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Original Research Article

Surgical Techniques & Outcome of Hypospadias Repair: A Retrospective Study

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Abstract: ***Introduction:*** Hypospadias, the most common congenital anomaly in the urethra of male children, is primarily identified by an uneven distribution of the chordee, urethral opening, and foreskin. The only proven cure for hypospadias is surgery, however, 5–70% of patients experience problems after the procedure. So, this study aimed to evaluate the outcome and postoperative complications of children aged between 3 to 13 years who underwent TIP & Duckett hypospadias repair. ***Methods:*** This was a retrospective observational study conducted in the Department of Paediatric Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from January 2014 to July 2016. In our study, we included 30 children with hypospadias who underwent hypospadias repair surgery tubularized incised plate (TIP), and Duckett at our institution. ***Results:*** In this study of 30 patients with a mean age of 5.8 years, 56.67% had midshaft hypospadias, and 60% underwent the TIP procedure. TIP showed the highest Qmax (20.2 ml/s) and voiding volume (145.2 ml) compared to Duckett, with significant differences ($p < 0.05$). The TIP procedure had a 56% success rate, while Duckett had a lower success rate (33%). The most common complications were urethrocutaneous fistula (44% & 58%), and meatal stenosis (11% & 25%) in TIP & Duckett respectively. ***Conclusion:*** Our study found that the highest complication rate was seen at the Duckett operation compared to the TIP operation. In contrast to patients who received Duckett, our results demonstrate that Qmax naturally increases in TIP recipients.
Keywords: Hypospadias, Surgical technique, Tubularized incised plate (TIP), Duckett.

INTRODUCTION

Hypospadias, the most common congenital anomaly in the urethra of male children, is primarily identified by an uneven distribution of the chordee, urethral opening, and foreskin. It is a congenital penile malformation caused by the insufficient tabularization of the urethral folds during embryonic development. It consists of an improperly located urethral meatus on the ventral part of the penis, which can vary from a proximal perineal meatus to a distal glanular. Associated anomalies include dorsal hooded prepuce, ventral curvature, and in more severe cases, genital ambiguity and a bifid scrotum. About one out of every 300 live male babies has this congenital abnormality, making it one of the most common. [1]

According to some recent statistics, the prevalence of hypospadias may be rising in developed nations. [2] The exact etiology of hypospadias is unknown, but most occurrences are spontaneous, with only a small fraction (<5%) caused by genetic abnormalities or androgen metabolism anomalies. [3] The only proven cure for hypospadias is surgery, however, 5–70% of patients experience problems after the procedure.[4] More than 250 surgical methods for treating hypospadias have been documented in the past century. Nevertheless, a process that works in every situation has not yet been created. Both the procedure and the surgeon's experience must be taken into account when evaluating the operation's outcomes. [5,6] The most widely used methods for treating hypospadias are based on earlier methods that produced positive outcomes, concurrent with advancements in reconstructive surgery. The features of the case, form, and location of the meatus as well as the related deformities, such as chordee, should guide the selection of the procedures and their adjustments. Wound healing is challenging at the operation site because of things like high edema potential, postoperative erection, and urinary problems. Hypospadias surgeries should be expected to be trouble-free due to these factors.[7] Thus, for pediatric urologists, hypospadias repair continues to be a significant challenge. The risk factors for postoperative complications of hypospadias repair have been the subject of numerous research, the majority of which concentrated on the following:

postoperative constipation, length of the repaired urethra, type of hypospadias, anesthesia technique, and age at the time of surgery. [8-10]

Surgical repair aims to restore penile function and anatomy. The primary objectives are to develop a straight, aesthetically normal penis with a properly positioned urethral meatus. Penile straightening is performed to allow the individual to attain a satisfactory erection, whilst the formation of a urethral meatus near the glans tip is intended to allow the individual to urinate while standing without misdirecting the urine stream. The site of the newly formed urinary meatus also allows for insemination and reproduction. [11].

The optimal period of urethral catheterization following hypospadias surgery has been questioned. Daher et al. discovered that complication rates following the Duplay technique were positively associated with 7 days of catheterization (p=0.008) and greater age at surgery (p=0.026). [12] Therefore, the optimal time frame for urethral stenting following proximal hypospadias correction was 4 to 6 weeks to reduce the occurrence of strictures. Experts from Europe and the American Academy of Pediatrics advise doing hypospadias surgery between the ages of 6 and 12 months. [13,14] Successful results with a low rate of complications have been made possible by advancements in medicine and the use of incredibly small sutures. However, there is still interest in these issues because reports of difficulties from prominent medical institutes are published in the worldwide literature. [15]

Therefore, in this study, we aimed to evaluate the outcome and postoperative complications of pediatric patients aged between 3 to 13 years who underwent TIP, & Duckett hypospadias repair.

METHODOLOGY AND MATERIALS

This was a retrospective observational study conducted in the Department of Paediatric Surgery, Bangabandhu Sheikh Mujib Medical University, Dhaka, Bangladesh during the period from January 2014 to July 2016. In our study, we included 30 pediatric patients with hypospadias who underwent hypospadias repair surgery (TIP, & Duckett) at our institution.

These are the following criteria to be eligible for enrollment as our study participants: a) Children aged between 3 to 13 years; b) Children with distal, proximal, & mid-shaft hypospadias; c) Children with a previous history of hypospadias; d) Children who were willing to participate were included in the study And a) Children with incomplete clinical data & less than 6 months of follow-up; b) Children with known allergy/hypersensitivity to anesthesia; c) Children with a history of any previous surgery; d) Children with any history of acute illness (e.g., renal or pancreatic diseases, ischemic heart disease, asthma, COPD etc.) were excluded from our study.

Data Collection

Information on the age at the time of surgery, type of hypospadias, body mass index (BMI), operation time, and complications were collected. Hypospadias was classified as distal (glandular, coronal, and subcoronal), midshaft, or proximal (penoscrotal, scrotal, and perineal). In this study, our study subjects underwent three surgical techniques (TIP, & Duckett), and the related data were collected by the surgeon.

Statistical Analysis

All data were recorded systematically in preformed data collection form. Quantitative data was expressed as mean and standard deviation and qualitative data was expressed as frequency distribution and percentage. The differences between surgical techniques were analyzed by unpaired t-test, chi-square (X^2) test, etc. Accordingly, postoperative maximum flow rate (Qmax), voiding volume (VV), and success rate were compared using a one-way ANOVA test. A p-value <0.05 was considered as significant. Statistical analysis was performed by using SPSS 16 (Statistical Package for Social Sciences) for Windows version 10.

RESULTS

Table 1: Distribution of Our Study Subjects by Characteristics and Properties of Hypospadias

Characteristics	N=30	P (%)
Age (years)		
3-6	6	20.00
7-10	14	46.67
>10	10	33.33
Mean age (years)	5.8 ± 3.3	
BMI (kg/m^2)	15.67±4.24	
Type of hypospadias		
Distal	5	16.67
Midshaft	17	56.67
Proximal	8	26.67
Surgical technique		
TIP	18	60.00
Duckett	12	40.00
Size of Urine Catheter		
6 Fr	2	6.67
8 Fr	19	63.33
10 Fr	9	30.00
Stenting Duration (Days)		
≤5	21	70.00
>5	9	30.00
Type of suture material		
Polyglactin 910 (Vicryl)	19	63.33
Chromicized catgut (Chromic catgut)	6	20.00
Polydioxanone (PDS)	5	16.67
Mean operation time (minutes)	125.7±24.7	
Mean follow-up period (days)	119.7±5.9	
No. of other congenital urologic disorders (%)		
≤2	7	23.33
>2	0	0.0

Table 1 shows the baseline characteristics of our patients. We found the mean age was 5.8 ± 3.3 years. Most of our patients (46.67%) were aged 7 to 10 years old. Among our patients, 56.67% had midshaft hypospadias and TIP was performed in 60% of patients. The mean BMI was 27.67±4.24 kg/m^2, the mean operation time was 125.7±24.7 minutes and the mean follow-up period was 119.7±5.9 days. Only 7(23.33%) patients had ≤2 urologic disorders and there were no patients with more than two urologic disorders.

Table 2: Distribution of Our Study Subjects by Surgical Outcome

Surgical outcome	TIP(n=18)	Duckett(n=12)	P-value
Qmax (ml/s)			
<5th, n (%)	4 (22%)	4 (33%)	
5-25th, n (%)	11 (61%)	6 (50%)	
>25th, n (%)	3 (17%)	2(17%)	
Mean±SD (ml/s)	20.2±1.4	17.2±2.0	<0.05
Mean Voiding volume (ml)	145.2±3.7	129.2±2.8	<0.05
Outcome			
Successful, n (%)	10 (56%)	4 (33%)	
Unsuccessful, n (%)	8 (44%)	8 (67%)	

Table 2 shows that the surgical outcomes of two techniques—TIP, and Duckett procedure—were assessed based on the Qmax and voiding volume. TIP showed the highest mean Qmax (20.2±1.4) compared to Duckett (17.2±2.0), with statistically significant differences ($p < 0.05$). The mean voiding volume was also greater in TIP (145.2±3.7) than in Duckett (129.2±2.8) ($p < 0.05$). The TIP procedure had a 56% success rate, while Duckett had a lower success rate (33%).

Table 3: Post-Operative Complications of Our Study Patients

	Surgical Techniques		
Post Operative Complications	**TIP (n=18)**	**Duckett (n=12)**	**P-value**
Urethrocutaneous fistula	8 (44%)	7 (58%)	0.54
Meatal Stenosis	2 (11%)	3 (25%)	0.61
Wound Infection	1(6%)	1 (8%)	0.14

Table 3 shows the postoperative complications among the surgical techniques: TIP, and Duckett. TIP had the lowest complication rates of urethrocutaneous fistula (44%), meatal stenosis (11%), and wound infection (6%). In contrast, Duckett presented higher complications, with urethrocutaneous fistula (58%), meatal stenosis (25%), and wound infection in 8% of cases.

DISCUSSION

In our study, the mean age of the first hypospadias repair during our study was 5.8 years, and increased postoperative complications were not observed regarding age. However, based on a review of psychological, anesthetic, and surgical factors, the current American Academy of Pediatrics recommendations support the completion of primary hypospadias repair at age 6 to 12 months. There was no evidence presented by Weber et al. to support their recommendations about the optimal age for hypospadias repair. [16] Moreover, they did not provide any evidence that surgery done before 18 months of age had an impact on the psychological or surgical outcome of hypospadias remediation. As a result, an optimal age for hypospadias correction could not be determined. [16]

The surgical principles of hypospadias repair include glanuloplasty, urethroplasty with vascularized covering, penile degloving, orthoplasty, and excellent aesthetic results. There are surgical options for both single-repair and staged-repair procedures. The three types of urethroplasty techniques include tubularization, augmentation, and replacement. Tubularization includes the Duplay and TIP processes. In contrast, augmentation makes use of the Snodgraft, Mathieu, and Duckett repair techniques. The distal urethral plate incision was first described in 1987 and is used to extend the urethral plate to a size that permits tubularization of the neourethra. This is performed after a midline plate incision without the need for a skin flap. [17] On the other hand, Snodgrass tubularises these well-vascularized strips as the neourethra by cutting the full length of the urethral plate at the midline in 1994. A dartos patch is then applied for strengthening. [18] As a consequence of its ease of use, low rate of complications, and satisfactory cosmetic outcomes, the TIP approach became the preferred treatment for distal hypospadias. [19]. The Duckett procedure, also known as transverse preputial island flap urethroplasty, creates the neourethra from the inner preputial tissue, leaving the axial vascular pedicle linked to the prepuce's dorsal layer. [20] MAGPI consists of a longitudinal incision in the dorsal portion of the meatus, which is closed using the transverse Heineke-Mikulicz procedure to advance the meatus distally, followed by glanuloplasty. This method is commonly used for mild hypospadias instances and is associated with favorable esthetic results and fewer problems. [21] Additionally, we consistently employed the TIP approach most often for our patients who had proximal and distal hypospadias.

According to reports, the rate of hypospadias repair problems ranges between 2% and 15%. The complication rate is determined by the complexity of repair, which is proportional to the degree of hypospadias and the repair technique chosen. The most common problems documented in other studies are fistula, stricture, and wound collapse. [22-24] In our analysis, the most prevalent complication (50%) was urethrocutaneous fistula, which occurred in all patients independent of the surgical approach. Nuhoğlu et al. discovered that urethrocutaneous fistula was the most common postoperative complication, affecting 57 (33.3%) of cases.[25] The lowest complication rates

reported in the literature range from 5% to 16%. [26,27] There are further studies with complication rates of 31% to 50%. [28,29] In forty-two individuals, Hensle et al. reported a 52.3% complication rate for hypospadias correction.[30] In a retrospective analysis of 693 patients who had primary hypospadias correction, Marrocco et al. found that patients older than a year experienced more problems than patients younger than a year (18.7% vs. 3.4%). [31] At a mean age of 7 years (range 1 to 14), Nuininga et al. observed a 54% long-term complication rate in 126 patients who underwent primary hypospadias repair. [32] In an examination of 31 patients who had their first hypospadias repaired after the age of 10, Dodson et al. found that 32% of them had a fistula, 13% had stricture, 6% had a hematoma, and 3% had lost repair. [33]

Surgical treatment at an older age may increase the risk of postoperative complications due to the increased volume of urethral secretions and nocturnal erections. Prior studies have indicated that early scheduling of surgery is beneficial for both patients and surgeons as it increases patient safety, reduces complications, and enhances results.

Limitations of the Study

Our study was a single-center study. We took a small sample size due to our short study period. After evaluating those paediatric patients, we did not follow up with them for the long term and did not know other possible interference that may happen in the long term with these patients.

CONCLUSION AND RECOMMENDATIONS

In our study, we found that the highest complication rate was seen at the Duckett operation compared to the TIP operation. In contrast to patients who received Duckett, our results demonstrate that Qmax naturally increases in TIP recipients. The tendency for Qmax to return to normal value indicates that TIP patients' neourethras will be able to adapt suitably to the tissue changes and penile expansion that come with puberty.

So further study with a prospective and longitudinal study design including a larger sample size needs to be done to validate the findings of our study.

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