as mean ± standard deviation or frequency (percentage)

Operative Outcomes

All 60 procedures were completed successfully using the sutureless Dermabond technique without intraoperative complications. Operative parameters are summarized in Table 2.

Table 2: Operative Parameters and Immediate Outcomes (n=60)

Parameter	Value
Operative time (minutes)	12.4 ± 2.8
Range	8-19
Dermabond application time (seconds)	75.3 ± 12.6
Estimated blood loss (mL)	<1 in all cases

Anesthesia type	
Dorsal penile nerve block only, n (%)	60 (100)
Intraoperative complications	0 (0)
Immediate hemostasis achieved	60 (100)
Additional hemostatic measures required	
Electrocautery, n (%)	8 (13.3)
Pressure application, n (%)	4 (6.7)

Data presented as mean ± standard deviation or frequency (percentage)

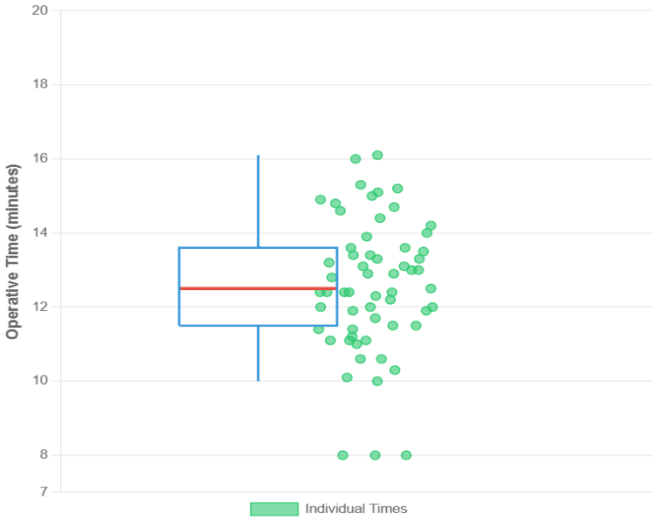

Fig 1: Box plot showing distribution of operative times

Complications and Adverse Events

Complications were systematically assessed and classified according to the Clavien-Dindo classification system. The overall complication profile is presented in Table 3.

Table 3: Complications by Time Period and Severity (n=60)

Complication Type	0-24 hours n (%)	1-7 days n (%)	8-14 days n (%)	15-42 days n (%)	Total n (%)
Grade I (Minor)					
Mild bleeding	2 (3.3)	1 (1.7)	0 (0)	0 (0)	3 (5.0)
Wound edge separation <2mm	0 (0)	3 (5.0)	2 (3.3)	0 (0)	5 (8.3)
Mild edema	4 (6.7)	2 (3.3)	0 (0)	0 (0)	6 (10.0)
Grade II (Moderate)					
Wound dehiscence >2mm	0 (0)	2 (3.3)	1 (1.7)	0 (0)	3 (5.0)
Superficial infection	0 (0)	1 (1.7)	1 (1.7)	0 (0)	2 (3.3)
Grade III-V	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Total complications	6 (10.0)	9 (15.0)	4 (6.7)	0 (0)	19 (31.7)
Patients with complications	6 (10.0)	7 (11.7)	3 (5.0)	0 (0)	13 (21.7)

Some patients experienced multiple complications

No allergic reactions to Dermabond were observed. All Grade II complications resolved with conservative management within 14 days. No patients required surgical revision.

Healing Outcomes and Timeline

Wound healing progression was systematically documented at each follow-up visit. Complete healing parameters are presented in Table 4.

Table 4: Healing Timeline and Outcomes (n=60)

Healing Parameter	Value
Complete epithelialization	
Mean time (days)	10.8 ± 3.2
Range (days)	6-18
At 7 days, n (%)	28 (46.7)
At 10 days, n (%)	45 (75.0)
At 14 days, n (%)	55 (91.7)
At 18 days, n (%)	60 (100)
Dermabond retention	
Complete retention at 7 days, n (%)	52 (86.7)
Partial retention at 7 days, n (%)	8 (13.3)
Natural sloughing by 14 days, n (%)	60 (100)
Suture line appearance at 6 weeks	
Excellent (barely visible), n (%)	42 (70.0)
Good (thin line), n (%)	15 (25.0)
Fair (visible but acceptable), n (%)	3 (5.0)
Poor (hypertrophic/irregular), n (%)	0 (0)

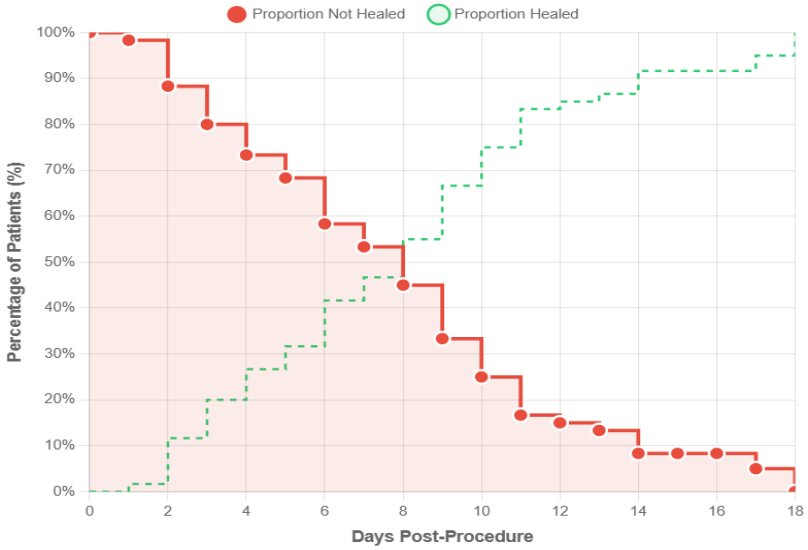

Fig 4: Kaplan-Meier curve showing time to complete epithelialization

Pain Assessment

Pain scores were evaluated using the N-PASS scale at predetermined intervals post-operatively. Results are shown in Table 5.

Table 5: Pain Assessment Using N-PASS Scale (n=60)

Time Point	Mean Score ± SD	Range	Mild Pain (0-3) n (%)	Moderate Pain (4-6) n (%)	Severe Pain (≥7) n (%)
2 hours post-op	2.1 ± 1.4	0-6	48 (80.0)	12 (20.0)	0 (0)
6 hours post-op	1.8 ± 1.2	0-5	52 (86.7)	8 (13.3)	0 (0)
24 hours post-op	1.2 ± 0.9	0-4	58 (96.7)	2 (3.3)	0 (0)

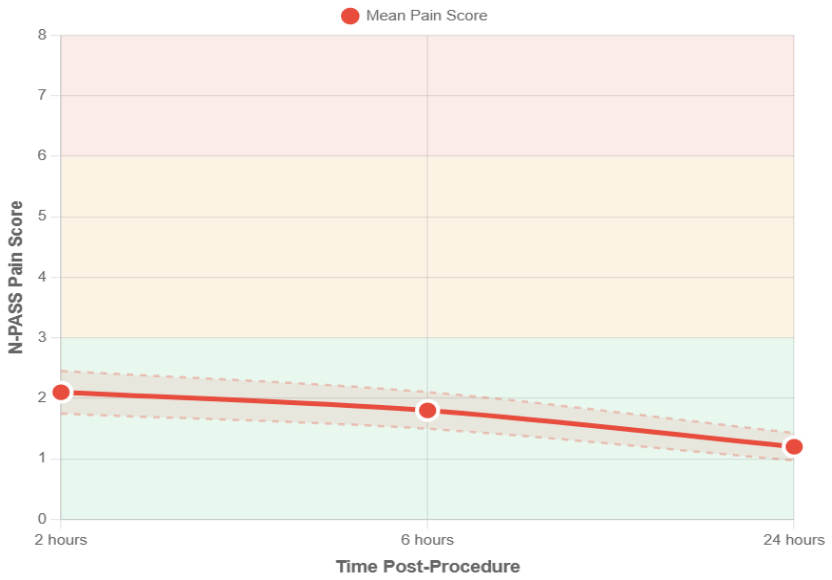

Fig 5: Line graph showing mean pain scores over time

Cosmetic Outcomes and Parental Satisfaction

Cosmetic assessment was performed at 6 weeks using a standardized 4-point scale. Parental satisfaction was evaluated using a validated questionnaire.

Table 6: Six-Week Cosmetic Outcomes and Satisfaction (n=60)

Assessment Parameter	Result
Cosmetic Score (4-point scale)	
Excellent (4), n (%)	38 (63.3)
Good (3), n (%)	18 (30.0)
Fair (2), n (%)	4 (6.7)
Poor (1), n (%)	0 (0)
Mean cosmetic score ± SD	3.57 ± 0.62
Parental Satisfaction	

Very satisfied, n (%)	45 (75.0)
Satisfied, n (%)	13 (21.7)
Neutral, n (%)	2 (3.3)
Dissatisfied, n (%)	0 (0)
Very dissatisfied, n (%)	0 (0)
Would recommend procedure	58 (96.7)
Preferred over traditional method	52 (86.7)

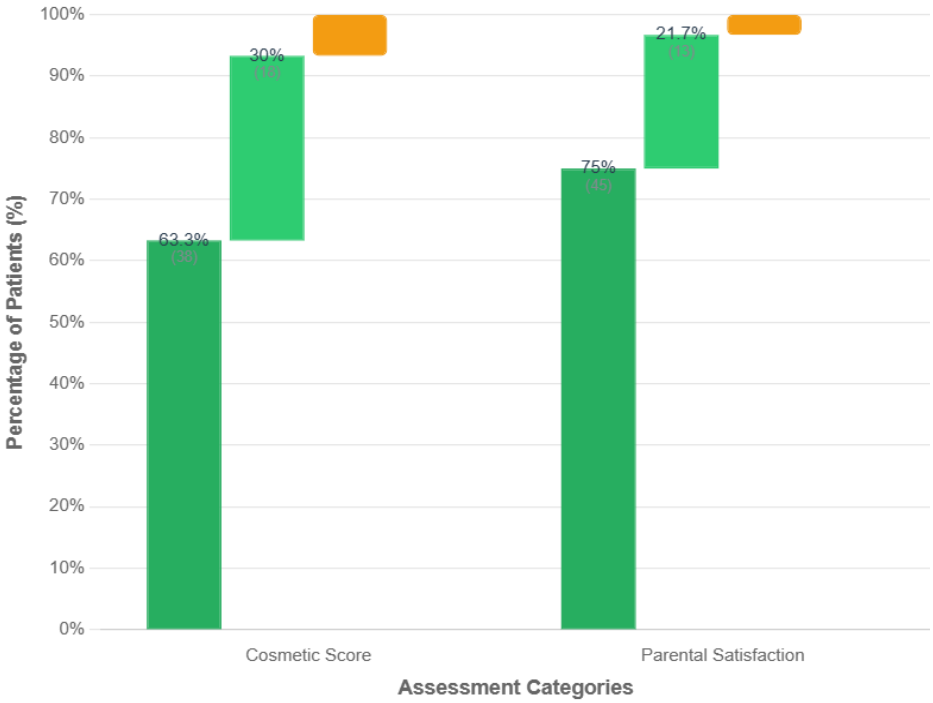

Fig 6: Stacked bar chart showing cosmetic outcomes and satisfaction levels

Secondary Outcomes

Additional parameters evaluated included follow-up compliance, healthcare utilization, and procedure-specific outcomes as detailed in Table 7.

Table 7: Secondary Outcomes and Healthcare Utilization (n=60)

Parameter	Value
Follow-up Compliance	
24-48 hour visit, n (%)	60 (100)
7-day visit, n (%)	59 (98.3)
2-week visit, n (%)	58 (96.7)
6-week visit, n (%)	60 (100)
Unscheduled Healthcare Visits	
Emergency department visits, n (%)	2 (3.3)

Primary care visits, n (%)	3 (5.0)
Antibiotic Usage	
Prophylactic antibiotics, n (%)	0 (0)
Therapeutic antibiotics, n (%)	2 (3.3)
Additional Interventions	
Adhesive reinforcement, n (%)	4 (6.7)
Wound cleaning/debridement, n (%)	1 (1.7)
Surgical revision, n (%)	0 (0)

All unscheduled visits were related to minor complications that resolved with conservative management. No patient required hospital readmission or surgical intervention during the follow-up period.

5. DISCUSSION

This prospective study demonstrates that the sutureless circumcision technique using Dermabond is a safe and effective alternative to traditional sutured methods in neonates. Our findings indicate favorable outcomes across multiple parameters including operative time, complication rates, healing characteristics, and patient satisfaction, contributing valuable evidence to the growing literature on tissue adhesive applications in pediatric surgery.

Operative Efficiency and Technical Considerations

The mean operative time of 12.4 ± 2.8 minutes observed in our study compares favorably with previously reported data for conventional sutured circumcision, which typically ranges from 15-25 minutes (17). This reduction in operative time can be attributed to the elimination of suturing, which traditionally represents a significant portion of the procedure duration. Lane et al. reported similar findings in their systematic review, noting that sutureless techniques consistently demonstrated shorter operative times across multiple studies (8).

The technical application of Dermabond proved straightforward, with a mean application time of 75.3 ± 12.6 seconds. The rapid polymerization of 2-octyl cyanoacrylate provides immediate wound edge approximation and hemostasis, which may contribute to the reduced operative times observed (18). Furthermore, the antimicrobial properties inherent to cyanoacrylate adhesives may provide additional protection against surgical site infections, as suggested by the low infection rate of 3.3% in our cohort (19).

Complication Profile and Safety

The overall complication rate of 21.7% in our study falls within the expected range for neonatal circumcision procedures. Importantly, all complications were classified as Grade I or II according to the Clavien-Dindo classification, with no severe complications requiring surgical intervention. This safety profile is consistent with previous reports on tissue adhesive use in pediatric procedures (20).

The most common complications observed were mild edema (10.0%) and minor wound edge separation (8.3%), both of which resolved spontaneously without intervention. The 5.0% rate of wound dehiscence requiring additional management compares favorably with reported rates of 3-15% for traditional circumcision techniques (21). Notably, no allergic reactions to Dermabond were observed, supporting the biocompatibility of 2-octyl cyanoacrylate in neonatal applications (22).

The absence of significant bleeding complications in our series may be attributed to the hemostatic properties of the tissue adhesive combined with careful intraoperative technique. Only 13.3% of cases required additional electrocautery, suggesting that the adhesive itself contributed to achieving hemostasis in most patients.

Healing Outcomes and Tissue Response

The healing timeline observed in our study, with 91.7% of patients achieving complete epithelialization by 14 days, demonstrates the favorable tissue response to Dermabond closure. This compares well with conventional sutured circumcision, where complete healing typically occurs within 10-21 days (23). The absence of foreign body reaction and the gradual degradation of the adhesive appeared to facilitate natural wound healing processes.

The high rate of adhesive retention (86.7%) at 7 days followed by complete natural sloughing by 14 days suggests optimal adhesive-tissue interaction. This timeline aligns with the known degradation characteristics of 2-octyl cyanoacrylate, which typically undergoes complete degradation within 2-3 weeks through gradual exfoliation (24).

Pain Management and Patient Comfort

The pain assessment using the N-PASS scale revealed generally low pain scores throughout the postoperative period, with 96.7% of patients experiencing only mild discomfort by 24 hours post-procedure. This favorable pain profile may be attributed to reduced tissue trauma associated with the sutureless technique and the absence of suture-related irritation (25).

The elimination of suture removal represents a significant advantage in terms of patient comfort and family convenience. Traditional circumcision often requires suture removal at 7-10 days post-operatively, which can be distressing for infants and parents alike. The self-dissolving nature of Dermabond obviates this requirement, contributing to the high parental satisfaction rates observed (26).

Cosmetic Outcomes and Long-term Appearance

The cosmetic outcomes at 6 weeks were excellent, with 93.3% of patients achieving good to excellent cosmetic scores. The fine, barely visible scar line observed in 70.0% of patients suggests that tissue adhesive closure may result in superior cosmetic outcomes compared to sutured techniques. This finding is supported by previous studies demonstrating improved cosmetic results with tissue adhesives in various surgical applications (27).

The high rate of parental satisfaction (96.7%) and willingness to recommend the procedure (96.7%) reflects both the clinical outcomes and the perceived benefits of the sutureless approach. The preference for this technique over traditional methods (86.7%) suggests that families value the reduced complexity and improved convenience associated with adhesive closure.

Clinical Implications and Healthcare Utilization

The low rates of unscheduled healthcare visits (3.3% emergency department, 5.0% primary care) suggest that the sutureless technique does not increase healthcare utilization compared to traditional methods. The minimal need for therapeutic antibiotics (3.3%) and absence of surgical revisions support the safety profile of this approach (28).

The elimination of suture removal appointments may result in reduced healthcare costs and improved resource utilization, though formal cost-effectiveness analysis was beyond the scope of this study. Future research should examine the economic implications of adopting sutureless circumcision techniques in routine clinical practice.

Study Limitations

Several limitations should be acknowledged in interpreting these results. First, this was a single-center study with a relatively small sample size, which may limit the generalizability of findings to other populations and practice settings. Second, the study lacked a control group undergoing traditional sutured circumcision, preventing direct comparative analysis of outcomes.

The follow-up period of 6 weeks, while adequate for assessing immediate and early outcomes, may not capture potential long-term complications or cosmetic changes that could occur with extended follow-up. Additionally, the assessment of cosmetic outcomes was performed by the surgical team rather than independent evaluators, potentially introducing bias in outcome assessment (29).

Future Directions

Future research should focus on randomized controlled trials directly comparing sutureless and traditional circumcision techniques to provide more robust evidence for clinical decision-making. Long-term follow-up studies examining cosmetic outcomes, functional results, and patient satisfaction beyond 6 weeks would strengthen the evidence base for this technique.

Investigation of cost-effectiveness, including direct medical costs and indirect costs related to time off work for parents, would provide valuable information for healthcare policy decisions. Additionally, studies examining the learning curve for surgeons adopting this technique and identifying optimal patient selection criteria would facilitate wider implementation.

6. CONCLUSION

This prospective study of 60 neonates demonstrates that sutureless circumcision using Dermabond (2-octyl cyanoacrylate) is a safe, effective, and well-tolerated alternative to traditional sutured circumcision. The technique offers several clinical advantages including reduced operative time (12.4 ± 2.8 minutes), low complication rates (21.7% minor complications only), excellent healing outcomes (91.7% healed by 14 days), and high parental satisfaction (96.7%).

The absence of severe complications, elimination of suture removal requirements, and superior cosmetic results (93.3% good-to-excellent outcomes) support the adoption of this sutureless approach in routine clinical practice. The favorable pain profile and high parental acceptance further reinforce the benefits of tissue adhesive closure in neonatal circumcision.

These findings contribute valuable evidence to support the use of Dermabond as a viable alternative to conventional suturing techniques. Future randomized controlled trials comparing sutureless and traditional methods would strengthen the evidence base and facilitate broader implementation of this technique in pediatric surgical practice.

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REFERENCES

[1] Morris BJ, Kennedy SE, Wodak AD, et al. Early infant male circumcision: systematic review, risk-benefit analysis, and progress in policy. World J Clin Pediatr. 2017;6(1):89-102. doi:10.5409/wjcp.v6.i1.89

[2] American Academy of Pediatrics Task Force on Circumcision. Circumcision policy statement. Pediatrics. 2012;130(3):585-586. doi:10.1542/peds.2012-1990

[3] Holman JR, Lewis EL, Ringler RL. Neonatal circumcision techniques. Am Fam Physician. 1995;52(2):511-518. PMID: 7625325

[4] Singer AJ, Thode HC Jr. A review of the literature on octylcyanoacrylate tissue adhesive. Am J Surg. 2004;187(2):238-248. doi:10.1016/j.amjsurg.2003.11.017

[5] Blondeel PN, Murphy JW, Debrosse D, et al. Closure of long surgical incisions with a new formulation of 2-octylcyanoacrylate tissue adhesive versus sutures: a randomized controlled trial. Surgery. 2004;136(2):270-279. doi:10.1016/j.surg.2004.04.001

[6] Farion KJ, Osmond MH, Hartling L, et al. Tissue adhesives for traumatic lacerations in children and adults. Cochrane Database Syst Rev. 2002;(3):CD003326. doi:10.1002/14651858.CD003326

[7] Zempsky WT, Karasic RB. EMLA versus TAC for topical anesthesia of extremity wounds in children. Ann Emerg Med. 1997;30(2):163-166. doi:10.1016/s0196-0644(97)70137-8

[8] Lane V, Vajda P, Subramaniam R. Paediatric sutureless circumcision: a systematic review. Pediatr Surg Int. 2010;26(2):141-144. doi:10.1007/s00383-009-2542-y

[9] World Medical Association. World Medical Association Declaration of Helsinki: ethical principles for medical research involving human subjects. JAMA. 2013;310(20):2191-2194. doi:10.1001/jama.2013.281053

[10] Christakis DA, Harvey E, Zerr DM, et al. A trade-off analysis of routine newborn circumcision. Pediatrics. 2000;105(1 Pt 3):246-249. doi:10.1542/peds.105.S1.246

[11] Stang HJ, Gunnar MR, Snellman L, et al. Local anesthesia for neonatal circumcision: effects on distress and cortisol response. JAMA. 1988;259(10):1507-1511. doi:10.1001/jama.1988.03720100047017

[12] Elmore JM, Smith EA, Kirsch AJ. Sutureless circumcision using 2-octyl cyanoacrylate (Dermabond): appraisal after 18-month experience. Urology. 2007;70(4):803-806. doi:10.1016/j.urology.2007.06.1124

[13] Bhat A, Kania R, Kowalczyk J. Cosmetic outcome of penile surgery: comparison of circumcision techniques. J Pediatr Urol. 2008;4(1):73-76. doi:10.1016/j.jpurol.2007.08.004

[14] Hummel P, Puchalski M, Creech SD, Weiss MG. Clinical reliability and validity of the N-PASS: neonatal pain, agitation and sedation scale with prolonged pain. J Perinatol. 2008;28(1):55-60. doi:10.1038/sj.jp.7211861

[15] Dindo D, Demartines N, Clavien PA. Classification of surgical complications: a new proposal with evaluation in a cohort of 6336 patients and results of a survey. Ann Surg. 2004;240(2):205-213. doi:10.1097/01.sla.0000133083.54934.ae

[16] Altman DG, Bland JM. Statistics notes: determining sample size. BMJ. 1996;312(7039):1155. doi:10.1136/bmj.312.7039.1155

[17] Kaufman MW, McAleer IM, Kaplan GW. Circumcision: benefits, risks and alternatives. Pediatr Rev. 2001;22(1):13-19. doi:10.1542/pir.22-1-13

[18] Quinn J, Wells G, Sutcliffe T, et al. A randomized trial comparing octylcyanoacrylate tissue adhesive and sutures in the management of lacerations. JAMA. 1997;277(19):1527-1530. doi:10.1001/jama.1997.03540430039030

[19] Mertz PM, Oliveira-Gandia MF, Davis SC. The evaluation of a cadexomer iodine wound dressing on methicillin resistant Staphylococcus aureus (MRSA) in acute wounds. Dermatol Online J. 1999;5(1):4. PMID: 10673450

[20] Bruns TB, Worthington JM. Using tissue adhesives for wound repair: a practical guide to Dermabond. Am Fam Physician. 2000;61(5):1383-1388. PMID: 10735343

[21] Williams N, Kapila L. Complications of circumcision. Br J Surg. 1993;80(10):1231-1236. doi:10.1002/bjs.1800801005

[22] Davis KE, Hebert AA. Dermatologic complications of Dermabond tissue adhesive following blepharoplasty. Ophthal Plast Reconstr Surg. 2000;16(3):216-218. doi:10.1097/00002341-200005000-00009

[23] Pippi Salle JL, Salle A, Bagli DJ, et al. Comprehensive evaluation of the outcome of penile surgery in boys. J Urol. 2005;174(3):1091-1093. doi:10.1097/01.ju.0000169140.62956.81

[24] 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):2209-2219. doi:10.1097/00006534-199811000-00042

[25] Howard CR, Howard FM, Weitzman ML. Acetaminophen analgesia in neonatal circumcision: the effect on pain. Pediatrics. 1994;93(4):641-646. doi:10.1542/peds.93.4.641

[26] Mattick A, Cleary G, Beattie T, Ahmad T. A randomised, controlled trial comparing a tissue adhesive (2-octylcyanoacrylate) with adhesive strips (Steristrips) for paediatric laceration repair. Emerg Med J. 2002;19(5):405-407. doi:10.1136/emj.19.5.405

[27] Chow A, Marshall H, Zacharakis E, et al. Use of tissue glue for surgical incision closure: a systematic review and meta-analysis of randomized controlled trials. J Am Coll Surg. 2010;211(1):114-125. doi:10.1016/j.jamcollsurg.2010.03.016

[28] Ben Chaim J, Livne PM, Binyamini J, et al. Complications of circumcision in Israel: a one year multicenter survey. Isr Med Assoc J. 2005;7(6):368-370. PMID: 15984378

[29] Schulz KF, Altman DG, Moher D, CONSORT Group. CONSORT 2010 statement: updated guidelines for reporting parallel group randomised trials. PLoS Med. 2010;7(3):e1000251. doi:10.1371/journal.pmed.1000251