

# Role of penile biometric characteristics on surgical outcome of hypospadias repair

Eloísio Alessandro da Silva · Tassia Lobountchenko ·  
Matheus Nemer Marun · Atila Rondon ·  
Ronaldo Damião

Accepted: 4 December 2013 / Published online: 28 December 2013  
© Springer-Verlag Berlin Heidelberg 2013

## Abstract

**Purpose** To assess influence of penile biometric characteristics on surgical outcome of tubularized incised plate (TIP) repair for hypospadias.

**Methods** We prospectively studied 42 boys with distal hypospadias that underwent TIP urethroplasty. Biometric assessment prior to surgery consisted of classifying glans shape, urethral plate (UP) length and width, prepuce vascularization and penile size, using a caliper rule, according to previous definitions. Surgical outcome was assessed according to the occurrence of dehiscence, fistula or urethral stricture.

**Results** There was no statistical difference among groups concerning postoperative complications. Glans shape: grooved (24/57 %), shallow (9/21 %) and conical (9/21 %). UP width: <10 mm (26/62 %) and ≥10 mm (16/38 %). UP length was evaluated in 29 patients: <10 mm in (12/41 %) and ≥10 mm (17/59 %). Prepuce vascularization: one predominant blood vessel (17/41 %), two predominant blood vessels (8/19 %), H-like form with communication between two well-developed blood vessels (6/14 %) and net-like form with no predominant blood vessels (11/26 %). Penile size was measured in 28 patients under 50th percentile (25/89 %).

**Conclusion** Glans shape, UP width, UP length, prepuce vascularization and penile size do not significantly affect the complication rate of TIP repair in distal hypospadias.

Most of the patients with distal hypospadias presented with penile size under mean length for age suggesting some form of mild hypogonadism.

**Keywords** Hypospadias · Urethra · Biometry · Children · Tubularized incised plate

## Introduction

Management of hypospadias is mainly surgical and aims to improve functional aspect and esthetic appearance. Successful outcome includes a vertical and glandular urethral meatus, with good urinary stream, conical glans aspect, straight penile shaft during erections and normal scrotal position. Although current techniques provide better results, the number of complications is still significant [1].

Choosing the operative technique for hypospadias repair depends on several issues such as meatal localization, urethral plate (UP) characteristics, such as width, depth, elasticity and presence of scar tissue, glans shape, curvature degree, penile size and the surgeons' preference. However, only a few articles in the literature have addressed the issue of local characteristic assessment, other than meatal localization, and subsequent surgical outcomes [2–5].

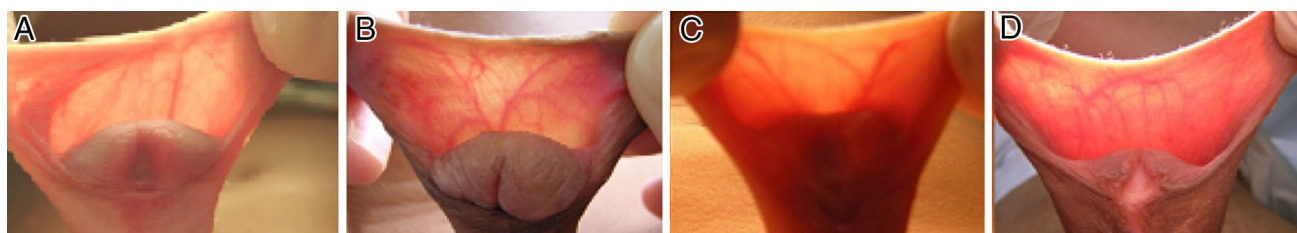
Although somewhat divergent, these reports suggest that there is a potential role in evaluating the local attributes and its impact on outcomes.

Simple UP tubularization (Thiersch-Duplay) or tubularization after a relaxing posterior incision (Snodgrass) has the advantage of performing anterior closure of the neourethra with the UP edges. These are among the most used techniques, with good results and low complication rates [6]. However, the role of the UP characteristics, glans

E. A. da Silva (✉) · T. Lobountchenko ·  
M. N. Marun · A. Rondon · R. Damião  
Laboratory for Translational Research in Urology-UroLab,  
Service of Urology, Pedro Ernesto Memorial Hospital,  
Rio de Janeiro State University, Av. 28 de Setembro,  
77-5° andar-Vila Isabel, Rio de Janeiro, RJ 20551-030, Brazil  
e-mail: urolab@uerj.br



**Fig. 1** Glans shape configuration: **a** grooved, **b** shallow, **c** conical



**Fig. 2** Assessment of prepuce vascularization using cold light transillumination technique and digital photography. **a** One predominant blood vessel, **b** two predominant blood vessels, **c** H-like form

with communication between two well-developed blood vessels, **d** net-like form with no predominant blood vessels

shape, penile size and foreskin characteristics as predictors of success is yet to be definitively determined.

We prospectively evaluated the impact of biometric characteristics of hypospadiac penis on operative success of tubularized incised plate (TIP) urethroplasty technique. As no established definition is set to evaluate each item, we assessed local characteristics according to clear criteria to be reliably graded and have reproducible quality.

## Materials and methods

After approval of the Research Ethics Committee, we prospectively studied 42 boys with distal hypospadias, with age ranging from 9 months to 18 years (median age of 9 years). Only cases of anterior hypospadias without previous surgery were included and none of these patients had received hormonal stimulation. Six patients were adolescents (Tanner  $\geq 2$ ).

Measurements were carried out prior to surgery in the same conditions by researchers that were part of the surgical team trained to use the same tools and methods, with the child supine and in the presence of parents.

Biometry consisted of assessment of glans shape, UP length and width, prepuce vascularization and penile size.

Glans shape was categorized according to UP depth into shallow or grooved, as described by Nguyen and Snodgrass [4], or as a conical glans, when no UP was found (Fig. 1).

UP length and width were measured in mm using a caliper ruler. UP width was measured at the level of the

smallest distance between UP edges. UP length was measured from the urethral meatus to the distal UP edge at the glans ventral surface. Patients were classified into two groups:  $<10$  mm and  $\geq 10$  mm.

Assessment of prepuce vascularization was performed using cold light transillumination technique and digital photography [7]. Vascularization was categorized into four groups: 1—one predominant blood vessel; 2—two predominant blood vessels; 3—H-like form with communication between two well-developed blood vessels; and 4—net-like form with no predominant blood vessels (Fig. 2).

The penile measure used was the length of the flaccid penis fully stretched under maximum manual traction, from the pubopenile skin angle to the end of the glans, after the prepubic fat was depressed, with a ruler located on the penile dorsal surface (RSLmax) [8].

All patients underwent TIP urethroplasty as described by Snodgrass [9]. The neourethra was closed in a subcuticular fashion with 6-0 or 7-0 polydioxanone sutures. A second covering layer from the dorsal prepuce was used in all cases. Patients were discharged home with 6–10F indwelling catheter, which was removed on postoperative day 5–7.

Patients were followed regularly for at least 6 months postoperatively and repairs were examined for complications. Surgical outcome was described as “success” or “complication” if during postoperative follow-up period any occurrence of dehiscence, fistula or urethral stricture had occurred.

**Table 1** Association between biometric characteristics and presence of postoperative complications [*N* (%)]

	Glans shape			<i>p</i>	
	Grooved	Shallow	Conical		
Complication	6 (14.3)	1 (2.4)	1 (2.4)	<i>p</i> = 0.526	
Success	18 (42.9)	8 (19.0)	8 (19.0)		
	Urethral plate width		<i>p</i>		
	<10 mm	≥10 mm			
Complication	5 (11.9)	3 (7.1)	<i>p</i> = 0.648		
Success	21 (50.0)	13 (31.0)			
	Urethral plate length		<i>p</i>		
	<10 mm	≥10 mm			
Complication	1 (3.4)	6 (20.7)	<i>p</i> = 0.108		
Success	11 (37.9)	11 (37.9)			
	Prepuce vascularization				
	One blood vessel	Two blood vessels	H-like form	Net-like form	
Complication	4 (9.5)	0	0	4 (9.5)	<i>p</i> = 0.130
Success	13 (31.0)	8 (19.0)	6 (14.3)	7 (16.7)	
	Penile size (RSLmax)		<i>p</i>		
	<50th percentile	≥50th percentile			
Complication	7 (25.0)	0	<i>p</i> = 0.406		
Success	18 (64.3)	3 (10.7)			

RSLmax real stretched length under maximum traction

Different factors were studied in relation to final surgical success. Association between biometric measurements and complication rate was assessed. Data were collected and processed using a commercially available software package (Epi Info®, version 7.1.1.4). Mantel–Haenszel  $\chi^2$  test and univariate analysis with Fisher’s exact test were used to assess possible risk factors for complications. A *p* value of <0.05 was considered statistically significant.

**Results**

**Glans shape**

Glans shape was categorized as grooved in 24 boys (57 %), as shallow in 9 (21 %) and as conical in 9 patients (21 %). Complications occurred in 8 cases (19 %) distributed as follows: 6 with grooved glans (14 %); 1 with shallow glans (2 %); and 1 with conical glans (2 %) (Table 1). There was no statistical difference among groups (*p* = 0.526).

**UP width**

UP width was <10 mm in 26 patients (62 %) and ≥10 mm in 16 boys (38 %). Complications occurred in 8 cases (19 %)

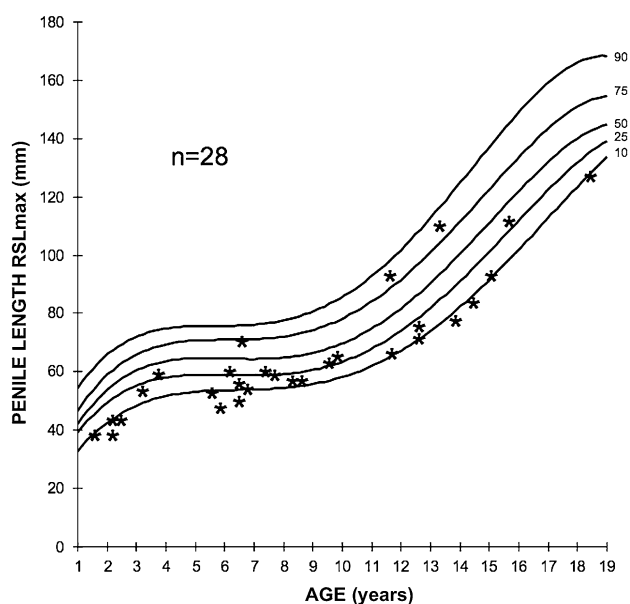
distributed as follows: 5 with UP width <10 mm (12 %) and 3 with UP width ≥10 mm (7 %). (Table 1) There was no statistical difference between groups (*p* = 0.648).

**UP length**

UP length was evaluated in 29 patients and was <10 mm in 12 cases (41 %) and ≥10 mm in 17 boys (59 %). Complications occurred in 7 cases (24 %): 1 with UP length <10 mm (3 %) and 6 with UP length ≥10 mm (21 %) (Table 1). There was no statistical difference between groups (*p* = 0.108).

**Prepuce vascularization**

Seventeen patients presented prepuce vascularization with one predominant blood vessel (41 %), 4 cases with complications; 8 patients had two predominant blood vessels (19 %), without complications; 6 patients had an H-like form with communication between two well-developed blood vessels (14 %), without complications; and 11 patients presented a net-like form with no predominant blood vessels (26 %), 4 cases with complications (Table 1). There was no statistical difference among groups (*p* = 0.130).



**Fig. 3** Distribution of penile size values plotted on a graph of percentile curves for ages according to penile anthropometry in Brazilian children and adolescents, assessed as real fully stretched length (RSLmax)

**Table 2** Complication rate after 6 months of regular postoperative follow-up

	Complications	
	No. of pts	%
Dehiscence	2	4.8
Stricture	4	9.5
Fistula	2	4.8
Total	8	19.0

#### Penile size (RSLmax)

Penile size was measured in 28 patients and results were plotted on a graph of percentile curves for ages according to penile anthropometry in Brazilian children and adolescents [8]. Twenty-five patients presented penile RSLmax under 50th percentile (89 %) (Fig. 3). There was no statistical difference among RSLmax measures concerning postoperative complications ( $p = 0.406$ ) (Table 1).

Table 2 summarizes the rate of complications experienced in the postoperative period.

#### Discussion

UP and genital tissues that could be potentially used on hypospadias repair are subjectively assessed by the surgeon considering factors that determine surgical difficulty, choice of technique and potential success. To our knowledge, few

studies in the literature have addressed this issue and most of them focus only on UP characteristics and position of urethral meatus, ignoring penis or genital role. Although TIP technique has been described some time ago, studies of penile anthropometric measurements comparing postoperative outcome, in patients with hypospadias, are recent [2–4].

Holland and Smith [3] assessed exclusively UP shape and width and concluded that a shallow groove predisposes to a narrower neourethra and meatal stenosis subsequently. Meatal stenosis occurred in 13 % of cases with a shallow urethral groove but that did not happen with deep urethral groove. Furthermore, 55 % of patients presented fistulas when UP width was  $<8$  mm, but in none of the cases that presented UP width  $\geq 8$  mm. Nevertheless, other groups assessing objectively the same UP characteristics presented opposing results and concluded that regardless of urethral plate configuration or width, the procedure has a low complication rate [4]. Similarly, our results showed that the glans shape and UP width do not significantly influence the complication rate.

The use of dorsal dartos flap as a protection layer over the neourethra has been used with good results [10, 11]. Well-vascularized flaps could be essential to decrease complication rate, representing a real protection but there was no statistical difference between groups in our series. Possibly prepuce vascularization would provide greater impact on techniques that use a foreskin flap to reconstruct the neourethra [12, 13].

One of the main aspects affecting the long-term satisfaction after hypospadias repair is penile length [14]. There is a difference between patients' vs surgeons' subjective perception concerning the size of the penis after hypospadias repair. Patients are less satisfied than the surgeon although no significant correlation is noted between penile satisfaction and penile length [15]. Some reports about proximal hypospadias convey the notion that penile length is negatively correlated to the degree of hypospadias [16]. Recent prospective series of children aged up to 5 years did not find any statistical difference [17]. However, this study measured the length of the dorsal aspect of the penis in the flaccid state, without stretching, and according to Gabrich et al. [8], this anthropometric measure presents low inter- and intra-individual reproducibility.

Our results clearly show that almost 90 % of the patients with distal hypospadias presented with penile size under mean length for age compared to penile anthropometry percentile curves in Brazilian children and adolescents [8]. None had micropenis. These data suggest some form of mild hypogonadism, mainly during fetal period that could affect penile development and cause hypospadias. Patients selected did not present any other signs of hypogonadism other than hypospadias and in general most patients with hypospadias do not. Models of urethral development and hypospadias induction show that inhibition of testosterone

action during fetal period may play a role in the genesis of hypospadias [18]. This finding might relate some form of mild hypogonadism during fetal period to hypospadias formation and penile underdevelopment.

Androgen stimulation with testosterone intends to improve the cosmesis and decrease the complications of hypospadias surgery since it temporarily increases the penis and claims to make surgical correction easier [19, 20]. A recent systematic review however shows that the real benefit of hormonal therapy in terms of improvement of the penis and surgical results has not been defined [21]. To our knowledge, penile size has not been previously evaluated as a potential risk factor for complications. Our results show that penile length do not influence on complication rate.

According to our study, there is no evidence that penile anthropometry has clinical utility in distal hypospadias cases, since none of the characteristics assessed presented statistically significant difference in the rate of complications, in a group patients with age ranging from 9 months to 18 years (median age of 9 years).

Our institution is a general tertiary high-complexity care center and patients are usually referred to our hospital older than we would prefer. Firstly because surgeons in secondary care centers may believe distal hypospadias are easier to treat and they try to operate on them. Secondly access to a tertiary care in a developing country is many times difficult. So we probably have a biased age at first surgery at our institution and these results therefore need to be interpreted considering that. In the other hand, results are especially interesting because due to the age range we could show that penile size was under mean length for age compared to penile anthropometry percentile curves.

## Conclusions

There is no evidence that penile anthropometry has clinical utility in distal hypospadias cases. Glans shape, UP width, UP length, prepuce vascularization and penile size do not significantly affect the complication rate of TIP repair in distal hypospadias.

Most of the patients with distal hypospadias presented with penile size under mean length for age compared to penile anthropometry percentile curves. This finding suggests some form of mild hypogonadism, mainly during fetal period that could affect penile development and cause hypospadias.

## References

- Lee OT, Durbin-Johnson B, Kurzrock EA (2013) Predictors of secondary surgery after hypospadias repair: a population based analysis of 5,000 patients. *J Urol* 190(1):251–256. doi:10.1016/j.juro.2013.01.091
- Sarhan O, Saad M, Helmy T, Hafez A (2009) Effect of suturing technique and urethral plate characteristics on complication rate following hypospadias repair: a prospective randomized study. *J Urol* 182(2):682–685. doi:10.1016/j.juro.2009.04.034 (discussion 685–686)
- Holland AJ, Smith GH (2000) Effect of the depth and width of the urethral plate on tubularized incised plate urethroplasty. *J Urol* 164(2):489–491
- Nguyen MT, Snodgrass WT, Zaontz (2004) Effect of urethral plate characteristics on tubularized incised plate urethroplasty. *J Urol* 171(3):1260–1262. doi:10.1097/01.ju.0000110426.32005.91 (discussion 1262)
- Merriman LS, Arlen AM, Broecker BH, Smith EA, Kirsch AJ, Elmore JM (2013) The GMS hypospadias score: assessment of inter-observer reliability and correlation with post-operative complications. *J Pediatric Urol*. doi:10.1016/j.jpuro.2013.04.006
- Bush NC, Holzer M, Zhang S, Snodgrass W (2013) Age does not impact risk for urethroplasty complications after tubularized incised plate repair of hypospadias in prepubertal boys. *J Pediatric Urol* 9(3):252–256. doi:10.1016/j.jpuro.2012.03.014
- Perovic SV, Radojicic ZI (2003) Vascularization of the hypospadiac prepuce and its impact on hypospadias repair. *J Urol* 169(3):1098–1100. doi:10.1097/01.ju.0000052820.35946.99 (discussion 1101)
- Gabrich PN, Vasconcelos JS, Damiao R, Silva EA (2007) Penile anthropometry in Brazilian children and adolescents. *Jornal de Pediatria* 83(5):441–446. doi:10.2223/JPED.1671
- Snodgrass WT (1999) Tubularized incised plate hypospadias repair: indications, technique, and complications. *Urology* 54(1):6–11
- Radojicic ZI, Perovic SV (2004) Classification of prepuce in hypospadias according to morphological abnormalities and their impact on hypospadias repair. *J Urol* 172(1):301–304. doi:10.1097/01.ju.0000129008.31212.3d
- Yucel S, Guntekin E, Kukul E, Karaguzel G, Ciftcioglu A, Melikoglu M, Baykara M (2004) Comparison of hypospadiac and normal preputial vascular anatomy. *J Urol* 172(5 Pt 1):1973–1976 (discussion 1976)
- Ceyhan L, Cagri Savas M, Baspinar S, Duman L, Buyukyavuz BI (2013) The correlation between preputial blood flow and microvessel density in distal hypospadias: a prospective clinical study. *J Pediatric Urol*. doi:10.1016/j.jpuro.2013.07.003
- Cagri Savas M, Kapucuoglu N, Gursoy K, Baspinar S (2011) The microvessel density of the hypospadiac prepuce in children. *J Pediatric Urol* 7(2):162–165. doi:10.1016/j.jpuro.2010.04.017
- Moriya K, Kakizaki H, Tanaka H, Furuno T, Higashiyama H, Sano H, Kitta T, Nonomura K (2006) Long-term cosmetic and sexual outcome of hypospadias surgery: norm related study in adolescence. *J Urol* 176(4 Pt 2):1889–1892. doi:10.1016/S0022-5347(06)00600-8 (discussion 1892–1883)
- Mureau MA, Slijper FM, Slob AK, Verhulst FC, Nijman RJ (1996) Satisfaction with penile appearance after hypospadias surgery: the patient and surgeon view. *J Urol* 155(2):703–706
- Bracka A (1989) A long-term view of hypospadias. *Br J Plast Surg* 42(3):251–255
- Fievet L, Harper L, Chirpaz E, Michel JL, Sauvat F (2012) Penile length is comparable in boys with and without hypospadias. *J Pediatric Urol* 8(5):493–496. doi:10.1016/j.jpuro.2011.10.006
- Kurzrock EA, Jegatheesan P, Cunha GR, Baskin LS (2000) Urethral development in the fetal rabbit and induction of hypospadias: a model for human development. *J Urol* 164(5):1786–1792
- Monfort G, Lucas C (1982) Dehydrotestosterone penile stimulation in hypospadias surgery. *Eur Urol* 8(4):201–203

20. Chalapathi G, Rao KL, Chowdhary SK, Narasimhan KL, Samujh R, Mahajan JK (2003) Testosterone therapy in microphallic hypospadias: topical or parenteral? *J Pediatr Surg* 38(2):221–223. doi:[10.1053/jpsu.2003.50047](https://doi.org/10.1053/jpsu.2003.50047)
21. Netto JM, PFF CE, Schindler Leal AA, Tucci S Jr, Gomes CA, Barroso U Jr (2013) Hormone therapy in hypospadias surgery: a systematic review. *J Pediatric Urol*. doi:[10.1016/j.jpurol.2013.03.009](https://doi.org/10.1016/j.jpurol.2013.03.009)