BIOFEEDBACK IN THE TREATMENT OF LOWER URINARY TRACT SYMPTOMS IN CHILDREN

Marina Dermanov1,2 and Dragana Živković1,2

Summary

Introduction. Bladder and bowel dysfunction describes a large spectrum of lower urinary tract symptoms along with fecal elimination issues. The aim of the study was to analyze the effects of biofeedback treatment in children with lower urinary tract symptoms. Material and Methods. A prospective study analyzed the effects of biofeedback treatment conducted in children with lower urinary tract symptoms. Questionnaires and voiding diaries were collected prior to the treatment. The patients were followed for two weeks on a daily basis. After the completion of the treatment, the data from voiding diaries and questionnaires were analyzed. Results. A total of 18 children were referred for biofeedback treatment. Seven patients had an overactive bladder, seven had isolated dysfunctional voiding, and in the third group three had difficulties starting to void and one had daily incontinence with dysfunctional voiding. A total of 14 patients presented with improvement of symptoms. The analyzed data showed no measurable improvement in one patient, even though he reported a personal feeling of improvement. Three patients without positive effects of the therapy were immature and non-cooperative. In six out of seven patients with overactive bladder with urine leakage, the symptom disappeared by the end of the treatment. Conclusion. Biofeedback is a very useful tool in the treatment of lower urinary tract symptoms in pediatric population. Although the main indication for initiating this therapy is dysfunctional voiding, the study showed an improvement of symptoms in patients with overactive bladder as well.

Key words: Lower Urinary Tract Symptoms; Biofeedback. Psychology; Urinary Bladder. Overactive; Urinary Incontinence. Urge; Urination Disorders; Child

Sažetak

Uvod. Sindrom disfunkcije mokraćne bešike i creva predstavlja široki spektar različitih simptoma donjeg urinarnog trakta zajedno sa teškoćama u eliminaciji stolice. Cilj ove studije bio je da se analizira efekat biofeedback terapije kod dece sa funkcionalnim poremećajem mokrenja. Materijal i metode. Sprovedena je prospek- tivna studija za analizu efekta biofeedback terapije kod dece sa funkcionalnim poremećajem mokrenja. Sakupljani su upitnici i dnev- nici mokrenja pre terapije. Pacijenti su svakodnevno praćeni tokom dve nedelje tretmana. Po završetku terapije analizirani su podaci dobijeni iz dnevnika mokrenja i upitnika. Rezultati. Kod ukupno 18 pacijenata sprovedena je biofeedback terapija. Sedam pacijenata je imalo hiperaktivnu bešiku. Drugih sedam pacijenata imali su izolovano disfunkcionalno mokrenje. U trećoj grupi pacijenata, tri pacijenta su imali teškoće u započinjanju mokrenja i jedan pacijent je imao dnevnu inkontinenciju sa disfunkcionalnim mokrenjem. Kod 14 pacijenata je registrovano poboljšanje simptoma. Analizom podataka uočeno je da kod jednog pacijenta nije bilo merljivog poboljšanja, iako je pacijent imao subjektivni osećaj poboljšanja simptoma. Tri pacijenta kod kojih nije registrovan pozitivan efekat terapije bili su nezreli i nekooperativni. Kod šest od sedam pacijenata sa hiperaktivnom bešikom sa prisutnim oticanjem urina, simptomati su u potpunosti nestali do kraja tretmana. Zaključak. Biofeedback se pokazao kao veoma dobra metoda lečenja pedijatrijskih pacijenata sa funkcionalnim poremećajem mokrenja. Iako je glav- na indikacija za ovaj vid terapije disfunkcionalno mokrenje, studi- ja je pokazala poboljšanje simptoma i kod pacijenata sa hiperaktivnom mokraćnom bešikom.

Ključne reči: simptomi donjeg urinarnog trakta; povratna infor- macija; hiperaktivna bešika; disfunkcionalno mokrenje; poremećaji mokrenja; dete

Introduction

Bladder and bowel dysfunction (BBD) describes a large spectrum of lower urinary tract symptoms (LUTS) along with fecal elimination issues such as constipation and encopresis [1]. Children without neurological or anatomical abnormalities of the uri- nary tract frequently have voiding disorders. Children with voiding disorders may present with a urinary tract infection and/or different LUTS, usually dysuria, urgency, urinary frequency, daytime incontinence, enuresis, dribbling, straining and uri- nary retention [2, 3]. Underlying urological condi- tions responsible for LUTS are most commonly overactive bladder (OAB) and dysfunctional voiding (DV) [1]. The diagnosis of voiding dysfunction is made by detailed medical history, voiding diary analysis, clinical examination, ultrasound examination, uroflow and urodynamics investigations [4]. Voiding diaries kept by the parents help in evaluation of voiding schedule, relationship between voiding and daily
Abbreviations
BBD – bladder and bowel dysfunction
LUTS – lower urinary tract symptoms
OAB – overactive bladder
DV – dysfunctional voiding
PVR – post void residual
EMG – electromyography
BF – biofeedback
VUR – vesicoureteral reflux
UTIs – urinary tract infections

Events such as meals, breaks at school and play activities, the occurrence of urgency or incontinence, as well as the voided volume [4, 5]. The physical examination includes abdominal palpation for masses, detection of full bladder or full rectal ampulla. The patient’s back is inspected for signs of occult spinal dysraphism. The penis should be evaluated for earlier surgery, meatal stenosis and palpable urethral abnormalities (stricture, diverticulum). The vaginal introitus should be inspected for the presence of labial adhesions, recessed urethra, urine pooling, infection and signs of sexual abuse [4, 6]. Urine analysis is used to detect glycosuria, proteinuria, diabetes insipidus or infection. Ultrasound examination of the bladder is performed when a child feels that his/her bladder is “full”, and can be used to estimate functional bladder capacity. Measured capacity is compared with the expected bladder capacity for the age, while post void residual (PVR) urine can be assessed after voiding. PVR measurement helps not only to identify patients who need further evaluation, but also to evaluate the effects of the treatment during the follow-up [5, 6]. A non-invasive uroflowmetry, with or without electromyography (EMG), allows the best assessment of detrusor contraction coordination with voluntary relaxation of the external sphincter [1, 6].

Treatment of any kind of LUTS starts with urotherapy that encompasses education about urinary tract physiology and dysfunctions, behavioral training regarding adequate fluid intake, voiding habits and postural training. Behavioral interventions are well suited for the primary health care. Elimination of bladder irritants from the diet, management of fluid intake, weight control, bowel management and timed voiding regimens are some of behavioral interventions which are leading to healthy bladder habits [7]. A lifestyle modification may be the only therapy needed in the majority of patients. Antimuscarinic agents are most commonly used for the treatment of OAB, with or without behavioral treatment [8].

Biofeedback (BF) therapy is a nonsurgical, non-pharmacological treatment of lower urinary tract dysfunction. Frequently, it is defined as a bladder re-education or rehabilitation [9]. Animated BF uses video- computerized systems to teach patients about controlling their body and normal physiological processes [10]. Electromyographic instruments electrically measure levels of muscle activity. Pelvic-floor exercise consists of tightening the pelvic muscles and holding the contraction for a period of time, followed by a resting period [11]. These changes in the electrical muscle activity are transformed into visual and audio signals [12, 13]. Using surface electrodes to identify changes in muscle activity, the user is visually or audibly warned [12]. Individuals learn to control the level of muscle activity in the body and in doing so they learn to achieve state of willing relaxation [11].

Material and Methods

Patients with LUTS were referred for BF treatment after 2 weeks of urotherapy. Our aim was to analyze the effects of BF treatment in children with LUTS.

After the approval by the Ethics Committee, a prospective study on the effects of BF treatment in patients with LUTS was conducted. Voiding diaries and questionnaires were collected prior to the BF treatment. The patients were followed throughout the treatment and diaries and questionnaires were analyzed after the therapy. The treatment was conducted daily for two weeks. According to patient’s ability to control pelvic floor muscles, they underwent either pediatric (in most cases), or medium pediatric protocol (in three patients). The pediatric protocol included 40 repetitions, with both contraction and relaxation phase, each lasting for 5 seconds, whereas the medium pediatric protocol included 20 repetitions, with both contraction and relaxation phase lasting 10 seconds each. Patients were able to choose between different animations modes. The data obtained in the study were statistically analyzed.

Results

A total of 18 children underwent BF treatment. The youngest patient was 4 years old, and the oldest was 13 years old, 7.6 years on average. All the patients were completely evaluated, including urodynamic examination. Seven patients had OAB with involuntary detrusor contractions during filling, complicated with an increased activity of the pelvic floor muscles registered on EMG during voiding. The other seven patients had isolated DV. The third group of four patients was a heterogenic group. One patient had spina bifida with insufficient external sphincter, one patient had an episode of transverse myelitis, one complained of painful voiding and the forth one had difficulties starting to void (Table 1).

A total of 14 patients presented with improvement of symptoms. There was no measurable improvement in one patient, even though he reported a personal feeling of improvement. Three patients without positive effects of the therapy were either immature and/or non- cooperative. In six of seven patients with OAB, leakage was noticeable during contractions at the first few sessions, but it disappeared by the end of the treatment. An increase in the strength of pelvic floor muscles was noted in all the patients. The mean contractions in all the patients over time are presented in Graph 1.

Discussion

Epidemiological studies reported LUTS in 21.8% school-age children [3]. Up to 40% of the pediatric patients in urology clinic have LUTS [4]. Seventy-
The BBD is a potential cause of significant physical and psychosocial burden for children and their families [1]. The condition may have a negative impact on self-confidence and quality of life, feelings of shame, poor progress at school, aggression. The quality of life of the patients with LUTS and their families is profoundly impacted but can be easily improved with adequate treatment [1, 8, 15].

Pharmacological agents used for the treatment of DV include alpha-adrenergic blockers (acting on the smooth muscle of the external sphincter) and anticholinergic agents (acting on the detrusor muscle). Although alpha-blockers are routinely used in adult population for facilitating bladder emptying, their use in children is currently off-label; yet, several studies have shown encouraging results [16].

Another pharmacological approach to facilitate bladder emptying is the application of botulinum-A toxin (Botox®). Botox inhibits acetylcholine release at the presynaptic neuromuscular junction and results in flaccid muscle paralysis. Clinically, Botox injections have been used safely for the treatment of focal dystonia, muscle spasm and spasticity. Botox has been subcutaneously applied in patients with LUTS and there are several reports of Botox treatment in children with detrusor-external sphincter dyssynergia [16].

Urotherapy may be the only therapy needed in the majority of patients with LUTS. It has been shown to decrease urinary tract infections (UTIs), improve constipation and decrease the need for intervention in patients with vesicoureteral reflux (VUR) [16].

Rehabilitation of LUTS includes prompted voiding, timed voiding with bladder training and lifestyle modification. The combination of standard urotherapy with BF therapy significantly improves the results [17, 15]. Our study investigated the effectiveness of a combination of urotherapy and BF therapy in 18 patients with LUTS. By evaluating the results of pelvic floor muscles EMG prior to and following the BF therapy, 14 out of 18 participants gained significant improvement. Authors have described a significant improvement in UTIs, urge incontinence, fractionated voiding, constipation, voided volume, maximum flow rate, average flow rate as well as postvoid residue in both patients with DV and OAB, but better results are observed in patients with DV [18].

Biofeedback has become a modality for the treatment of DV, DV has been associated with UTIs and VUR. Various studies have shown a great improvement in symptoms of DV after BF therapy. The results have shown a decrease of daytime and nighttime incontinence, patients were infection free and VUR was cured [19].

In patients with OAB, initial therapy consists of regulation of voiding frequency and voiding charts. Anticholinergic medications can be added, and if this fails, pelvic floor training with BF may be proposed [19]. Training to achieve pelvic floor relaxation during voiding may have a role in treating OAB. Some authors suggest that long term pelvic floor hyperactivity results in neural remodeling, causing end-organ histologic changes, resulting in clinical symptoms. BF helps patients to visualize the movements of their pelvic floor and therefore teaches them how to control the contraction and relaxation [3, 10].

In our study, three patients with OAB and one patient with DV showed no significant improvement. Higher rate success has been found in patients who understood the concept of BF. Good prognostic factors were associated with patient’s motivation, cooperation and maturity [10]. There was no measurable improvement in one patient, even though he reported a personal impression of improvement. Some authors explain that patients, who find the setting where the testing is done uncomfortable, may have worse performance during examinations. Also, some patients may come unprepared for testing. They are either not well hydrated, or may feel expectation to void and express urgency sooner than in a more typical setting [20]. Patients with difficulties in starting to void and with painful voiding have recovered completely after BF therapy, while patients with transverse myelitis and spina bifida have shown an immediate improvement after the therapy, but for a short period of time. These
patients may be considered for a life long treatment to sustain sufficient control of the symptoms. Patients may present with a combination of abnormalities that impact bladder emptying, but that are not always purely pelvic floor dysfunctions. Many of these patients can also benefit from urotherapy and BF [16, 21].

Conclusion

Biofeedback serves as an important method in the treatment of children with lower urinary tract symptoms. It is a good complementary method in education and reeducation for establishing physiological functions of the urinary bladder. The results can give an encouragement for implementation of this method in treating patients with lower urinary tract symptoms. Although the main indication for initiating this therapy is dysfunctional voiding, the study showed an improvement of symptoms in patients with overactive bladder as well. It is of utmost importance that patients are well prepared, well educated how biofeedback works, motivated and able to understand the purpose of the treatment.

References

1. Santos JD, Lopes RI, Koyle MA. Bladder and bowel dysfunction in children: an update on the diagnosis and treatment of a common, but underdiagnosed pediatric problem. Can Urol Assoc J. 2017;11(1-2 Suppl 1):S64-72.
2. Hellerstein S, Zagula AA. Outcome of overactive bladder in children. Clin Pediatr (Phila). 2003;42(6):553-6.
3. Desantis DJ, Leonard MP, Preston MA, Barrowman NJ, Guerra LA. Effectiveness of biofeedback for dysfunctional elimination syndrome in pediatrics: a systematic review. J Pediatr Urol. 2011;7(3):342-8.
4. Kavila R, Rashid TG, Ockrim JL. Stress urinary incontinence. J Clin Urol. 2013;6(6):377-90.
5. Robson WL. Clinical practice. Evaluations and management of enuresis. N Engl J Med. 2009;360(14):1429-36.
6. Palmer LS. Evaluation and targeted therapy of voiding dysfunction in children. Urology. 2016;92:87-94.
7. Wyman JF, Burgio KL, Newman DK. Practical aspects of lifestyle modifications and behavioural interventions in the treatment of overactive bladder and urgency urinary incontinence. Int J Clin Pract. 2009;63(8):1177-91.
8. Ramsay S, Bolduc S. Overactive bladder in children. Can Urol Assoc J. 2017;11(1-2 Suppl 1):S74-9.
9. Kibar Y, Pskin M, Irkilata HC, Aydur E, Gok F, Dayane M. Management of abnormal postvoid residual urine in children with dysfunctional voiding. Urology. 2010;76(6):1472-5.
10. Tugtepe H, Thomas DT, Ergun R, Abdullayev T, Kastarli C, Kaynak A, et al. Comparison of biofeedback therapy in children with treatment-refractory dysfunctional voiding and overactive bladder. Urology. 2015;85(4):900-4.
11. Vasconcelos M, Lima E, Caiafa L, Noronha A, Cangussu R, Gomes S, et al. Voiding dysfunctional in children. Pelvic-floor exercises or biofeedback therapy: a randomized study. Pediatr Nephrol. 2006;21(12):1858-64.
12. Strider FD, Strider MA. Current applications of biofeedback technology to the problems of children and youth. Behav Disord. 1979(5):1-13.

Rad je priljten 26. III 2018.
Recenziran 17. IV 2018.
Prihvacen za stampu 19. IV 2018.

BIBLID:0025-8105(2018):LXXI:5-6:167-170.