

Comparison the Diameter of the Urethral Meatus Before and After Circumcision and Evaluation of Urethral Stenosis

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Abstract

Objectives. This study focused on assessing the diameter of the meatus before and after circumcision to evaluate meatal stenosis. **Methods.** In this cross-sectional study, boys who met the inclusion criteria, their demographic parameters, and meatus diameter were recorded. Thirty days after circumcision, complications were evaluated meatus diameter was measured again and their information was analyzed by SPSS 26 software. **Results.** Four hundred boys were studied, and it was found that 41 cases (10.3%) developed meatal stenosis after circumcision, with 85% having a pre-circumcision meatus diameter of 4 mm or less. Statistical analysis revealed a significant correlation ($P < .05$) between smaller pre-circumcision meatus diameter and postoperative meatal stenosis. **Conclusions.** The study concludes that a smaller meatus diameter before circumcision significantly increases the risk of postoperative tightness. It suggests prophylactic measures like meatus dilatation or applying topical ointment for those at high risk (meatus diameter ≤ 4 mm) to prevent or mitigate postoperative meatal stenosis.

Keywords

circumcision, meatus diameter, meatal stenosis, complication

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Introduction

Male circumcision, which is one of the most common infant surgeries in the world, can be performed at different ages from infancy to adulthood.¹ During this surgery, part or all of the foreskin is removed from the glans.² The main reason for circumcision has been religious tradition, which exists mostly in some societies.³ However, it can also be carried out for health and medical reasons, such as providing better hygiene for the penis, reducing the rate of urinary tract infection, as well as reducing the incidence of venereal disease and decreasing phimosis and balanitis.⁴ As with other surgeries, circumcision is associated with a risk of complications during or after the operation. According to studies, this rate range is between 1% and 15%.^{5,6}

Among the complications that circumcision can cause, meatitis and meatal stenosis are more common.⁷

Meatal stenosis is a narrowing of the urethral opening and is one of the late complications of circumcision. It can also cause urinary obstruction, but it mostly appears as a mild form of stenosis, so that symptoms are reported in 3% of cases.^{5,8,9} Anatomically, this complication is defined as the diameter of the meatus less than 5 French (1/6 mm), which causes the narrowing of the urinary

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outlet.¹⁰ Diagnosis of this condition is delayed until toilet training and is not usually diagnosed in infants and children who wear diapers.¹¹ The most common signs and symptoms of this complication, including prolonged urination with a thin stream of urine, as well as pain at the beginning and straining while urinating.¹² Other rare manifestations include hematuria, incontinuity, nocturia, abdominal pain during and shortly after urination, vesicoureteral reflux, hydronephrosis, and renal failure.¹³

The etiology of meatal stenosis is not fully understood, but meatitis and meatal ischemia secondary to circumcision may cause it to happen.¹¹ Among other causes, it can be assumed that this condition may occur by the constant contact of the glans and meatus with environmental factors such as feces and urine, as well as underwear and diapers.^{10,11,14} Another issue that highlights the role of circumcision in the event of this condition is the lower occurrence of meatal stenosis in uncircumcised boys, so that they suffer from this condition 10 to 26 times less than circumcised boys.¹⁵

Mild cases of meatal stenosis may not require treatment, but severe cases are treated with surgery, called a meatotomy, in which an incision is made below the meatus to open or widen it.¹⁶

In this study, we decided to determine the relationship between the diameter of the urethral meatus before circumcision and its stenosis after circumcision.

Methods

This cross-sectional study was conducted in 2020 on boys who were brought to the Urology Clinic of Valiasr Qaemshahr Hospital for non-therapeutic circumcision. Boys who were referred to the hospital for circumcision and did not have any contraindications were included in this study.

According to the formula below, with $P=.16$ based on available studies, a margin of error of 0.05, and a confidence level of 95%, the sample size is calculated to be 384. However, a total of 400 cases will be included in the study.

$$n = \frac{z^2 1 - \frac{\alpha}{2} pq}{d^2}$$

Exclusion criteria included; pre-circumcision meatal stenosis, hypospadias, large and bulky hernia or hydrocele, microphallus, penoscrotal webbing, dorsal hood deformity, coagulopathy, and the need for other surgeries.

After the boys entered the study, their demographic parameters were recorded and the diameter of the meatus was measured by a ruler with millimeter



Figure 1. The measurement of the meatal diameter.

accuracy (Figure 1). All participants underwent local anesthesia with a dorsal penile nerve block and then were circumcised by a urologist using the sleeve resection method. The frenular artery was also ligated. Thirty days after circumcision, the diameter of the meatus was measured and recorded again.

Statistical Analysis

The Statistical Package for Social Sciences IBM (SPSS-IBM), version 26 (SPSS Inc., Chicago, Illinois, USA) was used to perform the analysis after the data had been double-checked. All statistical analyses were carried out using this software. Quantitative variables were used to describe the mean and the standard deviation. Qualitative variables were also defined based on numbers and percentages. A $P < .05$ was considered statistically significant. The study protocol was approved by the ethics committee of the Sari Islamic Republic University of Medical Sciences and informed consent was obtained from the patients' parents before enrollment.

Results

There were 400 boys who met the inclusion criteria and enrolled in the study. The mean age of the participants was 210.535 ± 108.96 days, and the youngest and oldest participants were 2 days and 9.5 years old, respectively. A total of 98% of participants in the study were under

Table 1. Demographic Data.

Age (mean ± SD)		108.9 ± 210.5
Weight (mean ± SD)		6.1 ± 2.2
Meatus diameter (mean ± SD)	Before circumcision	4.6 ± 0.85

Table 2. Frequency of Meatal Stenosis by Weight.

Weight groups	Meatal stenosis		Total
	+	-	
<4 kg Frequency	6	36	42
4-6 kg Frequency	19	173	192
6-8 kg Frequency	10	116	126
8-10 kg Frequency	3	26	29
>10 kg Frequency	3	8	11
Total Frequency	41	359	400
Pearson Chi-Square	$P > .05$ ($P = .291$)		

the age of 1 year. Analysis did not show significant relationship between age and post operation meatal stenosis ($P = .679$).

The demographic data is shown in Table 1. The mean weight of the participants was reported as 6.193 ± 2.25 kg. The largest group of participants was related to the weight between 4 and 6 kg, which included 192 participants (48.0%), followed by, 126 (31.5%) participants in the weight group of 6 to 8 kg. The highest rate of post-operation stenosis was seen in boys weighing 4 to 6 kg, which includes 19 of 41 participants (Table 2). Statistical analysis did not show a significant relationship between participants' weight and the possibility of meatal stricture after surgery ($P = .291$).

The mean diameter of the meatus before circumcision was 4.610 ± 0.85 mm (Table 1).

The lowest and highest diameters of the meatus that were recorded were 3 and 7 mm. The highest frequency of meatus diameter was 5 mm, and 160 of the participants had this size. In this study, 41 boys (10.3% of total) developed with meatal stenosis after circumcision, which among them, 35 cases (85.4%) had meatus diameter of 4 mm or less before circumcision (Table 3), which according to the analysis, mentioned correlation is considered significant ($P = .0001$).

No cases of infection after circumcision were reported, but 3 cases of bleeding after circumcision were observed.

Discussion

Perform circumcision by a specialist, causes fewer complications and, given the clinical significance of

Table 3. Frequency of meatal stenosis by meatal diameter before circumcision.

Meatal diameter before circumcision (mm)		Stenosis		Total
		+	-	
3 mm	Frequency	9	21	30
4 mm	Frequency	26	131	157
5 mm	Frequency	5	155	160
6 mm	Frequency	0	45	45
7 mm	Frequency	1	7	8
Total	Frequency	41	359	400
	Percentage	10.3	89.8	100

circumcision complications, such as urinary obstruction due to meatal stenosis, it is imperative to be performed by a specialist.^{1,3,7}

So far, several studies have investigated the effect of age, weight, and type of surgery on the occurrence of metal stenosis after circumcision, as well as Acimi et al¹⁷ showed that circumcision in the first week of infancy, complete adhesion of the prepuce to the glans, and the use of a healing product are associated with a higher probability of meatal stenosis after procedure. However, no study has yet been conducted to evaluate the relationship between the diameter of the urethral opening before circumcision and the stenosis after the operation. so, we conducted a study in this field. Our research revealed a significant relationship between the diameter of the meatus prior to circumcision and its stenosis following circumcision ($P = .0001$). In such a way that in 85.4% of cases, with meatus diameter of 4 mm or less, meatal stenosis was seen after circumcision.

In our study, the highest frequency of meatal stenosis was seen in the age group below 1 year, whereas Mahmoudi⁹ reported the highest frequency of meatal stenosis among children aged 1 to 2 years.

According to our study, approximately 10% of circumcisions resulted in meatal stenosis. A review of 7 clinical studies conducted between 1966 and 2013 indicates that between 5% and 20% of boys undergoing conventional circumcision surgery will suffer from meatal stenosis.¹⁸

A study conducted by Kajbafzadeh et al¹⁹ indicated that a total of 5% of 102 neonates were circumcised by the plastibell (Ring) method and 15% of 105 neonates were circumcised by the classical method developed with meatal stenosis after surgery. Thorup et al²⁰ reported a 0.6% frequency of strictures after circumcision. Yegane et al²¹ reported 0.9% metal stenosis in boys aged 6 to 12 years, who were Circumcised. However, in another study conducted by Ceylan et al,⁵ 26.6% of cases of meatal stenosis were reported after the circumcision.

The observed differences in the degree of meatal stenosis after circumcision can be related to the method of conducting the study. In population-based studies, it was observed that a lower percentage of people had this condition than in studies like ours, which may cause selection bias.

Several studies have reported that meatal stenosis can be asymptomatic, but Mahmoudi found that 35% of cases had discomfort in voiding along with 33.3% experiencing urinary deviation, which is noteworthy.^{9,22}

Although a number of studies have reported infections associated with circumcision, our study did not identify any cases of infection after circumcision, which could be due to the small sample size used.^{19,23}

The total rate of bleeding after circumcision has been reported to be 0.1%. However, it was 0.8% in our study and 1.5% in Thorup's study.^{19,24}

In our study, the frenular artery was ligated in all cases. However, it is unclear whether frenular artery ligation increases the risk of meatal stenosis and further studies are needed to evaluate this potential complication, according to the Hadidi hypospadias surgery book, dorsal penile arteries supply the circulation of prepuce by superficial branches and supply the circulation of the frenulum and glans ventrally by frenular branches,²⁵ so ligation of the frenular artery during surgery may impact blood supply to the glans and subsequently cause narrowing of the meatus. Also, in the study conducted by Shokri Varniab et al,²⁶ it was found that the incidence of meatal stenosis is higher in cases of circumcision where the frenular artery is ligated.

Considering the limitations of our study, it is recommended that other studies with a wider age range and a larger number of participants be conducted to obtain more reliable results, as well as the effect of closing the frenular artery as a possible influencing factor in the occurrence of meatal stenosis after circumcision examined.

Conclusions

The study concludes that a smaller meatus diameter before circumcision significantly increases the risk of postoperative tightness. It suggests prophylactic measures like meatus dilatation or applying topical ointment for those at high risk (meatus diameter \leq 4 mm) to prevent or mitigate postoperative meatal stenosis.

Author Contributions

Mohammad Kazem Hariri and Mohammad-Bagher Rajabalian: Project development, supervision, Review and editing manuscript. Behzad Narouie: supervision, Review and editing manuscript, Data collection and management. Seyedeh Fatemeh Yousefi Tilaki: Writing and editing original draft, Data

collection and management. Ghasem Rostami: Writing and editing original draft, Analysis and interpretation of data, Data collection and management. Sajede Jadidi: Writing and editing original draft, Analysis and interpretation of data, Data collection and management. Parham Torabinavid: Writing and editing original draft, Analysis and interpretation of data, Data collection and management.

Declaration of Conflicting Interests

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Ethics Approval

All procedures involving human participants in the study were approved by the Ethics Committee of the SARI University of Medical Sciences.

Ethical Number

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Informed Consent

Written Informed consent was signed by all children's parents or legal guardians.

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