

Efficacy of three types of circumcision for children in the treatment of phimosis

A retrospective study

Dongsheng Zhu, MD^{a,*} , Hongqi Zhu, MD^a

Abstract

Phimosis is a common condition of the urinary system in children and often requires surgical treatment. However, the optimal method of circumcision for children has not been determined. Herein, we analyzed the efficacy of 3 circumcision methods for children with phimosis. A retrospective analysis of 112 cases of pediatric phimosis after circumcision was conducted at our hospital. Among them, 36 cases were subjected to conventional operation (group A), 43 cases to ring circumcision (group B), and 33 cases to suturing device circumcision (group C). The duration of operation, amount of bleeding, pain, complications, healing time, and the satisfaction of the guardians were calculated. The operation time of group B and C was (6.26 ± 1.31) min and (7.67 ± 1.29) min, respectively, which was shorter than group A (27.42 ± 2.42) min ($P < .05$); besides, group A had the most blood loss volume, (9.67 ± 1.67) mL, and group B was the least (1.26 ± 0.44) mL ($P < .05$); group B had the strongest postoperative pain (4.05 ± 0.37), the longest pain time (6.84 ± 1.29) days, and the longest healing time (21.84 ± 4.23) days ($P < .05$). Postoperative complications were lowest in group C (11.11% vs 20.93% vs 6.06%), satisfaction of guardians was highest in group C (86.11% vs 85.27% vs 89.99%), but the difference was not statistically significant ($P > .05$). Three types of surgical procedures present with advantages and disadvantages. The conventional surgery led to longer operation time and more bleeding but did not require special medical equipment and was easy to carry out; ring surgery had the shortest operation time, the least bleeding, accompanied by the longest recovery time and pain duration; the complications of the suturing device were the least, the parents had the highest degree of satisfaction, however, it also needs a specific suturing device. Therefore, each type had its distinctive characteristics and may be flexibly selected based on their own conditions.

Keywords: circumcision, pediatric, phimosis

1. Introduction

Phimosis is a very common urinary system disease in children, and often requires surgical treatment. Left untreated, children can be plagued by dermatitis, retrograde urinary tract infections, lead to urinary tract strictures, and in severe cases even affect reproductive development.^[1] Phimosis has received increasing attention from parents following a gradual increase in parental attention to pediatric reproductive health as health awareness has increased. Currently, there is a large body of research on circumcision procedures in adults, but relatively little on circumcision in children, especially in children with phimosis. Our study is intended to compare the surgical efficacy and safety of conventional circumcision, ring circumcision and suturing device for the treatment of pediatric phimosis, and hope to provide some insight into the clinical treatment of pediatric phimosis.

2. Materials and Methods

2.1. Patients

After approval by the ethics committee of our hospital, the children who underwent circumcision in our outpatient surgery from October 2020 to October 2021 were retrospectively collected, including 112 children aged 6 to 12 years old with phimosis. According to the difference of surgical methods, they were divided into group A (conventional circumcision), group B (ring group), group C (suturing device), with 36 cases in group A, group B was 43 cases, and 33 individuals in group C. Inclusion criteria were as follows: diagnostic criteria: The foreskin tightens over the glans, and the glans cannot be properly exposed even with the aid of external force^[2]; the parents of the children aggressively requested the surgery and signed consent forms for the surgery. Exclusion criteria were as follows: unable

The authors have no funding and conflicts of interest to disclose.

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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How to cite this article: Zhu D, Zhu H. Efficacy of three types of circumcision for children in the treatment of phimosis: A retrospective study. *Medicine* 2022;101:48(e32198).

Received: 29 August 2022 / Received in final form: 15 November 2022 / Accepted: 15 November 2022

<http://dx.doi.org/10.1097/MD.00000000000032198>

to cooperate with local anesthesia; abnormal blood coagulation; with congenital abnormalities of the external genitalia, such as occult penis, hypospadias; serious local penile infection; does not meet the above inclusion criteria. All of the parents of the children signed an informed consent form before the study began.

2.2. Surgical procedures

The pre-surgery examination included routine blood test, blood clotting function, and blood transfusion-associated infection tests. If no contraindications were found, the patient was informed in detail of the 3 surgical modalities and possible complications and then chose which procedure to undergo and signed a surgical consent form. For the children in group B, a ring (Wuhu Shengda Medical Treatment Appliance Technology Co., Ltd., Wuhu City, Anhui Province, China), which is a disposable, single-use device, was used. For the children in group B, a one-time penile circumcision and suturing device (Jiangxi Yuanshenglang Medical Equipment Technology Co., Ltd. Yongfeng City, Jiangxi Province, China) was used. After skin preparation and draping, penile root nerve block anesthesia with 1% lidocaine was administered. We refer to the literature for the operational methods of the three groups, namely, group A^[3] (Fig. 1), group B^[4] (Fig. 2), and group C^[5] (Fig. 3), respectively. Oral antibiotics were given 3 days after surgery.

Ibuprofen was administered, if the pain was significant after surgery. In all groups, intraoperative and postoperative parameters were recorded, including time of surgery, blood loss during surgery, postoperative pain scores, wound healing time, complications and satisfaction. The intraoperative blood loss was calculated as a completely soaked 5 cm × 5 cm piece of gauze that indicated an average carrying capacity of 5 mL of blood.^[6] Pain scores were calculated using the internationally accepted Wong-Banker facial expression scale pain score method.^[7]

2.3. Statistical analysis

Analysis was performed using SPSS statistical software, version 22. Pearson's chi-square test, one-way ANOVA was used as appropriate, and results are presented as the means ± standard deviations. $P < .05$ was considered statistically significant in this study.

3. Results

After successful completion of all procedures, the patients were followed until the incisions had fully healed. The operation time was calculated to be 27.42 ± 2.42 min, 6.26 ± 1.31 min, and 7.67 ± 1.29 min ($P < .05$), while the blood loss was 9.67 ± 1.67 mL, 1.26 ± 0.44 mL, and 3.82 ± 1.40 mL, ($P < .05$) in group A, group

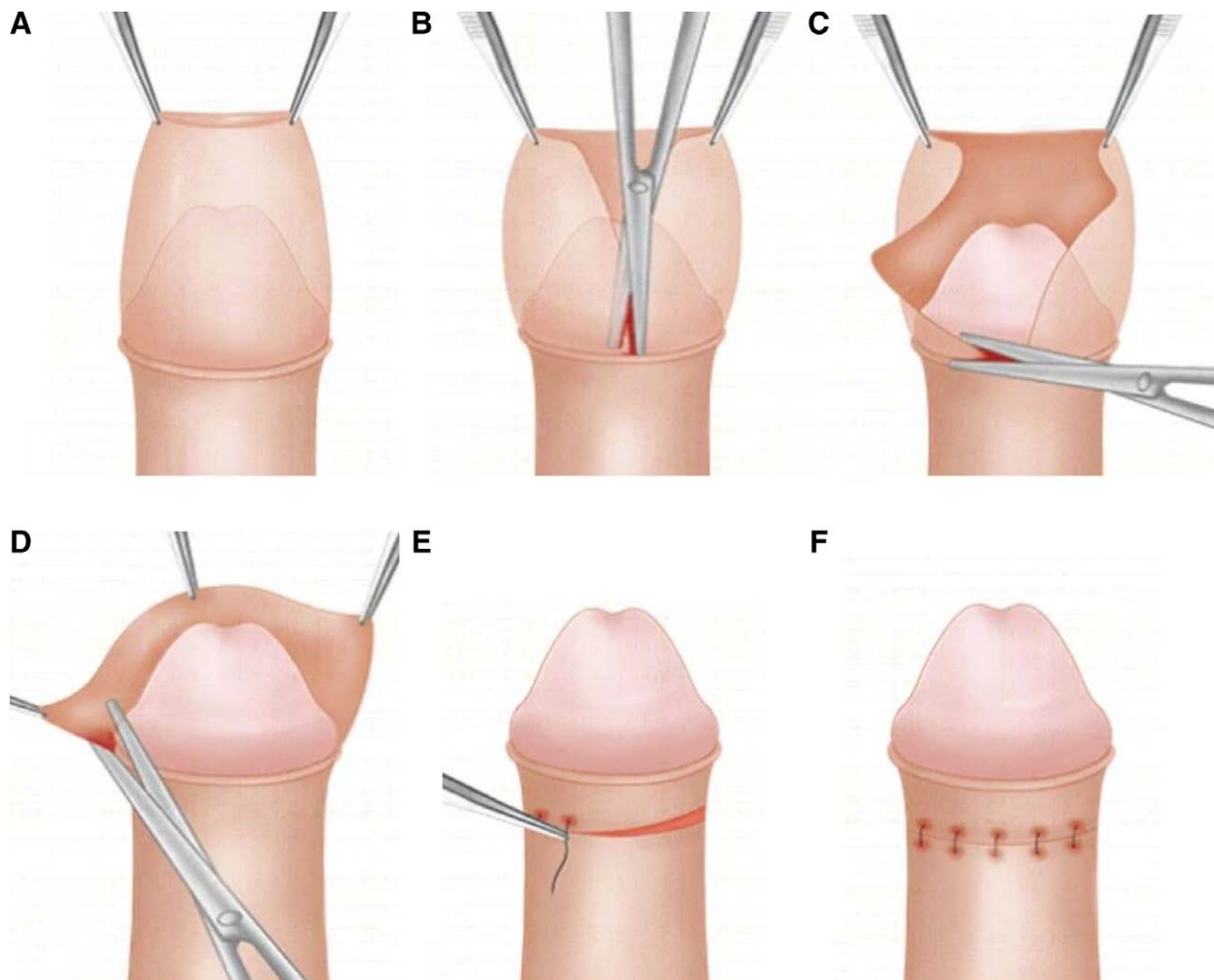


Figure 1. Conventional circumcision procedure. (A) Retract the foreskin, grasp the foreskin with 2 artery forceps; (B) make a dorsal incision; (C) a ring cut is made on the inner part of the foreskin 0.5 to 1 cm from the coronal sulcus; (D) dissection scissors to cut away the foreskin; (E) the skin edges are approximated using sutures; (F) the penis after circumcision.

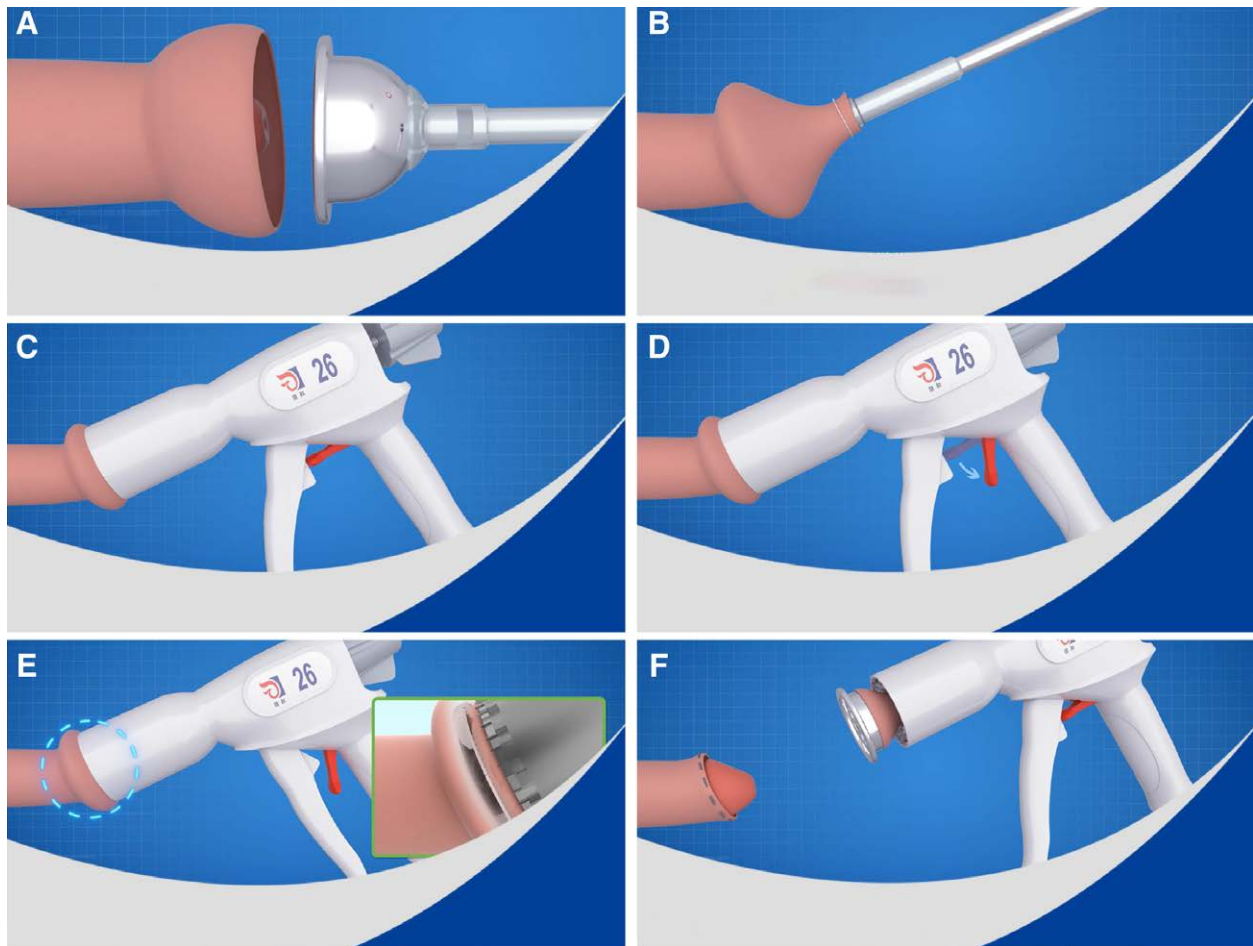


Figure 2. Surgical procedure of suturing device circumcision. (A) The glans receiver socket was wrapped by the foreskin; (B) the foreskin wrapped around the rod; (C) the rod was pushed down to trigger the circumcision device; (D) release the trigger safety device; (E) the excess foreskin was incised using the circumcision device; (F) the penis after circumcision.

B, and group C, respectively. In addition, the 24-h pain score, were determined to be 2.75 ± 0.55 , 4.05 ± 0.37 , and 2.64 ± 0.55 ($P < .05$) in group A, group B, and group C, respectively. The duration of pain was further analyzed to be 2.89 ± 0.58 d, 6.84 ± 1.29 d, and 2.97 ± 0.73 d ($P < .05$) in group A, group B, and group C, respectively. Healing time was additionally noted and revealed to be 12.39 ± 1.73 d, 21.84 ± 4.23 d, and 12.21 ± 2.21 d in group A, group B, and group C, respectively ($P < .05$) (Table 1).

In addition, surgical complications were observed and analyzed in children from all 3 groups. Postoperative edema was found in 10 cases, infection in 1 case, bleeding in 3 cases, and incision dehiscence in 1 case. It was important to note that after circumcision, edema was the most commonly diagnosed complication, and it was most commonly in group B. Postoperative bleeding was observed in a total of 3 cases, 2 in group A and 1 in group C. Only one case was found to be infected in group B, and no cases occurred in children in the remaining groups. Besides, only one individual, who was in group B, experienced incision dehiscence. However, there was no statistically significant difference between the three groups about total complications ($P > .05$) (Table 2).

Last, we assessed satisfaction with male circumcision after surgery in all groups. It was found satisfaction of guardians was 86.11%, 85.27%, and 89.99% in group A, group B, and group C, respectively. Although the total satisfaction was lowest in group B, the parents of the children had the highest levels of satisfaction with the surgical technique and the final appearance. The satisfaction rate for appearance was lowest in group A and

highest in group C. Total satisfaction was highest in group C. However, the difference between the three groups was not statistically significant ($P > .05$) (Table 3).

4. Discussion

Phimosis is one of the most common genital disorders in children, second only to redundant prepuce. One study, which included 2385 boys with a median age of 4 years, found that 21.5% of the children were accompanied by phimosis or redundant prepuce.^[8] While most physiological phimosis may be retractable by the age of 3, some children still require surgery.^[9] Circumcision is the oldest documented surgical procedure in human history.^[10,11] Although circumcision is known to be widely practiced in children, it remains a controversial practice in the pediatric age group and no gold standard technique has been described.^[12] Up to the present time, not only a wide variety of circumcisions have been practiced, but a variety of cutting instruments have also been introduced for children.

Because pediatric bodies are not mature, they have their own intrinsic characteristics: external genitalia are delicate; prepuce and glans often have adhesions; Sensitive to pain, not well tolerated; no good compliance during the operation. All of the above should be considered in preoperative preparation, intraoperative operation, and postoperative care.

The results of this study, from the perspective of operative time and blood loss: group A > group C > group B, the difference of the three groups was statistical significance ($P < .05$).

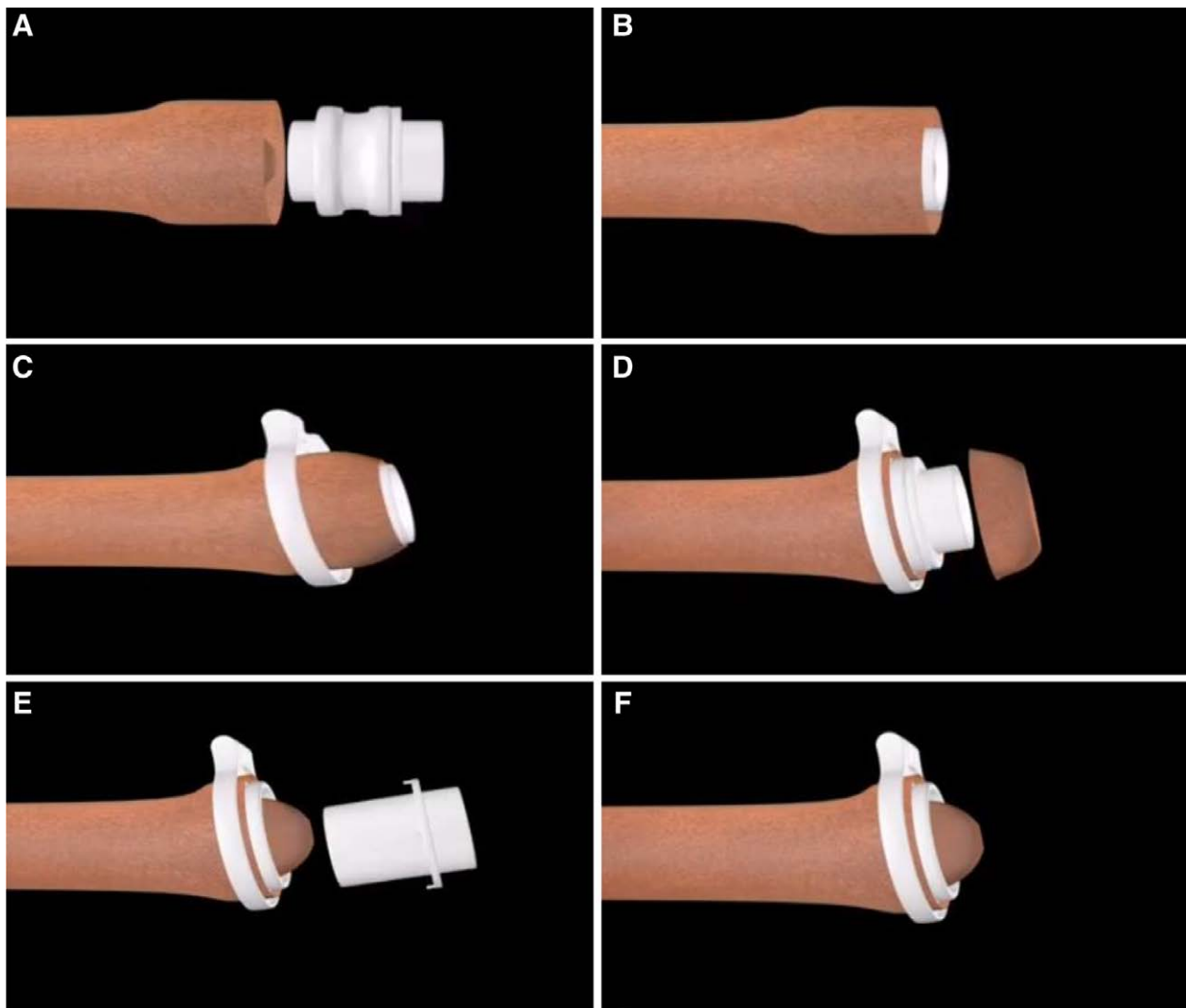


Figure 3. Surgical procedure of ring circumcision. (A) Expanded prepuce; (B) put an inner ring and a protector at the level of the coronal sulcus; (C) put on the outer ring, which is placed over the inner ring and locked; (D) redundant foreskin is removed by scissors. (E) Remove the protector; (F) the penis after circumcision.

Conventional circumcision, because of the absence of special cutting and suturing instruments, required manual labor by surgeons for procedures such as hemostasis and suturing. It was inevitable that the operation would be longer and the loss of blood more severe. This is also one of the concerns of parents of young children. Because of this, circumcision has continued to be improved, and new circumcision devices have continued to emerge, such as circumcision anastomoses and circumcision staplers, which can shorten the procedure and reduce the amount of bleeding, allowing children to have a good surgical experience.

In terms of pain and healing time: Group B > group A > group C, there were significant differences of the three groups ($P < .05$). However, the difference between group A and group C was not statistically significant ($P > .05$); it can be seen that the new circumcision equipment may also have drawbacks. However, we noticed, some literatures were not consistent in terms of pain scores and wound healing time.^[13,14] We analyzed controversial issues, which may be related to the following reasons: not to distinguish between phimosis or redundant prepuce; ignoring the age of the individual, the developmental status of the external genitalia varies due to the rapid growth and development of the

Table 1
Comparison of 3 pediatric circumcision observations ($\bar{x} \pm s$).

Characters	Group A (n = 36)	Group B (n = 43)	Group C (n = 33)	P value	P_{A-B} value	P_{A-C} value	P_{B-C} value
Operation time (min)	27.42 ± 2.42*	6.26 ± 1.31*	7.67 ± 1.29*	.000	.000	.000	.810
Blood loss (mL)	9.67 ± 1.67*	1.26 ± 0.44*	3.82 ± 1.40*	.000	.000	.000	.000
24 h pain score	2.75 ± 0.55	4.05 ± 0.37*	2.64 ± 0.55	.000	.000	.339	.000
Duration of pain (d)	2.89 ± 0.58	6.84 ± 1.29*	2.97 ± 0.73	.000	.000	.725	.000
Healing time (d)	12.39 ± 1.73	21.84 ± 4.23*	12.21 ± 2.21	.000	.000	.810	.000

PA-B = P values between groups A and B, PA-C = P values between groups A and C, PB-C = P values between groups B and C.
*Compared with other groups, $P < .05$.

Table 2**Complications of 3 types of circumcision in children.**

Characters	Group A (n = 36)	Group B (n = 43)	Group C (n = 33)	χ^2 value	P value
Total complications	4	9	2		
Infection	0	1	0		
Bleeding	2	0	1		
Edema	2	7	1		
Rupture of incision	0	1	0		
Total complication rate	11.11%	20.93%	6.06%	3.797	.147

Table 3**Satisfaction of 3 kinds of circumcision in children.**

Characters	Group A (n = 36)	Group B (n = 43)	Group C (n = 33)	χ^2 value	P value
Surgical experience					
Satisfied	29	42	31		
Unsatisfied	7	1	2		
Recovery experience					
Satisfied	33	28	28		
Unsatisfied	3	15	5		
Appearance					
Satisfied	30	40	30		
Unsatisfied	6	3	3		
Total satisfaction	86.11%	85.27%	89.99%	0.915	.633

child; different ages have different tolerances to pain, which can lead to bias in subjective pain scores; it was also related to the method of anesthesia used. In genitalia, edema is apt to occur under anesthesia of nerve blocks at the root of the penis, and in children under general anesthesia, there was no epidural edema after anesthesia. Edema can cause local changes in microcirculation that can affect healing time. After excluding the above bias, we found that group B had the strongest pain, the longest pain duration and the longest healing time ($P < .05$). We believed that this may be related to the following reasons: First, it may have something to do with the method of operation. Circumcision ring directly pressed against the inner and outer plates of the foreskin, causing ischemia, necrosis, and coagulation. During this period, the local inflammatory response was more intense and causes pain. Second, the size of the circumcision ring was fixed. When the penis was erect, there was no cushioning space, causing pain. Thirdly, the penis was in a hanging state, due to gravity, and the pain was caused directly by the pulling of the circumcision ring.

In terms of postoperative complications, the data showed 10 cases of edema, 3 cases of postoperative hemorrhage, infection, and incision dehiscence were observed in 1 case each, and the total complications were not statistically significant ($P > .05$). Complications were higher in group B than in the other 2 groups, with 10 cases of edema, 7 cases in group B, and infection and incision dehiscence in children also from group B. Reviewing other literatures, it was found that edema and infection were reported differently.^[13,14] Some scholars have proposed a no-flip technique to reduce edema^[15]; however, some researchers have argued that this had no effect on the occurrence of edema.^[16] Group C had the lowest complication rate, with only one case of postoperative hemorrhage and one case of edema, outperforming adult circumcision. The most common complication in adults was postoperative hemorrhage,^[13] which may be related to the asexual impulse in children and the low frequency of erections.

In terms of parental satisfaction, we divided it into 3 aspects: intraoperative satisfaction, postoperative recovery satisfaction,

and appearance satisfaction after complete healing. The total satisfaction levels for groups A, B and C were 86.11% versus 85.27% versus 89.99%, respectively. There was no statistical difference ($P > .05$). It can be seen that group C had the least complications and the highest satisfaction, while group A was the case of low intraoperative satisfaction and low satisfaction after healing, which was associated with longer operation times, more blood loss, the irregular cutting edges and a not-so-good appearance. The reasons for dissatisfaction in group B were as follows: the recovery process was long, the pain was intense and the postoperative edema was relatively severe; however, the incision edge was neat and beautiful after healing due to the fast operation speed. As a result, overall satisfaction was acceptable.

In the observation of the whole operation and postoperative recovery, together with the physiological characteristics of the child, we have some hints: Pediatric phimosis, the foreskin and glans often have adhesions and smegma, which, when separated, should be done gently, otherwise it is apt to cause bleeding and edema. The presence of smegma leads to an increased likelihood of postoperative infection, and the presence of edema during surgery is likely to result in irregular margin and poor postoperative appearance; when administering a local anesthetic, use a fine needle to prevent bleeding, and the needle must not be too deep to avoid damage to the urethra, and the injection speed and dosage should be reduced to prevent edema; it is best to use absorbable sutures to reduce the formation of subcutaneous induration after surgery, and no sutures need to be removed after surgery to reduce the pain in children; there is usually a great leakage of lymph and tissue fluid after the operation, which, when coagulated, will resemble a paste or gelatin, and even cause the adhesion of the urogenital meatus and the difficulty of micturition. We recommend no clean-up as long as there is no empyema and no urinary retention because it is apt to cause bleeding, and the secretions will soon reappear, which will increase the child's pain and fear; the child's pain can be alleviated by soaking the ring in sterile saline for 30 minutes before removing the ring, after which the knot softens and the ring can be removed easy; oral antibiotics can be used to prevent infection after the ring has been removed.

Our study has several limitations: including the retrospective observational design, the relatively small number of patients, single-center data, and lack of long-term follow-up. Although there were some shortcomings, we also had some experience and hope to provide some information for pediatric urologists.

5. Conclusion

Objectively, all 3 types of operations have their own advantages and disadvantages. Considering the operation time, blood loss, and recovery status, suturing device are recommended for surgical treatment of pediatric phimosis, although additional costs for suturing are required. From the point of view of poor compliance in pediatric surgery, circumcisions with a ring circumcision are also a good option due to their short operation time and good appearance after healing, but they require good care after surgery. Conventional circumcision, while more bleeding during the procedure and less good appearance, has fewer complications during recovery. It is also possible to reduce the amount of intraoperative blood loss and improve the appearance of the surgery as surgical skills and techniques improve. Therefore, it can be flexibly selected in clinical work.

Author contributions

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