The Effect of Untethering on Urologic Symptoms and Urodynamic Parameters in Children With Primary Tethered Cord Syndrome

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OBJECTIVE To evaluate urinary system symptoms (USSs) and urodynamic parameters (UPs) before and after untethering in children with primary tethered cord syndrome (pTCS).

METHODS USSs and UPs of patients undergoing untethering for pTCS during the period January 2008-July 2012 were evaluated preoperatively and at the postoperative third and 12th months. For analysis, patients were separated into 4 groups according to the presence of USSs: group 1, USSs preoperative positive and postoperative negative; group 2, USSs preoperative positive and postoperative positive; group 3, USSs preoperative negative and postoperative positive; group 4, USSs preoperative negative and postoperative negative. Preoperative and postoperative USSs and UPs were compared.

RESULTS Forty patients (average age, 7.2 years, follow-up of 2.8 years) were included. There were 13 patients in group 1, 11 in group 2, 3 in group 3, and 13 in group 4. All patients showed improvement when preoperative and postoperative USSs and UPs were compared. There was no correlation between USSs and UPs, both preoperatively and postoperatively. USSs and UPs at the postoperative third and 12th months were similar. Patients with no USS showed the most significant improvement in UP after untethering.

CONCLUSION Our study has demonstrated that untethering in patients with pTCS improves urologic symptoms and UPs. However, there is no correlation between improvement in symptoms and urodynamic findings. Urodynamic changes are similar at the postoperative third and 12th months. As the most significant improvement was seen in patients without USSs, it is important that these patients undergo urodynamic studies preoperatively and postoperatively. UROLOGY 85: 221–226, 2015. © 2015 Elsevier Inc.

Tethered cord syndrome (TCS) is the abnormal fixation of the spinal cord below the L1 vertebrae. Primary TCS (pTCS) occurs congenitally (such as sacral dysgenesis or occult spinal dysraphism), whereas secondary TCS is because of scarring after intraspinal surgery (such as repair of meningomyelocele or other dysraphic causes). Abnormal fixation of the spinal cord in TCS leads to stretching of the cord as well as hypoxia and ischemia of the sacral nerve roots.[1,2] This pathologic process leads to signs and symptoms related to urologic, neurologic, and musculoskeletal systems. Urologic symptoms include incontinence, impaired bladder sensation, vesicoureteral reflux, urinary tract infections (UTIs), and hydronephrosis, with widely variable clinical and radiologic presentation.[3]

In this study, we evaluated the effect of untethering surgery on urinary system symptoms (USSs) and urodynamic parameters (UPs) and compared preoperative and postoperative USSs and UPs in patients having untethering due to pTCS.

METHODS

This prospective study was performed at 2 tertiary centers from January 2008 to July 2012. All patients diagnosed with pTCS during this time were included in the study after parental informed consent. Institutional board approval and registration was obtained

Financial Disclosure: *The authors declare that they have no relevant financial interests.*

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This study was presented at 25th Anniversary Congress of European Society for Paediatric Urology, Innsbruck, Austria.

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Submitted: August 2, 2014, accepted (with revisions): October 8, 2014

Table 1. Urinary system symptoms of patients

Symptom	Group 1, n (%)	Group 2		Group 3, n (%)	Group 4
		Preoperative, n (%)	Postoperative, n (%)		
Urinary incontinence	9 (69.2)	6 (54.5)	4 (36.4)	2 (66.7)	No symptoms
Urge	1 (7.7)	1 (9.1)	1 (9.1)	0 (0.0)	
Voiding >7/d	2 (15.4)	0 (0.0)	0 (0.0)	1 (33.3)	
Voiding <3/d	1 (7.7)	1 (9.1)	1 (9.1)	0 (0.0)	
UTI	5 (38.5)	4 (36.4)	2 (18.2)	2 (66.7)	
VUR	3 (23.1)	1 (9.1)	1 (9.1)	0 (0.0)	

UTI, urinary tract infection; VUR, vesicoureteral reflux.

for this study (institutional trial registration number: 2013-0237). Diagnosis of pTCS was made by patient history, physical examination, and lumbar spinal magnetic resonance imaging (MRI).

Urologic symptom questioning and urodynamic studies were performed preoperatively and at the postoperative third and 12th months. All patients in this study had clear indications for untethering, and this urologic evaluation was performed for this study and not as a tool for determining surgical indication.

Daytime and/or nighttime incontinence, urgency, abnormal frequency of urination (>7 per day or <3 per day), history of UTI, and the presence of vesicoureteral reflux on voiding cystourethrogram was considered as positive for USSs. Urodynamic studies were conducted using standard techniques using MMS Solar Blue urodynamics and biofeedback device, and expected bladder volume, leak pressure, maximum detrusor pressure, postvoiding residue (PVR), and compliance were noted. No patients were sedated during urodynamic studies. Each patient routinely underwent 3 urodynamic fillings, and the best result from the second or third fillings were accepted. Expected bladder volume was calculated as 30 + (30 × age),[4] and leak pressure <40 cm H_2O, maximum detrusor pressure <15 cm H_2O, PVR <10% of expected bladder volume, and compliance >10 mL/cm H_2O were accepted as being normal.

Patients were divided into 4 groups according to the presence of USS

- Group 1: USS preoperative positive, postoperative negative
- Group 2: USS preoperative positive, postoperative positive
- Group 3: USS preoperative negative, postoperative positive
- Group 4: USS preoperative negative, postoperative negative

Urodynamic parameters of the aforementioned mentioned groups were compared with each other. Preoperative and postoperative third and 12th month urodynamic findings were compared in all patients.

Statistical analysis was performed using IBM SPSS Statistics for Windows, version 21.0 (IBM Corp, Armonk, New York, USA). The distribution of variables was controlled using the Kolmogorov-Simirnov test. Quantitative data were analyzed using the paired sample *t* test and the Wilcoxon test. Qualitative data were analyzed using the McNemar test. Statistical significance was accepted as $P < .05$.

RESULTS

Forty patients (25 female and 15 male) with diagnosis of pTCS who underwent untethering were included in this study. The average age was 7.2 years (1.5-16 years), and average follow-up was 2.8 years (1.0-6.6 years.)

The presenting symptom of patients was urological symptoms in 24 (%60), orthopedic symptoms in 18 (%45), sacral skin lesions in 22 (%55) and bowel symptoms in 14 patients (%35).

The following findings were observed on patients' MRIs: tight filum terminale (n = 30), dermal sinus (n = 3), filum terminale lipoma (n = 6), diastematomyelia (n = 4), intradural lipoma (n = 2), neurenteric cyst (n = 2), syrinx (n = 11), lipoma (n = 2), lipomyelocele (n = 1), sacral cyst (n = 1), and spinal cord tension factor (n = 7). The spinal cord ended below L1-L2 in 35 patients.

Urinary System Symptoms

Urinary symptoms of each group are listed in Table 1. There were 13 patients in group 1, eleven in group 2, three in group 3, and 13 in group 4. The most frequently observed USS was urinary incontinence in all groups, followed by UTI.

When USSs of patients at third and 12th postoperative month were compared, no statistically significant differences were found.

Urodynamic Parameters

UP results of all patients are listed in Table 2. UP comparison between groups is summarized in Table 3.

When UPs of patients at third and 12th postoperative months were compared, no statistically significant differences were found.

Bladder capacities of patients were found to be decreased by 0.5% preoperatively and increased by 2.6% and 9.5% at postoperative third and 12th months, respectively. When preoperative and postoperative 12th-month results are compared, patients with abnormal leak pressure decreased from 23 to 16, patients with abnormal maximum pressure decreased from 33 to 21, PVR <10% of expected bladder capacity decreased from 20 to 15, and patients with abnormal compliance decreased from 17 to 10. These changes were statistically significant for maximum pressure only.

When UPs were compared between groups, improvement was seen throughout the groups. Statistically significant improvement was seen for bladder capacity, abnormal leak pressure, and abnormal maximum pressure in group 4 (no USS preoperatively or postoperatively).

COMMENT

In this study, we compared 40 patients' preoperative and postoperative third- and 12th-month USSs and UPs after undergoing untethering for pTCS.