Circumcision with Thermocautery after Local Anesthesia in Males: A Retrospective Single-center Study with 1821 Patients

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Purpose: This study aimed to examine the short and long-term complications of thermocautery-assisted circumcisions with local anesthesia done in a sterile environment in operating room conditions, accompanied by literature.

Materials and Methods: The participants who consecutively underwent thermocautery-assisted circumcision with local anesthesia from June 2018 to May 2019 were included in the study. They were one month-17 years old, same ethnic origin, in same location. The age groups were compared in terms of complications.

Results: The participant age and surgical duration means were 4.89 ± 2.08 (30 days-17 years) years old and 7.484 ± 1.524 (5-20 minutes) minutes, respectively. Complications were observed in fifty-three participants or 2.9% of the whole observation set. The participants under intervals of one six months and over 6 years of age had significantly lower complication rates when compared to the other participants, and this comparison was statistically significant ($P = 0.001$).

Conclusion: The study results demonstrated that circumcision with thermocautery after local anesthesia is a viable, reliable, and effective method. It can be assumed that circumcisions in males especially may be effective in 1-6 months, and over 6 years of age. Parents choose this method because it is more appropriate and eliminates the risk of general anesthesia.

Keywords: circumcision; children; local anesthesia; complication; thermocautery

INTRODUCTION

Circumcision is the surgical removal of the skin covering the tip of the penis (prepuce)[1]. It is commonly conducted in neonates, infants, and males for religious, cultural, and medical reasons. An estimated one in three males worldwide is circumcised, with nearly universal coverage in some surroundings. In 2011, an estimate by an independent researcher found global male circumcision prevalence to be 37–40 %.[2,3]. The increased risk for urinary tract infection (UTI) in uncircumcised boys is highest with an incidence rate of 1% for boys less than 2 years of age. They found the single risk factor of lack of circumcision to confer a 23.3% lifetime chance of UTI.[4]. Apart from medical reasons, circumcision is performed to protect against sexually transmitted diseases, and mostly for traditional and religious reasons[5,6]. Complications related to the factors such as anatomical anomalies, clinical comorbidity, surgical methods used, and age of patients are seen in 1-4% of all circumcision procedures[7,8].

Circumcision methods are classified into 3 main groups according to Kaplan and Baskin: open surgery (Sleeve method, Dorsal Slit, and excision, Guillotine method), Sheldon method (such as Mogen clamp, circumcision shield), and special circumcision clamps[9,10].

Thermocautery has also been proven to be a cheap and practical circumcision method, and it has become more popular. This study aims to examine the types and frequency of complications of circumcision by using thermocautery with local anesthesia and conveying our experiences.

MATERIALS AND METHODS

Study population

This study was conducted by ethics committee approval obtained from Karamanoğlu Mehmetbey University Faculty of Medicine (issue 01/date 27.01.2021).

It was started with 2245 participants registered for circumcision in our hospital's database, but 1821 participants coming for control on the 10th day, 1st month, and 1st year after circumcision were included.

The data of patients circumcised by a pediatric surgery specialist doctor between June 2018 and May 2019 were retrospectively retrieved and included in the study at the Karaman Training and Educational Hospital Pediatric Surgery Clinic in Turkey. All participants were living in Karaman, Turkey and all of them were of the same ethnic origin. Candidates aged one month-17 years who underwent circumcision with local anesthesia were included in this cross-sectional retrospective study. Participants who had comorbid diseases, such as undescended testis were excluded. In addition, consent forms were obtained from the legal representatives of the patients for the use of the medical images. The patients were recorded by local voluntary agencies before the date of circumcision. All patients were examined before surgical intervention. All operations were carried out by one pediatric surgery specialist. As a local

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Table 1. Thermocautery circumcision complication rates

Complication		Clavien-Dindo classification
Perioperative	Bleeding (n:2)	3a
Early postoperative (< 10 days)	Bleeding (n:12)	3a
	Infection (n:8)	2
	Convulsion (n:7)	2
	Inability to urinate (n:1)	2
Late postoperative (> 10 days)	Trapped penis (n:2)	3a
	Meatal stenosis (n:5)	2
	Epidermal granuloma and inclusion cyst (n:4)	3a
	Adhesion of mucosa or skin to glans (n:6)	3a
	Glans skin bridge (n:1)	3a
	Sekonder phimosis (n:4)	2
	Urethral fistula (n:1)	3b

anesthetic, 20 mg /ml lidocaine HCl and 0.025 mg/ml adrenaline and bupivacaine 5 mg /ml were used together. The penile block was imposed on the radix and circumference of the penis; 2–5 ml of local anesthetic was used according to the patients' age, and weight. Regularly, the penis was cleaned with batticon and covered with a sterile surgical cover. Approximately 10 minutes after the injection of local anesthesia, the prepuce was retracted to prevent glans injury. The prepuce was held using two clamps placed obliquely at an angle close to 15-20°, with its ventral part facing upwards. Thus, the meatus and frenulum were protected from injury. The guillotine technique was used in all circumcisions performed with thermocautery included in our study. In this method, after the prepuce is suspended with clamps, the surgeon pulls the glans down with the thumb and index finger of one hand and places the flat clamp on the prepuce in the other hand so that it is above the glans. The prepuce is cut with a scalpel over the clamp. Then, the mucosa is held with clamps and the excess is excised. The skin and mucous membranes of participants were sutured all around with separate sutures (**Figure 2-3**). In this method, it should be ensured that the glans remain under the clamp. Otherwise, there may be serious glans injuries[1]. The skin of participants was held and stabilized on the anterior and posterior sides by the clamp and preputial tissue was cut just above the clamp (**Figure 2**) using a thermocautery device (Thermo-Med QX 2100; Thermo Medical, Adana, Turkey (**Figure 4**). The settings of the thermocautery device were established according to the participant's age: 500°C was used for patients under 2 years of age; 550-650°C was used for patients of 2-10 years of age,, and 700–750°C was used for patients older than 10 years of age. After bleeding was controlled, mucosal coherence in patients under 2 years of age was provided with two 5/0 absorbable sutures at 3,6,9 and 12 o'clock positions. A 4/0 absorbable suture was used in participants aged 2-10 years of age, with four sutures at 3, 6, 9, and 12 o'clock positions.

Finally, in patients older than 10 years of age, 3/0 absorbable suture was used with six sutures positioned at 2, 4, 6, 8,10, and 12 o'clock. The wound was then dressed with a nitrofurazone-containing bandage. Participants were observed for 2 hours postoperatively and analgesics were prescribed before discharge. The first follow-up was performed by the operating team, and 10 days after the operation, the wound dressing was removed in the Pediatric Surgery Outpatient Clinic, and a return to daily life was recommended.

Afterward, the participants and their parents were advised to continue their daily life routines. Possible

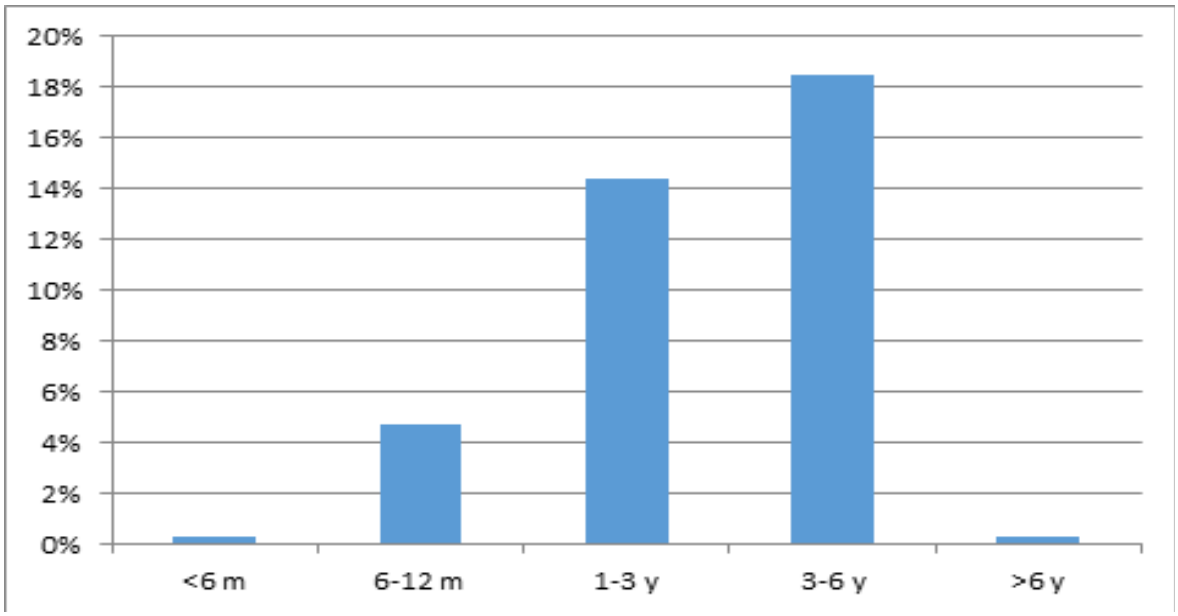

Figure 1. Complication rates in circumcised children by age group.

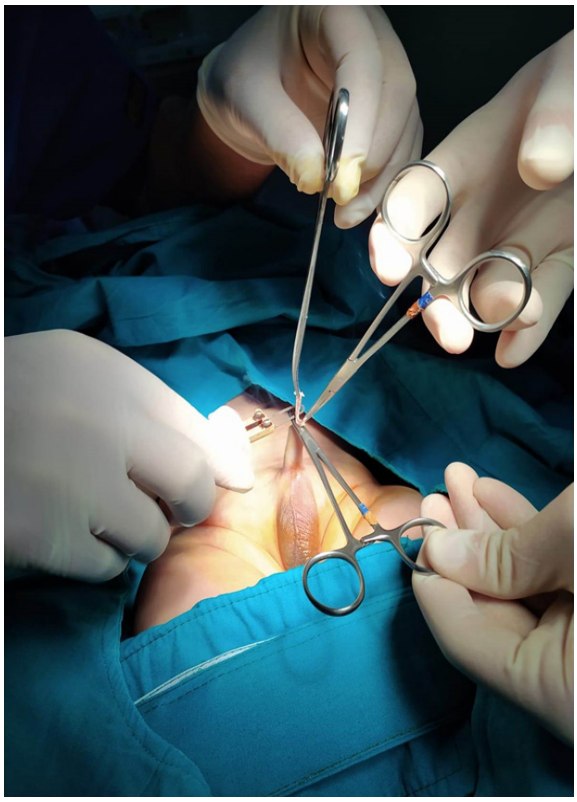

Figure 2. Surgical step of thermocautery circumcision.

complications were explained to participants and parents, and we asked them to visit the hospital if they developed any symptoms, such as penile bleeding, discoloration, or shape changes. In these cases, participants were evaluated, followed, and treated by the first author of this article.

There were not given oral antibiotics to use prophylactically or at home. We recommended ibuprofen to children as an analgesic after 1-year-old, and paracetamol before 1 year of age. The perioperative complications group included bleeding during the cir¬cumcision or the hospital stay. The early post¬operative complications group included complications emerging during the first ten days after discharge from the hospital. The long-term complications group included those complications occurring ten or more days after discharge from the hospital.

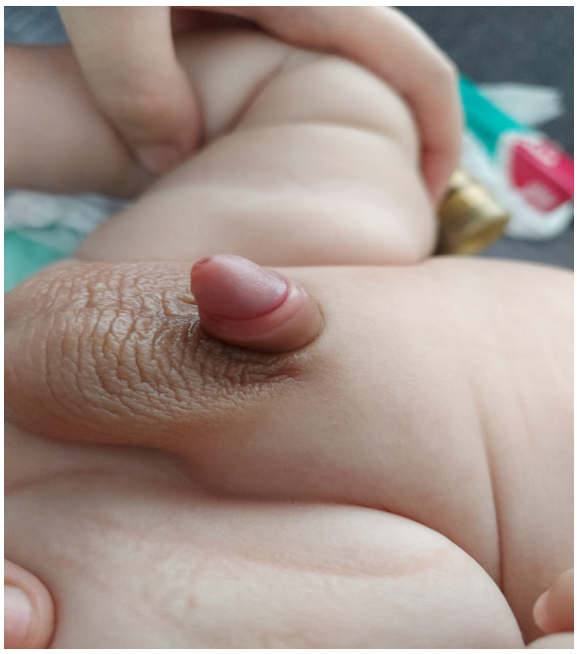

Figure 3. 1st-month control after circumcision

Statistical analysis

The observation set, which consisted of those patients circumcised using the thermocautery-assisted method, was evaluated with the Statistical Package for the So¬cial Sciences software (SPSS Inc.Chicago, IL, USA). The data distribution was examined using the Kol¬mogorov-Smirnov test. The continuous variables were expressed as the mean ± standard deviation (range: minimum-maximum), and the appropriate categorical variables were denoted as the numbers and percentages. The chi-squared and Mann-Whitney U tests were ap¬-plied to evaluate the categorical data and the quantita¬-tive variables, respectively. Two-tailed *P* values of less than 0.05 were accepted as statistically significant.

RESULTS

The number of participants included in the study according to age groups was as follows; 30 days-6 months 630 (34.6%), 6-12 months 358 (19.7%), 1-3 years 152 (8.3%),3-6 years 54 (3%), 6-17 years 627 (34.4%). The mean age of the participants was 4.89 ± 2.08 years old (range: 50 days–17 years old). The average surgical duration was 7.48 ± 1.52 minutes (range: 5-20 min¬utes). The complication rates for the age groups of participants included in the study were as follows; 30 days-6 months 2 (0.3%), 6-12 months 17 (4.7%), 1-3 years 22 (14.4%), 3-6 years 10 (18.5%), 6-17 years 2 (0.3%) (**Figure 1**). Complications were observed in fifty-three participants or 2.9% of the whole dataset. The complications of participants were evaluated according to the modified Clavien-Dindo classification method (Table 1). Two (0.11%) of the participants had bleed¬ing from the suture line, which was classified as a pe-rioperative complication. The bleedings of them were stopped immediately via cauterization. Twenty-eight (1,54%) of the participants who underwent circumcision had post-operative early complications. Eight (0.44%) infections and twelve (0.66%) bleeding cases were classified as early postoperative early complications. The infection was treated with antibiotics and dressing.

Due to a ligated artery, a four-year-old participant had frenular artery bleeding on the first day after the circumcision and it was controlled after taking to the operating room. Five of all participants who developed circumcision bleeding were controlled by stitching under local anesthesia. The ages of them were 11,22 months, 3, 4, and 5.5 years old, respectively. Six of all participants had dorsal vein bleeding that was treated via vein ligation. The ages of them were 10,16,18,22 months, and 3, and 4 years old, respectively.

Seven (0.38%) of all patients evolved convulsions due to local anesthesia. The ages of them were 8, 9, 10, 10 months, and three of them were one year old, respectively. Four of these convulsions were as nystagmus form and 3 were as the tonic-clonic form. The reason

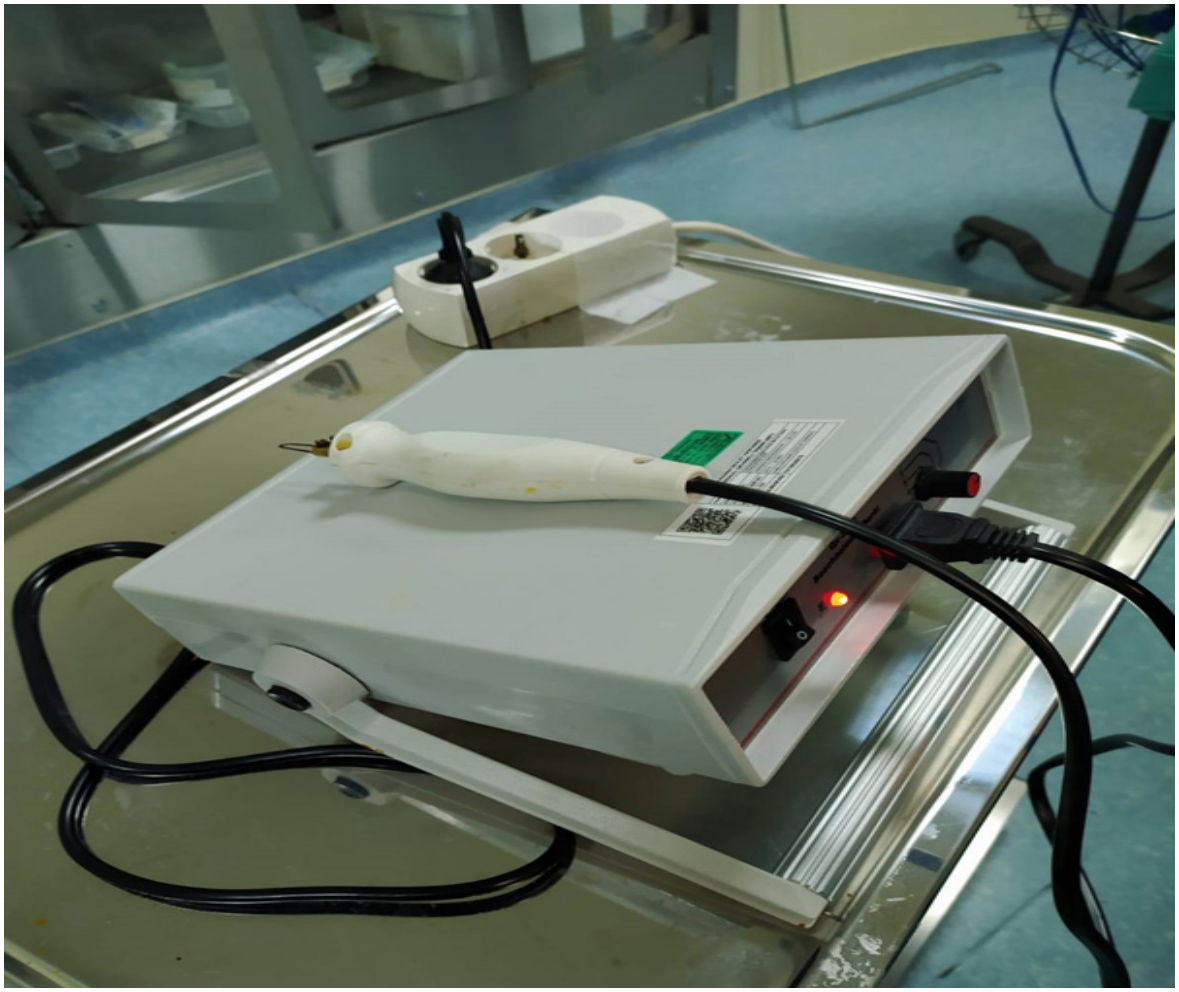

Figure 4. Thermocautery device

for the high number of convulsions under 1 year of age may be an allergy to bupivacaine. All convulsions were followed by rectal diazepam (0.5 mg/kg) for 24 hours. In one case (0.05 %) a 2.5-year-old participant could not urinate for the first 8 hours after local anesthesia, but this participant urinated spontaneously without a urinary catheter.

Twenty-three (1,26%) of the participants who underwent circumcision had late complications. The penises of two participants were trapped and they were surgically circumcised again. A total of five participants whose ages were 7,10,12,17,21 months during the circumcision required urethral dilatations after one month because of meatal stenosis. A one-year-old participant developed meatitis ten days after the circumcision, while a two-year-old participant had the same issue one month after the circumcision. Both children were medically treated.

Epidermal granüloma and inclusion cysts in the dorsal or ventral part of the penis were removed from the suture line with local anesthesia in 4 (0.22%) cases. The ages of these children were 4,9,14 months, and 2.5 years, respectively.

After circumcision, six of 7 (0.38%) cases were opened by simply retracting, while the skin bridge in one case was cut with a scalpel. Although we coagulated the vessels by holding them one by one, we saw ecchymotic changes in the skin in one case after circumcision, and lacerations due to a burn at the edge of the skin during the procedure in 3 cases. Finally, one participant had a glans-skin bridge complication six months after the circumcision, and he was treated surgically.

Secondary phimosis was detected in 4 (0.21%) of our cases and they were treated by circumcision revision. The ages of them were 10, 14 months, and 1.5, and 2 years, respectively.

Urethral injury and fistula occurred in a 4-year-old patient with an urethral ventral chord. About one year later, urethral fistula repair was performed under general anesthesia. Except for four participants, complications were only ob¬served in children older than six months and younger than six years old. The participants who were younger than six months or over 6 years of age had significantly lower complication rates when compared to the other patients, and this comparison was statistically significant (P = 0.001).

DISCUSSION

In this study, the age groups of participants were compared in terms of complications. It was also demonstrated that It can be presumed that circumcisions in males especially may be effective in 1-6 months, and over 6

years of age

Circumcision has been around for centuries. It is done as a routine for all newborn infant males in Muslim countries, reaching almost 100% (if no contraindications), in hospitals in Saudi Arabia. Circumcision continues to be done for a variety of religious, cultural, and medical reasons. The overall prevalence of circumcision in the United States is estimated to be about 80% for males, with most of these procedures performed in newborns[12].

A recent meta-analysis included 140 journal articles that came to the same conclusion; early infant male circumcision has immediate and lifelong benefits. It was shown to protect against urinary tract infections, phimosis, inflammatory skin conditions, candidiasis, various sexually transmitted diseases (STDs) in both sexes, genital ulcers, and penile, prostate, and cervical cancer [13].

Male circumcision has a low incidence of adverse events overall, especially if the procedure was performed during the first year of life[14]. The risk is further decreased and might be prevented, with careful consideration of the penile anatomy and the correct use of surgical equipment by trained clinicians in sterile environments. Although there are different studies of the vari¬ous circumcision methods in the literature, researchers are still debating the most convenient circumcision age and the safest circumcision method.

The applied tech¬nique should be practical, cheap, and safe, and it should induce very few or no complications. For this purpose, we compared the thermocautery-assisted method with the other circumcision methods in terms of the early and long-term complications. The early complications include bleeding, pain, inadequate skin removal, in¬fection, chordee, iatrogenic hypospadias, glanular ne¬crosis, and glanular amputation. The long-term com¬plications include epidermal inclusion cysts, suture sinus, penile adhesions, phimosis, urethrocutaneous fis¬tula, trapped penis, meatitis, and meatal stenosis[15-17]. In addition, hydronephrosis and permanent renal damage can be caused by meatal stenosis [18]. In our study, we didn't see hydronephrosis and permanent renal damage caused by meatal stenosis.

The thermocautery-assisted technique exploits the heat energy used for cauterizing. When compared with the monopolar cautery technique, which uses an electrical current, the thermocautery-assisted method carries the heat locally. According to the skin features of the pa¬tient, the heat levels are adjustable on the most recent¬ly developed thermocautery devices. Previous studies have shown that optimum hemostasis is achieved with a temperature ranging between 100°C and 400°C[19]. It has been shown that the thermocautery technique results in similar wound healing when com¬pared to the scalpel technique[20].

According to our observations, the circumcision line usually heals within 5 days before six months and 7 days after six months when using the thermo¬cautery technique. We observed that the wound heal¬ing was extended to 20 days in only two patients in our data set. Their ages are 8 and 10 years old during the circumcision. In addition to that knowledge, urinary retention was observed in one patient in our thermocautery-assisted circumcisions.

Saraçoglu et al. compared the thermocautery technique with conventional circumcisions in their prospective study. Hyperesthesia of the glans penis was observed in 12% of the patients with the thermocautery method and 10% of the patients with the surgical method[21]. This pa¬per provides a complete evaluation of the thermocau¬tery-assisted circumcision technique with respect to the short- and long-term complications. The patients in our dataset were followed up postoperatively for ten days, one month, and one year.

In a study carried out in England, 66519 circumcisions were reported, with a complication rate of 2%[22]. In the present study, similar to the literature, the most common early circumcision complication was found to be bleeding (0.77% of 1821 participants).

Hospital stay during the circumcision is short outpatient surgery and increases patient and parent satisfaction[23]. We applied local anesthesia to all our patients before circumcision. It was first reported in a study that lidocaine with epinephrine had a protective effect against bupivacaine toxicity and that it increased the asystole dura¬tion and improved hemodynamic parameters. Chiu et al. Added adrenaline to lidocaine and reported that its addition prolongs the duration of anesthesia[24]. In our cases, bupivacaine and lidocaine with epinephrine were given concurrently before the operation, and the most commonly observed problem was mucosal edema, which was seen in one-quarter of the patients. We believe that mucosal edema is a commonly observed but unheeded complication in thermocautery-assisted circumcision.

Ngcobo and colleagues[25] reported that 30% of the patients experienced penis swelling on the second day after surgery, which was a slightly higher rate than in our findings; however, the surgical procedure was not made clear.

Secondary phimosis can be seen due to fibrosis, which occurs especially after circumcision with cautery in which the electric current is not controlled[26]. Secondary phimosis was detected in 4 (0.21%) of our cases and they were treated with circumcision revision.

Urethral injuries often occur in circumcisions performed by people with limited experience and are due to urgent stitching due to bleeding during circumcision [26], and their treatment is in the form of primary urethral repair. In one case of our circumcision which had a urethral chordee was injured from the urethra (0.05%) during the operation and then we repaired the urethral fistula with general anesthesia over one year.

Frenulum injury was observed in 1.57% of patients but was resolved with treatment. Wound recovery, after thermocautery-assisted circumcision, is reported to occur in 1 week[27]. Similarly, we observed that healing started on the fourth day after the operation, and total recovery occurred in ten days. The ancillary technique leads to an increase of penis size, is safe and easy to perform, and does not increase significantly operative time or complication rate of the conventional procedure[28].

According to our observations, the circumcision line usually heals within 10 days under 6 months of age when using the thermocautery technique. We observed that the wound healing was extended overe three weeks in five patients in our data set, but their circumcision ages were over one year. This paper provides a complete evaluation of the thermocautery-assisted circumcision technique with respect to the short- and long-term complications. The patients in our dataset were followed up postoperatively for one month to one year.

Urethral injury and fistula occurred in a 4-year-old patient with a urethral ventral chordee. His urethral plate was very thin and weak, so a urethracutaneous fistula occurred. About one year later, urethral fistula repair was performed under general anesthesia. Prolongation of postoperative discharge time after general anesthesia often causes pain, nausea, and vomiting. No nausea and vomiting were observed in our cases. All our patients were discharged on the day of the operation. Adequate sedation, anxiolysis, and analgesia in circumcision cases a safe perioperative process should be planned.
Circumcision was not preferred for the first month because there may be additional problems such as neonatal jaundice and bleeding in newborns under 1 month. Since a newborn baby can establish a cause-effect relationship with the events around him at the 6th month and after birth, we recommend more circumcision with the thermocautery method after local anesthesia before the 6th month.

CONCLUSIONS

The main advantages of this technique can be that it is performed fairly quickly and allows for much more circumcision in all age groups of children in areas where the cost and availability of general anesthesia are prohibited.
Circumcision with thermocautery after local anesthesia is a viable, reliable, and effective method for circumcisions in males especially 1-6 months, and over 6 years of age. Parents choose this method because it is more appropriate and eliminates the risk of general anesthesia.

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All authors contributed to the study's conception and design. The study were performed material preparation (Mehmet Uysal), data collection (Mehmet Uysal) and analysis (Mehmet Uysal, Ahmet Şanlı). The first draft of the manuscript was written by (Mehmet Uysal) and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript. There is no financial and material support should mention for this study.

CONFLICT OF INTEREST

All authors have no conflicts of inrest to declare.
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