

Efficacy of transcutaneous electric nerve stimulation (TENS) therapy in overactive non-neurogenic neurogenic bladder (Hinman's Syndrome)

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ABSTRACT

Objective: To compare the outcome of the patients of overactive non-neurogenic neurogenic Bladder Syndrome with traditional treatment alone and traditional treatment plus Transcutaneous electrical nerve stimulation (TENS) therapy.

Methodology: Twenty eight patients of Hinmans syndrome (all below 12 years) were recruited for the study at The Children's Hospital and The Institute of Child Health Multan, from August 2008 to November 2010. It was a randomized controlled trial and individual patients were categorized as having mild moderate or severe disease, on the basis of Overactive Non-neurogenic neurogenic bladder symptom score (OABSS) scoring system. The patients with equal grades of severity were placed in control and study groups each comprising 14 patients. Group A was given traditional treatment while group B was treated with TENS therapy in addition to traditional treatment. Improvement was observed by OABSS and voiding diaries. After 12 weeks of treatment, the patients were re-evaluated for their symptoms and grade of severity of disease. t-test was applied to compare outcome between two groups and $p < 0.05$ was considered to be statistically significant.

Results: At the start of treatment, dribbling and increased frequency was observed in all 28 patients and urgency was noted in 22 patients (11 patients in each group). At the completion of treatment after 12 weeks, dribbling was observed in 11(78.51%) vs. 3(21.4%) children in group A and B respectively. Frequency was reduced to 8(57.14%) in group A and 5(35.7%) in group B patients. Urgency was also reduced to 8(72.7%) in group A while 3(27.3%) in group B patients. No marked side affect were noted, except local skin irritation in some patients.

Conclusion: Transcutaneous electrical nerve stimulation (TENS) Therapy is an effective and safe tool to improve the symptoms and quality of life of the patients with Hinman syndrome but still large scale studies with longer follow up are required.

KEY WORDS: Hinman syndrome, TENS Therapy, Traditional treatment.

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INTRODUCTION

Hinman, Allen and Dorfman first coined the term non-neurogenic neurogenic bladder or sub clinical neurogenic bladder and later Hinman syndrome, to describe a presumably acquired form of bladder-sphincteric dysfunction in children that was characterized by a bladder decompensation with incontinence, poor emptying and recurrent urinary

infection. Most children also have significant bowel dysfunction, including constipation and fecal impaction. It is a rare, severe form of dysfunctional voiding that can present even in the neonatal period and can lead to renal failure. Treatment is aimed at improving the child's ability to empty the bladder.

It is done traditionally by applying a frequent emptying schedule, psychological support and anticholinergic medicines. Now TENS therapy is said to be a useful current modality. Hinman's syndrome is a condition, where bladder is emptied infrequently due to lack of coordination in sympathetic and parasympathetic activity, sphincter muscles contract involuntarily obstructing urinary outflow.¹ The hypogastric plexus, originating from spinal level T10-L2, sympathetically innervates the bladder which results in relaxation of detrusor muscles and contraction of the intrinsic sphincter. In pelvic plexus, parasympathetic nerves from S2-S4 has an opposite effect and pudendal nerve innervates the pelvic floor and external sphincter.^{2,3}

In the absence of a definable structural or neurological cause, the bladder becomes large and trabeculated in response to repeated contractions against closed sphincter. Children present with incontinence, infrequent difficult voiding, faecal soiling and constipation and recurrent urinary tract infections. Radiological findings include hydronephrosis, renal scarring, vesicoureteric reflux, large volume trabeculated bladder, conical dilatation of the posterior urethra and persistent or intermittent narrowing in the region of external sphincter. The disorder usually affects children but some cases persist into adulthood where they present with bladder emptying problems, recurrent UTI, VUR and chronic renal failure^{4,5} resulting in a poor quality of life.⁶⁻⁸ The disorder is believed to have psychogenic origins there may be a fear of punishment if bedwetting occurs, in the long run these patients lose self esteem because of social unacceptability.^{1,9,10}

Voiding dysfunction is contributed by uninhibited detrusor contractions (OAB), dysfunction of the pelvic floor musculature (dysfunctional voiding) or decreased force of detrusor contractions (under active bladder).^{11,4}

Traditional management includes behavioral therapy, bowel treatment, physiotherapy, frequent scheduled urination, intermittent catheterization and anticholinergic drugs.⁴ Transcutaneous electrical nerve stimulation (TENS) currently is one of the most commonly used form of electroanalgesia. Hundreds of clinical reports exist, concerning the use of TENS for various types of conditions including overactive

non-neurogenic neurogenic bladder syndrome, many of these studies were uncontrolled, so there has been an ongoing debate about the degree to which TENS therapy is an effective remedy than a placebo.^{12,13} Hence, this study was planned to compare the outcome of the patients of overactive non-neurogenic neurogenic Bladder Syndrome with traditional treatment alone and traditional treatment plus TENS therapy.

METHODOLOGY

The suspected cases of Hinman's syndrome, presenting at Children's Hospital & The Institute of Child Health, Multan, from August 2008 to May 2010, were assessed by Paediatric Urologist and Paediatric Physician. Twenty eight diagnosed cases were recruited and divided in a Control and a Study groups, each comprising 14 patients. The patients with similar complaints but with any diagnosis other than non-neurogenic neurogenic bladder were excluded. Parents/Guardians and patients were informed about the benefits/risks of the management plans and informed consent was taken. Study protocol was approved by the Institutional Ethical Committee.

All the information about their biodata and symptomatology was recorded on a pre-designed proforma. Basic relevant investigations including, complete urine examination, urine culture & sensitivity, ultrasound KUB and MCUG were performed in all the patients. Patients were categorized as mild, moderate and severe on the basis of clinical evaluation, voiding diaries and Overactive Non-neurogenic neurogenic bladder symptom score (OABSS) scoring system.¹⁴ Patients with comparable grades of severity were placed in the two groups.

Group A patients were called weekly and given traditional treatment only which include, behavioral therapy, bowel treatment, frequent scheduled urination, intermittent catheterization and anticholinergic drugs. Urotherapy, a nonpharmacologic and nonsurgical combination of cognitive, behavioral, and physical therapy with an aim to normalize micturition pattern, was done. The children and their parents were educated on proper voiding mechanics, correct sitting or standing positions for voiding, pelvic floor exercises and clean intermittent catheterization. All the patients were given α -Adrenergic Blocker (Minipress) and imipramine (Tofranil).

While Group B patients were called on daily basis, given traditional treatment along with transcutaneous electric nerve stimulation (TENS) therapy. TENS therapy was given with TENS MED S82 machine by Enraf-Nonius, Netherlands. The electrodes of TENS

Table-I: Severity of Disease in Children with Overactive Non-neurogenic Neurogenic Bladder Syndrome.

Disease Severity	Group A		Group B	
	(at start of treatment)	(after treatment)	(at start of treatment)	(after treatment)
Mild	2(14.3%)	4(28.57%)	0(0%)	5(35.7%)
Moderate	9(64.3%)	8(57.1%)	11(78.6%)	8(57.1%)
Severe	3(21.4%)	2(14.28%)	3(21.4%)	1(7.1%)

Key: Disease severity was based on OABSS (Overactive non-neurogenic neurogenic bladder symptom score and bladder diaries. A score of <5 was defined as "Mild", a score of 6 – 11 as "Moderate" and >12 as "Severe")

Group A=Children treated with traditional treatment.

Group B= Children treated with transcutaneous electric nerve stimulation (TENS) therapy.

were placed on S2 dermatomes (Buttock thigh and posterior leg) and S3 dermatomes (Groin, medial thigh to knee) for 20 minutes with frequencies of 35Hz and the pulse width, set at 0.2ms.

All the patients were re-evaluated by panel of Paediatric Urologist, Paediatric physician and Physiotherapist for their symptoms and graded again for the severity of the disease according to OABSS and voiding diaries. The data was collected to check the significance and effectiveness of the intervention. t-test was applied to compare outcome between two groups and $p < 0.05$ was considered to be statistically significant.

RESULTS

Age of the children was 1-6 years in 6(42.9%) in group A vs. 6(42.90%) in group B while 7-12 years in 8(57.1%) vs. 8(57.10%) children in group A and B respectively. Mean age of the children was 6.60 ± 0.8 vs. $6.43 \pm .07$ years in group A and B respectively. There were 8 male and 6 female patients in group A and 7 male and 7 female in group B. At the start of treatment, dribbling and increased frequency was observed in all 28 patients and urgency was noted in 22 patients (11 patients in each group). At the completion of treatment after 12 weeks, dribbling was observed in 11(78.51%) vs. 3(21.4%) children in group A and B respectively. Frequency was reduced to 8(57.14%) in group A and 5(35.7%) in group B

patients. Urgency was also seen in 8(72.7%) in group A while 3(27.3%) in group B patients. (Table-II)

In group A, the severity of disease, before the start of treatment was mild in 2(14.3%), moderate in 9(64.3%) and severe in 3(21.4%) cases. At the completion of management after three months the noted categorization was mild 4(28.57%), moderate 8(57.1%) and severe 2(14.28%) cases (Table-I).

In group B, the severity of disease, before the start of treatment was mild in 0(0.0%), moderate in 11(78.6%) and severe in 3(21.4%) cases. At the completion of management after three months the noted categorization was mild 5(35.7%), moderate 8(57.1%) and severe 1(7.1%) cases.

T-test was applied to compare outcome between the two groups and $p = 0.024$ ($p < 0.05$) was obtained which shows statistical significance. So addition of TENS therapy is statistically significant as compared to the traditional therapy alone.

DISCUSSION

Over a century electrical neurostimulation and neuromodulation have been investigated as alternative treatment options in overactive bladder syndrome, various reports have been published, but there is a new enthusiasm about TENS therapy as a new modality in the management of Hinmans syndrome.¹⁵ Fall M et al was the first to report encouraging result for the 1st time to relief pain and

Table-II: Improvement in Renal Complaints at End of Treatment in Children with Overactive Non-neurogenic Neurogenic Bladder Syndrome.

Improvement in Complaint	Number of patients	Group	
		A	B
Dribbling	14	11(78.6%)	3(21.4%)
Urgency	11	8(72.7%)	3(27.3%)
Frequency	14	8(57.14%)	5(35.7%)

Group A=Children treated with traditional treatment.

Group B= Children treated with transcutaneous electric nerve stimulation (TENS) therapy.

Table-III: Descriptive statistics.

Variables (Mean±S.E.M.)	Group	
	A	B
Age (years)	6.60±0.8	6.43±0.7
Weight (kg)	23.36±2.6	21.07±1.9
No. of siblings	4.57±0.5	4.4±0.6

Group A=Children treated with traditional treatment.

Group B= Children treated with transcutaneous electric nerve stimulation (TENS) therapy.

symptoms of bladder over activity with TENS therapy.¹⁶ Results from our study showed an overall improvement in urinary symptoms and severity according to OABSS scoring system and bladder diaries though patients were not fully recovered but marked improvement was observed.

In this study we used OABSS scoring system and bladder diaries to see the improvement of the patients, on the other hand, there is limited data available in which OABSS scoring system is taken as parameter to observe the results of TENS therapy. Bladder diaries were being used as a tool of observation in previous studies by various authors.^{2,8} All these studies supported that TENS therapy is a useful remedy in overactive bladder syndrome which is in accordance with our study.

The frequencies used during TENS therapy may vary widely (1-100Hz), there has been no systematic evaluation to delineate the optimal parameters that should be used in these patients, whether they are neuropaths or not. There is therefore at present no consensus on the stimulation parameters used in TENS therapy for continence problems, and this area in particular may warrant further research. Hasan et al used a pulse width of 200µs when investigating the effect of TENS on 71 patients with idiopathic detrusor instability, but with a much higher frequency of 50Hz. Patients in that study had significant improvement in symptoms, similar to the present outcome, in which we used frequencies of 35Hz and the pulse width, set at 200µs.¹⁷

The mechanism by which TENS modifies detrusor function beneficially remains unclear, although TENS increases the level of cerebrospinal endorphins at various frequencies, which in turn may decrease detrusor activity and hence may exert a central effect. TENS may also exert a more peripheral effect by directly stimulating sacral nerve roots, causing an activation of the external urethral sphincter, which in turn will inhibit detrusor activity.

A more recent randomized study, comparing results from IDI treated with S2-3 TENS with those treated with T12 or sham stimulation, also reported a significant improvement in symptom scores in S2-3 dermatomes, In our study the electrodes of TENS

Overactive Non-neurogenic Neurogenic Bladder Symptom Score (OABSS) Scoring Criteria¹⁶

Question	Symptom	Score	Frequency
1	How many times do you typically urinate from waking in the morning until sleeping at night?	0	7 or less
		1	8-14
		2	15 or more
2	How many times do you typically wake up to urinate from sleeping at night until waking in the morning?	0	0
		1	1
		2	2
		3	3 or more
3	How often do you have a sudden compelling desire to urinate, which is difficult to defer?	0	Not at all
		1	Less than once a week
		2	Once a week or more
		3	About once a day
		4	2-4 times a day
4	How often do you leak urine, because you cannot defer the sudden desire to urinate?	5	5 times a day or more
		0	Not at all
		1	Less than once a week
		2	Once a week or more
		3	About once a day
		4	2-4 times a day
		5	5 times a day or more
Sum of scores			

It is recommended that a total score of 5 or less be defined as mild, a score of 6-11 as moderate, and 12 or more as severe

were placed on S2 dermatomes (Buttock thigh and posterior leg) and S3 dermatomes (Groin, medial thigh to knee), with comparable results. McGuire et al. also showed improvement in five of eight patients, treated in similar manner.¹⁸

The results from the present study support an overall improvement in urinary symptoms from TENS, showing a trend toward improved bladder functions, similar results has been described by Nakamura and Sakuri¹⁹ in a series of 12 patients treated with TENS. In this study, as already mentioned, the diagnosis was made on clinical grounds only, moreover as this is a rare disease.

CONCLUSION

To conclude, TENS Therapy is an effective and beneficial tool to improve the symptoms and quality of life of the patients with Hinman syndrome but still large scale studies with larger number of patient and longer follow up is required to verify the long term efficacy of TENS therapy in such patients.

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