PEDIATRIC UROLOGY

Pediatric sutureless circumcision: an effective and cost efficient alternative

Maria Voznesensky, MD,¹ Christopher Mutter, BA,² Matthew Hayn, MD,¹ Thomas Kinkead, MD,¹ Brian Jumper, MD¹

¹Maine Medical Center, Portland, Maine, USA ²Rocky Vista University, Parker, Colorado, USA

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Introduction: Circumcision is the most commonly performed surgical procedures in male children. Maine is one of 18 states in the United States which does not pay for neonatal circumcisions.

The aim of this study was to perform outcomes and cost analysis of a sutureless circumcision technique versus circumcision using sutures. Specifically, we evaluated Dermaflex (2-octyl cyanoacrylate, 2-OCA) surgical glue circumcision as a cost effective, faster, and safe alternative to traditional suture circumcision.

Materials and methods: Our study was a nonrandomized series. We collected the operative details prospectively, abstracted clinical outcomes retrospectively, and performed data analysis retrospectively. One hundred and twenty-six circumcisions were performed by two pediatric urologists over a 1 year period. Suture circumcisions were performed exclusively during the first 6 months, and 2-OCA glue circumcisions were performed during the second 6 months. Billing charges were analyzed to extrapolate variable costs between the two surgical procedures.

The technique used to perform the sutureless circumcision was a modification of the standard sleeve technique, with the use of monopolar diathermy instead of scalpel, and application of 2-OCA glue to approximate tissue edges. Results: From Jan 2013 to Jan 2014, 72 patients underwent circumcision with suture, and 54 patients underwent circumcision with 2-OCA glue. Mean age in the glue group was 61 months (range 8-202 months), and 50 months in the suture group (range 5-215 months), p = 0.19. All cases were performed under general anesthesia, as outpatient surgery. Mean operative cut time was 18.4 min for the glue group, and 28.6 min for the suture group (p < 0.01). The 10.2 min operative time difference translated to a \$378 cost savings per glue circumcision case. Complication rates were not statistically significant between the two groups.

Conclusion: The use of 2-OCA tissue adhesive for sutureless circumcision is an alternative to the standard technique. It results in faster operative times, with a significant cost savings, while maintaining comparable complication rates to the standard suture technique. This is a viable, less expensive surgical option for patients whose circumcisions are not covered by Medicaid.

Key Words: circumcision, glue, sutureless

Introduction

A study of circumcision in 15,000 infants found neonatal circumcision to be highly cost-effective during the first year of life, considering the estimated number of averted cases of infant urinary tract infection.¹ Circumcision has been associated with

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Address correspondence to Dr. Maria Voznesensky, Maine Medical Partners Urology, 100 Brickhill Avenue South Portland, ME 04106 USA decreased incidence of HIV, penile cancer, balanitis, and phimosis. The cost of post neonatal circumcision was 10-fold the cost of neonatal circumcision.¹

Medicaid does not reimburse for neonatal circumcision in all states, which poses a barrier to individuals without private insurance. In 32 states where Medicaid covered routine circumcision, the circumcision rate was 24% higher than in states without such coverage.²

Maine is one of 18 states in the United States which does not pay for neonatal circumcisions.^{3,4} Lack of coverage results in fewer elective neonatal circumcisions. These children present for circumcisions

at a later age, leading to significantly higher procedural cost for cases performed in the operating room.

Urologists need to identify rapid, inexpensive techniques for performing circumcisions without sacrificing safety or quality. This is especially important in the setting of health care policy in Maine.

A 2-octyl cyanoacrylate (2-OCA, Dermaflex) is an FDA approved device for skin closure. Multiple studies have reported on their experience using 2-OCA tissue glue in circumcisions. These have demonstrated excellent cosmesis, comparable complication rates, and faster operative times with the use of 2-OCA tissue glue.⁵⁻¹⁶

The aim of this study was to perform outcomes and cost analysis of a 2-OCA tissue glue circumcision, compared to standard technique using sutures. Specifically, we evaluated Dermaflex (2-octyl cyanoacrylate, 2-OCA) surgical glue circumcision as a cost effective, faster, and safe alternative to traditional suture circumcision.

Materials and methods

We obtained institutional review board approval for this study. Our study was a non-randomized series. We collected the operative details prospectively over a 1 year period, abstracted clinical outcomes retrospectively, and performed data analysis retrospectively.

Study inclusion criteria were patients 6 months to 18 years old who underwent primary circumcision. Study exclusion criteria were complexity beyond phimosis (e.g. chordee, penile torsion, hypospadias or phalloplasty), and age greater than 18 years.

One hundred and twenty-six circumcisions were performed by two pediatric urologists over a 1 year period. The first 6 months were used to collect data on suture circumcisions, and the second 6 months were used to collect data on 2-OCA circumcisions. All 126 cases were prospectively entered into a database, including all relevant clinical details, and were retrospectively reviewed.

The student's t test was used to compare continuous variables and chi-squared was used to compare categorical variables. Statistical analysis was performed using STATA11.2 (StataCorp, College Station, TX, USA).

The technique used to perform the sutureless circumcision was a modification of the standard sleeve technique, with the use of monopolar diathermy instead of scalpel, and application of 2-OCA to approximate tissue edges. After foreskin retraction and removal of smegma, the site was prepped in standard sterile fashion. The skin was marked to allow a tension free closure and creation of 5 mm mucosal cuff. Bovie monopolar cutery was used to excise redundant foreskin and achieve hemostasis. Three quarter inch needle point Bovie tip and a cutting current were used to make the incision. Electrocautery was set at 8 Watts and 10 Watts for smaller and larger children respectively.⁵ Mucocutaneous approximation was achieved by using a pair of Jake clamps to hold the two edges of the wound firmly together, as the surgical glue was applied. Two thin layers of tissue glue were applied to the incision and allowed to dry (approximately 30 seconds). Care was taken to release the clamps before the glue had dried. Any excess 2-OCA run down was wiped away. We also tried using quadrant sutures placed at the 12, 3, 6, 9 o'clock position for tissue approximation instead of clamps in several cases (the sutures were cut away once the glue had been applied).

Antibiotic ointment was applied to the urethral meatus to avoid accidental contact with glue, and to penile shaft and scrotum to prevent the repair from sticking to the skin. No dressing was used, and the patient was allowed to bathe 48 hours after discharge. Parents were allowed to reapply antibiotic ointment as needed, see Figure 1.

In the suture circumcision group, a scalpel was used to create the circumcising incision, and Bovie electrocautery was used to achieve hemostasis. A 5-0 Chromic suture was used in a simple interrupted fashion to repair the circumcision.

The circulating nurse recorded total operative time, and total case time. A follow up phone call was made on postoperative day 1, and all patients were seen 3 weeks after surgery. The wound was evaluated for infection, incision integrity, and appearance. An informal assessment of parent and patient satisfaction was performed. All correspondence between staff and patient was recorded in the electronic medical record. Retrospective chart review was carried out to assess incidence of complications.

Results

From Jan 2013 to Jan 2014, 72 patients underwent circumcision with suture, and 54 patients underwent circumcision with 2-OCA glue. All cases were performed under general anesthesia, as outpatient surgery.

Table 1 shows the mean age in the glue group was 61 months (range 8-202 months), and 50 months in the suture group (range 5-215 months), p = 0.2. Mean operative cut time was 18.4 min for the glue group (range 9-30 min), and 28.6 min for the suture group (range 19-45 min) (p < 0.01). Mean total OR time was 48.6 min for the glue group, and 57.3 min for the suture group (p < 0.01).



Figure 1. Applying the glue. A) Glue is drying; B) End of OR case; C) With Bacitracin applied to peno-scrotal area; D) Appearance of 2-OCA circumcision 2 weeks postop.

Residents participated in 39 (72%) of glue cases and in 34 (47%) of the suture cases. A total of 73 cases (58%) had resident coverage. Resident involvement did not affect operative cut time, however mean total OR time was 5 min longer with resident participation (p = 0.03). A total of 19 cases (15%) had medical student involvement. Medical student participation

resulted in a 3 min longer total cut time (not statistically significant), and an 8 min longer total OR time (statistically significant at p = 0.04).

Complication rates were not statistically significant between the glue and suture groups (p = 0.46). Four (7%) cases in the glue group and three (4%) cases in the suture group had minor postop complications.

TABLE 1. Characteristics of glue versus suture			
Variable	2-OCA glue (n = 54)	Suture (n = 72)	p value
Mean age months (range)	61 (8-202)	50 (5-215)	0.20
Mainecare no. (%)	40 (74)	38 (53)	0.01
Total cut time (min)	18.4	28.6	< 0.01
Total OR time (min)	48.6	57.3	< 0.01
Resident participation (%)	39 (72)	34 (47)	0.01
No. complications (%)	4 (7)	3 (4)	0.46

These included two cases of wound sticking, and one case of wound separation > 5 mm in the 2-OCA. Reoperation was required in one glue case, for a cicatrix. Complications in the suture group included two cases of adhesions, and suture remnants at 21 days postop. At 3 weeks postop, no patients or parents were dissatisfied with the cosmetic appearance.

The percent of Medicaid patients receiving a glue circumcision was 51%, versus 29% in the private insurance group (p = 0.01). Sixty-two percent of circumcision cases had Medicaid. Patients in the Medicaid group were not older than the private insurance group (average age 55 mo. in Medicaid versus 53 mo. in non-Medicaid).

Billing charges for the 2-OCA glue and suture circumcisions were analyzed. Certain charges were the same between procedures (e.g. surgeon cost, anesthesia cost, recovery room cost). Variable costs included charges for duration of OR time and the use of a Dermaflex glue packet. At our institution, Chromic suture cost \$4. A 2-OCA glue packet costs \$47, and a 15 min block of OR time costs \$556. The 10 min operative time difference between glue and suture circumcisions translated to a \$378 cost savings per glue circumcision case.

Discussion

Reimbursement for routine neonatal circumcision is lacking in Maine, as well as 17 other states in the United States. This has increased the number patients presenting to pediatric urologists for circumcision at a later age. The cost difference between routine neonatal circumcision and surgical circumcision is tenfold.¹ When patients lack private insurance, these costs are often borne by the family.

In the setting of rising health care spending, there is a need to pursue cost efficient alternatives to standard procedure without compromising outcomes. Urologists need rapid, inexpensive techniques for performing circumcisions without sacrificing safety or quality.¹⁷ This is especially important in the setting of health care policy in Maine.

Cyanoacrylates have been used worldwide since the 1990's, and were approved by the FDA in 1998.⁵ 2-OCA glue has proven to be a painless and equal substitute for tension free suture circumcision. Additionally, it provides a bacteriostatic barrier over the incision after drying.¹⁴ In 2007, Elmore et al first published a comparison of 2-OCA and suture circumcision in 267 cases.¹⁰ They showed that 2-OCA was a safe, rapid and cosmetically appealing alternative to sutures. However, they did not report on financial implications in their comparison.

In 2010 Kaye et al published a larger study of 741 cases where 2-OCA was used in 71% of the circumcisions during a 38 month period.⁵ Their results showed that the 2-OCA group required 15 minutes less OR time on average, with equivalent long term outcomes.

The aim of our study was to perform a cost analysis using Kaye et al glue circumcision technique compared to circumcision using sutures. Specifically, we evaluated Dermaflex (2-octyl cyanoacrylate, 2-OCA) surgical glue circumcision as a cost effective, rapid, and safe alternative to traditional suture circumcision.

2-OCA glue circumcisions resulted in faster operative times, with a significant cost savings of \$378 per procedure. No glue circumcision lasted longer than 30 minutes, unlike suture circumcisions which frequently lasted longer than 30 minutes. For each additional 15 minute block of OR time, the patient is billed \$556. 2-OCA glue circumcision represents a significant time saving advantage which translates to reduced procedural costs, while maintaining complication rates comparable to the standard technique.

Our study has several limitations. It was nonrandomized, and did not control for factors such as penis size. Our experience showed that glue circumcisions were made challenging by a small or buried phallus, and as such these cases were done with sutures. Final decision on which method to perform was selected by the surgeon at the time of the procedure based on favorable anatomy potentially introducing selection bias.

Additionally, we lacked a validated questionnaire to evaluate patient/parent and surgeon satisfaction with cosmesis. However, the results of an informal assessment of parent and patient satisfaction indicated very good or excellent parental satisfaction with ultimate appearance.

Conclusion

There is an ever-increasing emphasis on cost containment within the filed of medicine. We demonstrate that 2-OCA glue circumcision technique resulted in 10.2 min shorter operative cut time. This translated to a \$378 cost savings per procedure, while maintaining comparable complication rates to the standard suture technique. Therefore, cost-savings, time savings, and good results make this method suitable for patients whose circumcisions are not covered by Medicaid.

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