

A Comparative Study on the Efficacy of Four Types of Circumcision for Elderly Males with Redundant Prepuce

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Purpose: Circumcision is a common human urologic surgery performed in males with redundant prepuce to prevent the transmission and reduce the risk of urologic diseases. However, the optimal circumcision method for elderly men remains to be determined. Herein, the current study was conducted to characterize the efficacy of four different kinds of circumcision for elderly males with redundant prepuce.

Methods: This retrospective study included 132 elderly males diagnosed with redundant prepuce who underwent circumcision at the outpatient department. Among them, 38 cases were subjected to traditional surgery (Group A), 23 cases to sleeve circumcision (Group B), and 42 cases to Shang Ring circumcision (Group C) and 29 cases to suturing device circumcision (Group D). Subsequently, the operation time, loss of blood, postoperative pain, complications, wound healing, and the satisfaction were respectively compared and analyzed.

Results: The operation time of these 4 groups was calculated to be 27.3 ± 2.39 min, 30.4 ± 2.23 min, 6.3 ± 1.33 min, 7.6 ± 1.29 min, in Group A, Group B, Group C, Group D, respectively ($P < 0.05$). Besides, the loss of blood was 15.6 ± 2.84 mL, 11.8 ± 1.73 mL, 1.3 ± 0.44 mL, 3.7 ± 1.41 mL, respectively ($P < 0.05$). The elderly males who underwent Shang Ring circumcision exhibited the highest postoperative pain score, the longest pain duration, the longest healing time, the lowest recovery satisfaction rate and the highest operation experience satisfaction rate ($P < 0.05$).

Conclusion: Taken together, all four types of male circumcision present with advantages and drawbacks. The traditional male circumcision and sleeve circumcision led to longer operation time and more bleeding, but no additional medical equipment was needed. Meanwhile, the Shang Ring circumcision caused the shortest operation time and the least bleeding, accompanied by the longest pain duration and recovery time. Therefore, the application of sleeve circumcision or a suturing device was recommended for elderly males suffering from redundant prepuce.

Keywords: redundant prepuce; male circumcision; elderly; pain; complication.

INTRODUCTION

Redundant prepuce is one of the most common clinical disease in urology which affects normal penile development. Patients suffering from redundant prepuce often elect for operative treatment, and male circumcision is the most widely applied method globally.⁽¹⁾ Male circumcision also serves as risk-reduction for several diseases, such as urinary tract infections, pyelonephritis, penile cancer, cervical cancer in female partners, and some sexually transmitted diseases. Recent advancements have given rise to a plethora of male circumcision methods, such as the traditional male circumcision, sleeve circumcision, Shang Ring (SR) circumcision and suturing device circumcision. A significant proportion of males undergo circumcision, with prevalence reaching up to 30% worldwide. How-

ever, only 5% of the male populace in China have been circumcised, which is much lower compared to the rest of the world.⁽²⁾ These remarkably low male circumcision rates indirectly explain the extremely large number of elderly males suffering from redundant prepuce in China. The glans cannot be exposed naturally after urination in redundant prepuce, and the residual urine is caught between the prepuce and the glans, which results in the accumulation of smegma. If elderly males do not clean cautiously, smegma buildup may cause balanitis and retrograde urinary tract infections, sometimes leading to penile malignant tumors.⁽³⁾ With the gradual aging of society and improvements in health awareness, progressively increasing number of elderly males are undergoing circumcision in clinical scenarios. However, until recently, no study has compared the efficacy of male circumcision modalities in the elderly. Herein, the

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Table 1. Comparison and quantitation of four types of circumcision in elderly males.

Variables ^a	Group A (N = 38)	Group B (N = 23)	Group C (N = 42)	Group D (N = 29)	P-value
Operation time (minute)	27.32 ± 2.39	30.39 ± 2.23	6.26 ± 1.33	7.62 ± 1.29	.000
mean ± SD (range) ^b	(20 - 32)	(26 - 36)	(4 - 10)	(6 - 12)	
Loss of blood; mL	15.58 ± 2.84	11.78 ± 1.73	1.26 ± 0.44	3.72 ± 1.41	.000
mean ± SD (range) ^c	(12 - 26)	(9 - 15)	(1 - 2)	(2 - 8)	
24h pain; score	2.76 ± 0.54	2.70 ± 0.55	4.05 ± 0.38	2.66 ± 0.55	.000
mean ± SD (range) ^d	(1 - 4)	(2 - 4)	(3 - 5)	(1 - 3)	
7d pain; score	0.08 ± 0.27	0.17 ± 0.38	3.67 ± 0.65	0.14 ± 0.35	.000
mean ± SD (range) ^e	(0 - 1)	(0 - 1)	(1 - 4)	(0 - 1)	
Pain duration; day	2.95 ± 0.65	3.17 ± 0.78	6.83 ± 1.31	2.97 ± 0.73	.000
mean ± SD (range) ^f	(2 - 5)	(2 - 5)	(3 - 8)	(2 - 5)	
Healing time; day	12.42 ± 1.69	11.61 ± 1.44	21.90 ± 4.26	12.24 ± 2.31	.000
mean ± SD (range) ^g	(10 - 16)	(9 - 16)	(14 - 33)	(9 - 20)	

^a One-way analysis of variance (ANOVA) followed by LSD test as post hoc test

^b LSD post hoc test: PA-B = .000, PA-C = .000, PA-D = .000, PB-C = .000, PB-D = .000, PC-D = .003;

^c LSD post hoc test: PA-B = .000, PA-C = .000, PA-D = .000, PB-C = .000, PB-D = .000, PC-D = .000;

^d LSD post hoc test: PA-B = .611, PA-C = .000, PA-D = .384, PB-C = .000, PB-D = .773, PC-D = .000;

^e LSD post hoc test: PA-B = .434, PA-C = .000, PA-D = .602, PB-C = .000, PB-D = .779, PC-D = .000;

^f LSD post hoc test: PA-B = .365, PA-C = .000, PA-D = .938, PB-C = .000, PB-D = .430, PC-D = .000;

^g LSD post hoc test: PA-B = .284, PA-C = .000, PA-D = .429, PB-C = .000, PB-D = .799, PC-D = .000.

current study aims to examine the operation time, intraoperative blood loss, duration of postoperative pain, postoperative complications, complete healing time of the incision, and surgical satisfaction in order to evaluate the surgical outcomes of four different types of male circumcision, hoping to provide new insights for clinical urologists when offering circumcision to elderly males.

MATERIALS AND METHODS

Ethics statement

The current study was conducted under the approval of the Ethics Committee of the Second Hospital of Lianyungang. Signed consents were obtained from all participants.

Patients

A total of 132 elderly males with redundant prepuce undergoing circumcision at the outpatient department of the Second Hospital of Lianyungang I between December 2014 and December 2017 were recruited for the current study. All included subjects were older than 65 years, aged 65-82 years. In accordance with the different surgical methods, patients were divided into the following groups: Group A (traditional male circumcision, n = 38), Group B (sleeve circumcision, n = 23), Group C (SR circumcision, n = 42), and Group D (suturing device circumcision, n = 29). All included patients were diagnosed with redundant prepuce, accompanied by various degrees of foreskin balanitis. Among them, 13 patients suffered from diabetes and 6 patients presented with sexually transmitted diseases. The patients were recruited for the current study if they were at least 65 years old with a history of redundant prepuce, and were willing to participate in this study and sign the written informed consent. The exclusion criteria were as follows: 1) abnormal blood coagulation; 2) severe mental illness, cardiovascular diseases or other systemic intolerance surgery; 3) other congenital abnormalities of the penis, such as hypospadias or concealed penis; 4) local acute penile infection; or 5) poor blood sugar control.

Surgical Procedures

Shang Ring, thereafter referred to as SR (Wuhu Shengda Medical Treatment Appliance Technology Co., Ltd., Wuhu City, Anhui Province, China), as a disposable, single-use device, was employed for circumcision of elderly males in Group C. Whereas, a one-time penile circumcision and suturing device (Jiangxi Yuanshenglang Medical Equipment Technology Co., Ltd., Yongfeng City, Jiangxi Province, China) was applied for the individuals in the Group D. After skin preparation and draping, dorsal penile nerve block anesthesia was administered with 1% lidocaine. The operative methods of the 4 groups were in accordance with previous literature respectively, Group A,⁽⁴⁾ Group B,⁽⁵⁾ Group C,⁽⁶⁾ Group D.⁽⁷⁾ Oral antibiotics were administered to all the patients 3 days prior to the operation. Ibuprofen was administered, if post-surgery pain was significant. In addition, it was ensured that there was no bleeding or insufficient blood supply of the glans. The dressing was renewed every 24 hours after the surgery.

Evaluation of outcomes

In order to evaluate clinical outcomes, we measured and recorded various intraoperative and postoperative parameters, including operative time, blood loss during operation, postoperative pain scores, wound healing time, complications and degree of satisfaction in all 4 aforementioned groups. The operation time was recorded from the initiation of the surgery to the end of surgery. Intraoperative blood loss was measured using a piece of completely soaked gauze (5 cm × 5 cm), which represented an average carrying capacity of 5 mL blood.⁽⁸⁾ The pain scores were calculated using the internationally recognized Wong-Banker face pain rating scale.⁽⁹⁾

Identification of sample size

Based on our pilot data, the sample size was estimated at a study power of 80% and a significance level of 5%. It was suggested that at least 22 patients were required per group.

Statistical analysis

Statistical analyses was performed using SPSS 17.0 statistical software (SPSS Inc., Chicago, IL, USA). Measurement data were presented as means ± standard devi-

Table 2. Complications of four types of circumcision in elderly males.

Variables ^a	Group A (N = 38)	Group B (N = 23)	Group C (N = 42)	Group D (N = 29)	P-value
Infection	0	0	1	0	.54
Bleeding	2	0	0	3	.10
Edema	2	2	4	0	.38
Incision dehiscence	0	0	1	0	.54

^a Kruskal-Wallis one-way ANOVA

ation (range: minimum - maximum). One-way analysis of variance (ANOVA) was adopted to compare the differences in the mean among the 4 groups, followed by an LSD post hoc test. Meanwhile, the categorical data were expressed as numbers, which were analyzed by Pearson's chi-square and Bonferroni correction among 4 groups. The difference was statistically significant at $P < 0.05$.

RESULTS

After successful completion of all surgeries, the patients were followed up until the incision was completely healed. However, 5 patients were lost to follow-up, among whom 4 individuals belonged to Group A and 1 to Group C.

The operation time was calculated to be 27.3 ± 2.39 min, 30.4 ± 2.23 min, 6.3 ± 1.33 min, 7.6 ± 1.29 min ($P < .001$), while the blood loss was 15.6 ± 2.84 mL, 11.8 ± 1.73 mL, 1.3 ± 0.44 mL, 3.7 ± 1.41 mL, ($P < .001$) in Group A (traditional male circumcision), Group B (sleeve circumcision), Group C (SR circumcision), Group D (suturing device circumcision), respectively. In addition, the 24-h and 7-day pain scores were determined to be 2.8 ± 0.54 , 2.7 ± 0.55 , 4.0 ± 0.38 , 2.7 ± 0.55 ($P < .001$), and 0.08 ± 0.27 , 0.17 ± 0.38 , 3.67 ± 0.65 , 0.14 ± 0.35 ($P < .001$), in Group A, Group B, Group C, Group D, respectively. The duration of pain was further analyzed to be 2.9 ± 0.65 d, 3.2 ± 0.78 d, 6.8 ± 1.31 d, 3.0 ± 0.73 d ($P < .001$) in Group A, Group B, Group C, Group D, respectively. Healing time was additionally noted and revealed to be 12.4 ± 1.69 d, 11.6 ± 1.44 d, 21.9 ± 4.26 d, 12.2 ± 2.31 d in Group A, Group B, Group C, Group D, respectively ($P < .001$) (Table 1). Furthermore, the surgical complications in patients from the 4 groups were observed and analyzed. Merely 1 case was found to be infected in Group C, which did not occur in the patients of the remaining groups ($P = .54$). Postoperative bleeding was observed in a total of 5 cases, among which 2 cases were in Group A and 3 cases in Group D ($P = .10$). It is noteworthy that edema was the most commonly diagnosed complication after male circumcision. Totally, 8 cases were noted, with 2 cases in Group A, 2 cases in Group B, and 4 cases in

Group C ($P = .38$). Besides, only 1 individual experienced incision dehiscence, who was in Group C ($P = .54$) (Table 2).

Additionally, we assessed the degree of satisfaction about the male circumcision after surgery in all groups. In total, 5 patients were lost to follow-up, with 4 cases in Group A and 1 in Group C. Elderly males in Group C were the most satisfied with the surgical procedures ($P = .02$), while being the least satisfied with the recovery process ($P = .03$). In term of the appearance, the patients in Group A displayed the lowest satisfaction rate, but no statistical differences were identified among the 4 groups ($P = .31$) (Table 3).

DISCUSSION

Male circumcision is the operative-treatment of choice for redundant prepuce in the elderly. In addition to its use in redundant prepuce, male circumcision also has additional benefits of augmenting local hygiene, relieving discomfort, as well as reducing the risk of foreskin balanitis and urinary tract infections. Furthermore, male circumcision can enhance the prevention of sexually transmitted diseases and even the incidence of spouse cervical malignancies.⁽¹⁰⁾ Circumcision is also applied for the treatment of premature ejaculation, a common sexual dysfunction in elderly males. The process of male circumcision possesses the ability to diminish the sensitivity of the glans, thereby effectively relieving the symptoms of premature ejaculation.^(11,13) A recent survey established that 84.5% of elderly males between 60 - 69 years of age are sexually active, and so are the 31.1% of elderly males above the age of 80 years.⁽¹³⁾ Thus, it is of critical significance to explore the clinical values and efficacy of male circumcision in the elderly males.

Firstly, the key findings of the current study revealed that elderly males in the 4 different groups presented with significant differences in terms of operative time and blood loss. Notably, Group C (SR circumcision) exhibited the shortest operation time and the least blood loss, which was consistent with the results reported in previous studies.^(5-7,14) In addition, patients in Group C presented with the longest healing time, the most

Table 3. Satisfaction evaluation of four types of circumcision in elderly males.

Variables ^a	Group A (N = 34)	Group B (N = 23)	Group C (N = 41)	Group D (N = 29)	P-value
Operation experience; satisfaction/dissatisfaction; n	27/7	20/3	41/0	27/2	.02
Recovery; satisfaction/dissatisfaction; n	29/5	20/3	25/16	23/6	.03
Appearance; satisfaction/dissatisfaction; n	27/7	21/2	37/4	27/2	.31

^a Pearson's chi-square test and ANOVA with Bonferroni correction

complications, and the most immense pain, which was different with some studies performed among adult patients.⁽¹⁸⁾ In the clinical scenarios, the elderly are found with inherent characteristics: 1) they have a long history of male circumcision, and some patients suffer from severe local adhesion; 2) they experience years of repeated friction, and hyperplasia and hypertrophy occur in foreskin; 3) they have plenty of smegma and urine impregnation, rhagades, redness, and even skin ulceration; 4) the immune function is degraded due to old age, and some are diagnosed with diabetes. In regard to SR circumcision, some patients were still inflicted by incrustation and edema even after the SR was removed, due to the thicker foreskin in elderly males. However, Group C also exhibited the longest healing time and pain duration, which may be attributed to the slow metabolism and weak healing ability.

Additionally, we evaluated the degree of satisfaction by comparing and analyzing the surgical experience, post-operative recovery, and appearance after healing. Intra-operative anxiety in elderly males is usually dependent on operation time and the occurrence of bleeding, thus, the satisfaction in operation experience of patients in Group C was the highest among the 4 groups owing to shorter operation times and less bleeding. However, longer recovery times and pain duration documented in the subjects also resulted in the most unfavorable recovery satisfaction in Group C. A recent study conducted by Lv et al. consistently reported that suturing device circumcision was associated with a pronounced decline in intraoperative and postoperative pain compared to SR circumcision using a satisfaction-evaluation study encompassing 942 patients.⁽¹⁶⁾

The findings of the current study suggest that more emphasis should be laid on the preoperative examinations for prepuce with hyperplasia and hypertrophy, when determining the surgical modality for elderly males with redundant prepuce, in which case SR circumcision should be avoided. Our discoveries also indicate that sleeve circumcision has an obvious superiority in elderly males with local prepuce with enlarged and increased veins. Collectively, the patient demographics of elderly males should be clearly inspected, in order to opt for surgical methods with short operation and recovery times, due to heart burden, myocardial ischemia, severe angina pectoris, and even myocardial infarction caused by pain stimulation.

Nonetheless, the limited sample size and data collection from a single-center population may lead to deficiencies of the current study. Despite these limitations, our findings shed light and provide clinical values on circumcision for elderly males with redundant prepuce, enlightening the urologists treating redundant prepuce.

CONCLUSIONS

In summary, our observations and discoveries suggest that all 4 types of surgical methods have their own advantages and drawbacks. Strikingly, the application of a suturing device or sleeve circumcision is recommended for the treatment of elderly patients with redundant prepuce. Thereby, the SR circumcision associated with long healing time and short operation time should be carefully evaluated prior to the surgery.

CONFLICT OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. Dunsmuir WD, Gordon EM. The history of circumcision. *BJU Int.* 1999;83 Suppl 1:1-12.
5. Ben KL, Xu JC, Lu L, et al. [Male circumcision is an effective "surgical vaccine" for HIV prevention and reproductive health]. *Zhonghua Nan Ke Xue.* 2009;15:395-402.
6. Kelly R, Kiwanuka N, Wawer MJ, et al. Age of male circumcision and risk of prevalent HIV infection in rural Uganda. *Aids.* 1999;13:399-405.
7. Tobian AA, Adamu T, Reed JB, Kiggundu V, Yazdi Y, Njeuhmeli E. Voluntary medical male circumcision in resource-constrained settings. *Nat Rev Urol.* 2015;12:661-70.
8. Abdulwahab-Ahmed A, Umar A. Dorsal slit-sleeve technique for male circumcision. *J Surg Tech Case Rep.* 2014;6:46.
9. Ma Q, Fang L, Yin WQ, et al. Chinese Shang Ring Male Circumcision: A Review. *Urol Int.* 2018;100:127-33.
10. Han H, Xie DW, Zhou XG, Zhang XD. Novel penile circumcision suturing devices versus the shang ring for adult male circumcision: a prospective study. *Int Braz J Urol.* 2017;43:736-45.
11. Shen J, Shi J, Gao J, et al. A Comparative Study on the Clinical Efficacy of Two Different Disposable Circumcision Suture Devices in Adult Males. *Urol J.* 2017;14:5013-7.
12. Ye JJ, Lee KT, Chou YY, Sie HH, Huang RN, Chuang CC. Assessing Pain Intensity Using Photoplethysmography Signals in Chronic Myofascial Pain Syndrome. *Pain Pract.* 2018;18:296-304.
13. Tobian AA, Gray RH, Quinn TC. Male circumcision for the prevention of acquisition and transmission of sexually transmitted infections: the case for neonatal circumcision. *Arch Pediatr Adolesc Med.* 2010;164:78-84.
14. Tian Y, Wazir R, Wang K. Male circumcision decreases penile sensitivity as measured in a large cohort. *BJU Int.* 2013;112:E2-3.
15. Senel FM, Demirelli M, Misirlioglu F, Sezgin T. Adult male circumcision performed with plastic clamp technique in Turkey: results and long-term effects on sexual function. *Urol J.* 2012;9:700-5.
16. Lee DM, Nazroo J, O'Connor DB, Blake M, Pendleton N. Sexual Health and Well-being Among Older Men and Women in England: Findings from the English Longitudinal Study of Ageing. *Arch Sex Behav.* 2016;45:133-44.
17. Wu X, Wang Y, Zheng J, et al. A report of 918 cases of circumcision with the Shang Ring: comparison between children and adults. *Urology.* 2013;81:1058-63.
18. Peng YF, Yang BH, Jia C, Jiang J. [Standardized male circumcision with Shang

Ring reduces postoperative complications: a report of 351 cases]. *Zhonghua Nan Ke Xue*. 2010;16:963-6.

19. Lv BD, Zhang SG, Zhu XW, et al. Disposable circumcision suture device: clinical effect and patient satisfaction. *Asian J Androl*. 2014;16:453-6.