Comparison of Biofeedback Therapy in Children With Treatment-refractory Dysfunctional Voiding and Overactive Bladder

Halil Tugtepe, David Terence Thomas, Raziye Ergun, Tural Abdullayev, Cansu Kastarli, Ayten Kaynak, and Tolga E. Dagli

OBJECTIVE To evaluate and compare the effectiveness of biofeedback therapy (BF) in children with treatment refractory overactive bladder (OAB) and dysfunctional voiding (DV).

METHODS This study was performed between April 2012 and March 2014. Patients with treatment refractory OAB and DV were included. All patients had 3 months of BF. Patients' urologic system symptoms and uroflow parameters before BF and 3 months after BF and response rates were compared.

RESULTS Forty-five patients completed the study. Significant improvement was seen in urinary tract infections, urge incontinence, fractionated voiding, constipation, voided volume, maximum flow rate (Qmax), average flow rate (Qave), and postvoiding residue for patients with DV and in urinary tract infection, frequency, urge incontinence, Qmax, Qave, voiding time, and postvoiding residue for patients with OAB. Overall, better results were observed in patients with DV.

CONCLUSION BF is an effective treatment modality in children with treatment refractory OAB and DV; however, patients with DV show better improvement. UROLOGY 85: 900–904, 2015. © 2015 Elsevier Inc.

Urinary incontinence (UI) is one of the most commonly treated pathologies in children and symptoms may include daytime and/or nighttime wetting, urgency, frequency or infrequency, constipation and/or fecal incontinence, and urinary tract infection.[1]

Normal voiding requires a bladder that expands easily during the filling phase and contracts to empty completely during the voiding phase. Detrusor contractions should not occur during the filling phase, and the sphincter should be completely relaxed during the voiding phase. Voiding dysfunction is caused by an abnormality in 1 or both of these phases. After exclusion of neurologic or anatomic pathologies, children with UI can be divided into 2 groups: overactive bladder (OAB; detrusor contractions during filling phase) and dysfunctional voiding (DV; sphincter contractions during voiding phase).[2]

Despite good results, some children can be resistant to standard therapies.[3] Literature reports several options for the management of such children, such as use of double anticholinergic medication, biofeedback, intravesical application of anticholinergics, botulinum toxin injection, and electrical neuromodulation.[4]

Animated biofeedback, described by McKenna et al in 1999,[5] is the use of video-computerized systems, obtaining information from the body to train patients to learn about and control normal physiological processes, such as pelvic floor muscle contractions and relaxation.

The use of biofeedback (BF) in patients with DV and OAB has been previously reported. However, there is no study comparing the effectiveness of BF in these 2 groups of patients.[6,7] In this study, we compared the effectiveness of BF in treatment refractory patients with DV and OAB.

METHODS

This study was performed between April 2012 and March 2014. For inclusion in this study, patients aged >5 years first underwent evaluation according to our policy for UI.

- Patients were evaluated with urinary ultrasonography, urinalysis, uroflow electromyography (EMG; at least 2 times),

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

From the Division of Pediatric Urology, Department of Pediatric Surgery, Marmara University School of Medicine, Istanbul, Turkey; the Department of Pediatric Surgery, Pendik State Hospital, Istanbul, Turkey; the Department of Pediatric Surgery, Marmara University School of Medicine, Istanbul, Turkey; and the Pediatric Urodynamics and Biofeedback Unit, Division of Pediatric Urology, Department of Pediatric Surgery, Marmara University School of Medicine, Istanbul, Turkey

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

Address correspondence to: Halil Tugtepe, M.D., Division of Pediatric Urology, Department of Pediatric Surgery, Marmara University School of Medicine, Mimar Sinan Cad. Fevzi Cakmak Mah., Kaynarca, Istanbul, Turkey. E-mail: htugtepe@yahoo.com

Submitted: October 30, 2014, accepted (with revisions): December 22, 2014

http://dx.doi.org/10.1016/j.urology.2014.12.031
0090-4295/15

Table 1. Urinary system symptoms and uroflow parameters in patients with dysfunctional voiding before and after BF

Parameter	Before BF	After BF	Change (%)	P*
Symptoms				
Urinary tract infection, n (%)	20 (71.4)	4 (14.3)	−80.0	.0002
Frequency, n (%)	4 (14.3)	1 (3.6)	−75.0	.3711
Urge incontinence, n (%)	11 (39.3)	3 (10.7)	−72.7	.0133
Fractionated voiding	9 (32.1)	1 (3.4)	−88.9	.0133
Constipation	8 (28.6)	1 (3.4)	−87.5	.0455
Uroflow parameters				
Voided volume, mL	220.3	316.4	43.6	.00410
Qmax, mL/s	20.3	29.6	46.0	.00030
Qave, mL/s	8.8	13.7	55.8	.00038
Flow time, s	29.0	25.6	−11.7	.23014
Voiding time, s	36.2	29.3	−19.1	.12852
Postvoiding residue, mL	42.4	12.3	−80.0	.01878

BF, biofeedback; Qave, average flow rate; Qmax, maximum flow rate.
* McNemar test.

and voiding diaries (at least 2 days). Patients with anatomic or neurologic causes of incontinence as determined by physical examination, urinary ultrasonography, and magnetic resonance imaging, where necessary, were excluded.

- Patients were divided into DV and OAB groups according to uroflow-EMG and clinical history. DV was defined as habitual contraction of the urethral sphincter during the voiding phase, as demonstrated by 2 uroflowmetry EMGs performed in 2 separate sessions, showing staccato pattern and increased EMG activity while voiding. OAB was defined as patients with urgency symptoms and urge incontinence and/or frequency (>7) with no EMG activity on uroflow-EMG.[8]
- For patients with DV, our first line of treatment was urotherapy for 3 months.
- For patients with OAB, urotherapy plus anticholinergic medication (0.4 mg/kg/day oxybutynin) was performed for 3 months.
- Standard urotherapy included education on bladder function, fluid intake, and regular voiding. The child was motivated for treatment. Optimal voiding posture was demonstrated.
- Constipation when present was always treated through parental and children's education, instructions of daily toilet visits after a major meal, adequate posture during defecation, dietary and hydration changes, as well as laxatives where necessary. Diagnosis and follow-up of constipation was performed using Bristol stool scale. Bristol type 1 and 2 were accepted as constipation.
- Urinary tract infection (UTI) was defined as >100,000 colonies on urine culture. Each UTI was treated with the appropriate antibiotic.
- Patients' symptoms were evaluated according to our institutional policy. The presence of UTI (before BF: at least 1 positive culture; after BF: at least 1 positive culture after 1 month from commencement of BF), frequency (>7/day), urge incontinence, fractionated voiding, and constipation were queried.

At the end of initial treatment, patients were re-evaluated with urinary system symptom (USS) questioning, uroflow-EMG, and voiding diaries. Treatment outcome was defined as: 0%-49% (no response), 50%-89% (partial response), 90%-99% (response), and 100% (full response).[8] Patients with partial or no response were re-evaluated for anatomic or neurologic causes and excluded from this study if diagnosed. Patients who had no response were included in this study.

BF was performed by placing patch electrodes on the perineum at the 3- and 9-o'clock positions, using a standard animated BF system (MMS SolarBlue urodynamics/biofeedback device). A reference electrode was placed on the lateral side of one thigh. BF was performed by a specialist nurse, once per week for the first month, once per fortnight for the second month, and once per month for the remaining 4 months, totaling 6 months of therapy for each patient. All medical treatment was discontinued before commencement of BF therapy. Animated computer games (such as Dolphin, Bird, Monkey, and so forth) were used, where movements in the game represented the appropriate muscular responses in the child. To complete the game, the patient had to tighten and relax the pelvic muscles in a controlled fashion, according to instructions given by the computer game. For example, correct muscular action (contraction or relaxation) by the patient results in the successful jump of a dolphin through serial hoops.

Uroflow parameters and USS were compared immediately before commencement and 3 months after the completion of BF therapy.

For USS, patients were queried for presence of UTI, frequency, urge incontinence, fractionated voiding, and constipation. Uroflow parameters analyzed were voided volume, maximum flow rate (Qmax), average flow rate (Qave), flow time, voiding time, and postvoiding residue (PVR).

Two-tailed McNemar test was used for comparing paired nominal data; comparison of means for related samples was performed using the Wilcoxon test.

RESULTS

Forty-five patients (38 female, 7 male) with an average age of 8.5 ± 2.2 years were included in this study. There were 28 patients with DV (25 female, 3 male; average age 8.8 ± 2.1 years) and 17 patients with OAB (13 female, 4 male; average age 7.9 ± 2.9 years). There was no statistical difference in the ages between the 2 groups ($P = .2246$).

After initial treatment, spina bifida occulta was found in 5 patients (4 with OAB, 1 with DV) that had no or partial response to treatment, and these patients were excluded from this study.

USS and urodynamic parameters before and after BF are listed in Tables 1 and 2.