

Assessment of Bladder Capacity and Pelvic Floor Muscle Strength in Children with Primary Nocturnal Enuresis

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ABSTRACT

Background: Enuresis is a health issue suffered in childhood. This problem is common and difficult to cure for 10-15% of the 5 years old children in their growing stage. Primary Nocturnal Enuresis (PNE) is commonest type of all other types of enuresis. The parents and family of children with enuresis suffers emotional trauma and anxiety as a part of adverse effect of the condition. Genetic, Obstructive sleep Apnea and detrusor muscle inactivity are the common associated factors of PNE. Urodynamic studies are the most evaluative method to check bladder functions for child enuresis or incontinence. There is a lack in uroflowmetry and surface electromyography values for effective diagnosis of PNE.

Objectives: The present study focuses on to find out the score of uroflowmetry and surface electromyography in Paediatric Primary Nocturnal Enuresis.

Methods: A cross-sectional Design was done on 21 Participants from the children of 5-15 years, of both genders and educational levels. The uroflowmetry and Surface Electromyography was performed to subjects who diagnosed as children with PNE by Paediatrician and who want to participate in the study.

Results: The uroflowmetry records of 21 Enuretic children shows that the mean value of voiding volume is 158.28 ± 53.41 ml/sec and mean of Average flowrate is 10.36 ± 2.62 ml/sec. The surface electromyography shows that the highest maximum voluntary activity (MVA) of perianal muscle is $513 \mu v$ and the lowest value is $111 \mu v$.

Conclusion: This small cross-sectional study, which expands the scant existing literature on uroflow parameters and Surface electromyography (sEMG) in Enuretic children, will hopefully promote wider application of uroflowmetry testing and surface EMG of pelvic muscles in the paediatric population having PNE.

Key words: Primary Nocturnal Enuresis, Uroflowmetry, Surface Electromyography, Voiding volume, Pelvic floor muscles

INTRODUCTION

Enuresis is called as (enourein) in Greek word, which means "to void Urine". There are two types of enuresis: Day time and Nocturnal Enuresis. Nocturnal Enuresis also known as bedwetting, occurs at night. The

definition of Enuresis is voluntary or involuntary wetting of clothes or bedding with urine for a period of at least 3 consecutive months in children older than 5 years of age. American Paediatric Academy defined as enuresis is the involuntary wetting

of clothes or bedding by urine during the daytime or nighttimes¹. Night time bedwetting is more commonly observed in children of 5-10 years of age. The children suffer with low self esteem, anxiety and be embraced due to the problem. So the enuresis is a personal barrier for the children to involve in the social activity.

There were two forms of Enuresis: primary and secondary.

The children who never had dry nights since birth and no control on micturition classified as Primary enuresis. The condition where children had control of wetting for a consistent period of time of 6 months and again starts wetting are known as Secondary enuresis.² After the 5 years of age if the children had two or more wet nights per month, it defined as Nocturnal Enuresis. And if the two or more wetting per month occurs while child is awake after 3 years of age it known as diurnal enuresis.³

The worldwide prevalence of enuresis among children aged 6-12 years is 1.4 - 28 %.⁴ the prevalence in India is 7.61- 16.3 %. The prevalence is highest in children aged 5-8 years and lowest in children aged 11-12 years.⁵

The etiology for the nocturnal enuresis is multi factorial and the prevalence is higher in male children than female children.⁵ A positive family history, the number of siblings, birth sequence, family's education and economic status, male gender, number of individuals in the family, constipation, and previous history of urinary tract infection have been found to be associated with nocturnal enuresis⁶.

Anxiety, Attention deficit/hyperactivity disorder (ADHD), certain genes, constipation that puts pressure on the bladder, Delayed bladder development, Diabetes, not enough anti-diuretic hormone (ADH) in the body during sleep, obstructive sleep apnea are commonest causes of enuresis. Von Gontard et al. determined that genes 8q, 12q, and 13q are responsible for the tendency to develop enuresis⁷.

The three main factors in Pathophysiology of enuresis are: Nocturnal polyuria, Arousal disorder, and Nocturnal low bladder capacity or increased Detrusor activity. Yeung CK et al. found that patients with primary nocturnal enuresis (PNE) have a functional bladder capacity corresponding to 70% of the expected capacity. An increase in bladder wall thickness was also found with ultrasonography of the same patients⁸. In another study of children with PNE, electroencephalography (EMG) and cystometry records demonstrated that bladder contractions could not be inhibited in 30%- 32% of enuretic children, and that this led to their enuresis⁹. Due to multiple etiologic factors, nocturnal enuresis is still not clearly defined.

The above mentioned pathology triggers the mandate need of evaluation of bladder capacity and strength of muscles responsible for urination.

The evaluation methods for diagnosis of enuresis are: history taking, physical examination, frequency volume chart (bladder Diaries), urinalysis or urine culture, urinary system ultrasonography and Urodynamic studies.

History helps determine whether enuresis is primary or secondary, the pattern of enuresis (number of nights/week and number of episodes/night), and the pattern of night time fluid intake.⁵ Also the detail family history and questions for co morbidities should be obtained.

Physical examination should involve evaluation of the abdomen (check for distended bladder and fecal impaction), rectum, genitalia (identify signs suggestive of sexual abuse which may be the cause of secondary/persistent enuresis), ears, nose, and throat. Neurological assessment is also required to identify Spina-bifida, ADHD, genetic abnormality and bladder delayed development.

A baseline record of the enuresis pattern over 2 weeks can assess enuresis severity and give an objective measure of bladder performance. Vande Walle et al provided a format for a daytime diary which recorded

the volume of fluid intake, volume of urine, and occurrence of leakage. The measurement of maximum voided volume should be made over at least 2–4 days.⁵

Urodynamic studies generally reveal storage problems such as low bladder capacity and decreased bladder compliance or detrusor over activity in patients with primary enuresis¹⁰. Urodynamic study is especially useful for demonstrating neurogenic bladder or outlet obstruction in children with enuresis. Recently it has been demonstrated by urodynamic studies that 25–73% of adults with PNE have bladder dysfunction¹¹.

There are very few studies have used uroflowmetry and Surface electromyography (sEMG) of perianal muscles as an assessment method in the cases of incontinence and dysfunctional voiding in pediatrics. So the purpose of the study to assess the bladder function in children with enuresis using uroflowmetry and surface electromyography sEMG.

MATERIAL & MATHEDOLOGY

Institutional ethical approval for this cross sectional study was obtained by Ethical committee of Dr. D.Y. Patil Vidyapeeth and the registration number is EC/454/2020. A total of 21 Enuretic children of both genders were enrolled in the study. The Sample population was children having bed wetting problem at least 2 times in week. The children were assessed for Enuresis at Paediatric Out Patient Department of Dr. D.Y.Patil hospital, Pimpri, Pune and the children with confirmed diagnosis of enuresis were included in the study according to the selection criteria.

The inclusion criteria were children having age of 5-15 years, history of day/night time bed wetting for at least 2 times a week, since 6 consecutive months and equal socio-economic status. Children with global

developmental delay, conditions related to CNS, mental retardation were excluded. Written informed consent was taken from the parents of participant meeting the inclusion and exclusion criteria.

All the 21 Children were first assessed by pediatrician to confirm the diagnosis of enuresis, and then were referred for uroflowmetry to assess the bladder functions. The procedure of uroflowmetry was explained to the parents and children were trained to do the test. A single uroflow record including Peak flow rate, time to peak flow, voided volume, flow time, voiding time and average flowrate from each child was evaluated and all 21 records were analyzed. After uroflowmetry the surface electromyography (sEMG) of perianal muscles was performed for 21 children with enuresis to check the strength of the muscles. The procedure for sEMG like electrode placement, intensity of current, muscle contraction techniques etc. was informed to the child and the mother. The Spontaneous activity and Maximum Voluntary Activity (MVA) were recorded.

All the hygiene and safety precautions were taken into consideration for uroflowmetry as well as surface electromyography. The results of uroflowmetry and values of sEMG were recorded in data collection sheet and analyzed.

DATA ANALYSIS

The bladder function of the Enuretic children was assessed by uroflowmetry and surface electromyography in the study. The Uroflowmetry and Surface electromyography data were collected, tabulated and analysed. For statistical analysis SPSS 16.0 was used.

RESULTS

TABLE I – The Descriptive Analysis for Values of Uroflowmetry

Variables		No. Of children	Uroflowmetry Values		
			Mean ±SD		
			Voiding volume (ml)	Flow time (s)	Average flowrate(ml/s)
Age	5-10 years	17	142.6±30.2	11.4±5.1	9.5±2.43
	10-15 years	4	201.72±70.52	16.1±2.2	11.63±5.3

	Total	21	158.28±53.41	15.36±3.17	10.36±2.62
Gender	Girls	13	163.21±49.9	9.2±4.1	14.2±5.7
	Boys	8	132±38.7	13.7±2.5	9.8±4.6

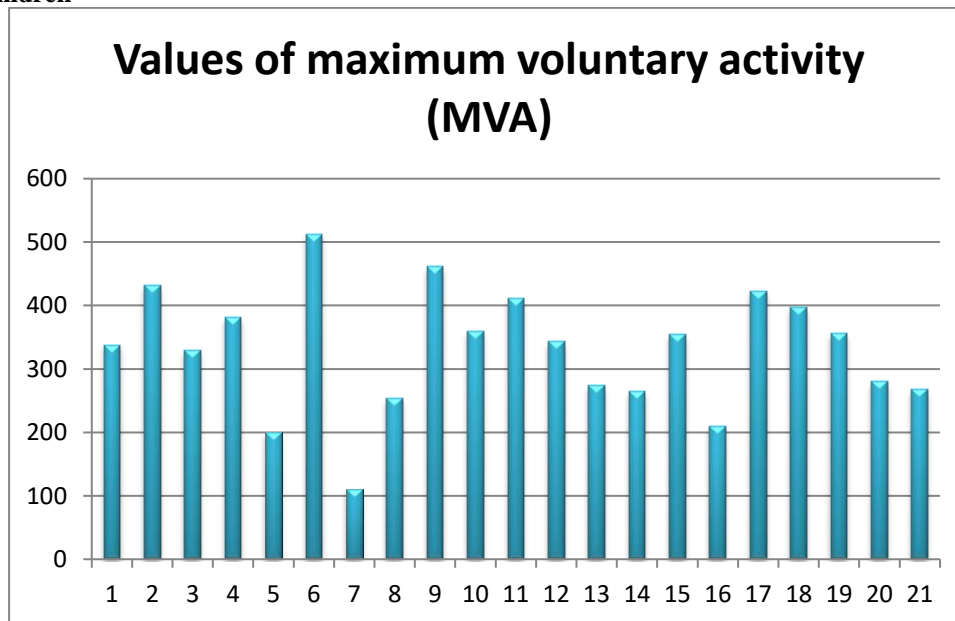
Table I shows that the PNE children with age group of 5-10 years have bladder capacity of 142.6 ml and 10-15 years old have the bladder capacity of 201.72ml. The Girls have more bladder capacity (163.21ml) than boys (132.21ml).

TABLE II- The Mean Scores of SPA and MVA By Surface electromyography

Variables	No. Of children	Surface Electromyography Mean ±SD
SPA	21	0
MVA	21	331.6µV ± 103.45

The table II shows that the SPA (spontaneous activity) is 0 as there is no presence of pathology of perianal muscle at rest. The peak to peak amplitude in MVA (maximum voluntary activity) is 331.6µV.

Graph I: Maximum voluntary Activity (MVA) and QMUP values of Surface Electromyography in enuretic children



The graph shows that the maximum value of MVA is 513µv at 90/sec turns and minimum is 111µv at 71/sec turns.

DISCUSSION

Now a days, Urodynamics, the study of bladder and its outflow mechanism, has been used in the investigation of wetting to elucidate lower urinary tract dysfunction and intrinsic bladder abnormalities. However, these are extremely invasive, expensive and distressing for the child.

The results of the present study will provide additional quantitative assessment tool in Enuresis and these may be useful for evaluation of Enuresis as reference value. Also the uroflowmetry (bladder capacity) testing and perianal surface electromyography both are non-invasive method of investigation for bladder functions in Enuretic children.

Dheeraj Kumar Gupta et al studied Uroflowmetry Nomograms for Healthy Children 5 to 15 Years Old. In that study the Voiding volume in boys is 120.93 ± 61.56

and in girls is 169.12 ± 125.01 in the age group of 5-10 years. And the average flowrate is 7.68 ± 3.26 ml per second in boys and 9.19 ± 4.23 ml per second in girls.¹³

Also, Ersan Arda found that the uroflowmetry results of Enuretic children support the pathological finding stated as the children with enuresis have decreased bladder capacity.¹⁰ The present study measures voiding volume in enuretic children which can be compared with normal children of same age, BMI and Gender in future.

The results of the present study shows that there were 21 Enuretic (13 girls and 8 boys) children having BMI between 75th to 90th percentiles, negative family history and equal socio-economical status included in the study. In the uroflowmetry records the mean value of voiding volume is 158.28 ± 53.41 ml/sec and mean of Average flowrate is 10.36 ± 2.62 ml/sec.

Also the pelvic muscle strength was assessed by recording peak to peak amplitude i.e. Maximum Voluntary Activity (MVA) in Surface electromyography. Which shows that the enuretic children have amplitude mean is $331.6 \mu V \pm 103.45$. The study titled as "Surface electromyography of perianal muscles in children with and without enuresis: A cross sectional study" done by Vidhi shah et al also found that the mean value of amplitude of surface EMG in normal children was $428.6 \pm 118.6 \mu V$ and for enuretic children was $248.01 \pm 45.85 \mu V$.¹⁴ so, the enuretic children have weak muscle strength.

CONCLUSION

This study provides reference values of uroflowmetry (Voiding volume, Flowrate and time) and surface electromyography of perianal muscles for Enuretic children. Also this new simplified description of uroflow parameter values as well as sEMG of pelvic muscles may be useful for screening, diagnosing enuresis and determining response to treatment in the paediatric population.

Limitation

The present study has small sample size so comparison of uroflowmetry with reference to age was not analysed. Also, the gender wise difference needs to evaluate in future.

Declaration by Authors

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