Three-week or one-week bladder catheterization for hypospadias repair? A retrospective-prospective observational study of 189 patients

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ABSTRACT

Purpose: While there is little scientific evidence over the optimal duration for transurethral bladder catheterization after hypospadias repair, most surgeons leave the catheter for 7–10 days. We herein describe our experience with bladder catheterization for three weeks after hypospadias repair, an approach not previously described in the literature.

Patients and Methods: We reviewed the charts of 189 patients who underwent hypospadias repair by a single pediatric urologist. The study population was divided as follows: group 1 consisted of children operated between March 2007 and September 2010 and whose catheters were left for one week (n = 95); group 2 consisted of those operated between September 2010 and July 2013 and whose catheters were left for three weeks (n = 94). The primary objective of the study was to compare complication rates between the two groups. Secondary outcomes were evaluation of the effect of age, surgical technique, curvature, and hypospadias degree as potential factors for postoperative complications.

Results: Median age at hypospadias repair was 18 months (range, 3–100 months) in group 1, and 16 months (range, 2–96 months) in group 2, P = .209. The complication rate was 22.1% (n = 21) for group 1 and 7.4% (n = 7) for group 2, P = .005. Complications observed in group 1 and 2 were meatal stenosis (n = 4 and 2, respectively) and urethro-cutaneous fistulas (n = 17 and 5, respectively). Coronal fistulas manifested more frequently in patients in group 1 compared to those in group 2 (13.7% vs. 3.2%, P = .01). Complications were observed in 20 patients out of 139 (11.5%) after Duplay, and in 8 patients out of 15 (53.3%) after Duckett (P < .001). In Duplay cases, complications were significantly associated with one-week bladder catheterization (OR: 5.00; 95% CI: 1.53–16.32; P = .008) and higher age group at operation (OR: 1.88; 95% CI 1.07–3.28; P = .026). In Duckett cases, number of surgeries, age, severity, curvature and catheter duration were not found to be associated with complications.

Conclusion: In cases of Duplay, a three-week instead of one-week catheterization and age below 6 months at hypospadias repair are associated with a better outcome and fewer complications.

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retrospective part of our study. Since September 2010, we initiated the prospective part of our study, where all patients had the catheter left for 3 weeks (group 2). Chart review was performed after approval from the institutional review board, and included age, severity of hypospadias, intraoperative details, length of hospital stay, follow-up period, and complications. Surgical indications included all patient with hypospadias that presented after the age of 3 months. Patients with cripple hypospadias requiring buccal mucosal graft repairs, as well as those who had a MAGPI repair were excluded. Complications and cosmetic appearances were documented on outpatient clinic visits after 1 week, 3 weeks, and 6 months after the repair. A “very good” cosmetic result was defined as a normal appearance of a circumcised penis, with the meatus present on the distal part of the glans, with no curvature. “Good” result was defined as a near normal appearance of a circumcised penis, with meatus present on the glans, with no curvature. “Acceptable” result was defined as a near normal appearance of a circumcised penis, with meatus present just distal to the coronal sulcus, with no curvature left.

1.2. Data analysis

Statistical significance was set at a \( P < .05 \) using the Chi-squared test for categorical and the non-parametric Wilcoxon–Mann–Whitney \( U \) test for continuous variables. Multivariate analyses were conducted using logistic regression analysis. Statistical calculations were performed with IBM SPSS Statistics (version 20.0, IBM Corp., Armonk, NY).

1.3. Study objective

This is a single center, single surgeon nonrandomized observational retrospective-prospective study examining hypospadias outcomes in the pediatric population after changing one technical parameter: the duration of urethral catheterization. The primary outcome of the study was to compare complication rates between cases where the catheter was left for one week (group 1) and cases where it was left for three weeks (group 2), with the hypothesis that extended catheterization after hypospadias repair will result in lower rates of fistula formation and meatal stenosis. Secondary outcomes were evaluation of the effect of age, surgical technique, curvature, and hypospadias degree as potential factors associated with postoperative complications.

1.4. Operative technique

All hypospadias repairs were performed by the same senior surgeon (PD), with 20 years of experience in hypospadias repair. No preoperative testosterone therapy was used.

In all cases, we begin by complete degloving of the penis and release of cutaneous and fibrous curvature if present. In cases where a straight penis is obtained, we proceed with a modified Duckett procedure (Table 2.1). As for cases operated by Duplay, birepative analysis showed that complication incidence was significantly associated with increasing age group, and manifested more frequently in patients in group 1 compared to those in group 2 \( (13.7\% \text{ vs. } 3.2\%, P = .01) \). No significant difference between the two groups was found in case of mid-shaft fistulas \( (1.1\% \text{ vs. } 1.1\%, P = .994) \), peno-scrotal fistulas \( (3.2\% \text{ vs. } 1.1\%, P = .317) \) and meatal stenosis \( (4.2\% \text{ vs. } 2.1\%, P = .414) \). All complications took place within the first six months postoperatively. We have not observed late complications. Meatal stenoses were managed with urethral meatotomy. Urethro-cutaneous fistulas were managed with excision of the fistulous tract followed by approximation of healthy urethral tissue and three weeks bladder catheter drainage, resulting in a successful closure in all cases. No additional procedures were performed or needed in either group.

Complications were observed in 20 patients \( (11.5\%) \) after Duplay, and in 8 patients \( (53.3\%) \) after Duckett \( (P < .001) \). Number of surgeries, age group, hypospadias severity, curvature and catheter duration were not found to be statistically associated with complications in cases operated by Duckett procedure (Table 3). As for cases operated by Duplay, univariate analysis showed that complication incidence was significantly associated with increasing age group, and manifested more frequently in patients in group 1 compared to group 2 (Table 2.2).

Multivariate analysis of factors associated with postoperative complication after a Duplay procedure showed that a one-week bladder catheterization was associated with five times more complications compared to three-week bladder catheterization \( (OR 5.00, 95\% CI 1.53–16.32) \), and about twice the possibility of complications with increasing age \( (OR 1.88, 95\% CI 1.07–3.28) \). Primary vs. reoperative procedure and hypospadias degree were not significantly associated with development of complications in those operated by Duplay procedure (Table 3).

3. Discussion

Hypospadias is the most common congenital malformation in males [9]. The modern repair involves a single stage procedure with the aim to provide satisfactory cosmetic and functional results [8,10]. Despite the advanced surgical techniques, postoperative complications still occur. Complete dehiscence, urethro-cutaneous fistula, and meatal stenosis are the most common complications, and typically develop within 6
months postoperatively [11–13]. The incidence of urethro-cutaneous fistula after hypospadias repair ranges from 0 to 30% [14,15]. Interposition of vascularized tissues between the repair and the skin (such as Darts flap) has shown to decrease the incidence of fistula [6,7,16]. The protective layer that we have been using in both groups consists of a Y-to-I spongiosaplasty wrap, as previously described by Verkes et al. [7], because not only it reduces fistula formation, but also provides support to the urethra and thus prevents diverticula [14], and therefore we did not find it necessary to add a Darts flap.

Although many factors have been found to affect the occurrence of complications, there is still much debate over the role of urinary diversion and urethral stenting in this regard [4,15]. Many discourage the use of suprapubic urinary diversion and urethral stents and consider them to increase infection risk and patient discomfort (owing to bladder spasms) with no additional beneficial effect on surgical outcome [1,17]. Although Almodhen et al. had no fistula in a retrospective review of 32 of stent-free repairs, the limited number of cases and lack of a control group might explain why their results contrasted other reports [14].

In order to avoid the risks of urinary retention and extravasation following stent-free procedures, some authors compared their cases of urethral stent to those with only suprapubic urinary diversion after hypospadias repair. They found that suprapubic urinary diversion provides a significantly lower fistula rate, but more meatal stenosis [2,3]. Of notice, their patients had a urethral stent and not a bladder catheter. While placing a catheter inside the bladder helps divert the urine freely, a common side effect is having bladder spasms owing to irritation of the detrusor by the tip of the catheter, but those symptoms typically resolve by administering anticholinergic medications. In order to avoid patient discomfort, some surgeons recommend placing a urethral “stent” where the tip is placed just below the external urinary sphincter. However, the main disadvantage of this method is voiding difficulty. On the other hand, in their randomized controlled trial, Arda et al. reported no case of bladder spam in their bladder catheter group and found that urethral stenting not only leads to significant patient irritability and voiding difficulty, but also resulted in significantly more complications such as meatal stenosis and fistula, concluding that bladder catheterization prevents these complications [4].

The majority of pediatric urologists do leave a bladder catheter after their hypospadias repairs, as it has shown to have less complications than either stenting or no-diversion methods [4,18]. However the ideal duration for leaving the catheter has not been determined. Asian and colleagues hypothesized that leaving a catheter for longer duration may induce more of an inflammatory reaction, further inhibiting scarless healing and promoting fistula; but their retrospective review of 128 repairs found similar complication rates when comparing patients with very early catheter removal to those who were left for up to one week with their catheters [5].

To better understand the urethral healing processes, Matthias et al. analyzed urethral wound healing in a rat model of urethroplasty, and found that urethral healing recapitulates the phases of dermal healing (acute inflammation, proliferation, maturation and remodeling), however, with longer duration of each phase [19]. They also noted that the

### Table 1

Patient and surgical demographics.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Group 1</th>
<th>Group 2</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient number</td>
<td>95 (50.3%)</td>
<td>94 (49.7%)</td>
<td>.883</td>
</tr>
<tr>
<td>Surgery</td>
<td>19 (20%)</td>
<td>18 (19.1%)</td>
<td>.209</td>
</tr>
<tr>
<td>Reoperative</td>
<td>18 (3–100)</td>
<td>16 (2–96)</td>
<td>.09</td>
</tr>
<tr>
<td>Age group</td>
<td>1.6 (0.8–3.2)</td>
<td>1.5 (0.8–3.0)</td>
<td>.39</td>
</tr>
<tr>
<td>≤6 months</td>
<td>20 (21.1%)</td>
<td>25 (26.6%)</td>
<td>.371</td>
</tr>
<tr>
<td>&gt;6 months to ≤12 months</td>
<td>19 (20%)</td>
<td>20 (21.3%)</td>
<td>.828</td>
</tr>
<tr>
<td>&gt;12 months to ≤18 months</td>
<td>10 (10.5%)</td>
<td>10 (10.6%)</td>
<td>.880</td>
</tr>
<tr>
<td>&gt;18 months</td>
<td>46 (44.4%)</td>
<td>39 (41.5%)</td>
<td>.338</td>
</tr>
</tbody>
</table>

### Table 2

Univariate analysis of factors associated with complications after a Duplay procedure.

<table>
<thead>
<tr>
<th>Procedure</th>
<th>n (%)</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complication</td>
<td>8/15 (53.3%)</td>
<td>.85 (.04–16.85)</td>
<td>.919</td>
</tr>
<tr>
<td>Surgery</td>
<td>7 (53.8%)</td>
<td>1 (50%)</td>
<td></td>
</tr>
<tr>
<td>Age group</td>
<td>1.2 (.12–11.86)</td>
<td>.543</td>
<td></td>
</tr>
<tr>
<td>≤6 months</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>.876</td>
</tr>
<tr>
<td>&gt;6 months to ≤12 months</td>
<td>2 (50%)</td>
<td>2 (50%)</td>
<td>.876</td>
</tr>
<tr>
<td>&gt;12 months to ≤18 months</td>
<td>2 (100%)</td>
<td>2 (100%)</td>
<td>.155</td>
</tr>
<tr>
<td>&gt;18 months</td>
<td>2 (40%)</td>
<td>2 (40%)</td>
<td>.464</td>
</tr>
</tbody>
</table>

### Table 3

Multivariate analysis of factors associated with complication occurrence in cases operated by Duplay procedure.

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>OR (95% CI)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter duration</td>
<td>5.00 (1.53–16.32)</td>
<td>.008</td>
</tr>
<tr>
<td>Primary vs. reoperative</td>
<td>1.09 (0.33–3.58)</td>
<td>.881</td>
</tr>
<tr>
<td>Hypospadias severity</td>
<td>1.79 (0.90–3.54)</td>
<td>.093</td>
</tr>
<tr>
<td>Age category</td>
<td>1.88 (1.07–3.28)</td>
<td>.026</td>
</tr>
</tbody>
</table>

OR: odds ratio; CI: confidence interval.
cellular infiltrate was not limited to the exact site of injury but that it extended laterally into the periurethral tissue. Because one reason for the prolonged phases during urethral healing may be the presence of urine extravasation through the urethra into the periurethral tissue, we agree with the authors that although catheter placement will likely not completely prevent urine leaking into the periurethral tissue, it will certainly decrease the amount of it, and consequently the rate of fistula formation. Additionally, in their canine model of hypospadias repair, Bleustein et al. found that even by day-21 postoperatively, the sutured repair still presented with a desmoplastic and inflammatory response [20]. This further supports our belief to leave the catheter till the 21st postoperative day, in addition to our finding that leaving the bladder catheter for three weeks instead of just one week significantly decreases up to three times the probability of complications, particularly fistulas. On the other hand, because leaving a bladder catheter promotes bladder spasms and consequently urine extravasation, we believe that it is crucial to decrease those effects by administering scheduled anticholinergic medications as long as the catheter is in place.

There is still much debate regarding the effect that age at hypospadias operation has on the rate of complications. A recent review of 307 patients found that complication rate increases with patient age. However their youngest patient was 9 months old [21]. We have further noticed on univariate and multivariate analysis in our series that age below 6 months at the time of repair was significantly associated with fewer complication rates, and associated with more complications if the repair was done beyond the age of 18 months. Our decision to offer hypospadias repair to children as young as 3 months of age is based on the finding that glans size does not correlate with age in patients with hypospadias between 3 and 24 months old (Warren Snodgrass, personal communication, February 24, 2012) [22].

While it is true that we transitioned our practice from one-week to three-week bladder catheterization, the pattern of improved results cannot be explained by an improved learning curve, because the surgeon has an already established experience in hypospadias repair 20 years before the study.

The limitations of our study include its retrospective-prospective nature, where no randomization was performed. Additionally, we did not measure other potential factors for complications, such as penile size and glans width, but we plan to evaluate those in our future study. Another relative limitation of our study is the absence of very long-term follow-up after hypospadias repair, although most of the complications would usually occur in the first 6 months postoperatively.

4. Conclusions

While presence of curvature, severity of hypospadias and surgical technique do not seem to have an impact on postoperative complication rate, it appears that in cases of Duplay procedures a three-week instead of one-week catheterization is associated with fewer complications after hypospadias surgery. Furthermore, age below 6 months at hypospadias repair seems to provide a better outcome and less complication rate. Those observations need to be confirmed by a randomized-control study.

References