

## Urethral Meatus and Glanular Closure Line: Normal Biometrics and Clinical Significance

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**Purpose:** The aim of this study is to explore the normal external urethral meatal and glans closure line in normal boys, and to investigate the correlation between these glans biometrics and the age of the participants.

**Material and Method:** 103 male children were asked to participate in the study during ritual circumcision. Parents of 94 of them (mean age 5.9 years, range 0.6–13) accepted while remaining 9 did not. Glans biometrics were measured using digital calipers.

**Result:** 100% of the study participants had a vertical slit-like meatal opening located at the tip of the glans. The length of the meatal opening was 5.3 ( $\pm$  1) mm and of ventral glans closure was 4.8 ( $\pm$ 1.1) mm. Significant correlation between both the external meatal opening and closure lines lengths and age was observed. Moreover, the meatal opening size was correlated to the glans closure line as well ( $r = 0.36$ , confidence interval 0.14–0.54,  $P < .001$ ).

**Conclusion:** The site and size of the meatus opening in normal male children is consistent, and ventral glans closure is equal to or slightly less than meatal length. These findings could aid in glanular reconstruction configuration during hypospadias surgery.

**Keywords:** hypospadias; meatus; glans closure

### INTRODUCTION

Significant improvements have been achieved in the field of hypospadias repair over the last 3 decades with noticeable reduction of complications and adverse outcomes. The ultimate aim of the different surgical operations for hypospadias repair is to achieve a near-normal glans and penis anatomy with a specific consideration to get a slit-like meatus and satisfactory glanular approximation.<sup>(1–4)</sup> Likewise, it was put forward that having better understanding of the penile anatomy and standardization of the procedures applied would bring better outcomes.<sup>(5,6)</sup> To date, it has been in pure discretion and judgment of the operating surgeon to assess the pattern of “normal” glans configuration in regards to meatus length and the extent of glanular closure line with scarce studies in this field.<sup>(2)</sup> The aim of this study is to provide a base of “nomogram” for the meatal and glanular closure dimensions on which the future hypospadias reconstructive procedures can depend on.

### MATERIALS & METHODS

Between January 2015 and December 2016, 103 patients who were asking for ritual circumcision in circumcision clinic of Hamad Medical Corporation, Doha, Qatar were included in this prospective analytical study. Overall, 94 male children (mean age 5.9 years, range 0.6–13) participated and remaining candidates

did not proceed because either the child or parents declined. Patients with known genitourinary anomaly, or previous penile surgery were excluded from the study. All the patients were examined under general anesthesia just prior to the commencement of the surgical procedure of circumcision. Longitudinal meatal length (AB) and vertical glans closure lines (BC) were measured using digital caliper following gentle retraction of the foreskin (Figure 1). Results were expressed as mean  $\pm$  standard deviation (SD) and Spearman’s rank correlation between meatus length and closure line and between meatus length and the age of the patients; 95% CI were calculated and  $P \leq 0.05$  was considered statistically significant. The study was approved by the Medical Research Centre Institutional Review Boards of Hamad Medical Corporation, Doha, Qatar (Protocol No. 16/16090) and also Approved by IRB committee of the Medical Research Centre, Hamad Medical Corporation 3050, Doha, Qatar, Tel: 0097444392440.

### RESULTS

100% of the study participants had a vertical slit-like meatal opening located the tip of the glans penis and ran ventrally (Figure 1). The length of the meatal opening (AB) was (5.3,  $\pm$  1) mm and of ventral glans closure was (4.8,  $\pm$ 1.1) mm. The AB/BC ratio was calculated and found to be 1.1 – 1.3. Significant correlation be-

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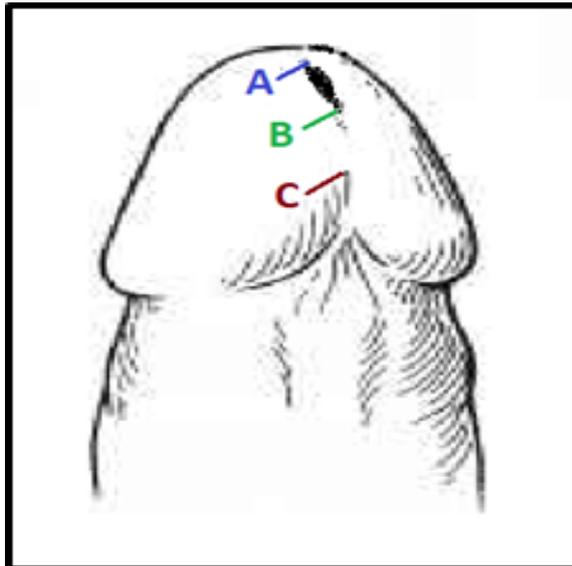
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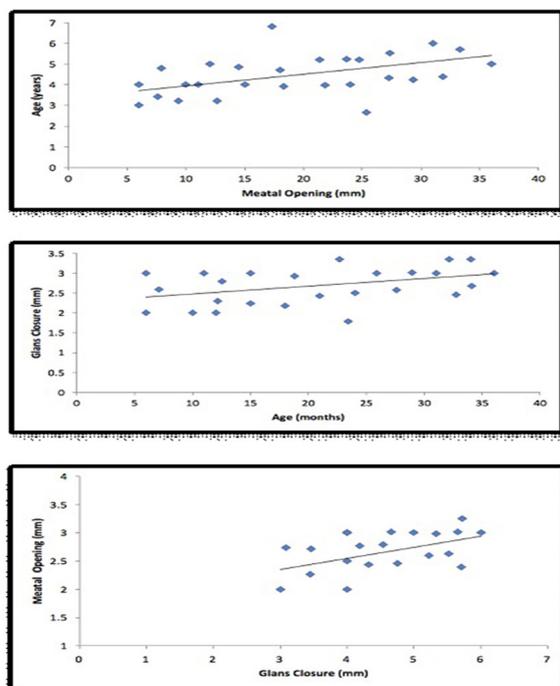
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**Figure 1.** Photograph of one of the participants penis showing the different landmarks used for data measurements. Point (A) is the distal extent of the meatal opening, point (B) is the proximal extent of the meatal opening and distal limit of glanular closure line, and point (C) is the proximal limit of glanular closure line. Therefore, A to B is the length of the meatal opening while B to C is the extent of the vertical glanular closure line.

tween both the external meatal opening ( $r = 0.52$ , CI 0.22–0.61,  $P < 0.04$ ) and closure lines lengths and age of the participants was observed. Moreover, the meatal opening size was correlated to the glans closure line as well ( $r = 0.36$ , confidence interval 0.14–0.54,  $P < .001$ ). (Figure 2)



**Figure 2.** Graphical data distribution of different variables.

## DISCUSSION

Towards the direction of “perfection” in hypospadias repair, several significant milestones have been accomplished. However, the “normal” dimensions of glanular configurations had not gain much attention so far. Although one of the key components of hypospadias surgery is to get a slit-like meatus opening,<sup>(7)</sup> no objective normative data exist to guide the surgeon to reconstruct the different “topographical” elements.

The findings of the present study present objective data that can help the surgeon in the process of decision making during glanular reconstruction in hypospadias cases as well as other penile anomalies including: bladder exstrophy-epispadias complex, cloacal exstrophy, disorders of sexual development and traumatic penile injuries. The size of the meatus opening in normal male children is consistent, and ventral glans closure is equal to or slightly less than meatal length. This is similar to what have been reported by Hutton et. al.<sup>(8)</sup> However, it has been recently shown that the structure of the ventral closure line separating the two glanular wings is a septum and not a glanular tissue.<sup>(9)</sup> On the other hand, our data show significant correlation between the length of the meatal opening and age similar to previous reports.<sup>(8,10)</sup>

Besides the size of the meatus, it has been suggested that the ideal location of the meatal opening should be aimed to locate at the tip of the glans following analysis of 300 boys.<sup>(11)</sup> Therefore, creation of a slit-like apical meatal opening can be considered as a criterion for successful hypospadias repair.<sup>(12)</sup> However, it is interesting that in most distal hypospadias cases the anatomical landmarks (hillocks) of the meatal opening are well preserved and should be marked prior to incision.<sup>(13)</sup> Creating a longer glans closure could lead to meatal stenosis and increase the risk of urethra-cutaneous fistula.

On the other hand, defining the diagnostic criteria of meatal stenosis is considered a clinical challenge as no consensus exists in this regard. However, failure to pass 5F catheter in boys 5-10 years old has been chosen by some authors and happens with high frequency that reaches up to 20% in circumcised children.<sup>(14)</sup> Meatal stenosis has the potential to cause lower urinary tract obstruction with its subsequent complications.<sup>(15,16)</sup> Moreover, about one quarter of patients with meatal stenosis are considered asymptomatic<sup>(17)</sup>. It was also shown that 11.1 % of patients with asymptomatic meatal stenosis have hydronephrosis and vesicoureteric reflux.<sup>(14)</sup> The present study findings can help defining the size of the meatus in proportion to the age of the patients in more accurate manner and facilitate noninvasive diagnosis of mild forms of meatal stenosis during that can be utilized for screening purposes as well. Limitations of the study include the relatively small number of the study cohort and not correlating the meatal length and closure line to other biometric measurements of the penis including the size of the glans.

In conclusion, the findings of the present study can help in decision making of glanular topographic proportions during glanular reconstruction, facilitate objective assessment of cosmetic post-operative outcomes, help in defining the features of abnormal meatal shape to ease the clinical diagnosis of meatal stenosis. The size of the meatus opening in normal male children is consistent, and ventral glans closure is equal to or slightly less than meatal length.

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