
Running Title: Clinical effects of modified circumcision

A Comparative Study on the Clinical Efficacy of Modified Circumcision and Two Other Types of Circumcision

Quanxin Su^{1,2}, Shenglin Gao¹, Jiasheng Chen¹, Lu Chao, Mao Weijiang, Wu Xingyu, Lifeng Zhang*, Li Zuo*

¹Department of Urology, The Afliated Changzhou No. 2 People's Hospital of Nanjing Medical University, Changzhou 213003, Jiangsu, China

² Dalian Medical University, Dalian, Liaoning, China

¹These authors are Co-first authors.

***Corresponding Author:**

Lifeng Zhang, Department of Urology, The Afliated Changzhou No. 2 People's Hospital of Nanjing Medical University, Changzhou 213003, Jiangsu, China

E-mail: nj-likky@163.com

PHONE:+86 519 88123501

Li Zuo, Department of Urology, The Afliated Changzhou No. 2 People's Hospital of Nanjing Medical University, Changzhou 213003, Jiangsu, China

PHONE:+86 519 88123501

E-mail: zuoli1978@hotmail.com

Abstract

Purpose: To compare the clinical effects of three methods of circumcision: modified circumcision, traditional circumcision, and disposable suturing device circumcision.

Materials and Methods: Male patients (n = 241) with redundant prepuce and/or phimosis were included in a clinical trial from January 2019 to March 2020. Patients were divided into 3 groups based on the surgical method: group A, traditional circumcision (n = 79); group B, modified circumcision (n = 80); and group C, disposable suturing device circumcision (n = 82).

Results: The operation times in groups A, B, and C were 25.2 ± 3.3 min, 10.2 ± 2.7 min, and 6.7 ± 1.4 min, respectively. The volumes of intraoperative blood loss in groups A, B, and C were 12.7 ± 2.3 mL,

8.1 ± 3.4 mL, and 2.2 ± 0.8 mL, respectively ($P < 0.05$). Groups A and B were superior to group C in terms of the 6-h postoperative visual analog scale score and appearance satisfaction ($P < 0.05$). There were no obvious differences in the 7-day postoperative pain score and total healing time ($P > 0.05$). The operating expenses in groups A and B were lower than that in group C ($P < 0.05$).

Conclusion: Modified circumcision, with its advantages of shorter operation time, less blood loss and pain, lower cost, and better postoperative penile appearance, is easily accepted by patients and deserves wide clinical application.

Keywords: redundant prepuce, phimosis, disposable circumcision suture devices, postoperative complications.

Introduction

Redundant prepuce and phimosis are common male external genital diseases, and circumcision is the first-choice therapy for such diseases.(1) Due to the long operation duration, great intraoperative blood loss, and prolonged postoperative healing course, traditional circumcision has lower acceptance in patients. In recent years, disposable circumcision sutures with the advantages of incisions with favorable appearance, less bleeding, and short operation time have been widely used, gradually replacing traditional circumcision.(2) However, with their popularity in the clinic, some problems have also been identified. Herein, we aimed to examine the operation time, intraoperative blood loss, postoperative complications, complete healing time of the incision, and surgical satisfaction in order to evaluate the surgical outcomes of three different types of male circumcision.

Materials and Methods

Study Population

The data was collected from January 2019 to March 2020. Three different types of circumcision were conducted in adult patients with redundant prepuce or phimosis in our department, where the choice of surgical method followed patient's preference. A total of 241 patients were enrolled in the study and all patients enrolled have completed follow-up record. In accordance with the different surgical methods, the patients were divided into the following groups: Group A (traditional circumcision, $n = 79$), Group B (modified circumcision, $n = 80$), and Group C (suturing device circumcision, $n = 82$). There were no significant differences between the three groups in terms of the indications for male circumcision ($P > 0.05$). The patient characteristics of the three groups are illustrated in Table 1.

The study was approved by the ethics committee of our hospital, and every participant provided written

informed consent. The study excluded patients with foreskin balanitis, glans or prepuce tumors, abnormal penis development, occult penis, diabetic complications, or abnormal hematological examination results. The postoperative routine follow-up lasted 3 months.

Surgical Procedures

Three groups of patients underwent the same preoperative preparation: supine position, routine preparation of the skin, routine field disinfection with povidone iodine, and spreading of a towel, with 2% lidocaine block anesthesia of the penile dorsal nerve which children used 10mL and adults used 15-20mL based on height and weight. All patients were wrapped around the cutting edge with Vaseline-coated gauze after the surgery, and the outer layer was properly pressurized and bandaged using elastic bandages. Patients with high risk of thrombus were treated with nadroparin calcium (QD) . The gauze was removed 3 days after the surgery and medicine was changed once every 2 days.

Group A

First, the foreskin inner and outer plates were lifted using artery forceps at the 3 and 9 o' clock positions, resulting in perpendicular positioning of the penis. Second, between the two artery forceps, at the 12 o' clock position, dissection scissors were used to make an incision (the dorsal slit) extending up to but not beyond the coronary sulcus. Redundant foreskin was then removed symmetrically on both sides. Third, the bleeding vessels were then tied off using sutures, and the skin edges were approximated using sutures beginning at the frenulum.

Group B

First, the foreskin inner and outer plates were lifted using artery forceps at the 6 and 12 o' clock positions, resulting in perpendicular positioning of the penis. Second, the redundant foreskin was clamped using long straight forceps carefully, while the long axis of the forceps extended from the 6 o' clock to the 12 o' clock position. The 6 o'clock position was slightly higher than the 12 o' clock position. Third, the redundant foreskin was excised with the outer aspect of the forceps using a scalpel. The inner plate length was then trimmed appropriately. Fourth, the bleeding vessels were then tied off using sutures, and the skin edges were approximated using sutures beginning at the frenulum. (Step Reference Figure 1)

Group C

First, an appropriate circumcision suture device was selected according to the penis circumference (used TONCARE circumcision suture devices).(Figure2) Second, the prepuce was clamped using 2–3 artery forceps and lifted to place the glans receiver socket on the glans. The redundant prepuce was then fixed

to the bell pole using the tie. Third, the bell pole was inserted into the center of the housing carefully. The adjustment knob was installed and tightened clockwise to align the end of the bell pole with the top of the adjustment knob. After removing the safety catch, the handles were grasped to excise the redundant prepuce. Fourth, the entire bell stand was detached, followed by pressure bandaging of the surgical wound.

Evaluations

In order to evaluate the clinical outcomes, we measured and recorded various intraoperative and postoperative parameters, including the ① operation duration (the time spent from the onset of anesthesia to the end of surgery), ② blood loss during the operation (calculated by 5 cm×5 cm gauze pads that could absorb 5 mL of blood), ③ postoperative pain scores [calculated using the internationally recognized visual analogue scale (VAS) score], ④ postoperative complications assessment (including postoperative edema, bleeding, infection, and other surgical complications), ⑤ wound healing period (the time from the day of the surgery to the day of complete wound healing), ⑥ operating expenses, ⑦ appearance satisfaction (follow-up of patients 1 month after the surgery, including incision healing, cutting edge neatness, residual foreskin symmetry, and appropriate frenulum length; the patient satisfaction was reported as "satisfactory" and "dissatisfactory"), and ⑧ sexual function (follow-up of patients 3 months after the surgery).

Statistical Analysis

SPSS 22.0 statistical software was used to process the data. Measurement data are presented as means±standard deviations (range: minimum–maximum). One-way analysis of variance was conducted to compare the differences in the mean among the 3 groups, q test was used for pairwise comparisons between groups, and the X² test was used for the comparison of rates. *P*-values < 0.05 were accepted as statistically significant.

Results

1. Operation time, volume of intraoperative blood loss, and operating expenses

The operation time and volume of blood loss in groups B and C were significantly lower than those in group A (*P* < 0.05). The costs of the operation were similar between groups A and B, which were significantly lower than that in group C (*P* < 0.05) (Table 2).

2. Postoperative pain score and total healing time

The 6-h postoperative pain scores in groups B and C were lower than that in group A (*P* < 0.05). There

were no significant differences in the 7-day postoperative pain scores and total healing times among all three groups ($P > 0.05$) (Table 2).

3. Postoperative complications

Complications occurred in 39 of 241 patients, with an incidence rate of 16.1%. The complication rates in groups B and C were lower than that in group A ($P < 0.05$), with no significant difference between groups B and C ($P > 0.05$). Compared to those in the other two groups, the incidence of edema in group C was lower, but the incidence of hematoma was higher ($P < 0.05$) (Table 2).

4. Appearance satisfaction and erectile function

The appearance satisfaction in groups B and C were higher than those in group A ($P < 0.05$), with no significant difference between groups B and C ($P > 0.05$). In terms of the impact on sexual and erectile function, four patients reported that their sexual function improved, with no significant difference among the three groups ($P > 0.05$) (Table 3).

Discussion

Phimosis and redundant prepuce are common diseases of the male external genitalia. With many complications, male health is severely affected, and circumcision is the most effective treatment for these diseases. Studies have shown that circumcision reduces the incidences of urinary tract infections and penile cancer. (3,4) Moreover, circumcision significantly reduces the spread of human immunodeficiency virus, human papillomavirus, herpes simplex virus, and other sex-related diseases. (5-8) While reducing the risk of gynecologic inflammation in these patients' sexual partners, circumcision has also become an important component of global health intervention strategies.(9,10) Other studies have shown that circumcision can improve male sexual function and prolong sexual life. (11)

Circumcision has greatly reduced the incidence of prepuce glans and penile tumors, and its surgical method is constantly improving. Although traditional circumcision is effective, its shortcomings are also obvious, such as the long operation time, bleeding, postoperative edema, obvious pain, and unsatisfactory postoperative appearance.(12,13) Although modern medicine has applied absorbable sutures to traditional circumcision and electrosurgical hemostasis on bleeding points during the operation, which has reduced the ligation of bleeding points and the fear caused by stitching removal. Traditional circumcision is still feared by many patients.

In recent years, the appearance of circumcision sutures has significantly improved these problems. Circumcision suture devices are a novel type of instrument for redundant prepuce cutting and

anastomosis. The principle is similar to that of stomach tubes and intestinal staplers. The two steps of incision and suturing are completed simultaneously in an instant, which significantly simplifies the procedure. In this study, patients who used disposable circumcision staplers had short operative time, less bleeding, less postoperative pain, and high profile satisfaction, which is consistent with previous studies. (14,15)

However, with the popularity of its clinical application, suturing also exposes some problems, such as greater hematoma after the surgery, shorter frenulum, and greater operating expenses. This study also confirmed these problems. The reason may be that there is a gap between the suture nails; if the blood vessels are not stapled or nailed off, bleeding or even hematoma may occur. Meanwhile, a surgeon cannot directly assess the excision site of the foreskin inner plate during the surgery, resulting in a significantly increased risk of an excessively short postoperative frenulum.(16,17) In addition, we also found some other problems in the process of research. ①Disposable suture device is not suitable for patients with severe adhesion of prepuce and penis and difficult to put clock seat. ②Patients with severe phimosis need to cut the prepuce from the center of the back of the penis to a suitable position until it can be put into the bell seat before applying the ring cutter, which undoubtedly increases the risk of intraoperative bleeding. ③For some children, there is no suitable disposable suture device size for them.

In this study, the position of the coronal sulcus was determined in the modified circumcision, which can accurately control the length of the frenulum from the coronary sulcus, and avoid the frenulum being too long or too short after circumcision. Moreover, it can keep the uniform distance from the coronal sulcus, cut the redundant prepuce, keep the incision edge neat, and have high satisfaction with the appearance after operation. At the same time, we pruned the redundant inner plate after cutting the redundant prepuce to avoid the problem of redundant prepuce in patients with phimosis. Compared with the traditional operation group, the modified operation group had less postoperative complications. The rate of postoperative edema in modified group was lower than that in the traditional group. The reason is that we have further trimmed the redundant inner plates on the basis of traditional operation. Although there is no significant advantage in postoperative edema compared with the disposable circumcision suture devices group, the postoperative edema in modified group was mild swelling and could gradually subside within only 4-5 days. The study shows that Diosmin and maizhiling have certain curative effect on edema after prepuce operation. (18)The operation cost of the modified group was significantly lower than that of the stapler group. Meanwhile, the modified operation is suitable for patients including

phimosis and children.

In addition, penis is a sexual organ, so it is very important to pay attention to the changes of sexual function after operation. At present, there are few studies focusing on the changes of sexual function after prepuce. Some studies suggest that circumcision can reduce the risk of premature ejaculation in men. (19) In this study, all three groups had patients complained that the ejaculation latency was longer than before, suggesting that their sexual ability was improved after operation. However, the follow-up data of patients obtained in this study are less and a larger sample study is needed in the follow-up.

Conclusion

In conclusion, our observations and discoveries suggest that all 3 types of surgical methods have their own features. Strikingly, in contrast to the other two circumcision methods, we found that modified circumcision preserves the advantages of the suture and overcomes the drawbacks of the traditional procedure. With a low cost of surgery, a similar treatment effect to that of circumcision sutures can be achieved. Together, novel improved circumcision is beneficial to promote in primary hospitals and economically underdeveloped areas, which has significant clinical application value.

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Conflict of interest

The authors declare no conflict of interest.

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Table1.General information about the three groups.

Variables	A (n = 79)	B (n = 80)	C (n = 82)	P-value
Age (yr)	26.8 ± 5.3	26.7 ± 6.1	26.5 ± 6.0	> 0.05
mean±SD(range)	(5 - 65)	(5 - 68)	(6 - 67)	
Redundant prepuce	55	56	49	> 0.05
Phimosis	24	24	33	> 0.05

Group A: traditional circumcision, Group B: modified circumcision, Group C: suturing device circumcision.

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Table 2. Comparison of observation indexes of the three groups

Variables	A (n = 79)	B (n = 80)	C (n = 82)	P-value
Operation time; min	25.2 ± 3.3	10.2 ± 2.7*	6.7 ± 1.4* [△]	< 0.001
Intraop blood loss; mL	12.7 ± 2.3	8.1 ± 3.4*	2.2 ± 0.8* [△]	< 0.05
Operating expenses; yuan	743 ± 83	739 ± 77	1590 ± 170* [△]	< 0.001
6h pain; score	6.5 ± 1.3	3.9 ± 1.4*	3.9 ± 1.1* [△]	< 0.05
7d pain; score	3.3 ± 1.5	3.1 ± 1.3	2.9 ± 1.4	> 0.05
Total healing time; day	13.5 ± 3.7	13.2 ± 2.2	12.7 ± 2.2	> 0.05
Edema	16(20.3)	9(11.3)	3(3.7)* [△]	< 0.05
Infection	3(3.8)	0(0)	1(1.2)	> 0.05
Hematoma	1(1.3)	1(1.3)	5(6.1)* [△]	< 0.05

Compared to Group A, * $P < 0.05$; Compared to Group B, [△] $P < 0.05$

Group A: traditional circumcision, Group B: modified circumcision, Group C: suturing device circumcision.

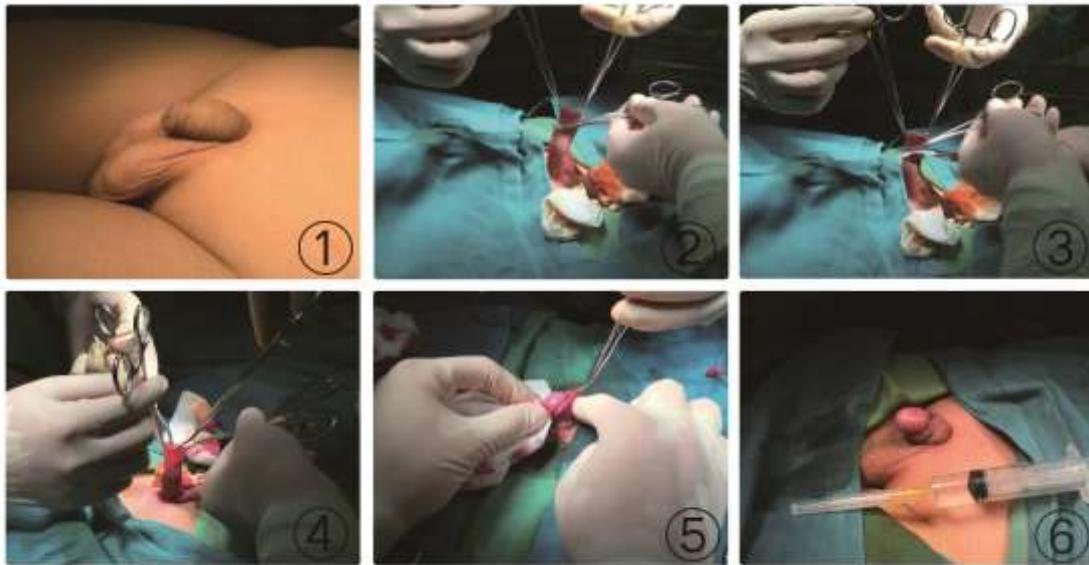
Table3. Comparison of appearance satisfaction and sexual function among the three groups

Variables	A (n = 79)	B (n = 80)	C (n = 82)	P-value
Appearance;satisfaction/dissatisfaction; n	63/16	75/5*	77/5*	< 0.05
Sexual function impact; n	1	1	2	> 0.05

Compared to Group A, * $P < 0.05$

Group A: traditional circumcision, Group B: modified circumcision, Group C: suturing device circumcision.

Figure1. Surgical procedures for modified circumcision.



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Figure2. TONCARE circumcision suture devices.



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