Original Article

Comparison of the Safety and Efficacy of Thermocautery-**Assisted Circumcision and Conventional Surgical Circumcision**

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ABSTRACT

Objective: The aim of our study was to compare the short- and long-term efficacy and safety of thermocautery-assisted circumcision and conventional surgical circumcision.

Methods: In our study, the data of patients who underwent conventional surgical circumcision (group 1) or thermocautery-assisted circumcision (group 2) were retrospectively analyzed. Patients between the ages of 2 months and 18 years were included in the study, and all circumcisions were performed with sedation and penile dorsal nerve block. Only patients who underwent circumcision were included in the study; patient age, operation time, and perioperative and postoperative complications were recorded.

Results: Of the 1425 patients included in the study, 737 were in group 1 and 688 were in group 2. The mean ages of the 2 groups were found to be similar. The mean operation time for patients in group 1 was 13.63 ± 0.08 minutes, while it was 5.86 ± 0.05 minutes for patients in group 2 (P < .0001). No statistically significant difference was observed between the groups in terms of early and late complications (P = .11).

Conclusion: Thermocautery-assisted circumcision is a practical circumcision method that can be safely applied with low complication rates and short operation times.

Keywords: Circumcision, complication, thermocautery

INTRODUCTION

Circumcision is a procedure involving the removal of sufficient amounts of the prepuce to expose the glans penis. Circumcision performed for religious reasons is one of the oldest and most common surgical procedures in the world.¹ The history of circumcision dates back approximately 6000 years.² Today, it is still one of the most common surgical procedures performed on men for religious, cultural, or medical reasons, and it is estimated that 1 in every 3 men in the world is circumcised.³ The definitive indications for circumcision are recurrent balanitis and pathological phimosis that does not respond to medical treatment.4

In some boys with congenital urinary anomalies, prophylactic circumcision is recommended in the treatment and follow-up process of these patients, as urinary

system infections are less common in circumcised children.⁵ Apart from religious and cultural reasons, the lower rates of penile cancer and sexually transmitted infections observed in circumcised men have led to an increasing demand for circumcision among men. Some studies conducted in the United States have shown that the rates of circumcision among newborn boys have exceeded 50%.6,7 For religious and cultural reasons, in some countries, nearly 100% of male children are circumcised. Especially in densely populated countries, circumcision surgery is performed on thousands of men every day using different techniques for religious and cultural reasons. The aim of different instruments and techniques is safe, fast, and effective surgery. Recently, thermocautery has been used in circumcision for these purposes, and its use is becoming increasingly widespread.^{8,9} The aim of this study is to compare the safety and effectiveness of

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conventional surgical circumcision and thermocauteryassisted circumcision.

MATERIAL AND METHODS

This study was planned in accordance with the Declaration of Helsinki. After obtaining approval from the Ethics Committee of Karabük University Non-Interventional Clinic Research Ethics Committee (approval no.: 2024/1858 date: 26.06.2024), the data of patients circumcised in the Urology Clinic between January 2018 and December 2023 were retrospectively analyzed. Before the procedure, written informed consent was obtained from the patient and his parents if possible, or only from the mother or father if not possible. Patients who were circumcised between 2 months and 18 years of age and came for follow-up on the 10th and 30th postoperative days were included in the study. Patients with anomalies such as undescended testis, hypospadias, and buried penis were excluded from the study. The operations were performed by 2 urologists experienced in circumcision. Each urologist applied only one method. The patients included in the study were divided into 2 groups: those who underwent conventional surgical circumcision and those who underwent thermocauter-assisted circumcision. All circumcisions were performed in the operating room under sterile conditions, with ketamine-propofol sedation and penile dorsal nerve block (bupivacaine in doses varying according to age and weight).

Surgical Technique

In conventional circumcision, after cleaning the surgical field with 10% povidone iodine, the level at which the prepuce would be cut was marked with a surgical pen. Then, the preputium was incised dorsally and the skin and mucosa were cut with scissors using the dorsal slit method. After bleeding was controlled with bipolar cautery, the skin and mucosa were sutured with 4/0 or 5/0 absorbable sutures depending on the patient's age. Then, the dressing was applied, the penis was wrapped, and the procedure was concluded.

In thermocautery (Thermo-Med QX 2100; Thermo Medical, Adana, Türkiye) (Figure 1) assisted circumcision, the prepuce was retracted after cleaning the surgical field to prevent glans injury. The preputium was held with 2 clamps placed obliquely at an angle of 15-20°, with the ventral side facing upwards. Thus, injuries to the glans and frenulum were avoided. Then, the prepuce was cut with thermocautery over the straight clamp in accordance with the guillotine technique (Figure 2). The settings of the thermocautery device were determined according to the age of the patient. About 500°C was used for patients under 2 years of age, 550-650°C for patients between 2 and 10 years of age, and 700-750°C for patients over 10



Figure 1. Thermocautery device.

years of age. The procedure was terminated after bleeding was controlled with thermocautery (Figure 3). The patients were discharged after being monitored in the hospital for 6 hours and prescribed analgesics.

Postoperative Follow-up

Perioperative and postoperative complications were recorded. Postoperative complications were divided into 2 periods: early and late. Early complications (first 10 postoperative days) were classified as bleeding, infection, and swelling. Late complications were determined as meatal stenosis, inadequate skin excision, skin bridge between the glans and the shaft of the penis, secondary phimosis, and urethral fistula. Patients were called for a check-up on the 10th day and 1 month after discharge. Patients with problems detected during control examinations were monitored at more frequent intervals according to their treatment needs. In order to monitor long-term



Figure 2. Surgical step in thermocautery-assisted circumcision.



Figure 3. After thermocautery-assisted circumcision.

complications, detailed information was given to patients and parents, and the follow-up period for some patients was extended.

Statistical Analysis

The data analysis was performed using Statistical Package for the Social Sciences (SPSS) for Windows version 23 (IBM SPSS Corp.; Armonk, NY, USA). The Shapiro-Wilk test, Kolmogorov-Smirnov test, histogram, and Q–Q plots were used to evaluate whether the variables showed normal distribution. In the comparison of continuous independent variables between the 2 groups, the Student's *t*-test and Mann–Whitney *U*-test were used, and in the comparison of categorical variables, the chi-square test was used.

RESULTS

Data from a total of 1602 patients who were circumcised between January 2018 and December 2023 were examined. Eighty-five patients were excluded due to not attending postoperative follow-up, 45 patients were excluded because circumcision was performed along with undescended testis surgery, 26 patients were excluded due to circumcision following hypospadias repair, 16 patients were excluded because they were over 18 years old, and 5 patients were excluded because they underwent circumcision revision. A total of 1425 patients included in the study were divided into 2 groups according to circumcision technique. Seven hundred thirty-seven patients underwent conventional surgical circumcision (group 1) and 688 patients underwent thermocautery-assisted circumcision (group 2). While the mean age of patients in group 1 was 9.12 ± 0.13 , the mean age of patients in group 2 was 8.72 ± 0.15, and no statistically significant difference was observed between the groups (P=.12). The mean operative time of group 1 was 13.63 ± 0.08 minutes (min-max, 8-21 minutes), and the mean operative time of group 2 was 5.86 ± 0.05 minutes (min-max, 3-15 minutes). The mean operation time was observed to be statistically significantly shorter in group 2 (P < .0001). The mean hospital stay of the patients was 6 ± 2 hours.

Bleeding was observed in 8 patients in groups 1 and 2 patients in group 2 before discharge from the hospital, and the bleeding was stopped with primary suturing. In group 1, bleeding was observed in 1 patient after the dressing was removed on the first postoperative day and the penis was re-wrapped. The dressing was removed in the hospital 1 day later and no bleeding was observed. A total of 3 patients with postoperative wound infection were treated with oral antibiotics. In the late period, secondary phimosis was observed in 1 patient in each group. The patient in group 1 underwent circumcision under general anesthesia, while the patient in group 2 was treated with topical steroids. No statistically significant difference was observed between the groups in terms of early and late complications. Complications for both groups are listed in Table 1.

DISCUSSION

Male circumcision is one of the most common surgeries in the world and also one of the oldest surgical procedures in the world.¹⁰ Although there are numerous complications associated with circumcision surgery, major complications are rare.¹¹ Although major complications such as glans amputation or necrosis are rarely observed, they can have devastating consequences. It may not always be possible to provide appropriate conditions for large numbers of circumcisions to be performed in a hurry, especially in countries with large populations where circumcision is performed for religious or cultural reasons.⁹ This situation

Table 1. Early and Late Complications of Conventional Circumcision and Thermocautery-Assisted Circumcision			
Complications	Group 1 (n = 737)	Group 2 (n = 688)	Р
Perioperative			
Bleeding	8	2	
Early postoperative (<10 days)			
Bleeding	1	0	
Infection	2	1	
Late postoperative (>10 days)			
Inadequate skin excision	1	2	
Glans skin bridge	1	0	
Secondary phimosis	1	1	
Total	14 (1.89%)	6 (0.87%)	.11

will naturally have a negative impact on complication rates. For this reason, circumcision must be performed under appropriate sterile conditions, by competent people, and with the appropriate method. Although there are many studies in the literature on circumcision methods and complications, a consensus has not been reached on the safest circumcision method.¹²

Among the circumcision methods defined in the literature, the most preferred techniques are surgical methods such as Sleeve, Free Hand, and Guillotine techniques. In addition, Mogen clamp, Gomco clamp, and Plastibell device are also frequently used methods.13,14 A wide range of complications has been reported in the literature for circumcisions performed with these conventional methods, ranging from 0.1% to 35%.^{1,15,16} Mass circumcisions that are not performed under appropriate conditions and by competent hands in underdeveloped countries may also play a role in this difference in rates. In our study, consistent with the literature, the complication rate was 1.89% in conventional surgical circumcision and 0.87% in thermocautery-assisted circumcision. Although not statistically significant, it is noticeable that the complication rate is lower in thermocautery-assisted circumcision. The difference in complication rates between the 2 groups is largely due to the lower incidence of bleeding in thermocauteryassisted circumcision. Many studies in the literature show that the most common complication of circumcision is bleeding.^{2,9} Thermocautery devices cut the tissue while also cauterizing it with heat, which significantly reduces the amount of bleeding. In this respect, the use of thermocautery in circumcision seems advantageous. No major complications were observed in our study. Complication rates other than bleeding were similar in the 2 groups.

There are studies in the literature reporting that the operative time in thermocautery-assisted circumcision is shorter than in conventional surgical circumcision. In a study conducted by Tuncer et al.⁹ in 2017, the average surgery time for conventional circumcision was reported as approximately 14.38 minutes, while this time was reported as 5.02 minutes for thermocautery-assisted circumcision. In the current study, the procedure time in thermocautery-assisted circumcision was found to be shorter than the conventional method. Since there is less bleeding in thermocautery-assisted circumcision, the time spent on bleeding control is also very short. Especially in circumcisions performed under sedation, the short duration of the surgery will also reduce the dose of anesthetic agents used. This may provide an advantage to the patient for early discharge. Since bleeding is rarely seen in thermocautery-assisted circumcision, there is usually no need to apply a pressure dressing to the penis. This can relieve the family and the patient from the stress and fear of removing the pressure dressing.

On the other hand, contradictory results have been reported in the literature for monopolar cautery devices used for bleeding control. Since monopolar cautery transfers electrical energy directly to the tissue, penile tissue and nerve damage may result. It is safer to use bipolar cautery for bleeding control and tissue excision.¹⁷ Since thermocautery devices convert electrical energy into heat energy, there is no direct transfer of electricity to the tissue. Hemostasis is achieved while the prepuce is excised with the resulting heat effect. Studies in the literature support the idea that thermocautery-assisted circumcision is faster and safer than conventional surgical circumcision, while animal experiments have shown that wound healing is comparable to conventional techniques.^{18,19} In a study conducted on rats, it was observed that wound epithelialization was completed within 24 hours after the use of thermocautery. In the same study, it was reported that thermocautery was superior to the bipolar cautery group in terms of epithelialization and depth of injury.¹⁹ In another study, it was reported that secondary phimosis rates were higher than with other methods because dense scar tissue could develop along the circumcision line cut with thermocautery.²⁰ In our study, one case of secondary phimosis was observed in both groups.

There are also some limitations to our study. First of all, the retrospective nature of our study was our most important limitation. Secondly, patients were called for a follow-up visit after 1 year to see the long-term results, but since most of the patients did not come for a follow-up visit, we did not have any data on the long-term results.

In conclusion, thermocautery-assisted circumcision can be performed safely with low complication rates. It can be preferred as an easily applicable and practical circumcision method because the procedure time is significantly short, and the wound healing is also rapid.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethical committee approval was received from the Ethics Committee of Karabük University Non-Interventional Clinic Research Ethics Committee (approval no.: 2024/1858 date: 26.06.2024).

Informed Consent: Written informed consent was obtained from the patients and parents of the patients who agreed to take part in the study.

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REFERENCES

- Shabanzadeh DM, Clausen S, Maigaard K, Fode M. Male circumcision complications -a systematic review, meta-analysis and meta-regression. *Urology*. 2021;152:25-34. [CrossRef]
- Cakiroglu B, Gozukucuk A, Arda E, Tas T. Reliability of thermocautery-assisted circumcision: retrospective analysis of circumcision performed voluntarily in countries of low socioeconomic status. *Ther Adv Urol.* 2019;11: 1756287219882598. [CrossRef]
- Uysal M, Şanlı A. Circumcision with thermocautery after local anesthesia in males: a retrospective single-center study with 1821 patients. Urol J. 2022;19(3):221-227. [CrossRef]
- Hayashi Y, Kojima Y, Mizuno K, Kohri K. Prepuce: phimosis, paraphimosis, and circumcision. *ScientificWorldJournal*. 2011;11:289-301. [CrossRef]
- Matar L, Zhu J, Chen RT, Gust DA. Medical risks and benefits of newborn male circumcision in the United States: physician perspectives. *J Int Assoc Provid Aids Care*. 2015;14(1):33-39. [CrossRef]
- Robinson JD, Ortega G, Carrol JA, et al. Circumcision in the United States: where are we? J Natl Med Assoc. 2012;104(9-10):455-458. [CrossRef]
- Torosian T, Quint JJ, Klausner JD. Decline in frequency of newborn male circumcision after change in Medicaid coverage status in selected states in the United States. *Public Health Rep.* 2021;136(3):338-344. [CrossRef]
- Tuncer AA, Değer M. Incidence of complications following thermocautery-assisted circumcisions. Urol J. 2018;15(6): 359-364. [CrossRef]

- Tuncer AA, Erten EEA. Examination of short and long term complications of thermocautery, plastic clamping, and surgical circumcision techniques. *Pak J Med Sci.* 2017;33(6):1418-1423. [CrossRef]
- 10. Morris BJ, Wamai RG, Henebeng EB, et al. Estimation of country-specific and global prevalence of male circumcision. *Popul Health Metr.* 2016;14:4. [CrossRef]
- 11. Prabhakaran S, Ljuhar D, Coleman R, Nataraja RM. Circumcision in the paediatric patient: a review of indications, technique and complications. *J Paediatr Child Health*. 2018;54(12):1299-1307. [CrossRef]
- El Bcheraoui C, Zhang X, Cooper CS, Rose CE, Kilmarx PH, Chen RT. Rates of adverse events associated with male circumcision in U.S. medical settings, 2001 to 2010. JAMA Pediatr. 2014;168(7):625-634. [CrossRef]
- O'Sullivan DC, Heal MR, Powell CS. Circumcision: how do urologists do it? Br J Urol. 1996;78(2):265-270. [CrossRef]
- 14. Omole F, Smith W, Carter-Wicker K. Newborn circumcision techniques. *Am Fam Phys.* 2020;101(11):680-685.
- Pippi Salle JL, Jesus LE, Lorenzo AJ, et al. Glans amputation during routine neonatal circumcision: mechanism of injury and strategy for prevention. J Pediatr Urol. 2013;9(6 Pt A):763-768. [CrossRef]
- Okeke LI, Asinobi AA, Ikuerowo OS. Epidemiology of complications of male circumcision in Ibadan, Nigeria. BMC Urol. 2006;6:21. [CrossRef]
- 17. Uzun G, Ozdemir Y, Eroglu M, Mutluoglu M. Electrocautery-induced gangrene of the glans penis in a child following circumcision. *BMJ Case Rep.* 2012;2012:bcr-2012. [CrossRef]
- Lane JE, O'brien EM, Kent DE. Optimization of thermocautery in excisional dermatologic surgery. *Dermatol Surg.* 2006;32(5):669-675. [CrossRef]
- 19. Tuncer AA, Bozkurt MF, Bayraktaroğlu A, et al. Examination of histopathological changes of scalpel, monopolar, bipolar, and thermocautery applications in rat experimental circumcision model. *Am J Transl Res.* 2017;9(5): 2306-2313.
- 20. Akyüz O, Tatar Z. Is it safe to use a thermocautery device for circumcision? Examination of the histopathological changes emerging after thermocautery-assisted circumcisions. Andrologia. 2021;53(3):e13968. [CrossRef]