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Trends in Hypospadias Surgery: Results of a Worldwide Survey

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Abstract

Background: Hypospadias is a challenging field of urogenital reconstructive surgery, with different techniques currently being used.

Objective: Evaluate international trends in hypospadias surgery.

Design, setting, and participants: Paediatric urologists, paediatric surgeons, urologists, and plastic surgeons worldwide were invited to participate an anonymous online questionnaire (<http://www.hypospadias-center.info>).

Measurements: General epidemiologic data, preferred technique in the correction of hypospadias, and preferred technique in the correction of penile curvature were gathered.

Results and limitations: Three hundred seventy-seven participants from 68 countries returned completed questionnaires. In distal hypospadias (subcoronal to midshaft), the tubularised incised plate (TIP) repair is preferred by 52.9–71.0% of the participants. Meatal advancement and glanuloplasty (MAGPI) is still a preferred method in glandular hypospadias. In the repair of proximal hypospadias, the two-stage repair is preferred by 43.3–76.6%. TIP repair in proximal hypospadias is used by 0.9–16.7%. Onlay flaps and tubes are used by 11.3–29.5% of the study group. Simple plication and Nesbit's procedure are the techniques of choice in curvature up to 30°; urethral division and ventral incision of the tunica albuginea with grafting is performed by about 20% of the participants in severe chordee. The frequency of hypospadias repairs does not influence the choice of technique.

Conclusions: In this study, we identified current international trends in the management of hypospadias. In distal hypospadias, the TIP repair is the preferred technique. In proximal hypospadias, the two-stage repair is most commonly used. A variety of techniques are used for chordee correction. This study contains data on the basis of personal experience. However, future research must focus on prospective controlled trials.

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1. Introduction

Hypospadias is the most common malformation of the penis, and literally countless techniques for its repair have been described [1]. In large, systematic reviews of various types of hypospadias correction, no urethroplasty technique appears to be definitively superior. Moreover, comparison between series in the literature is challenging because of a lack of reliability in reporting outcome, which

complicates creation of universal recommendations [2–4]. In 2009, the European Association of Urology published guidelines for the treatment of hypospadias, with a level of evidence between case series and systematic reviews of cohort studies with or without homogeneity [5]. In clinical practice, many factors influence the choice of surgical technique, including “personal taste, upbringing, situational preference, training, experience and personal success” [6]. For that reason, we sought to determine which

techniques are most commonly being used today. We surveyed an international sample of paediatric surgeons, urologists, and plastic surgeons to identify common practices in terms of treatment of hypospadias.

2. Methods

We developed a multiple-choice questionnaire in English to address issues relevant to treatment of hypospadias. Table 1 gives an overview of all topics of the survey. This article deals with (1) general epidemiologic data of the participants, (2) preferred technique in the correction of hypospadias, and (3) preferred technique in the correction of penile curvature. The survey can be accessed online (<http://www.hypospadias-center.info>) and completed via drop-down menu, where we also presented photographs of typical hypospadias. Between October 2010 and February 2011, the survey was offered to national and international associations of paediatric surgery, paediatric urology, urology, and plastic surgery worldwide to be forwarded to the members. Moreover, personal e-mail lists and three Yahoo groups (pedsurg, pedurolog, and arab_pedsurg) were invited to participate. The study was carried out with permission of the ethical committee of the Medical University Vienna. Unidentifiable data collection was performed using a Structured Query Language database (client-server model for database access, Server 1&1, Vienna, Austria). Statistical analysis was performed using SPSS v.17.0 (IBM Corp., Somers, NY, USA).

To identify significant associations among demographic factors of the participating surgeons (age, number of operations, specialty, continent of origin) and preference of surgical techniques, we used the Pearson χ^2 test. The groups were divided into high-volume surgeons (>50 hypospadias operations per year), low-volume surgeons (<50 hypospadias operations per year), and surgeons <50 or >50 yr of age (arbitrary cut-off, meant in the sense of being less or more experienced); $p < 0.05$ was considered significant. Although not clearly defined, in the literature, >50 hypospadias operations per year is thought to be desirable for being called an experienced specialist [7]. Images of hypospadias used in the survey as well as detailed results can be accessed on the institution's Web site as supplementary material (http://www.hypospadias.info/supplement_eu/supplement.pdf).

Table 1 – Topics of the International Hypospadias Surgery Survey

Demographic data of participants	Age Country Specialty
Technique	Number of operations Preferred age for surgery Surgical technique for hypospadias repair Surgical technique for chordee correction Stents and catheters Suture material, suture technique Use of androgens Use of antibiotics Use of epinephrine Wound dressing
Follow-up and assessment of outcome	Follow-up period Methods of assessment
Complications	Infection Fistula Glandular dehiscence Breakdown Stricture Recurrent or persistent chordee
Anaesthesia, psychology	
Quality of survey	

Table 2 – Demographic characteristics of the 377 participants

Variable	No. (%)		
Age, yr	20–30	7 (1.9)	
	31–40	81 (21.5)	
	41–50	141 (37.4)	
	51–60	117 (31.0)	
	>60	27 (7.2)	
	Missing	4 (1.1)	
Gender	Male	331 (87.8)	
	Female	40 (10.6)	
	Missing	6 (1.6)	
Specialty	Paediatric surgery	228 (60.5)	
	Paediatric urology	99 (26.3)	
	Urology	27 (7.2)	
	Plastic surgery	15 (4.0)	
	Missing	8 (2.1)	
Region	Asia/Australia	120 (31.8)	
	Europe	118 (31.3)	
	Middle East/Turkey/ Arabic countries	64 (17.0)	
	South America	41 (10.9)	
	United States/Canada	25 (6.4)	
	Africa	4 (1.1)	
	Missing	6 (1.6)	
	Operations per year	<10	33 (8.8)
		11–25	108 (28.6)
		26–50	107 (28.4)
51–75		57 (15.1)	
76–100		37 (9.8)	
>100		28 (7.4)	
Missing		7 (1.9)	
Preoperative androgen application	Never	63 (16.7)	
	Rarely	257 (68.2)	
	Regular	41 (10.9)	
	Always	7 (1.9)	
Missing	7 (1.9)		

3. Results

Four hundred thirteen surgeons from 68 countries took part in the survey. Of the returned surveys, 36 were ineligible and thus were not completed or returned blank. In the final analysis, we included data from 377 participants (91.3%) with completed questionnaires. Table 2 provides demographic information about the cohort (age, sex, specialty, continent of origin, number of hypospadias corrections per year). In glandular hypospadias, the technique of choice is tubularised incised plate (TIP) urethroplasty ($n = 143$ [39.0%]), meatal advancement and glanduloplasty (MAGPI; $n = 125$ [34.1%]), other techniques ($n = 55$ [15.0%]), and no correction ($n = 44$ [12.0%]). Figure 1 shows the preferred techniques as percentages in the correction of several typical types of hypospadias with increasing severity (order: coronal, subcoronal, midshaft, penoscrotal, scrotal, perineal). Figure 2 shows the preferred technique of chordee correction and penile straightening as percentages between <10° and >50°.

The frequency of preoperative androgen application is also shown in Table 2. One hundred eight participants (39.4%) use topical dihydrotestosterone, 120 (43.8%) use intramuscular (IM) testosterone, 43 (15.7%) use testosterone cream, and 3 (1.1%) use β -human chorionic gonadotropin (β -HCG).

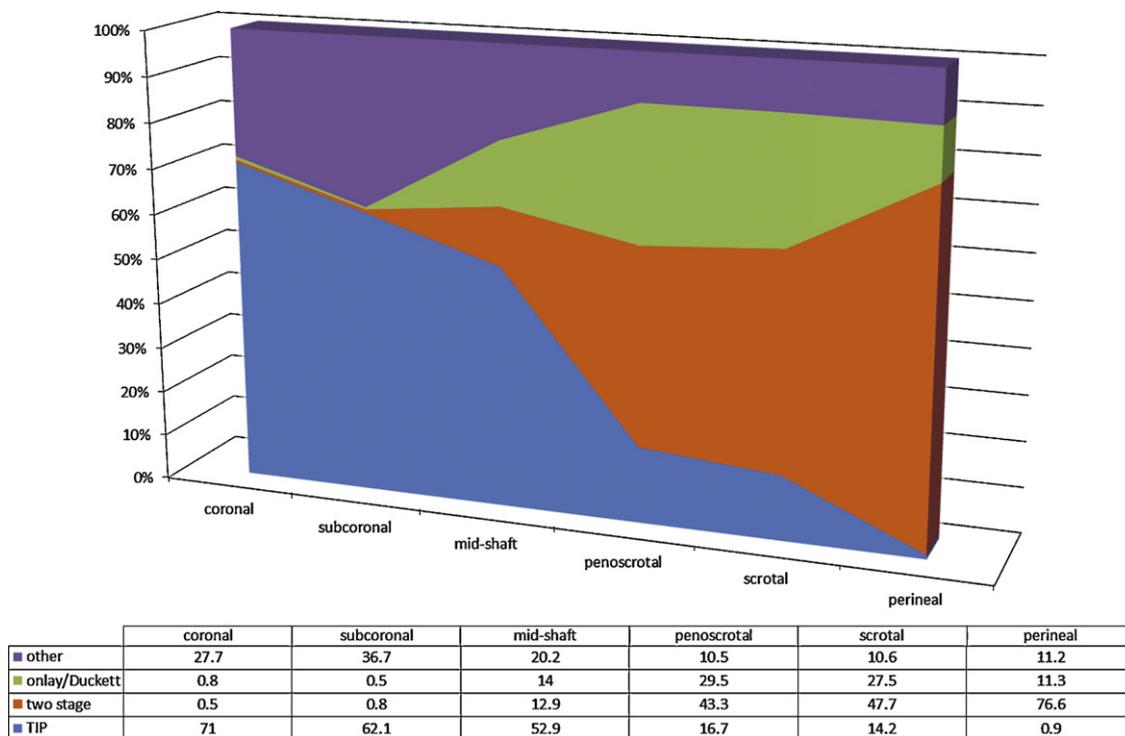


Fig. 1 – Preferred techniques of hypospadias repair as percentages (n = 377).
TIP = tubularised incised plate.

Interestingly, the frequency of hypospadias repairs per year does not influence the choice of technique. However, we observed that older surgeons (>51 yr of age) tend to use TIP repair in distal hypospadias less frequently than younger surgeons. Moreover, they more frequently use

other techniques than the two-stage repair in the correction of proximal hypospadias (Table 3). There were no significant differences in the groups for the choice of technique in the correction of chordee. There were no consistent differences between origin of surgeon, specialty of surgeon,

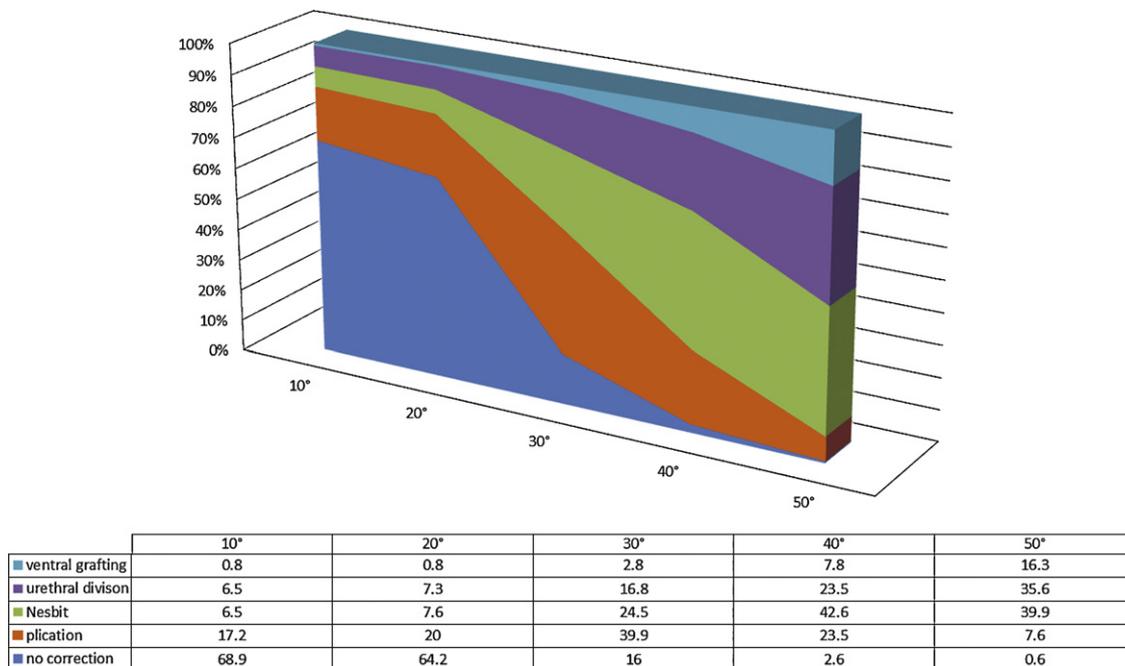


Fig. 2 – Preferred techniques of chordee correction as percentages (n = 377).

Table 3 – Observed differences in the choice of technique by age of surgeon (<51 or >51 yr of age) and number of repairs performed (<50 or >50 operations per year), χ^2 testing

	Subcoronal 1		Subcoronal 2		Midshaft		Penoscrotal 1		Penoscrotal 2		Perineal	
	TIP	Other	TIP	Other	TIP	Other	Two stage	Other	Two stage	Other	Two stage	Other
<51 yr of age, %	74.4	25.6	63.0	37.0	55.9	44.1	50.9	49.1	58.7	41.3	79.4	20.6
>51 yr of age, %	65.2	34.8	60.7	39.3	48.6	51.4	32.4	67.6	41.8	58.2	72.7	27.3
<i>p</i>	0.061		0.661		0.180		0.001		0.002		0.153	
<50 operations per year, %	70.5	29.5	62.6	37.4	54.5	45.5	44.7	55.3	53.4	46.6	76.8	23.2
>50 operations per year, %	72.3	27.7	60.5	39.5	50.4	49.6	41.4	58.6	50.9	49.1	77.6	22.4
<i>p</i>	0.726		0.706		0.471		0.557		0.652		0.862	

TIP = tubularised incised plate.

and preferred technique in the correction of hypospadias or chordee, except an insignificant trend among plastic surgeons preferring the two-stage repair.

4. Discussion

In this study, we sought to determine which techniques for hypospadias repair were most commonly being used by an international cohort of paediatric surgeons, urologists, and plastic surgeons. To our knowledge, the present study is the largest international, Internet-based survey for a special paediatric urologic issue ever performed. Our cohort consisted of surgeons from all continents, resulting in a large, heterogeneous sample with differences in origin, age, and speciality.

Classification of hypospadias is challenging. Although parameters such as the division of the corpus spongiosum, degree of ventral hypoplasia, quality of the urethral plate, and size of the glans play an important role, the location of the urethral opening most likely is the best means for a reliable and reproducible classification [8]. However, for this survey, we tried to choose images of typical hypospadias representing the whole spectrum, with the exclusion of redo cases.

4.1. Number of operations performed per year

According to Manzoni, for a good outcome, at least 40–50 cases of hypospadias repairs per year is desirable and, even more, relevant for complex redo cases [7]. Others have taken >20 operations per year as a criterion for a high-volume surgeon. However, what exactly constitutes a high-volume operator is a matter of discussion [9]. No prospective trials so far have defined a clear cut-off. Nevertheless, systematic reviews of other fields of surgical urology have shown a clear volume–outcome relationship, with potential benefits for the patient [10]. Two-thirds of our participants perform ≤ 50 hypospadias operations per year. Surprisingly, we could not show any differences in the choice of procedure and the caseload of our participants. A hypospadias surgeon should perform a high number of cases, be intellectually interested in hypospadias, and continuously review his or her results [8].

4.2. Preferred technique in the correction of hypospadias

Apparently, for the majority of our study group, even minimal forms of hypospadias should be corrected. Only

12% of the study group were in favour of “no correction” for glandular hypospadias. The MAGPI procedure was introduced in 1981 for the correction of distal defects with otherwise good appearance of the tissues [11]. Today, MAGPI and its modifications, with creation of slit-like meatus, continue to have a place in the repair of the most distal hypospadias and are regularly used [12].

The TIP procedure is the technique of choice in distal forms of hypospadias with sufficient urethral plate and good glandular and adequate ventral tissue because of its reliability and high success rate shown in large series [13,14]. In a literature review, the overall complication rate of TIP in distal hypospadias ranged between 0% and 23%, with an average of 7% in a multicentre study including five European and North American centres. However, 29.0–47.1% of the participants in this survey would have chosen other techniques than the TIP procedure in the repair of distal hypospadias. In a North American survey from 2005, 81.2–91.1% of 101 participants favoured the TIP procedure in the correction of distal hypospadias [15]. After nearly two decades of TIP, some concerns have been raised about long-term outcome, meatal stenosis, and pathologic uroflow pattern [4,16,17]. We are wondering whether our data reflect a more critical attitude towards the TIP procedure in the study group than some years ago or whether the images in the survey show typical hypospadias suitable for the TIP procedure.

In comparative single-centre studies, it has been shown that of the many techniques for proximal hypospadias repair with or without preservation of the urethral plate, two-stage repair, TIP, and onlay urethroplasty provide satisfactory functional and cosmetic outcome, with no statistically significant differences and similar complication rates [18,19]. However, the majority of our cohort prefers the two-stage repair for the correction of proximal hypospadias. This technique seems to represent a reliable solution when a full circumference urethroplasty is required or when the urethral plate is of dubious quality [20]. It is particularly appropriate for severe hypospadias associated with a poor plate and chordee [21]. Regardless of convincing results recently published [22], in our study group, the TIP repair in the correction of proximal hypospadias is not widely used. Six years ago in the study by Cook et al, the majority of surgeons still preferred a single-stage operation using island flaps or tubes in the correction of proximal hypospadias [15]. Only a small

number of participants in this study would have chosen island flaps or tubes in proximal hypospadias, although excellent long-term results of these procedures and their modifications have been published [23].

4.3. Preferred technique in the correction of penile curvature

Penile curvature resulting from chordee may be the most challenging part of hypospadias surgery. Persistent or recurrent curvature requires correction in later life or adulthood, which is associated with a high morbidity rate as recently encountered [24]. In our survey, we adopted the classification and treatment modalities for correction of penile curvature from Bologna et al. [25]. This approach may present an oversimplification, ignoring the complex nature of chordee with several subtypes, such as superficial cutaneous chordee; fibrous tissue between the corpora cavernosa and the urethral plate; a deficient, atretic urethral plate; and ventral hypoplasia of the tunica albuginea [26]. Again, there is no consensus on when and how chordee should be corrected.

A variety of techniques are applied for various degrees of chordee. Plication techniques have been proposed with or without mobilisation of the neurovascular bundle. The dorsal midline incision minimises the risk of injury to underlying neural structures [27]. However, shortening of the penis is the most striking disadvantage of any plication technique. In contrast, grafting of the ventral side, which is the most aggressive approach, results in penile straightening without shortening. More than 60% of the participants considered chordee $<20^\circ$ insignificant. There is some consistency with the data from Bologna et al, which showed that 80% of the respondents preferred no intervention in chordee $<10^\circ$ and 25% preferred no intervention in chordee $<20^\circ$ [25]. The dorsal approach, including simple plication, as well as Nesbit's procedure are the techniques of choice in curvature up to 30° ; urethral division and ventral incision of the tunica albuginea with grafting is performed by about 20% of the participants in severe chordee.

4.4. Preoperative androgen application

Androgens have been used to increase the size of the penis and to improve tissue quality prior to surgery. Negative effects of androgens on wound healing or other endocrine effects have not been sufficiently studied [28]. There is no evidence or consensus in the literature about preoperative androgen application [8]. The majority of the participants of our study either never use androgens or use them only in selected cases. They do use a variety of androgens, however: topical dihydrotestosterone, testosterone as IM injection or dermal application, and even β -HCG. Future placebo-controlled, multicentre studies will be necessary to generate general recommendations.

4.5. Limitations of the study

Our study group presents an extremely heterogeneous sample, and it is difficult to know how representative the 400 responders are. Unfortunately, from the data given, it is

not possible for us to give a reliable estimation of the response rate. We do not know how many societies have forwarded our invitation. For example, there were only 25 American responders, even though there are about 300 paediatric urologists in the United States. In contrast, 52 surgeons from India, 28 from Pakistan, and 15 from the United Kingdom took part in the survey. Limitations of language and the availability of e-mail contact may explain difficulties in reaching surgeons from Africa, Russia, and China. Moreover, it should be acknowledged that asking surgeons to list the number of hypospadias cases per year may result in an erroneous answer because of their (1) not knowing the correct number or (2) overestimation of their own numbers.

4.6. Recommendations for future studies

We were surprised by the high number of participants. We feel that online surveys in the future could be preferable tools for studies in the treatment of complications of hypospadias, complex redo surgery, or other controversial topics in paediatric urology.

5. Conclusions

In this study, we identified current international trends in the management of hypospadias. In distal hypospadias, the TIP repair is the preferred technique. In proximal hypospadias, the two-stage repair is most commonly used. A variety of techniques are used for chordee correction. This study contains data on the basis of personal experience. However, future research must focus on prospective, controlled trials.

Author contributions: Alexander Springer had full access to all the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

Study concept and design: Springer, Horcher.

Acquisition of data: Krois, Springer.

Analysis and interpretation of data: Springer, Krois.

Drafting of the manuscript: Springer, Krois.

Critical revision of the manuscript for important intellectual content: Springer, Horcher.

Statistical analysis: Springer, Krois.

Obtaining funding: None.

Administrative, technical, or material support: Krois.

Supervision: Horcher.

Other (specify): None.

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