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A standardized classification of hypospadias

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KEYWORDS

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Abstract *Objective:* Systems for categorizing hypospadias are based on the location of the external meatus. The presented proposal draws on the organogenesis of the urethra and its position against the bone structure of the pelvis. The aim of the study was to examine the position of the corpus spongiosum division relative to pelvic bone structures as an indicator of the true level of hypospadias.

Patients and methods: The study involved 150 patients aged 6 months to 22.8 years admitted for primary repair. The division of the corpus spongiosum was examined relative to the shaft of the penis and the upper pubis. Hypospadias above the pubis was categorized as penile, while below was proximal, with further subcategorization. The quality of the distal urethral canal was assessed.

Results: The external meatus was above the pubis in 94.1% while the division of corpus spongiosum was located above the pubis in 90% (distal penile 38%, mid shaft 25.3%). There was a considerable difference in hypospadias level relative to the indicator used. The distal meatus/urethra was stenotic in 84%, hypoplastic in 86.8% with true chordee in 10.4%.

Conclusions: A classification of hypospadias based on organogenesis and in respect to bony structures of the pelvis seems reliable, consistent, and more surgically oriented. The distal urethral canal should be regarded as a fistula.

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Introduction

Present systems for categorizing hypospadias variants are based on the location of the external meatus with respect to specific penile elements and/or surrounding structures such as the scrotum or perineum. The assessment is carried

out prior to surgery or after penis straightening procedures. Difficulty in classification occurs when the scrotum is distally transposed or when curvature of the penis is present. The presented proposal draws on developmental similarities between hypospadias and ano-rectal malformations in which the level of malformation is defined by position of the normal proximal bowel against the bone structure of the pelvis, rather than the location of the fistulous opening on the perineum. The definition of hypospadias issued by the European Association of Urology in 2008 defines the condition as 'hypoplasia of the tissues

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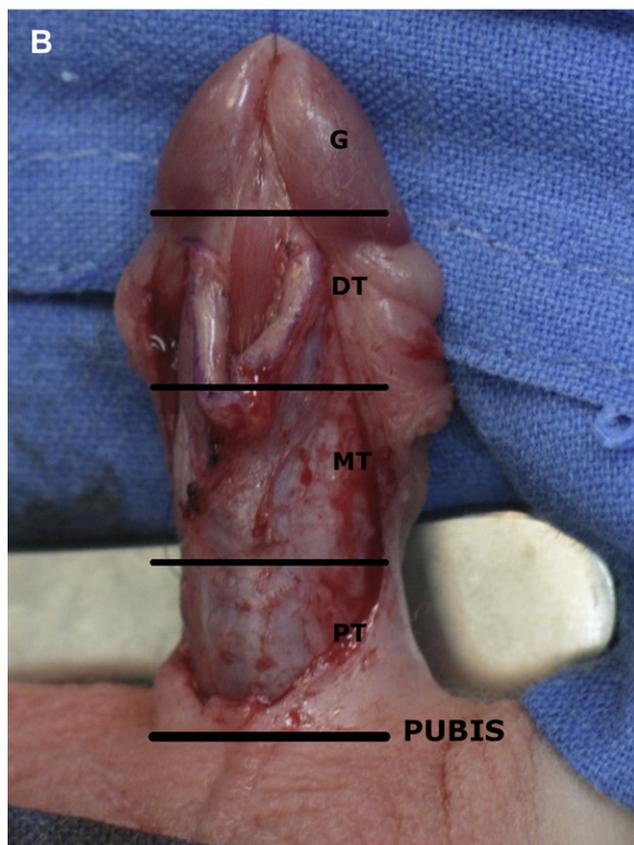
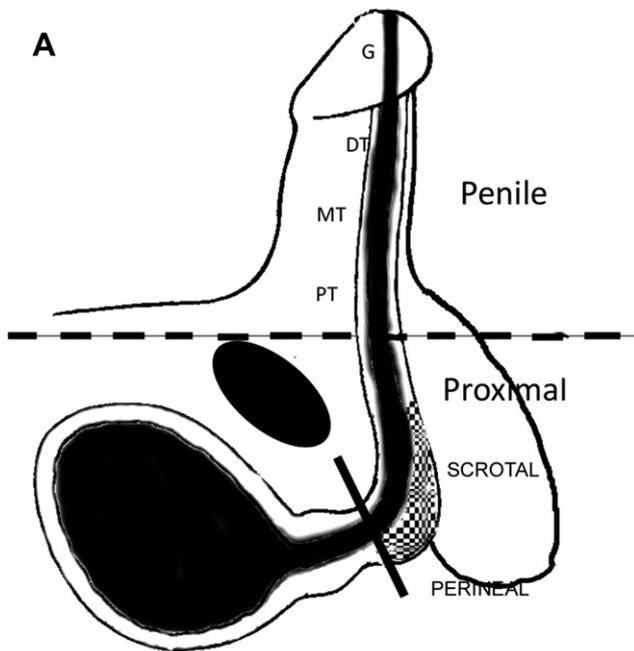


Figure 1 (A) A horizontal line at the upper pubis level categorizes hypospadias as penile (above) or proximal (below). Penile variants: PT – proximal third of the shaft, MT – middle third, DT – distal third, G – glanular. Proximal variants: scrotal and perineal. (B) A finger or a ruler pressed against the upper pubis as a practical tool for classification.

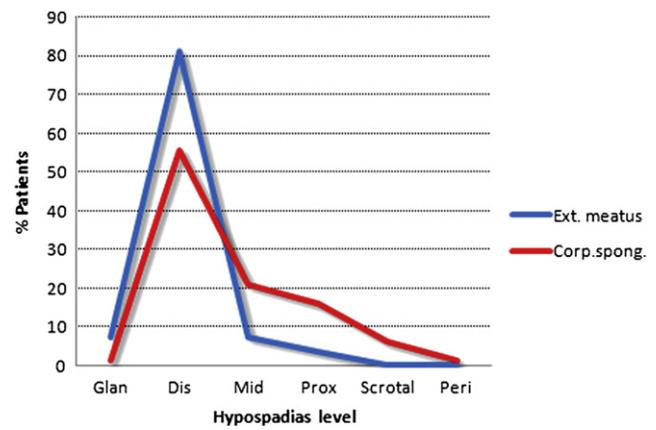


Figure 2 Position of external meatus versus the division of the corpus spongiosum in relation to upper pubis shows a shift towards more proximal variants.

forming the ventral aspect of the penis beyond the division of the corpus spongiosum' [1]. It seemed logical to clinically re-evaluate the definition of hypoplasia/hypospadias, and to examine the position of the corpus spongiosum division relative to the penile shaft and pelvic bone structures as an indicator of the true level of hypospadias.

Patients and methods

The study was performed in 150 consecutive patients aged 6 months to 22.8 years admitted for primary hypospadias repair. The quality of the distal urethra from the division of the corpus spongiosum toward the external orifice was assessed by its location and width, the presence of hypoplasia or chordee, and the need for a straightening procedure as reported earlier [2]. The position of the division of the corpus spongiosum was examined relative to the shaft of the penis and the upper pubis with the patient in the prone position after full mobilization of the skin flaps to determine the true level of hypospadias. Hypospadias above the upper pubis was categorized as penile, while hypospadias below that level was categorized as proximal

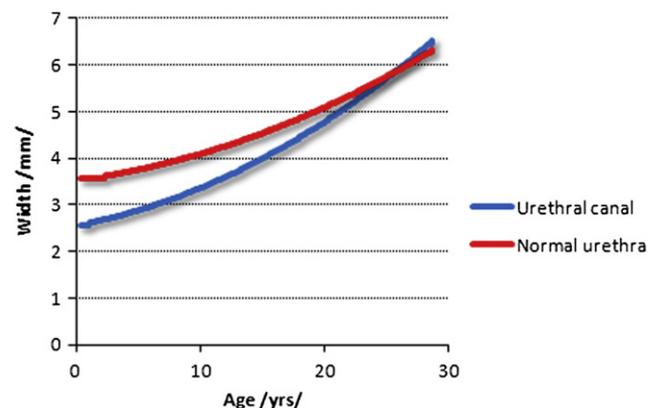


Figure 3 Quality of distal urethra: difference in size between distal urethral canal and proximal, normal urethra. The distal urethra is considerably narrower than proximal to division of corpus spongiosum in the majority of patients.

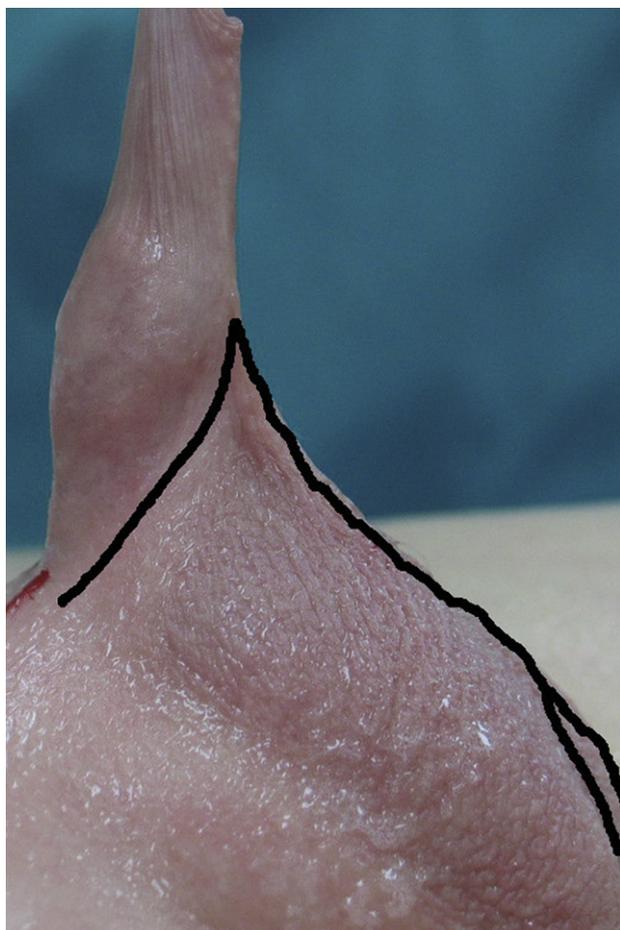


Figure 4 Quality of distal urethra: distally translocated scrotum in hypospadias may result in difference in hypospadias categorization: subcoronal or scrotal.

(Fig. 1). Penile hypospadias was further subcategorized as glanular, distal third, middle third, or proximal third of the shaft. Proximal hypospadias was subdivided into scrotal and perineal variants.

Results

Location of the external orifice of the distal urethra versus the division of the corpus spongiosum

The external meatus was above the upper level of the pubis in the majority of the patients (99.9%), referred to as the external meatus group (Fig. 2). It was mainly coronal and within the distal third of the penis in 81.4%. The position of the corpus spongiosum division (corpus spongiosum group) was more proximal than the external meatus in nearly all patients. The majority (76.6%) presented a division in the distal or middle third of the penis with an increase in proximal forms (16.0%) compared with the external meatus group (3.7%). Thus, there was a considerable difference in hypospadias level when the location of the division of the corpus spongiosum was regarded as the true indicator.

Quality of the distal urethra

The width of the distal urethra was measured with Hegar dilators and compared with the normal proximal urethra and age-dependent values, as recently reported [2]. Stenosis was found in 84% of cases (Fig. 3).

Hypoplasia of the ventral aspect of the penis was diagnosed when the skin covering the urethra appeared transparent and stayed closely attached to the thinned covering

Table 1 Different classifications of hypospadias according to the location of the external meatus versus location of division of the corpus spongiosum.

Location of external meatus in relation to penile shaft or scrotum						
Smith 1938	Schaefer 1959	Avellan 1975	Browne 1938	Duckett 1996		Hadidi 2004
1st degree	Glanular	Glanular	Glanular	Glanular	Anterior	Glanular
2nd degree	Penile	Penile	Sub-coronal	Sub-coronal		Distal
			Mid shaft	Mid shaft	Middle	
3rd degree	Perineal	Penoperineal	Penoscrotal	Proximal penile	Posterior	Proximal
		Perineal	Midscrotal	Penoscrotal		
		Perineal w/o Bulb	Perineal	Scrotal		
				Perineal		
Location of division of corpus spongiosum in relation to upper pubis						
Orkiszewski 2010						
Glanular & Coronal						Penile
Distal third						
Mid shaft						
Proximal third						
Scrotal						Proximal
Perineal						

Modified from Hadidi [3].

skin. Only 22 patients (14.7%) lacked hypoplasia or exhibited minimal hypoplasia.

Skin tethering was found in the majority of the patients and was released after extensive skin mobilization. A Nesbit or Baskin type of procedure was needed to fully straighten the penis in only 11 patients (7.3%), with need for transecting the urethral plate in 3 patients.

Discussion

The clinical description of a patient with hypospadias is currently based on the anatomical location of the external meatus relative to either the penis or to non-penile structures such as the scrotum or perineum. While the position of the external meatus within the distal penis (i.e. glanular, subcoronal, or distal penile) seems to be reliable and may be consistently described, this measure is less reliable in patients with peno-scrotal, scrotal or perineal hypospadias, as the scrotum may be translocated as far as the distal penis in these patients (Fig. 4).

The widest survey of hypospadias classifications based on location of the external meatus has recently been published by Hadidi (Table 1) [3]. In conclusion, the author recommends that 'surgeons conduct both a preoperative assessment based on the clinical site of the meatus and an intraoperative assessment based on the position of the meatus after straightening of the penis. Such a classification should help to standardize the description of different types of hypospadias and associated anomalies'. A more surgically oriented classification appears necessary not only for practical reasons but also to allow a better evaluation of surgical results, and because of reported increases in hypospadias incidence in various regions. A population-based study in Nova Scotia conducted from 1980 through 2007 identified hypospadias in 0.76%. The hypospadias was glanular in 77.8% of cases, coronal in 14%, within the penile shaft in 6.2%, and proximal to the penile shaft in 2.2% [4]. These results differ significantly from those reported earlier by Duckett and colleagues [5]. In Duckett's study of 1289 hypospadias cases, 49% were described as anterior, 21% were described as middle, and 30% were described as posterior. The ambiguity in definitions of hypospadias severity has also been highlighted in a recent commentary [6].

The classification proposed here is based on the position of the corpus spongiosum division after complete mobilization of skin flaps. A horizontal line marked by a plastic ruler or a finger (Fig. 1) at the pubis level divides hypospadias into penile (above the pubis) and proximal (below the pubis). Preoperatively, the exact position of the division of corpus spongiosum can be found by drawing lines between preputial mucosa and skin as demonstrated by Mouriquand [7]. The lines cross where the corpus spongiosum divides (Fig. 5).

Penile hypospadias may be subdivided as glanular, distal third, mid shaft, and proximal third penile variants. Proximal hypospadias is subdivided into scrotal and perineal. This classification is nominally similar to Duckett's with the exception that the system refers to the division of corpus spongiosum and not the external meatus in respect to the

solid bone structures of the pubis. This classification not only eliminates ambiguity in patients with curvature of the penis but is reliable even in patients with perineal anomalies (Table 1).

The assessment of the distal urethra shows that it is usually remarkably incomplete in structure. The quality of the distal urethra differs significantly from the normal urethra; it lacks a normal spongiosal covering (Fig. 6), the external meatus and the distal urethra are much narrower than a normal urethra (Fig. 3), and the overlying skin is considerably thinned with only poor or absent subcutis in the vast majority of patients (Fig. 7).

The distal urethra appears incomplete in structure compared with a normal urethra. Logically, the repair of the urethra should extend proximally as far as the division of the corpus spongiosum and distally to the tip of the glans, when possible.



Figure 5 The lines drawn along the preputial border between the preputial skin and preputial mucosa cross where the corpus spongiosum divides. Reproduced by permission of John Wiley and Sons Ltd from: Mouriquand PDE, Mure P-Y. Current concepts in hypospadiology, *BJU Int* 2004; 93(Suppl 3):26–34, Figure 14 [7].

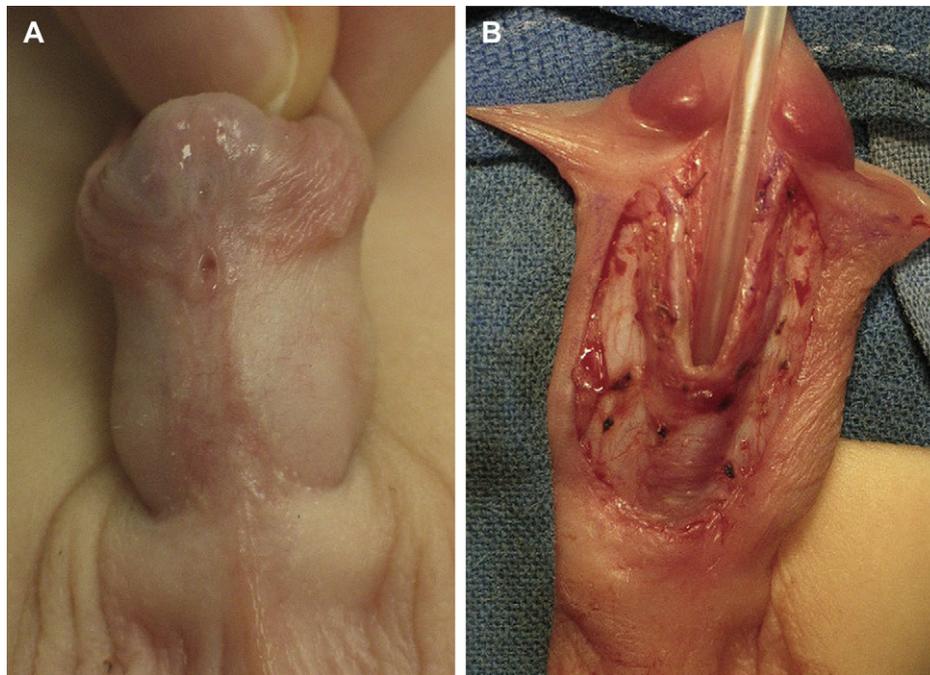


Figure 6 (A & B). Quality of the distal urethra: external meatus becomes as wide as the proximal urethra after urethrotomy at division of corpus spongiosum.

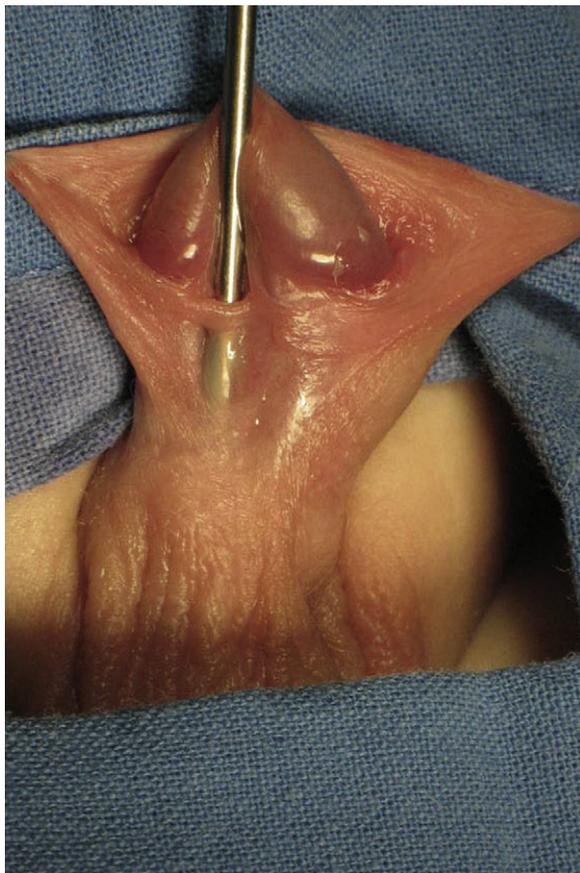


Figure 7 Hypoplasia of the ventral tissues of the penis extends far below the external meatus.

Conclusions

A classification of hypospadias based on the position of the division of corpus spongiosum in respect to the penile shaft and bony structures of the pelvis seems reliable, consistent, and more surgically oriented.

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