

CLINICAL STUDY

Physical therapy of non-neurogenic voiding dysfunction in children with occult spinal dysraphism

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Abstract: Background: In children with occult spinal dysraphism one of the symptoms is disbalance in bladder emptying and filling. Goal of our study was to estimate the correlation of medicamentous treatment alone and combined medicamentous and physical treatment in patients that are diagnosed with occult spinal dysraphism with non-neurogenic bladder dysphunction.

Methods: We evaluated 69 patients aged from 4 to 12 years treated at the University children's Hospital in Belgrade during 2005-2008 years period. In the first group of 29 patients only medicamentous therapy was implemented. In the second group of 40 patients combined medicamentous and physical therapy were applied. Physical therapy methods that were used included: transcutaneous electric nerve stimulation and exponential current. We monitored daily enuresis, enuresis nocturna, urgency and frequency. Urodynamic evaluation included: bladder capacity, onset of unstable contractions, residual urine and detrusor sphincter dyssynergia.

Results: Statistical analysis showed that there is significant improvement ($p < 0.001$) in all evaluated symptoms after 6 months and for urgency there was significant improvement ($p < 0.05$) after 3 months from the beginning of the treatment with combined therapy. Our study pointed out significant improvement in the group treated with combined therapy for detrusor sphincter dyssynergia and unstable contractions after 3 months while after 6 months from the beginning of the treatment there was significant improvement ($p < 0.001$) for all urodynamic parameters.

Conclusions: Combined medicamentous and physical treatment is more beneficial for patients with non-neurogenic bladder instead of medicamentous treatment alone (Tab. 2, Ref. 11). Full Text in free PDF www.bmj.sk.
Key words: voiding dysphunction, urodynamics, physical therapy, children.

Normal miction represents a balance between sphincter and detrusor function and is under the central nervous system (CNS) willing control. During maturation of CNS induction of miction control occurs and is completed until 4 years of age. One the causes of dysfunctional voiding is the disbalance in synchronization between sphincter and detrusor activity (1).

It was demonstrated in several studies that in children with occult spinal dysraphism, one of symptoms is disbalance in bladder emptying and filling. Ultrasound and voiding cystourethrography (VCUG) findings in such patients are usually normal and thus unspecific, while urodynamic parameters can show presence of disbalance in compliance, capacity and detrusor sphincter dyssynergia (DSD) (2).

In normal circumstances, for adequate storage and complete evacuation of urine synergistic unit composed of the detrusor muscle, bladder neck and striated external sphincter should func-

tion properly. In healthy bladders the normal range difference of less than 10–15 cm H₂O is between empty and full bladder. Normal voiding pressures for males and females range from 50 to 80 cm H₂O and from 40 to 65 cm H₂O, respectively (3).

Leak-point pressure is one of the urodynamic parameters that help clinicians to differentiate patients with relatively low or high risk for subsequent upper urinary tract deterioration. Detrusor sphincter dyssynergia leads to dysfunctional voiding implicating inadequate filling and emptying of bladder (4).

On time diagnostics and treatment are beneficial in prevention of renal complications and secondary bladder wall changes in children with occult spinal dysraphism (5).

Goal of our study was to estimate the correlation of medicamentous treatment alone and combined medicamentous and physical treatment in patients that are diagnosed with occult spinal dysraphism with non-neurogenic bladder dysphunction.

Methods

We evaluated 69 patients treated at University children's Hospital in Belgrade during 2005-2008 years period. Study design was retrospective-prospective and included children aged between 4 and 12 years. There were 31 boys and 38 girls without structural lesions enrolled. All patients were with occult spinal

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Tab. 1. Treatment results of children with non-neurogenic bladder.

Symptoms (%)	Group with medicamentous therapy/ Group with combined therapy		
	After 3 months	After 6 months	After 12 months
Daily enuresis	57.14/50.00	28.57/10.00**	0/0
Enuresis nocturna	65.52/59.46	41.38/10.81**	31.03/5.41**
Urgency	64.71/47.62*	47.06/9.52**	35.30/0**
Frequency	62.50/52.38	56.25/23.81**	43.75/9.52**

*p<0.05; **p<0.001

dysrhythmism and non-neurogenic bladder with dysfunctional voiding at the first visit.

In first group of 29 patients only medicamentous therapy with anticholinergic drugs was implemented. In the second group of 40 patients combined anticholinergic and physical therapy were applied.

Physical therapy methods that we introduced included: transcutaneous electric nerve stimulation (TENS) and exponential current (EC). Transcutaneous electric nerve stimulation was induced by application of surface electrodes on skin at paravertebral site at the level S2-S4 and for EC surface electrodes were applied on anterior abdominal wall.

Bladder function was estimated by urodynamic investigations at the first visit in order to establish the diagnosis and then after treatment after 3 months, 6 months and 12 months respectively.

Further parameters were also monitored: daily enuresis, enuresis nocturna, urgency and frequency. All data were collected from patient's diary during the treatment.

Urodynamic evaluation included: bladder capacity, onset of unstable contractions, residual urine (RU) and detrusor sphincter dyssynergia (DSD).

For statistical analysis we used percentages to describe proportion of all evaluated parameters during the 12 months course of monitoring period. For comparison of symptoms between two evaluated and urodynamic parameters in two groups after 3, 6 and 12 months respectively, Chi squared test was used.

Results

Effects of medicamentous and combined medicamentous and physical therapy on the daily enuresis, enuresis nocturna, urgency and frequency are analyzed in Table 1. In the group of patients that were treated with medicamentous treatment we had 7 patients with daily enuresis, 29 with enuresis nocturna, 17 with urgency and 16 with frequency symptoms. In the group of patients with combined therapy we had 10 patients with daily enuresis, 37 with enuresis nocturna, 21 with urgency and 21 with frequency symptoms (Tab. 1).

Results of urodynamic parameters in group of children that were treated with medicamentous and combined therapy are analyzed in Table 2. In the group of patients that were treated with medicamentous treatment we had 29 patients with lower bladder

Tab. 2. Urodynamic parameters of treated patients.

Urodynamic parameters (%)	Group with medicamentous therapy/ Group with combined therapy		
	After 3 months	After 6 months	After 12 months
Lower bladder capacity	72.41/70.00	58.62/25.00**	34.48/7.50**
Unstable contractions	66.67/44.00*	33.33/12.00**	27.78/4.00**
RU	66.67/52.94	44.44/5.88**	33.33/0**
DSD	86.67/42.11**	60.00/10.53**	46.67/0**

*p<0.01; **p<0.001

capacity, 18 with unstable contractions, 9 with RU and 15 with DSD urodynamic parameters. In the group of patients that were treated with combined treatment we had 40 patients with lower bladder capacity, 25 with unstable contractions, 17 with RU and 19 with DSD urodynamic parameters (Tab. 2).

All urodynamic parameters showed positive trend in patients treated with combined therapy.

Discussion

It is estimated that frequency of functional bladder disorders in pediatric population is between 5-15 % (6). Detrusor contraction will not occur unless it is voluntarily initiated even when the desire to void is strong. Such studies point out the importance of the development of normal and coordinated urinary control. Majority of children by the age of 4 develop adult pattern of urinary control (6). In the absence of such development the result is the overactive bladder (OAB) that is defined as both involuntary detrusor contractions and urethral instability (7).

There is a great need for optimal and most effective treatment since the presence of residual urine can lead to infections of urinary tract in children with non-neurogenic bladder dysfunction (8, 9).

It is observed that electroneuromodulation as therapy module in children with voiding dysfunctions can be used with benefit (10).

In our study the most frequent symptom was enuresis nocturna, while daily enuresis was the least presented one.

Our results showed that there is no statistical difference for daily enuresis, enuresis nocturna and frequency in both groups 3 months after treatment commencement. These findings stress out that medicamentous treatment is equally effective as combined one for those symptoms. Significant statistical difference (p<0.05) was observed only for urgency after 3 months from the treatment commencement. Patients with daily enuresis, enuresis nocturna, urgency and frequency symptoms that are included in combined therapy presented with highly significant statistical improvement (p<0.001) after 6 months and statistical significance remained unchanged until complete follow-up period except for daily enuresis where we observed complete resolution in both groups.

There are studies stressing out that long term behavioral therapy without biofeedback techniques is effective for children with daily enuresis (11). These findings are in correlation with our results.

Results gained from this study pointed out that medicamentous therapy is as effective as combined module for those patients with daily enuresis symptom. Combined treatment is most effective for those with urgency with signs of improvement within 3 months from therapy commencement.

After 12 months of treatment in the group of combined therapy, proportion of patients that remained with enuresis nocturna decreases for more than 10 times, while in group with medicamentous treatment decreases twice. Proportion of participants with frequency symptom in group with combined treatment decreases 5 times while in second group decreases less than double. We have found that combined therapy lead to complete resolution of urgency in evaluated patients, while those patients that were under only medicamentous regime decreased proportion of such symptom less than double.

These findings stress out great effectiveness of implementation both medicamentous and physical therapy together in the treatment of patients with non-neurogenic voiding dysfunction.

This finding suggests that during 3 months of treatment it is not possible to draw conclusions about the course of therapy in either module because except for urgency there are no signs of significant improvement.

Other parameters that are indicators of bladder dysfunction are urodynamic parameters. Their evaluation is of great importance in predicting functional recovery in patients that are treated. In the group of patients that were treated with combined therapy, there was significant improvement for unstable contraction ($p < 0.01$) and for DSD ($p < 0.001$) after 3 months from treatment commencement. Patients that undergo combined treatment showed significant improvement ($p < 0.001$) for all evaluated urodynamic parameters: lower bladder capacity, unstable contractions, RU and DSD. Such improvement remained in same statistical significance ($p < 0.001$) after 12 months from the beginning of the therapy. As for lower bladder capacity and residual urine effects and prediction of efficacy of the therapy module within first 3 months of treatment is hard to predict since our results showed that there was no statistical difference. The most effectively responding urodynamic parameter was DSD. Such improvement was even more significant after 6 months from

the beginning of therapy and remained on the same statistical level at the completion of the treatment. What we have observed is that urodynamic parameters RU and DSD resolved completely after 12 months from the commencement of therapy strongly indicating high efficacy of combined medicamentous and physical therapy.

Our goal to compare the results in patients that were treated only with medicamentous treatment on one side and physical and medicamentous therapy on other side justify the benefit of physical therapy as minimally invasive and cost effective treatment module in patients with dysfunctional voiding.

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