



# Are mechanical and chemical trauma the reason of meatal stenosis after newborn circumcision?

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## Abstract

Mechanical and chemical trauma are a widely accepted theories to explain the pathogenesis of meatalstenosis after newborn circumcision. The aim of the present study was to explore the theory that an exposed glans is prone to meatal stenosis. This was done by a novel investigation of boys who were born with “hooded prepuce”, a condition in which the glans is completely exposed. Physical examination, lower urinary tract symptoms, urethral meatus configuration, and surgical procedures of 18 children admitted for routine circumcision, who had congenital hooded prepuce with normally located urethral meatus, were analyzed. The study period was 2013 and 2018. All the cases have been seen because of neonatal circumcision request, but was postponed due to hooded prepuce. The only presenting complaint in children was a cosmetically unattractive appearance. There were no symptoms associated with meatal stenosis, they circumcised in an average of 6 years and non of them required any additional procedure.

**Conclusion:** Meatal stenosis did not occur in cases whose glans penis are naked with hooded prepuce. These findings do not support the default chemical and mechanical trauma theories. Hooded prepuce without any penile anomalies is only a cosmetically unattractive appearance and circumcision can correct this.

## What is known:

- *The common theory of meatal stenosis etiology is that the meatus undergoes irritation with chemical/mechanical trauma in the absence of a prepuce after newborn circumcision.*
- *Circumcision is usually postponed in newborns with hooded prepuce.*

## What is new:

- *We did not notice meatal stenosis in cases whose urethral meatus were not covered with a prepuce congenitally. Ammoniacal dermatitis or mechanical trauma theories may not explain the cause of meatal stenosis.*
- *Hooded prepuce is not a handicap to newborn circumcision. It is just a cosmetic problem and circumcision can solve it.*

**Keywords** Circumcision · Diaper · Etiology · Meatal stenosis · Neonatal

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## Abbreviations

MS Meatal stenosis

## Introduction

Circumcision has been a very common practiced procedure since ancient times [7, 10]. However, focusing on circumcision and meatal stenosis (MS) seen after circumcision are an actual and a controversial issue. In the study by Morris and Krieger, which is the recent systematic review and meta-analysis of all studies of MS in males, the MS risk was approximately 0.7% among circumcised males, although prevalence seemed to be higher in some studies [2, 12, 21].

Moreover, MS prevalence was higher, but not significantly so, in circumcised than in uncircumcised males in this meta-analysis [12]. Symptoms of MS are usually masked in infants and young boys in diapers, thus the diagnosis is often delayed until the toilet training stage. Deflection of the urinary stream, dysuria, hematuria, urinary frequency, and incontinence are the most common reported symptoms [16, 22]. The etiology of MS seen after circumcision is uncertain. It is suggested that after newborn circumcision, the exposing of penile glans and meatus with underwear, diaper, feces, or by a chemical reaction with ammoniacal urine results in chronic irritation [1, 22]. These mechanical and chemical trauma cause the loss of the delicate epithelial lining of the naked distal urethra, resulting in adherence of the epithelial lining at the ventral side and leaving a pinpoint orifice at the tip of the glans [3, 16]. However, we did not notice such condition in cases whose glans and urethral meatus were not covered with a prepuce congenitally. Their normally positioned naked meatus is always rubbing the diaper and the other risk factors also present for these cases. Do these children have MS? In this study, we aimed to discuss the etiology of MS in the light of by this information.

## Methods

Approval statement was obtained from the Koç University School of Medicine local ethics committee for the study. The ones who had any type of hypospadias were excluded from the study. Age at the circumcision, lower urinary tract symptoms (including frequency, holding maneuvers, urgency, intermittency, hesitancy, incontinence, dysuria), voiding patterns (thin micturation, upward deflation of urinary stream), urethral meatus configuration, caliber of the meatus, operation procedures, and postoperative follow-up were noted. It is our policy to check the meatus with an

age-matched catheter before performing the circumcision in this type of anomaly. So we already had the chance to evaluate the caliber of the meatus.

## Results

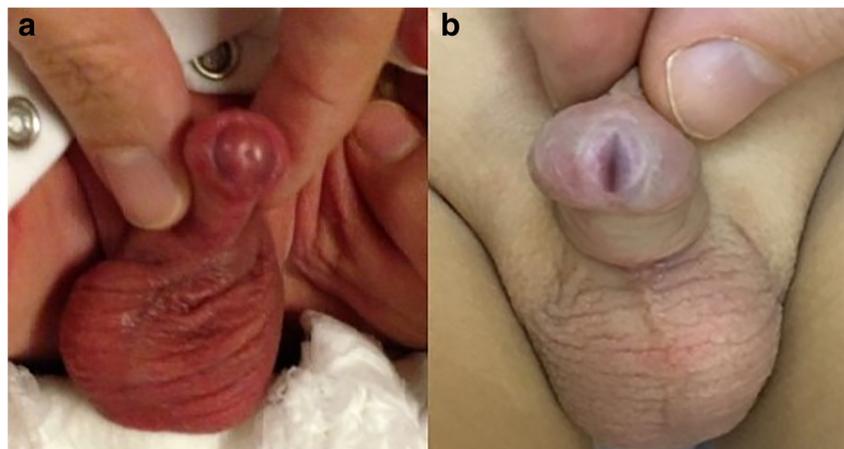
Neonatal circumcision is a very common procedure in our hospital. According to our hospital's policy, a pediatric surgeon examines each baby before the procedure to check for any possible congenital anomaly [6, 8]. In the last 5 years, we performed circumcision in 18 patients with hooded prepuce and normal positioned meatus, whom we checked at the neonatal period due to a circumcision request; however, circumcisions were delayed because of the hooded prepuce anomaly in all (Fig. 1a).

The children were circumcised in an average age of 6 years. They had no complaint regarding the MS before the circumcision. These children were brought to the outpatient clinic for the routine circumcision and the only presenting complaint in children was a cosmetically unattractive appearance. Urethral meatus was checked for stenosis during circumcision and the caliber of all the orifices was normal. They were all calibrated easily with a lubricated 8-F feeding tube. There was no additional pathology except hooded prepuce and none of them required any additional procedure (Fig. 1b). There were no symptoms at follow-up.

## Discussion

Hooded prepuce is a condition of incomplete circumferential formation of foreskin with an absent ventral component [5]. Although it is usually associated with hypospadias, hooded prepuce with a normally localized meatus is a rare, but well-known abnormality [5]. In the study by Mousavi and Mohammadjafari, 184 children were referred for hypospadias

**Fig. 1** **a** Naked external urethral meatus appearance during the newborn period. **b** Appearance of naked external urethral meatus before circumcision



repair and they had four infants who had hooded prepuce without hypospadias [14]. In this pathology, urethral meatus is always naked similar to the children who have had newborn circumcision. Over 500 newborn circumcisions are performed per year in our center after routine detailed genital examination of the babies. We postpone the circumcision of babies who had hooded prepuce with normal localized meatus to correct any possible chordee or to add glanuloplasty in necessary cases. In many references, preputial defect is a contraindication for early circumcision [4]. In this study, we re-evaluated 18 patients in terms of MS, who had naked urethral meatus, and whose circumcision has been postponed in the newborn period due to hooded prepuce, when they applied for circumcision in an average 6 years of age.

Meatal stenosis can develop after newborn circumcision as a complication of this procedure. Although it is often assumed that MS is a late complication of circumcision [17, 18], a recent study that monitored MS onset by repeated examination following neonatal circumcision found that most MS developed in the first few weeks of circumcision: on average 2.3 and 3.8 weeks in the two groups studied [13, 19]. Nevertheless, underlying causes are not completely understood. Naked urethral meatus theory is usually used to explain the pathogenesis of MS. This popular theory is that meatal mucosa undergoes chronic irritation in the absence of a prepuce. This irritation can be in the form of the meatus-rubbing trauma against diapers or by a chemical reaction trauma with ammoniacal urine. These traumas may lead to adhesion formation and subsequent scarring, changing the normally elliptical meatus to a rounded or pinpoint orifice at the tip of glans [1, 3, 22].

In contrast to this theory, in this study, there was a defect at the ventral side of the prepuce in all boys; so the meatus of boys was always naked, exposed to urine, and was always prone to mechanical rubbing trauma of the diaper. Although all of the mentioned risk factors implicated in the etiology of MS after neonatal circumcision were present in this group, there was no stenosis in any of these 18 children. None of them had any of the known clinical presentations of MS, including upward deflation of urinary stream, pain, burning, or need to sit during urination [9, 15] and they were all calibrated easily with a lubricated 8-F feeding tube before the circumcision. We have not observed a single case of ammoniacal dermatitis during all our practice years. But MS is a known fact, which may have been seen after neonatal circumcision. So if naked meatus theory is not correct, what may be the reason of this complication? Two other mechanisms have been proposed for how circumcision might influence MS: (1) Damage to the frenular artery; Shenoy et al. had not seen any case of MS after circumcision in their series which they protected the frenular artery [20]. Persad et al. have suggested a role of the division of the frenular artery in MS pathogenesis. Meatal ischemia following damage to the frenular artery at

circumcision is suggested as a possible cause of MS [17]. (2) Initial meatus trauma due to intra-operative peeling; in majority of the newborns, the prepuce has tightly adhered to the glans penis and needed to retract it during the circumcision [11]. It is suggested that initial trauma due to intra-operative forceful retraction of the prepuce potentially can play a role in intensifying and accelerating the development of meatal stenosis [19].

In our study, there was a defect at the ventral side of the prepuce in patients with hooded prepuce. Thus, the meatus is always naked, always exposed to urine, and is always prone to mechanical rubbing trauma of the diaper. However, none of these 18 children had MS. After these observations, ammoniacal dermatitis or mechanical rubbing trauma hypothesis may not be enough, or correct to explain the possible cause of the MS. Ischemia, resulting from damage to the frenular artery during circumcision, was associated with poor blood supply to the meatus and subsequent fusion of the ventral sides of the orifice, and injury to the meatus due to intra-operative peeling of the foreskin off the glans may be more appropriate hypothetical scenarios to explain the pathogenesis of MS after newborn circumcision. Preservation of the frenular artery and external urethral meatus is our advice to avoid the risk of MS after circumcision.

Circumcision is usually postponed in newborns with hooded prepuce. In the present series, we checked these patients during the newborn period due to a circumcision request. There was no additional penile anomaly including hypospadias, chordee, urethral meatus configuration disorder, and buried penis except hooded prepuce with normal localized meatus. At that time, circumcisions were delayed because of the hooded prepuce anomaly in all babies. In the last 5 years, these children were brought to the outpatient clinic for the routine circumcision and the only presenting complaint in children was a cosmetically unattractive appearance. We performed circumcision in these 18 patients and none of them required any additional procedure such as cordectomy and glanuloplasty. The caliber of all the orifices was normal. In the light of these observations, another outcome of this study is that none of the 18 patients with hooded prepuce required any additional surgical procedure except circumcision. Hooded prepuce is not a handicap to newborn circumcision. It is just a cosmetic problem and circumcision can solve it.

## Limitations

The major limitation of our study is the retrospective design and the limited number of patients although it is a very rare entity.

## Conclusions

Meatal stenosis did not occur in cases whose glans penis is naked with hooded prepuce. This finding does not support the effect of mechanical and chemical irritation mechanism to explain MS after newborn circumcision. Hooded prepuce without any penile anomalies has only a cosmetically unattractive appearance, and circumcision can correct this.

**Authors' contributions** Özen MA and Eroğlu E had primary responsibility for subjects screening, enrollment, follow-up, and manuscript preparation. Gündoğdu G and Taşdemir M were involved in the literature search and revised the manuscript. All authors read and approved the final version of the manuscript. Egemen E is the guarantor.

## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Informed consent** Written informed consent was obtained from all individual participants included in the study and their parents (or legal guardians). All procedures performed involving human participants were in accordance with the ethical standards of the local ethics committee and with the 1964 Helsinki declaration and its later amendments.

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