Effects of Intraoperative Tourniquet Use on Recovery Following Circumcision: A Randomised Controlled Study

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Abstract

Objective

To evaluate the safety and efficacy of intraoperative tourniquets when performing a circumcision using a disposable circumcision stapler.

Methods

251 male patients; Mean age: 29.2 years, patients with excessively long prepuce and/or phimosis were enrolled in a randomized clinical trial between July 2019 and August 2020. Patients were divided into two groups: group A received Huitai annulus suture device (n = 111), and group B received Huitai annulus suture device with intraoperative tourniquet (n = 140). Operative time, intraoperative and postoperative pain, intraoperative and postoperative bleeding, postoperative complications, wound healing time, penis appearance and sexual satisfaction were measured.

Results

The intraoperative and postoperative bleeding in group A was more serious (4.432 ± 1.384 ml) than that in group B (1.879 ± 1.019 ml). In particular, 1 case in group A had incision fracture due to postoperative active bleeding and was returned to hospital for surgical suture to stop bleeding. Moreover, we found that the degree of swelling of the disposable circumcision suture device in group B was reduced after the tourniquet was applied (group A and group B: 18.41 ± 3.152 vs 16.69 ± 3.047), and there was no significant difference in postoperative pain score 7 days after surgery between group A and Group B: 3.054 ± 1.197 vs 2.993 ± 1.190, the postoperative infection rate was lower (group A and group B: 3.60% vs 1.43%), and there was no significant difference in sexual life between group A and group B: 0.8018 ± 0.4005 vs 0.8429 ± 0.3652).

Conclusion

There are differences in postoperative and intraoperative complications of tourniquet in disposable circumcision suture device. There was less risk of intraoperative bleeding, less risk of postoperative hematoma, earlier removal of nails, a more satisfactory appearance of recovery, and no significant difference in the risk of postoperative pain and post-operative infection. Transient ischemia after tourniquet had no effect on postoperative sexual life.

Introduction
Hyperprepuce and phimosis are common external genital diseases in men, and circumcision is the preferred treatment for these diseases \(^1\). Traditional circumcision is characterized by long operation time, much bleeding and postoperative swelling\(^2\text{–}^4\). Disposable circumcision suture device appeared in China in 2013 and has been widely used. Foreskin incision and suture machine adopts enterostapler cutting principle, can complete foreskin incision and suture simultaneously \(^5\).

At present, in our clinical practice, there are a variety of different disposable circumcision stapler, which are based on the cutting principle of enteric stapler. However, in surgical use, circumcision suture exists suture gap, and blood vessels are not stitched intermittently. Once bleeding, subcutaneous hematoma will be formed in a short time. This article will summarize the intraoperative and postoperative data of using tourniquet in circumcision suture device, and compare the difference of their therapeutic effects.

**Materials And Methods**

**Study population**

The data were collected from July 2019 to August 2020. Our department of prepuce is too long or phimosis patient surgery when the same brand, the same working principle of disposable prepuce suture device. This study was approved by the ethics Committee of our hospital and informed consent was signed with the patients before surgery. Routine follow-up was conducted for 2 months after surgery. Patients with postoperative complications were followed up to six months. Adult male patients with complete follow-up records were included. After we excluded four patients with prepuce condyloma acuminatum and other conditions, A total of 251 patients were included and divided into two groups according to different hemostatic methods during surgery (Group A was treated with Huitai cyclotomy suture device, group B was treated with Huitai cyclotomy suture device + intraoperative tourniquet). Results there were 111 cases in group A and 140 cases in group B. The data of enrolled patients are shown in Table 1. We found that the average age of group A was 30.07 ± 1.479 years, and that of group B was 28.59 ± 1.558 years. In group A, there were 65 cases of overlong foreskin and 46 cases of phimosis. In group B, there were 94 cases of overlong foreskin and 46 cases of phimosis. Counting comparison of any two groups of data showed that there was no statistical difference in each of these enrolled patients \(P > 0.05\).

<table>
<thead>
<tr>
<th>Group</th>
<th>The number of cases</th>
<th>Age (y)</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phimosis</td>
</tr>
<tr>
<td>Group A</td>
<td>111</td>
<td>30.07 ± 1.479</td>
<td>46</td>
</tr>
<tr>
<td>Group B</td>
<td>140</td>
<td>28.59 ± 1.558</td>
<td>46</td>
</tr>
</tbody>
</table>
Table 2
Comparison of clinical outcomes and complications between the two surgeries (X ± S).

<table>
<thead>
<tr>
<th></th>
<th>Group A (n = 111)</th>
<th>Group B (n = 140)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intraoperative</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operation time (seconds)</td>
<td>471.8 ± 77.24</td>
<td>473.7 ± 60.96</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Blood loss (ml)</td>
<td>4.432 ± 1.384</td>
<td>1.879 ± 1.019</td>
<td>&lt; 0.01</td>
</tr>
<tr>
<td>Pain within 24 hours after surgery (score)</td>
<td>3.054 ± 1.197</td>
<td>2.993 ± 1.190</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td><strong>Postoperative recovery</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short fiber complete shedding time (D)</td>
<td>20.67 ± 4.128</td>
<td>18.39 ± 3.598</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Incision edema time (D)</td>
<td>18.41 ± 3.152</td>
<td>16.69 ± 3.047</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Cases requiring manual removal of staples</td>
<td>7/111</td>
<td>4/140</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Incision dehiscence</td>
<td>1</td>
<td>0</td>
<td>&gt; 0.05</td>
</tr>
<tr>
<td>Postoperative incision infection cases, infection rate</td>
<td>4, 3.60%</td>
<td>2, 1.43%</td>
<td>&lt; 0.05</td>
</tr>
<tr>
<td>Sexual consistency</td>
<td>0.8018 ± 0.4005</td>
<td>0.8429 ± 0.3652</td>
<td>&gt; 0.05</td>
</tr>
</tbody>
</table>

Medical equipment

Foreskin stapler: from Huitai Medical Instrument (Zhejiang) Co., LTD. (Fig. 1).

*Surgical method*

1. Measure the glans with the built-in ruler and select the appropriate stapler;

2. Press the fine-tuning nut, the glans cap automatically falls off, and remove the nail bin protection cover;

3. after disinfection of local anesthesia with surgical forceps to support the foreskin, separation of the foreskin attached part, into the glans cap, so that the glans cap edge and coronal groove to keep parallel (if there is a narrow penis mouth, scissors can be used for sharp incision, and then lift the penis mouth, stapler on the glans);

4. The tie belt will fix the guard on the bell pole, forming a 45° Angle. The bell pole should be carefully inserted (or tied with its own rope to be cut foreskin), and imported into the stapler main body;
5. press the fine-tuning nut, hear the sound of "click", and then turn the fine-tuning nut clockwise to fix the foreskin to be cut. (Group B, tighten the tourniquet at the base of the penis);
6. the left hand hold the handle, the right hand turn the knob 3–4 times, from loose to tight hear the "kaka kaka" sound until it can not move, indicating that the nail has been bent;
7. Counterclockwise loosen the fine-tuning nut 3–4 times, press the fine-tuning nut, the glans cap automatically pops up, and the glans cutting place is separated from the stapler;
8. The incision was neat and disinfected. The wound was wrapped with sterile gauze and then bound with elastic bandage (6–8). After 2–4 weeks, the nail will be removed automatically.

Evaluation:

1. Operation time: refers to the time from the beginning of anesthesia to the end of the operation.
2. Pain score: The pain score was recorded on VAS with a range of 0–10 points, including intraoperative pain, pain within 24 hours after surgery and pain within 1 week after surgery.
3. Intraoperative swelling of prepuce
4. Blood loss: calculated by 5cm×5cm mesh, 5ml blood can be sucked.
5. Evaluation of postoperative complications: including postoperative infection, bleeding, incision dehiscence, secondary surgery and other surgical complications.
6. Wound healing period: the time from the day of surgery to the day of complete wound healing.
7. Appearance satisfaction: The postoperative prepuce of the patient was recorded during the reexamination in our department one month after surgery, including incision healing, incision tidiness, residual symmetry of prepuce, and penile erection limitation; Patient satisfaction was reported as "satisfied" and "dissatisfied".
8. Record the postoperative nail shedding and determine whether the patient needs to go to the hospital to remove the nail manually.

Statistical analysis

Prism 9.3.0 statistical software was used to process the data, and T test and χ² test were used to compare the calculated data Comparison of counting data showed that P < 0.05 was considered statistically significant.

Results

The intraoperative and postoperative results of the two groups were compared. The intraoperative blood loss in group A was higher than that in group B. In group A, 1 patient was returned to the hospital for surgical suturing and hemostasis due to incision cracking due to postoperative active bleeding. Group A had A longer postoperative time of nail flake shedding and A higher probability of going to hospital for nail flake removal. In addition, these patients had longer postoperative edema, greater postoperative pain, and a higher incidence of postoperative infection.
We currently use a routine disposable circumcision suture device in our medical center. Although such surgical instruments are based on the principle of enteric stapler, and can simultaneously complete the cutting and suturing of the foreskin, postoperative hematoma is relatively common. In group B, we used the method of ligating the tourniquet before cutting and suturing the lacing site after intraoperative cutting, and compared the effects of the two (Fig. 2A, B).

Compared with patients with foreskin stapler in group B, patients with foreskin stapler in group A had more significant intraoperative blood loss and higher risk of postoperative bleeding. Two of the 114 patients showed obvious exudation within 6 hours after operation, and all received the second surgical incision suture for hemostasis. By comparing these two different measures, we found that group B staplers, under the tourniquet, had slower bleeding at the cutting edge and better suture effect at the lacing. And it was this difference that led to the fact that the tourniquet in group B had more desirable intraoperative and postoperative compression hemostasis and significantly reduced the risk of intraoperative and postoperative bleeding.

We also found that patients in group B had a shorter postoperative recovery time. First, the size of postoperative hematoma in group B was significantly smaller than that in group A, and the degree of postoperative pain and postoperative infection rate were also significantly shorter than those in Group A. We believe the tourniquet method is beneficial for the above reasons. As mentioned above, the bleeding at the margin of group B was slower, which was beneficial to shorten the suture time at the frenulum. Therefore, it is easier to cause smooth wound surface. Under the action of elastic bandage, small blood vessels and wound surface are pressed to stop bleeding, thus reducing local edema and inflammation, especially in the foreskin frenulum site, which seems to be the most prone to edema. Edema can accelerate incarceration, causing local pain and even local inflammation (Fig. 3A-C).

Secondly, compared with group A, the nail shedding time of group B was shorter than that of group A, and the situation of manual nail shedding was less. We believe that the postoperative incision hematoma edema in group B is less than that in group A, and the incision edge healing is more ideal, which is conducive to nail shedding. We followed up the sexual life of the patients 2 months after the operation. The sexual life of the patients in group B was earlier, and there was no difference between the two groups in terms of sexual satisfaction.

**Discussion**

Surgical excision of the excess foreskin to expose the penis is currently the mainstream method for the treatment of long foreskin and phimosis, and excision of the excess foreskin can also reduce the risk of HIV infection (2,9-12).

Traditional surgical circumcision bleeding, need to suture knot, operation time is long, wound exposure for a long time increases the risk of infection, immature surgeons easy to lead to the edge of the resection is not regular, but in recent years, disposable circumcision suture device has been recognized and selected by more and more urologists.
Compared with the traditional surgery, disposable circumcision suture has shorter operation time, pain is small, the advantages of less blood loss, however, with the wide use of disposable ring cut suture machine, we found that there exist some problems in the operation process itself, such as intraoperative incision bleeding, postoperative bruises, hematoma, edema, infection, local incision dehiscence, nail delayed suture postoperatively, For those patients whose nails do not come off, they need to go to the hospital and have them removed manually. All this adds to the patient's suffering and mental stress (13-16).

Perioperative hemorrhage is the most common, and hematoma affects incision dressing during surgery, resulting in postoperative ecchymosis and clots. This is related to the fact that the gap between the suture nails leads to the broken end of the blood vessel being not blocked, or the suture nails puncture part of the blood vessel wall leading to incomplete closure of the blood vessel. Some studies have shown that about 6.79% of patients with postoperative bleeding need immediate suture for several stitches to stop bleeding. Previously, scholars found that the bleeding activity after circumcision with disposable circumcision suture device could reach 13.8%. Arteriole activity is common at the frenulum leading to more dynamic bleeding.

Through the investigation of postoperative adverse symptoms and causes of the two surgical methods, we concluded that the postoperative complications of disposable circumcision suture device after tourniquet treatment can reduce these adverse symptoms. For the circumcision stapler, intermittent reinforcement of the wound with absorbable sutures can be used after intraoperative foreskin anastomosis, and patients are required to reduce physical activity within 24 hours after surgery to reduce the risk of postoperative bleeding. Inform the patient of the duration of postoperative edema to relieve postoperative anxiety. However, if there is active bleeding within 6 hours after surgery and there is still obvious pain within 24 hours, you should go to the hospital in time.

**Conclusion**

In conclusion, suture circumcision is an aesthetic, time-saving and satisfactory surgical procedure. During surgery, especially before cutting, the simple use of elastic tourniquet at the root of the penis can more effectively reduce bleeding during surgery, prevent the occurrence of hematoma, and improve the safety of surgery, which is worthy of our promotion in clinical work.

**Declarations**

**Acknowledgments**

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**Footnote**

**Conflicts of Interest:** The authors have no other conflicts of interest to declare.
**Ethical Statement:** The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this case report and accompanying images.

**Authors’ contributions**

Junwen Shen contributed to the conception of the study; Meng Zhang and Huan Zhong collected information and followed up patients, Jianguo Gao performed the data analyses and wrote the manuscript. All authors read and approved the final manuscript.

**References**


Figures

Figure 1

Huitai disposable circumcision suture device.
Figure 2

Surgical results in group A and group B.

(A) A tourniquet was not applied at the root of the penis, and a frenulum hematoma appeared immediately after circumcision. (B) Tourniquet is applied at the base of the penis.
Figure 3

The recovery of after circumcision.

(A) Group B showed mild edema of prepuce inner plate after elastic bandage removal 3 days after surgery. (B) The prepuce inner plate edema increased in group B on the 10th day after surgery. (C) The wound healing of group B was good on the 30th day after surgery.