An Update of Current Practice in Hypospadias Surgery

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Abstract

Today, a multiple number of surgical techniques, modifications, and combinations of techniques are used to improve cosmetic and functional outcomes and to minimise the procedure burden for the patient. Nevertheless, controversy exists regarding the ideal management of hypospadias. This update is based on current literature following a systematic review using MEDLINE.

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1. Introduction

Modern hypospadiology has considerably evolved since the 1980s but significant challenges remain like standardising the management with evidence-based protocols and the assessment of longer-term outcomes. The salient points from this update have been classified in terms of level of evidence and grade of recommendation as proposed by the Centre for Evidence Based Medicine [1] and shown in Table 1. Application of a structured analysis of the literature was not possible in many conditions due to a lack of well-designed studies. The limited availability of large randomised controlled trials— influenced also by the fact that a considerable number of treatment options relate to surgical interventions on a large spectrum of a congenital pathology—means this document is largely a consensus document.

2. Why should hypospadias be corrected?

Hypospadias may implicate functional and cosmetic impairment. Indication for hypospadias surgery therefore includes the need for the correction of penile deviation and rotation, glans cleft and tilt, ectopic and stenotic urethral meatus, hooded prepuce, penoscrotal transposition, and penile size.

The ideal result of surgery is construction of a good calibre urethra with a slit-like urethral meatus at the tip of the glans and a straight penis. Voiding and sexual activity should not be impaired by hypospadias or its corrective procedure.

Surgery should allow boys with hypospadias to grow up as self-confident young men with a normal body image. Long-term outcome and health-related quality of life is associated with the severity of hypospadias and the sequelae of surgery. Hypospadias is usually classified based on the anatomical location of the proximally displaced urethral orifice. This is clinically not relevant, does not relate well with the outcome, and pathology may significantly change after degloving of the skin.

It is more common that hypospadias is classified as distal and proximal, where proximal cases are more severe. Patients with severe hypospadias and those with non-favourable surgical outcomes are more likely to suffer a negative psychological impact than those with minor hypospadias and good surgical results. Therefore there is
an argument for a new classification of hypospadias based on the cost-benefit ratio for the patient [2].

The position of the meatus allows standardised nomenclature and is thought to be a major prognostic factor for outcome [3]. Other more complex items (level of division of the corpus spongiosum, penile curvature, ventral hypoplasia, quality of urethral plate, etc.) should also be taken into account in the classification but they are much more difficult to assess reliably and objectively with validity [4,5].

3. When should hypospadias be corrected?

Based on expert opinion, it is better to perform surgery of the male genitalia between 6 mo and 18 mo of age [6,7]. This recommendation is based on surgical and anaesthetic considerations and the psychology of the infant male (cognitive development, genital awareness, emotional development, and psychosexual development). However, there is spare evidence regarding this and there are contradictory findings [8]. It is generally believed that early repair is associated with a lower complication rate, but again, there is inconsistency in literature. Last but not least, there are rising concerns by patient groups that esthetical genital surgeries in minor hypospadias without functional impairment should be postponed to an age where informed consent can be given by the patient himself [9].

4. Preoperative androgens?

Androgen stimulation has been used for a long time to enhance the size of the penis and to improve quality of tissues [10]. There are two randomised controlled trials showing that preoperative androgen stimulation improves outcome (cosmesis and complication rate) [11,12]. There is no consensus on the best type of androgen, the application route, and correct way of application. Two recent systematic reviews and meta-analysis critically assess the effect of androgen stimulation on surgical outcomes but remained inconclusive [13,14]. It is a fact that androgens stimulate penile growth [15]; however, the real benefit in hypospadias surgery and long-term side effects of male sexual hormone application still needs to be defined.

5. Perioperative antibiotics, urinary drainage, and wound dressing

For now, there is no consensus on the type of urinary drainage, stenting of the urethra, wound dressing, or the use of antibiotics. Each surgeon has his or her own preference. Urine can be drained using a transurethral catheter, transurethral dripping stent, or a suprapubic tube of various sizes. Most surgeons would agree that postoperative urinary diversion seems to reduce complications. However, in cases of distal hypospadias, some surgeons prefer no drainage at all [16–23]. With regards to urinary diversion, there is no clear evidence that wound dressing is of any benefit for surgical outcome. The rational for wound dressing seems clear: dry, safe, and clean immobilisation of the penis for a limited period of time to allow wound healing and minimise postoperative discomfort and there are many different products available: foam dressing...
(Cavicare), transparent film dressing (Tegaderm), simple circular wound dressing, and indigenous home-made devices. However, two prospective randomised trials show no difference between postoperative dressing versus no postoperative dressing [24,25]. Most surgeons use prophylactic antibiotics in hypospadias repair but there is no consensus regarding when to administer what type of antibiotics for what period of time [26,27]. Evidence for prophylactic antibiotics in hypospadias management is very limited and there is still ongoing discussion if there is a real benefit in administering antibiotics [28–31].

6. Preferred technique for hypospadias repair

Literally hundreds of techniques have been reported over the years. The choice of the technique mainly depends on the experience of the surgeon with the technique and his experience on different types of hypospadias. The surgeon should be able to define the anatomic components well, and choose and modify the technique according to the anatomy. Although common sense demands standardisation of procedures, many times there will be a need to make minor modifications in the technique which can only be done by dedicated surgeons at high-volume centres. The use of magnification and microsurgical instruments, tissue handling with minimal trauma and fine suture material are essential. For now, the search for the ideal procedure for all hypospadias continues. An algorithm to the management of hypospadias is shown in Figure 1.

7. Mild hypospadias repair

In the recent past, tubularised incised plate urethroplasty (TIP) repair has become the most popular technique for distal hypospadias repair worldwide [32–34]. Meta-analysis and systematic reviews of large retrospective cohort studies show that there is enough evidence to recommend the TIP repair as versatile, highly standardised, and a simple technique that provides favourable cosmetic and functional short- and long-term results with a reasonably low complication rate [35–38]. Since its introduction in 1994, TIP repair has evolved and consecutive modifications have significantly lowered the complication rates and it has come down to a fistula rate of 5.7% in primary mild hypospadias and a reoperation rate of 4.5%, respectively [39]. In particular, the fistula rate can

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Fig. 1 – Algorithm of surgical management of hypospadias.
TIP = tubularised incised plate urethroplasty.
be decreased by covering the urethral plate with a waterproofing layer of dartos tissue [40–42]. There are many other techniques described with personal modifications. For example, Mathieu urethroplasty and its modifications are still popular procedures with excellent results [43]. Systematic reviews comparing the TIP repair and Mathieu repair show that no technique appears to be significantly superior over the other with similar fistula rates (3.4–3.6%), but there is a higher incidence of meatal stenosis in TIP (3.0% vs 0.6% in Mathieu) after 6–12 mo follow-up [44,45].

8. Severe hypospadias

Management of severe hypospadias is challenging and should only be offered in specialised centres with an adequate number of patients. Outcome is influenced by the presence of chordee (penile curvature), quality of the urethral plate, quality of ventral tissues, scrotal transposition, and last but not least the size of the penis. Over the years, large numbers of techniques have been described. In single centre studies, most of those techniques could provide favourable cosmetic and functional outcomes. In a recent 20-yr systematic review for surgical correction of severe hypospadias no approach appeared to be superior over the other [46]. Another systematic review comparing the transverse island flap technique and TIP show no major differences in clinical outcome [47]. However, both reviews indicated general problems of reporting data in hypospadiology: no clear definition of severe hypospadias, limited number of patients, limited follow-up, and no clear defined outcome measures. The authors therefore come to the conclusion that "these data have to be confirmed by more well-designed randomised controlled trials with high quality in the future" [47]. Today’s surgical armamentarium in the management of hypospadias is huge and diverse, as shown in Table 2, with a clear international majority favouring a staged repair in complex hypospadias [32].

The two-stage repair, either using grafts or flaps, is a versatile technique when there is severe chordee, a small glans, and ventral scarring [48,49]. In two-stage repair, the operation starts with (ventral) degloving. The decision to sacrifice the urethral plate is key and is left until after artificial erection test. Chordee correction could take place in many ways after fibrous tissue is excised as much as possible. Multiple transverse corporotomy incisions can be applied to lengthen the ventral aspect of the corpora cavernosa [50]. If necessary, dorsal plication with or without mobilisation of the neurovascular bundle can help to straighten the penis [51,52]. The dorsal midline incision minimises the risk of injury to the neurovascular bundle. More aggressive techniques like ventral corporal grafting are rarely needed and their long-term outcomes are doubtful [53]. The glans wings are mobilised extensively. Inner or outer preputial skin or buccal mucosa are the preferred graft materials. The graft is quilted onto the corpora. It is recommended to place tunica darts flaps onto the corpora laterally as a bed providing an extensive amount of healthy tissue for the second-stage urethroplasty [54]. Appropriate urinary drainage and pressure wound dressing is crucial for a good outcome. Second-stage urethroplasty is performed by tubularisation of the graft with two further layers of tunica darts to cover the urethroplasty.

9. Follow-up and outcome

Long-term follow-up is of substantial importance. A recent systematic review showed that there is a significant lack in long-term data. Although there is a growing number of articles reporting reliable and valid data like inclusion and exclusion criteria, study design, primary and secondary outcome parameters, follow-up, a detailed description of the surgical procedure, and so on [55], quality of data is influenced by low follow-up periods and rates, heterogeneous patients and data, and a lack of validated questionnaires and control groups [56]. It has been criticised that follow-up periods—particularly in Northern America—are short [39], although some believe that most complications occur early after surgery [57]. However, there is evidence that the real number of complications is only to be assessed in long-term follow-up after puberty or even adulthood [58,59]. Although some current long-term studies have follow-up rates between 12.7%, 22.4%, and 56.2%, most outcome studies do not provide a follow-up rate or those lost to follow-up [60–62]. Table 3 shows long-term outcome studies from 2010 to 2015. Although the majority of patients do well after hypospadias repair there are reports

<table>
<thead>
<tr>
<th>Name</th>
<th>Reference</th>
<th>Yr</th>
<th>N</th>
<th>Generic name</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patel</td>
<td>[77]</td>
<td>2004</td>
<td>73</td>
<td>Duckett</td>
<td>Preputal flap as transverse island tube or island onlay flap with long- term f/u of 14.2 yr. Very versatile technique with many modifications in literature, widely used.</td>
</tr>
<tr>
<td>Obaidullah</td>
<td>[79]</td>
<td>2005</td>
<td>1415</td>
<td>Two stage repair</td>
<td>Two-stage repair very safe and applicable to all cases.</td>
</tr>
<tr>
<td>Snodgrass</td>
<td>[82]</td>
<td>2011</td>
<td>26</td>
<td>TIP</td>
<td>Suitable when no minor curvature and good quality of urethral plate.</td>
</tr>
<tr>
<td>Vepakomma</td>
<td>[83]</td>
<td>2013</td>
<td>24</td>
<td>Koyanagi</td>
<td>Based on a parametral foreskin flap, many modifications since its introduction in 1983, technically challenging.</td>
</tr>
<tr>
<td>Hadidi</td>
<td>[84]</td>
<td>2014</td>
<td>63</td>
<td>BILAB</td>
<td>Bilateral based preputial and penile skin flaps, generous blood supply.</td>
</tr>
</tbody>
</table>

f/u = follow-up; TIP = tubularised incised plate urethroplasty.
Table 3 – Long-term outcome studies from 2010 to 2015

<table>
<thead>
<tr>
<th>Name</th>
<th>Reference</th>
<th>Yr</th>
<th>N</th>
<th>Age at surgery (yr)</th>
<th>Age at FU (yr)</th>
<th>FU period (mo)</th>
<th>Fistula (%)</th>
<th>Curvature (%)</th>
<th>Stenosis (%)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ortvist</td>
<td>[85]</td>
<td>2015</td>
<td>167</td>
<td>4</td>
<td>34</td>
<td>29</td>
<td>16.4</td>
<td>23</td>
<td>5</td>
<td>Impaired cosmesis, shorter penis, more UTIs</td>
</tr>
<tr>
<td>Andersson</td>
<td>[86]</td>
<td>2015</td>
<td>40</td>
<td>3.6</td>
<td>15.2</td>
<td>11.6</td>
<td>5</td>
<td>15</td>
<td>22.5</td>
<td>Uroflow improves over time.</td>
</tr>
<tr>
<td>Hueber</td>
<td>[87]</td>
<td>2015</td>
<td>153</td>
<td>2.9</td>
<td>&gt;10</td>
<td>21/16/5</td>
<td>0/4/2</td>
<td>16/16/10</td>
<td>Favourable outcomes ([TIP/Mathieu/MAGPI].</td>
<td></td>
</tr>
<tr>
<td>Fraumann</td>
<td>[61]</td>
<td>2014</td>
<td>13</td>
<td>1.2</td>
<td>21</td>
<td>20</td>
<td>7.5</td>
<td>38.5</td>
<td>7.5</td>
<td>Satisfactory outcome, lower orgasmic function.</td>
</tr>
<tr>
<td>Ekmark</td>
<td>[88]</td>
<td>2013</td>
<td>114</td>
<td>4.5–5</td>
<td>16</td>
<td>12</td>
<td>11</td>
<td>5.4</td>
<td>3.6</td>
<td>Curvature can develop over time.</td>
</tr>
<tr>
<td>Perera</td>
<td>[60]</td>
<td>2012</td>
<td>60</td>
<td>1.8</td>
<td></td>
<td>11.3</td>
<td></td>
<td></td>
<td></td>
<td>Uroflow lower than controls, associated with previous chordee.</td>
</tr>
<tr>
<td>Ciancio</td>
<td>[89]</td>
<td>2015</td>
<td>20</td>
<td>5</td>
<td>33</td>
<td>28</td>
<td></td>
<td>Good cosmesis, no erectile dysfunction, low IPSS, penis shorter.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ruppen-Greff</td>
<td>[90]</td>
<td>2013</td>
<td>45</td>
<td></td>
<td>26.2</td>
<td></td>
<td></td>
<td>HRQoL were not impaired among men.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chertin, Prat</td>
<td>73,91</td>
<td>2012</td>
<td>119</td>
<td>2.7</td>
<td>Adults</td>
<td></td>
<td></td>
<td>Good cosmetic results, mild erectile dysfunction, numerous techniques, high complication rates (0–100%).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Robinson</td>
<td>[92]</td>
<td>2012</td>
<td>18</td>
<td>2.5</td>
<td>12.5</td>
<td>10.5</td>
<td></td>
<td>Good flow and cosmesis.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kiss</td>
<td>[59]</td>
<td>2011</td>
<td>104</td>
<td>24–42</td>
<td>20–30</td>
<td></td>
<td></td>
<td>Less satisfaction with genital appearance, however healthy psychosexual development possible.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jiao</td>
<td>[64]</td>
<td>2011</td>
<td>43</td>
<td>21.6</td>
<td></td>
<td></td>
<td></td>
<td>Main complaint penile size and curvature, sexual function impaired.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

FU = follow-up; HRQoL = health-related quality of life; IPSS = International Prostate Symptom Score; LUTS = lower urinary tract symptoms; MAGPI = meatal advancement and glanduloplasty; TIP = tubularised incised plate urethroplasty.

of adult reconstructive urologists trying to attract attention to the fact that some patients need redo surgery in adulthood. Table 4 shows the current series of hypospadias redo surgeries in adults.

In literature, short-term and mid-term outcomes of hypospadias surgery seem favourable. However, the majority of these publications present single-centre and single-surgeon retrospective case series with a limited follow-up period and a limited number of patients undergoing follow-up [63]. Assessment of outcome includes: cosmesis, functional outcome (micturition and sexuality), and quality of psychosexual life.

9.1. Cosmesis

Patients who had surgery for hypospadias may have a significant concern about penile appearance and penile size. Generally, a better cosmetic outcome is related to better

Table 4 – Series of hypospadias redo surgery in adults

<table>
<thead>
<tr>
<th>Name</th>
<th>Reference</th>
<th>Age at surgery (yr)</th>
<th>FU period (mo)</th>
<th>n</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stein</td>
<td>[70]</td>
<td>2014</td>
<td>39.7</td>
<td>15 (3–28)</td>
<td>163</td>
</tr>
<tr>
<td>Myers</td>
<td>[93]</td>
<td>2012</td>
<td>38</td>
<td>7.4</td>
<td>50</td>
</tr>
<tr>
<td>Ching</td>
<td>[94]</td>
<td>2011</td>
<td>37</td>
<td>55</td>
<td>55</td>
</tr>
<tr>
<td>Barbaglio</td>
<td>[95]</td>
<td>2010</td>
<td>31</td>
<td>60.4</td>
<td>1176 (926 older than 16 yr)</td>
</tr>
</tbody>
</table>
sexual outcome [64]. There are several objective and validated scores to evaluate the outcome of hypospadias surgery (Hypospadias Objective Scoring Evaluation, Paediatric Penile Perception Score, Hypospadias Objective Penile Evaluation Score) [65–67]. For example, the Hypospadias Objective Penile Evaluation Score evaluates the position and shape, the shape of the glans, the penile skin, and curvature and torsion of the penis [65]. An independent person should ideally rate the outcome. Scoring is easy to apply, can be kept in the patients notes, and allow prospective evaluation. The International Disorders of Sex Development registry [68] and The Dutch (International) Hypospadias Study [65] are international databases for the allocation of prospective hypospadias patients. Every hypospadias surgeon is encouraged and invited to join such a database for personal audit and research purposes.

9.2. Functional outcome

Functional outcomes are just beginning to be reported in literature. A recent systematic review recommends a uroflow study after toilet training. Children with obstructed flow parameters or borderline flows should be followed until adulthood. However, the significance of this advice remains uncertain [69]. In an Australian study of long-term follow-up, urinary flow rates were significantly lower compared with age-matched controls but still fell within the normal range without significant association with lower urinary tract symptoms and poor urinary flow. However, severe chordee preoperatively seems to be a significant risk factor for poor urinary flow [60]. Therefore, in adults following hypospadias surgery it may be necessary to have a repeated close look at urinary flow, postvoid residuals, symptoms of lower urinary tract symptoms, or other urinary signs.

In most of the cases sexual function, strength and duration of erection, problems with ejaculation (spraying, dribbling, retrograde ejaculation, and premature ejaculation), and masturbation are not impaired. However, depending on the severity of chordee, ventral hypoplasia, type and length of urethroplasty, burden of surgery, and other factors, there may be concerns for the patient and there are standardised assessment scores available to objectively rate those concerns (International Prostate Symptom Score, International index of erectile function, and Sexual Symmetry Score) [63]. A certain prevalence of erectile dysfunction hypospadias patients has been reported [70].

9.3. Psychosexual outcome

Psychosexual well-being is far more difficult to evaluate. There are only a few studies assessing long-term psychosexual adjustment and sexual function, health-related quality of life, and quality of sexual life without or matched with control groups. These data are very limited and controversial [62,64,71–76]. Generally speaking, hypospadias patients should do well in adulthood in all regards (cosmesis, function, and psychology), but there can be significant issues, like impaired capacity for social and emotional relations, self-esteem, relationships, sex life, etc. The more severe the hypospadias, the less satisfactory the long-term outcome and as alluded to earlier, better cosmetic outcome is related to better sexual outcome [64]. In patients at risk, it seems important to provide meticulous transitional care where the paediatric patient is transferred into an adult urology service.

Conflicts of interest

The authors have nothing to disclose.

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[58] Spinnoit AF, Poelaert F, Groen LA, Van Laecke E, Hoebeke P. Hypospadias repair at a tertiary care center: long-term followup is


