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An Evaluation of the Effectiveness of External Urethral Meatus Incision in Girls with an Anterior Deflected Urinary Stream and Symptoms of Detrusor Overactivity

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A – research concept and design; **B** – collection and/or assembly of data; **C** – data analysis and interpretation; **D** – writing the article; **E** – critical revision of the article; **F** – final approval of article; **G** – other

Abstract

Background. Urethral stenosis or abnormalities in the external urethral meatus in girls may lead to serious functional bladder outlet obstruction and recurrent urinary tract infections.
Objectives. The aim of the study was to analyze the efficacy of meatotomy in girls with an anterior deflected urinary stream (ADUS) and symptoms of detrusor overactivity.
Material and Methods. A group of 67 girls between the ages of 5 and 16 (mean age: 8.6 years) with symptoms of detrusor overactivity participated in the study. The girls were treated with oxybutinin in the years 2010–2011. The group included 37 girls with ADUS (the ADUS group) while the remaining 30 girls (the OXY group) were found to have a normal urinary stream. In the ADUS group an external urethral meatus incision was performed. The follow-up period was three months. The presence of urinary tract infections (UTI) as well as nocturnal bedwetting and daytime incontinence were analyzed before and after treatment.
Results. After three months, in the ADUS group no UTI was found in 12 children (32%) ($p < 0.05$), including 11 patients with prior febrile UTI ($p < 0.05$). Recovery from daytime urinary incontinence was observed in 20 girls (54%) and recovery from nocturnal bedwetting in 8 girls (22%). In the OXY group no infections were found in three girls (10%); recovery from daytime urinary incontinence was noted in 21 girls (70%) and from nocturnal bedwetting in 10 girls (33%).
Conclusions. Girls with symptoms of detrusor overactivity accompanied by an anterior deflected urinary stream experience UTIs and fever more often than girls with detrusor overactivity and a normal urinary stream. An incision in the external urethral meatus in girls with ADUS and detrusor overactivity seems to be effective treatment for recurrent urinary tract infections, especially febrile ones (**Adv Clin Exp Med 2014, 23, 2, 283–287**).

Key words: ADUS, meatotomy, detrusor overactivity, UTI.

In the 1960s significant attention was drawn to the correlation between urethral stenosis or abnormalities in the external urethral meatus and recurrent urinary tract infections [1–3]. In 1999 Hoebeke et al. described two types of external urethral meatus anomalies [4]. The first anomaly was identified as female hypospadias characterized by the external urethral meatus being displaced dorsally and located on the front wall of the vagina. The other anomaly was defined as a membrane on the front wall of the vagina – a fold of mucous membrane covering the urethral meatus – or as hidden hypospadias.

It is believed that girls with an anterior deflected urinary stream (ADUS) avoid urinating outside

the toilet by assuming a hovering position and contracting their thigh muscles. This position prevents normal muscle relaxation of the deep perineal pouch (urogenital diaphragm) during urination, which may in turn lead to a functional bladder outlet obstruction and result in complaints of detrusor overactivity [4, 5].

An incision in the external urethral meatus is one of the methods of treating these anomalies. In this paper, the efficacy of external urethral meatus incision (meatotomy) in girls with symptoms of detrusor overactivity and an anterior deflected urinary stream was analyzed.

Material and Methods

The study included 67 girls between the ages 5 and 16 (average age 8.6 ± 3.0) with detrusor overactivity. The patients were treated with oxybutynin in the Department of Pediatric Surgery and Urology and the Department of Pediatric Nephrology at Wroclaw Medical University from March 2010 to July 2011. Each child underwent urine stream evaluation during micturition. Girls with signs of detrusor overactivity accompanied by an anterior deflected urinary stream underwent diagnostic cystoscopy during which the anatomy of the lower urinary tract was studied. After filling the bladder and removing the cystoscope, pressure was applied to the abdomen and the urine stream was observed (Fig. 1). Once an anterior deflected urinary stream was confirmed, an incision was made in the urethral meatus at the 6 o'clock position and pressure to the abdomen was applied once more to check and evaluate the urine stream.

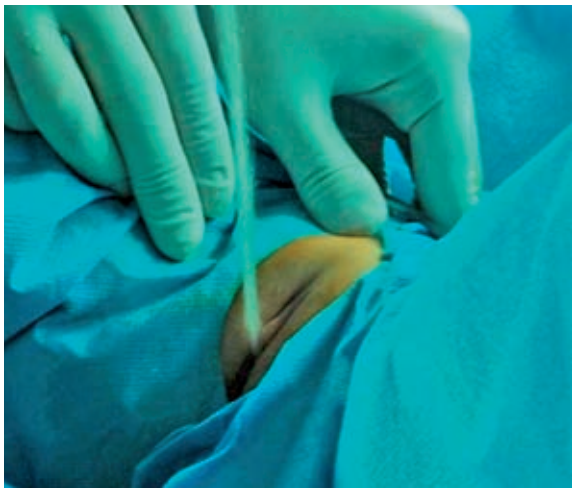

Fig. 1. Anterior deflected urinary stream after pressing the abdomen with the filled bladder, shortly after the cystoscopy was removed

Ultimately, the patients were divided into 2 groups:

– the ADUS group: 37 girls with detrusor overactivity and an accompanying anterior deflected urinary stream were treated with oxybutynin and underwent an incision in the external urethral meatus (meatotomy);

– the OXY group: 30 girls with detrusor overactivity and a normal urine stream underwent conservative treatment (oxybutynin) for 3 months.

The character and incidence of UTIs as well as daytime incontinence and nighttime bedwetting were analyzed before and after treatment. No UTIs after the treatment meant no infection with fever or a positive urine culture. All the girls in the ADUS group were given a check-up 3 months after the procedure at a pediatric urology center. The girls in the OXY group also underwent check-up after 3 months of treatment. Student's *t*-test and Pearson's chi-squared test were used for the statistical analysis of the results. A p value < 0.05 was considered statistically significant. Additionally, the statistical odds of changing symptoms were calculated, with the 95% confidence interval for the odds ratio. StatSoft Statistica v.8 software (license no. JHNP712D837117AR-3) was used for the statistical analysis.

Results

In the ADUS group three months after the treatment, no UTI was found in 12 children (32%), including 11 patients with prior febrile UTIs ($p < 0.05$). Recovery from daytime urinary incontinence was observed in 20 girls (54%) and from nocturnal bedwetting in 8 girls (22%). In the OXY group 3 months after the treatment, no infections were found in 3 girls (10%); recovery from daytime urinary incontinence occurred in 21 children (70%) and from nocturnal bedwetting in 10 patients (33%). None of the participants experienced complications following the treatment.

The chances of improvement in children with UTI who underwent the ADUS procedure was over 9 times greater (OR = 9.33) than in children who underwent conservative treatment. The results of the treatment are summarized in Tables 1–2.

Discussion

Urethral calibration has been used to treat girls with suspected stenosis of the external urethral meatus for many years [1–3, 6]. In 1965 Lyon and Tanagho were the first to describe the anomaly, and they established its strong connection with

Table 1. Basic statistics characterizing the study group

Characteristic (random variable)	**Total N = 67**	**ADUS group N = 37**	**OXY group N = 30**	**Comparison group 1 vs. 2**
Age [years]: mean ± SD	8.6 ± 3.0	9.1 ± 2.8	8.0 ± 3.1	P = 0.126[a]
UTI				
None	42 (62.7%)	22 (59.5%)	20 (66.7%)	
No improvement after treatment	10 (14.9%)	3 (8.1%)	7 (23.3%)	P = 0.040[b]
Significant improvement after treatment	15 (22.4%)	12 (32.4%)	3 (10.0%)	
UTI with fever				
No symptoms	55 (82.1%)	25 (67.6%)	30 (100%)	
No improvement after treatment	1 (1.5%)	1 (2.7%)	0 (0%)	P = 0.003[b]
Significant improvement after treatment	11 (16.4%)	11 (29.7%)	0 (0%)	
Nocturnal enuresis:				
No symptoms	26 (38.8%)	13 (35.1%)	13 (43.3%)	
No improvement after treatment	23 (34.3%)	16 (43.2%)	7 (23.3%)	P = 0.218[b]
Significant improvement after treatment	18 (26.9%)	8 (21.6%)	10 (33.3%)	
Daytime incontinence				
No symptoms	6 (9.0%)	6 (16.2%)	0 (0.0%)	
No improvement after treatment	20 (29.8%)	11 (29.7%)	9 (30.0%)	P = 0.062[b]
Significant improvement after treatment	41 (61.2%)	20 (54.1%)	21 (70.0%)	

[a] significance Student's *t*-test, [b] independence Pearson's chi-squared test, statistically significant differences indicated at $p < 0.05$, N – number, vs. – versus, SD – standard deviation, UTI – urinary tract infection.

Table 2. Characteristics of the subjects – variable values (categorized)

Characteristic	**ADUS group N (%)**	**OXY group N (%)**	**P value**	**OR**	**95% CI**
UTI					
Improvement	12 (80.0)	3 (30.0)	0.018	1.00	ref.
No improvement	3 (20.0)	7 (70.0)		9.33	1.46–59.5
Nocturnal enuresis					
Improvement	8 (66.7)	10 (41.2)	0.105	1.00	ref.
No improvement	16 (33.3)	7 (58.8)		0.35	0.10–1.27
Daytime incontinence					
Improvement	20 (64.5)	21 (70.0)	0.193	1.00	ref.
No improvement	11 (35.5)	9 (30.0)		0.78	0.27–2.28

OR – odds ratio, 95% CI – confidence interval, N – number, vs. – versus, SD – standard deviation, UTI – urinary tract infection.

recurrent UTIs [1, 2]. They attributed the voiding difficulty in stenosis to fibrosis of the distal urethra. In 1973 Kaplan et al. found that urethral calibration and urethrotomy do not yield better results than conservative treatment [7]. The causes of lower urinary tract dysfunction were sought in functional rather than anatomical reasons. Several papers described detrusor-sphincter dyscoordination as acquired or learned behavior that subsides spontaneously with time [8–10]. In 1999 Hoebecke et al. demonstrated that girls with an anomaly of the external urethral meatus are statistically more likely to suffer from lower urinary tract dysfunction [4]. Among 288 girls with urinary tract disorders, 88 showed anomalies in the external urethral meatus, i.e. female hypospadias or hidden hypospadias. More frequent anterior deflected urinary stream, daytime incontinence and urinary urgencies were observed as statistically significant in a group of female hypospadias patients. Additionally, during video urodynamic evaluations more frequent dysfunctional voiding was observed. Surgical treatment of girls with hypospadias entailed partial hymenectomy, in which the front part of the hymen was removed. In girls with a "meatal web", the urethral meatus was incised longitudinally and then sutured transversely. The children were also treated pharmacologically and underwent urotherapy.

A group of girls in the current study was diagnosed with detrusor overactivity and an accompanying anterior deflected urinary stream. They were treated by oxybutynin and underwent external urethral meatus incision. A significant decrease in urinary tract infections, especially UTIs with high fever, was observed three months after the external urethral meatus incision was performed. The statistical analysis showed that the chance of recovery from recurrent urinary tract infections in girls after the procedure is nine times greater than in children with regular urine flow who were treated conservatively. No significant association was found between the correction of anterior deflected urinary flow and the easing of urinary incontinence.

Van Bogaert's 1992 article on female hypospadias deals with adult women with the so-called "urethral syndrome" who were treated for uncoordinated miction as children [11]. This may possibly be associated with uncoordinated voiding in patients with minimal anomalies of the external urethral meatus. One hypothesis assumes that in the case of an anterior deflected urinary stream, the stream of urine hits the clitoris and stimulates the bulbospongiosus muscle, thus increasing sphincter activity. In female hypospadias, there is significantly increased urethral sphincter activity that may stimulate the same reflex. For girls with an anterior deflected urinary stream, assuming a hovering position and contracting the thigh muscles may be the only defense against urinating outside the toilet [5]. This position prevents normal muscle relaxation of the deep urogenital diaphragm during urination, which may in turn lead to a functional bladder outlet obstruction. Increased vaginal micturition in girls with hypospadias may cause postmicturition dribble [4]. In order to avoid this, these girls tighten the sphincter muscle very hard several times a day. This may lead to hypertrophy of the sphincter muscle and induce dysfunctional voiding as a result.

In the available literature there is a shortage of publications about meatotomy in girls. In a group of 171 girls, Klijn et al. diagnosed anterior deflected urinary stream in 66 patients [12]. The patients experienced recurrent UTIs, staccato or intermittent urinary flow as well as residual urine after miction above 10% of the expected bladder capacity. They underwent meatotomy with 50% effectiveness during a five-month observation period. The remaining group of patients was found to suffer persistent anomalies despite having undergone the corrective procedure and having normal urine flow. It was concluded that in all girls with an anterior deflected urinary stream and dysfunctional voiding, external urethral meatus incision should be performed first.

The current study has certain limitations, such as a relatively small group of patients and a short follow-up period of only three months. However, the analyzed group consists of girls in whom, due to their age, spontaneous improvement of urinary tract infections is expected. Therefore the authors considered that a short observation period, during which there was a statistically confirmed decrease of the frequency of infections, is sufficient. In the study by Klijn et al. the follow up was quite similar: five months [12]. The small number of participants in the current study, especially in the ADUS group, is the result of the fact that urethral meatus incision has been performed in the authors' department only for a short time. Although the small study population is certainly a limitation, the groups analyzed were sufficiently numerous to do a statistical analysis.

Despite the limitations of the study, the promising results yielded by the surgical treatment of children with detrusor overactivity prompted the authors to publish these findings. The data in the available literature shows that this type of treatment is not currently common. The results presented indicate that a significant improvement can be observed after this minor and simple procedure. None of the children has experienced any complications. Given the fact that persistent and often extended medical

treatment provides varying degrees of effectiveness, performing meatotomies in girls with anterior deflected urinary streams is worth considering.

The authors concluded that girls with symptoms of detrusor overactivity and the accompanying anterior deflected urinary stream experience urinary tract infections and high fevers more often than girls with symptoms of detrusor overactivity and a normal urine stream. Incision in the external urethral meatus in girls with an anterior deflected urinary stream and symptoms of detrusor overactivity seems to be an effective method of treating recurrent urinary tract infections, especially febrile UTIs. The advantage of this treatment method is undoubtedly the fact that it is a simple and quick surgical technique.

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