

Technical refinements to improve outcomes following distal hypospadias repair

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Introduction: Hypospadias complications, most notably meatal stenosis, are commonly reported to occur after tubularized incised plate (TIP) hypospadias repair. We focus on a point of technique in TIP repair and its effect on outcome of this possible complication, as well as other commonly reported complications. Meatal stenosis after TIP can be avoided if the urethra and overlying glans are dissected and sutured separately with no attempt at cross suturing whether the urethra ends below, behind, or above the glans sutures. This hypothesis was evaluated by a prospective data collection before and after implementation to evaluate the effect of a technical refinement on rates of meatal stenosis in TIP hypospadias repair.

Materials and methods: All cases of coronal to midpenile hypospadias repair during two periods were included in our study. Group 1 included 140 consecutive patients over a 30 month period. Group 2 included 122 consecutive patients over a 36 month period during which the above mentioned technical changes were implemented by all participating pediatric urologists. Rates of complications between the two groups were compared with special emphasis on meatal stenosis.

Results: Median follow up for both groups was > 1 year. Overall complication rate in Group 1 was 31.5% compared to 9.8% in Group 2. Meatal stenosis was significantly reduced from 13 patients (9.3%) in Group 1 to 2 patients (1.6%) in Group 2, $p = 0.008$.

Conclusion: The technical refinements described resulted in reduction of complication rates and a decrease in incidence of meatal stenosis.

Key Words: meatal stenosis, hypospadias, pediatric urology, reconstruction, urethra

Introduction

Although the majority of urologic procedures can be performed by general urologists at the end of their basic training, there is a subset of procedures that most would agree require specialized training. Among these procedures is hypospadias. Specialized hypospadias training serves a dual purpose: primarily to learn how to perform the multitude of procedures used to correct the condition but also to gain experience in a large volume of these cases in a condensed period of time. Even with the additional training, it is recommended

that a minimum number of hypospadias procedures be performed yearly to maintain skill and improve results.

Pediatric urologic literature is teeming with hypospadias repair techniques but few reports addressing training in hypospadias surgery and the associated learning curve of hypospadias repair which extends beyond training.¹⁻³ Those reports almost uniformly address complication rates and learning curves after fellowship training. Our report is a unique opportunity to review outcomes in two study groups with data collected prospectively. Changes were employed after review of results and applied by a group of practicing urologists. The decision to make these changes was driven by the addition of one urologist after specialized pediatric training. Thus, our report provides insight into surgical outcomes after refinements in hypospadias repair technique were employed following fellowship training.

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Materials and methods

We assessed our results and outcomes of hypospadias repair before and after the changes employed. All cases of tubularized incised plate (TIP) repair for hypospadias ranging from coronal to midpenile during two periods were included in our study. The changes in technique as a result of this training were implemented by each of the three surgeons on the pediatric urology team.

Group 1 included 140 consecutive distal hypospadias patients over a 30 month period. Group 2 included 122 consecutive distal hypospadias patients over a 36 month period. All revision cases were excluded to limit confounding factors. Patient ages ranged from 6 months to 12 years, and the mean age was 3.49 ± 3.02 years. The suture material used was 6-0 Vicryl for tubularization of the urethra in the earlier experience. The later cases in the first group as well as the majority of the second group used 7-0 polydioxanone suture (PDS). The position of the hypospadiac urethral meatus, urethral plate width, thickness of urethra, size of glans and penis, presence and degree of curvature, whether the patient was circumcised or uncircumcised, and postoperative complications were recorded.

The basic principles of the TIP hypospadias repair were employed as described by Snodgrass.⁴ Several points of technique were adopted as changes from previous practices by the group. First, incising the plate and tubularizing the tube to distally was avoided. Care was always taken to mark the site of the meatus preoperatively to be on the undersurface of the glans and below the level of the urethral dimple. This was done to ensure a wider meatus and prevent meatal stenosis. Second, suturing the urethra to the glans was avoided in all cases in the second period. The glans was approximated on top of the urethra irrespective of the final location of the urethral meatus. Third, the urethra was dissected without a catheter in place to avoid

elevation of the urethra closer to the skin, resulting in meticulous full thickness dissection of the urethra with intact covering spongiosum facilitating spongioplasty whenever possible. Fourth, dissection of the glans wings with tenotomy scissors rather than scalpel dissection was performed to allow for adjustment and ensure adequate thickness of corpus tissue on the urethral side as well as the glans side. Having adequate spongiosum on the glans side facilitates approximation of the glans wings using one underlying stitch. Fifth, the size of the indwelling catheter was reduced to 6 French in all cases and in the second group of patients in contrast to mostly 8 French before.

All patients received follow up at 1 week for catheter removal and again at 6 weeks, 6 months, and 1 year postoperatively. The second visit included urethral calibration.

Results

Our study included 262 patients divided into two groups. Their ages ranged from 6 months to 12 years, and the mean age was 3.49 ± 3.02 years. All patients included in our study underwent primary repair using the TIP technique. The urethral catheter and suture material utilized were consistent among all patients and stages of the operation. Spongioplasty was performed for 67.2% of patients, depending on tissue availability.

No statistically significant difference was found between Groups 1 and 2 regarding age of the patients, position of meatus, width of urethral plate, thickness of urethra, size of glans and penis, presence and degree of chordee, and whether the patient was circumcised or uncircumcised.

The rate of meatal stenosis reported in Groups 1 and 2 was compared, Table 1. Group 1 had 13 patients with meatal stenosis rate accounting for 9%. Of those,

TABLE 1. Type and frequency of post-surgical complications in Groups 1 and 2

Parameter	Number of patients (%)		p value
	Group 1 (n = 140)	Group 2 (n = 122)	
Meatal stenosis	13 (9.3%)	2 (1.6%)	0.008
Fistula	14 (10%)*	6 (4.9%)	N.S.
Hematoma	6 (4.3%)	3 (2.5%)	N.S.
Dehiscence	11 (7.9%)	2 (1.6%)	0.021
Total	44 (31.5%)	13 (10.7%)	N.S.

*5 of these patients had meatal stenosis
N.S. = not significant

5 patients developed fistulae as a result, and 8 patients required a second trip to the operating room for a meatotomy/meatoplasty procedure. The patients of Group 2 had only 2 patients with meatal stenosis accounting for 1.6%. The reduction was statistically significant ($p = 0.008$). The fistula rate was halved but was not statistically significant. Other complications included dehiscence which was reduced from 11 (7.9%) to 2 (1.6%) as a result of improved glans dissection. In addition we had hematoma formation in 6 (4.3%) and 3 (2.5%) respectively which resolved without any intervention.

We compared the complications in both groups to assess the effect of improved surgical training (in Group 2) on the results of hypospadias repair. We found an overall complication rate of 31.45% in Group 1 and 9.8% in Group 2, which is consistent with previously reported values in the literature. There was a remarkable decrease in the rate of complications as a whole in Group 2, though not quite statistically significant.

Discussion

While learning curves in surgery are high for other technically challenging procedures such as laparoscopic surgery, there have been few reports examining the learning curve involved in obtaining proficient, acceptable outcomes in hypospadias repair.¹ In this study, we assessed the outcome of distal hypospadias repairs before and after technical refinements employed following specialized training.

We compared the outcome of surgery in two periods before and after these changes were employed. These modifications resulted in a decline in complication rate as it reduced the incidence of both anastomotic leak and meatal stenosis, which in turn lead to lower fistula rates. The result improvement was across the board for all surgeons employing the technical changes despite their varying degrees of training and experience. Other changes that resulted in better cosmetic appearance included incision along the mucosal collar line and the median raphe allowing complete reconstruction without apparent suture line appearance. Subcuticular suture also avoided the presence of suture marks along the skin.

Reported complication rates vary after TIP hypospadias repair.⁵⁻⁷ Eliçevik et al⁶ reported a complication rate of 23% in primary cases and 30% in secondary cases. Most reports have low fistula rates for distal lesions while proximal lesions continue to have higher rates. Snodgrass and Lorenzo reported a 33% complication rate for TIP in proximal lesions with a fistula rate of 21%.⁷ Later reports have a lower variance for fistula formation between 0% and 16%.^{8,9}

It is well-documented that success of hypospadias repair depends on the severity of the malformation. More distal hypospadias yield better results, but complication rates remain relatively high in some studies.^{10,11} Other factors are infection, suture material, neo-urethra stenting, form and duration of temporary diversion, type of dressing, and type of repair.¹² All cases in our study were repaired using TIP technique without any statistically significant difference between groups in the following criteria: age, position of meatus, width of urethral plate, thickness of urethra, size of glans and penis, presence and degree of chordee, and whether circumcision had been previously performed. Although there was a trend towards decreases in the rates of meatal stenosis, fistula formation, hematoma, and loss of repair, the only statistically significant difference was found in the rates of meatal stenosis and loss of repair. This improvement in results and decrease in complications associated with gained surgical experience is comparable to other published studies addressing the same issue.

We acknowledge that some of our patients were older but that was dictated by the nature of the practice in a tertiary care hospital in a developing country where not all patients are referred in a timely fashion. We previously reported on our team's experience in the different age groups.¹³ As noted in that report, the differences were smaller than mentioned in this comparison. As a result, the authors do not believe this significantly impacted the results.

In a prospective study, Horowitz and Salzhauer² reported on the 5 year learning curve in hypospadias surgery of a full-time practicing pediatric urologist immediately following completion of a 2 year fellowship. In their series, all patients with previous hypospadias or staged repairs were excluded from the analysis. The repairs used a variety of techniques. They found a statistically significant improvement measured by a yearly decline of the fistula rate from initially 24% to 18%, 14%, 9.3% and 6%, for the 5 year period after fellowship completion. Their conclusion was simple and intuitive — surgical complications decrease with experience. However, what is perhaps most important about the study is that this particular pediatric urologist continued to improve every year for 5 years after completion of a pediatric urology fellowship. However, as noted by Snodgrass,^{3,4} complication rates differ among the various procedures and outcomes and over time are best compared using one technique by one surgeon. Uygur et al have critically evaluated their own results with hypospadias repair, looking at individual techniques as well as different single stage repairs.^{14,15} They divided their series into three

sequential 5 year intervals, and noted decreasing fistula rates during each period, from 52% to 28% to 11%. Although differences in the length of the flap, type of suture, and thickness of suture were statistically significant, when evaluated separately only increasing experience remained significant on multivariate analysis. The authors concluded that with increasing experience the surgeon is better equipped to apply the most suitable technique to each individual case.

In our study, several shortcomings deserve attention. First, as with almost all hypospadias literature, evaluation was performed on what some will argue are subjective and poorly defined variables. Outside of fistula formation (because it is either objectively present or it is not) and meatal stenosis (none requiring dilatation after calibration), all of the variables evaluated in this study can be scrutinized for accepting the operating surgeons assessment of outcomes as reliable and unbiased. Unfortunately, to date there has been no real consensus or standardized methods agreed upon by pediatric urologists to evaluate the outcomes of hypospadias repair.

This is a retrospective review of data collected prospectively, so there are inherent biases in patient selection. After assessment of initial results in the first group, a decision was made to implement changes. We feel that improvement in overall complication rates found in this study supports the notion that the changes brought about by specialized training can indeed have desirable effects. One confounding factor could have been experience gained by surgeons throughout the course of the study, as it is logical to improve technique over time with increased numbers of cases. But we believe that the changes and refinements to technique were integral to the improvement of results. These improvements were immediate, significant, and affected results of more than one surgeon with varying experience. Furthermore, the case volume of 140 cases was more than enough to show improvement in technique prior to the specific technical refinements discussed above. Based on our experience, we would recommend avoiding cross suturing between urethra and glans, approximating the glans by one underlying suture primarily, as well as limiting the number of sutures on the glans to not exceed 3-4 stitches of approximately 1 mm apart.

Conclusions

The complication rates of loss of repair and meatal stenosis diminish considerably when specific technical refinements are made. Individual skills and technical refinements are of great value to achieving acceptable

success rates after hypospadias repair. While we have shown that technical refinements have contributed to a reduction of complications, it is difficult to pinpoint what each one of those changes contributed. It is our impression, however, that avoiding sutures between the urethral meatus and the glanular tissue was the most important factor. We recommend constant critical review of personal results with improvement of technique continuously as a tool to improve both cosmetic and functional results. □

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