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ORIGINAL ARTICLE

Urodynamic Evaluation of Children with Nocturnal Enuresis.

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ABSTRACT

Background: Nocturnal Enuresis (NE) is a serious problem that affects children and their families. It may be monosymptomatic or non-monosymptomatic nocturnal enuresis. Urodynamic study helps to define the functional status of the lower urinary tract.
We aim to re-evaluate children with non-physiological NE by urodynamic study who resist treatment for more than three months.

Methods: It was a cross-sectional study carried out at the Pediatric Nephrology Clinic and Pediatric Urology Clinic of Zagazig University Hospital over a period of 2 years from August 2017 to July 2019. The total sample size included 48 children, They were divided into three groups, monosymptomatic nocturnal enuresis, non-monosymptomatic nocturnal enuresis with daytime incontinence, and non-monosymptomatic nocturnal enuresis without daytime incontinence. All patients were subjected to urine analysis, urine culture, x-rays on the lumbosacral area, ultrasound (US) examination, and urodynamics.

Results: The studied groups showed statistically significant differences as regards normal US findings but no differences in the other bladder US findings. The studied groups showed highly significant statistical differences in each of normal urodynamics, over-acting bladder, and overacting bladder + detrusor hyperactivity, and no difference between them as regards detrusor hyperactivity. There was a significant difference between the studied groups as regards normal voiding cystourethrogram findings, while no difference between groups as regards widening of the bladder neck, and bladder diverticulum, unreported and irregularity of bladder wall.

Conclusions: Ultrasonography uroflowmetry can detect most (urinary incontinence) UI children.

Keywords: Nocturnal enuresis; Urodynamic study Children.

INTRODUCTION

Nocturnal enuresis (NE) is the state of wetting during sleep in children older than 5 years. Enuresis is characterized as monosymptomatic nocturnal enuresis if is isolated with no other urinary problems, and non-monosymptomatic nocturnal enuresis if there are other lower urinary tract symptoms [1].

Monosymptomatic nocturnal enuresis is divided into 1ry and 2ry forms with primary enuresis representing 80% of it. 1ry enuresis is said when children have never had at least 6 months of night dryness, while if presented after a satisfactory period of nighttime dryness, it is called 2ry enuresis [2].

A urodynamic study is composed of a group of interactive tests, which give information about the physiology, and function of the bladder and urethral function during urine storage and emptying. These tests include uroflowmetry, electromyography, cystometrogram (CMG), pressure-flow studies (PFS), leak point pressure measurements, post-void residual (PVR), and urethral pressure profilometry [3].

METHODS

Patients and study design

This was a cross-sectional study carried out at the Pediatric Nephrology Clinic and Pediatric Urology Clinic of Zagazig University Hospital over a period of 2 years from August 2017 to July 2019.

The total sample size included 48 children divided into 3 groups:

Group (1): Monosymptomatic nocturnal enuresis (MNE) (14 children)

Group (2): Non-Monosymptomatic nocturnal enuresis without daytime incontinence (NMNE) (8 children).
Group (3): Non-Monosymptomatic nocturnal enuresis with daytime incontinence (26 children).
Inclusion criteria: all children of both sex, aged more than 5 years up to 16 years, had UI and were treated with general and medical therapy for more than 3 months and didn't show improvement in treatment, as well as children who had spina bifida without neurological deficits, were included in the study.
Exclusion criteria: children who had neurologic deficits (myelodysplasia, spinal injury or surgery, cerebral palsy, or mentally retarded children) and those with known urological disorders (especially vesicoureteric reflux and posterior urethral valve) were excluded from the study.
Written informed consent was obtained from all participants' parents.
Detailed personal history (age, sex, family history of enuresis, primary or secondary enuresis, present medication and preceding therapy, including surgical interventions), urinary history, bowel history, and history of perianal pruritus were taken for all cases.
The back and sacral regions were inspected carefully to look for spina bifida, and the abdomen was palpated for distended bladder, kidneys, and genital region for abnormal genitalia, and anatomical defects.
All patients did urine analysis, urine culture, pelvi-abdominal ultrasonography, voiding cystourethrography (VCUG), radiograph of the spine, uroflowmetry, and cystometrography (CMG).
Ethical clearance:
Approval was obtained from the ethical committee in the faculty of medicine at Zagazig University after taking Institutional Review Board (IRB) approval. The study was done according to the Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies.

Statistical analysis

Data were entered and analyzed using Microsoft Excel software, then imported into SPSS version 24.0 software for analysis (SPSS Inc., 2007). The mean and standard deviation (mean ± SD) of quantitative data was presented.
Differences between quantitative independent groups by t-test, multiple by ANOVA, and correlation by Pearson's correlation. P value was set at <0.05 for significant results & <0.001 for highly significant results, for nonparametric data quantitative independent groups by Mann Whitney test, multiple by Kruskal Wallis test, correlation by Spearman's correlation. The test results were considered significant when the p-value ≤ 0.05, highly significant when the p-value ≤ 0.01, and non-significant when the p-value >0.05**.** All p values are two-tailed.

RESULTS

The total sample size included 48 children above 5 years, 52.08 % were male children, and their mean age was 8.5 years.
As shown in Table 1, the studied groups showed no statistically significant difference as regards age while there was male predominance in group 1 and group 2, and female predominance in group 3.
There was no statistically significant difference between them as regards the history of UTI, similar family history, type of enuresis, or history of therapy as shown in Table 2.
Group 2 was significantly higher in increased voiding frequency and straining than other groups, Group 3 was significantly higher in urge incontinence and wetting during a nap than other groups, while there was no statistically significant difference between the studied groups as regarding constipation, encopresis, holding maneuvers, dribbling, giggle incontinence, encopresis + constipation, urge incontinence + increased voiding frequency and intermittency as shown in Table 3.
As shown in Table 4 there was no statistically significant difference between the studied groups as regards urine culture
As shown in Figure 1, ultrasound findings in group 1 were significantly higher in normal ultrasound findings than in other groups, but there was no difference between them as regards other bladder ultrasound findings.
As regards, urodynamic findings group 1 was significantly higher in normal UDS, and OAB + detrusor hyperactivity than other groups, also, group 2 was significantly higher than other groups in OAB. while there was no difference between them as regards detrusor hyperactivity as shown in Figure 2.
Regarding VCUG findings, as shown in Figure 3, group 1 was significantly higher than other groups in normal VCUG, while there was no significant difference between them as regards widening bladder neck, bladder diverticulum, unreported, and irregularity of bladder wall

Table 1: Demographic data in the study population.

Variable	Group 1 Monosymptomatic nocturnal enuresis (N=14)		Group 2 Non Monosymptomatic nocturnal enuresis without daytime incontinence (N=8)		Group 3 Non Monosymptomatic nocturnal enuresis with daytime incontinence (N=26)		F	P value
Age: (years):								
Mean ±SD	8.4±2.06		8.6±2.4		8.4±2.5		0.023	0.977
Range	6-13		6-12		5-15			
	No.	**%**	**No.**	**%**	**No.**	**%**	χ^2	**P value**
Sex:								
Female	4	28.6	2	25.0	17	65.4	6.9	**<0.05 (S)**
Male	10	71.4	6	75.0	9	34.6		

Table 2: History data in the studied groups

Variable	Group 1 (n=14)		Group 2 (n=8)		Group 3 (n=26)		χ^2	P-value
	No.	**%**	**No.**	**%**	**No.**	**%**		
Past history of UTI:								
	5	35.7	3	37.5	10	38.5	0.02	0.985
Positive family history:								
	10	71.4	5	62.5	18	69.2	0.195	0.907
History of therapy:								
	14	100.0	8	100.0	26	100.0	0.0	1
Type of enuresis:								
Primary	12	85.7	7	87.5	18	69.2	1.98	0.369
Secondary	2	14.3	1	12.	8	30.8		

UTI: urinary tract infection.

Table 3: Urinary and Bowel symptoms of the studied groups

Variable	Group 1 (N=14)		Group 2 (N=8)		Group 3 (N=26)		χ^2	P-value
	N	**%**	**N**	**%**	**N**	**%**		
Increased voiding frequency	0	0	7	87.5	26	61.5	19.83	<0.001 (HS)
Straining	0	0.0	2	25.0	1	3.8	5.99	<0.05 (S)
Constipation:	2	14.3	0	0.0	7	26.9	3.16	0.205
Encopresis	0	0.0	1	12.5	3	11.5	1.8	0.406
Wetting during nap	4	28.6	2	25.0	18	69.2	8.41	<0.05 (S)
Urge incontinence	0	0.0	4	50.0	16	61.5	14.4	**<0.001 (HS)**
Holding maneuvers Yes	0	0.0	3	37.5	4	15.4	5.77	0.055
Dribbling	0	0.0	2	25.0	6	23.1	3.96	0.137
Giggle incontinence	0	0.0	2	25.0	7	26.9	4.57	0.101
Encopresis + constipation	0	0.0	0	0.0	3	11.6	2.7	0.258
Urge incontinence + increased voiding frequency	0	0.0	3	37.5	7	26.9	5.61	0.06
Intermittency	0	0.0	0	0.0	2	7.7	1.76	0.413

Table 4: Types of Isolated organism of the UTI patients according to culture

Patients	E. coli		Klebsiella pneumonia		Proteus mirabilis		Staph aureus	
Frequency	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Group 2	1	12.5	1	12.5				
Group 3	3	11.5	2	7.7	1	3.8	1	3.8

Figure 1: Bladder ultrasound findings of the studied groups

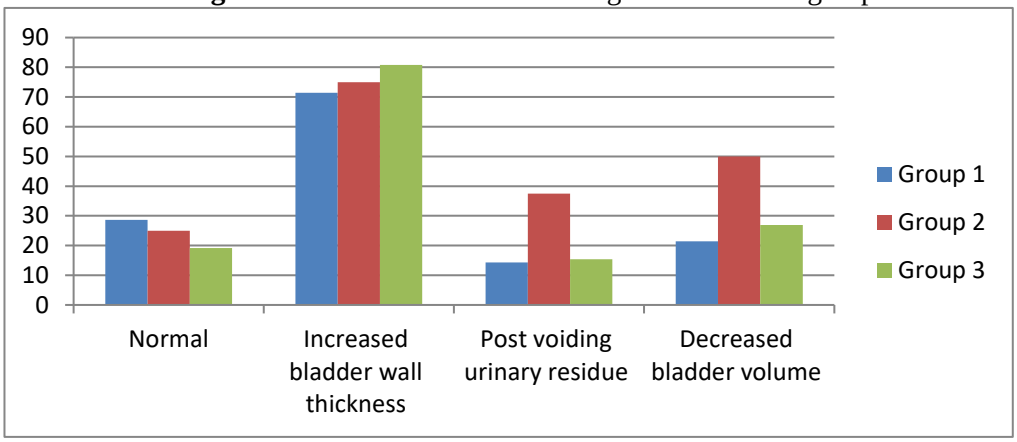


Figure 2: Urodynamic studies results of the studied groups

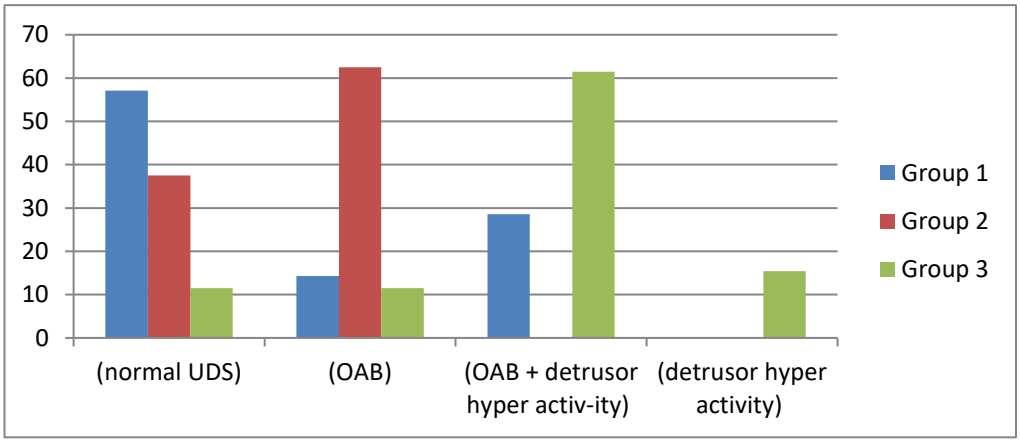
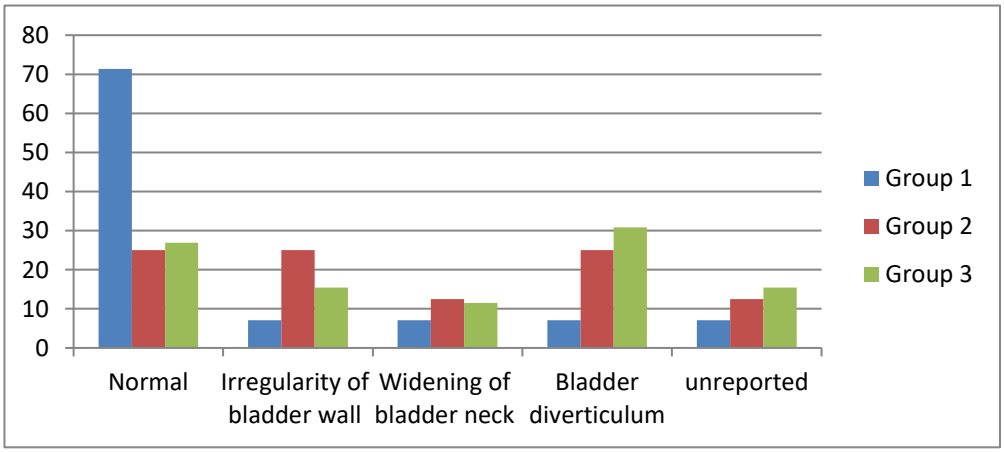


Figure 3: VCUG findings of the studied groups



DISCUSSION

Although nocturnal enuresis is considered a simple problem, it may have a lot of concealed causes that require a multidisciplinary approach that involve a pediatrician, pediatric nephrologist, urologist, and child and adolescent psychiatrist. The complexion in evaluation and treatment verifies the physician's need for practice parameters to face this problem [4].

Urine control is a complex skill and has not been understood yet. It is composed of different developmental stages till reaches the adult pattern

of urinary control when achieving the final stages which are mostly achieved at 3 to 4 years old [5].

In agreement with a study by Naseri and Hiradfar, NMNE is more common than MNE [5]. On the other hand, Yeung et al. observed that with age the number and severity of wetting episodes increase progressively [6].

Our study showed male predominance (52% male and 48% female). Group 1 and Group 2 showed male predominance 71.4% and 75% respectively but Group 3 showed female more than male children (65.4% female and 34.6% male).

Our study showed a significant difference as regards sex in agreement with Naseri and Hiradfar and Yeung et al. who reported that bedwetting was more common in boys than girls and daytime incontinence the majority were girls [5, 6].

Our results were supported by Naseri and Hiradfar who observed no relation between the type of enuresis and the history of UTI [5]. There was no significant difference between the studied groups as regards positive family history for enuresis. Our results were supported by Von Gontard and his colleagues, who published that NE runs in families and twins and NE demonstrated a high heritability [7]. There was no significant difference between the studied groups as regards the type of enuresis, in agreement with Naseri and Hiradfar who reported that primary enuresis is more common [5]. Also, our study was supported by Naseri and Hiradfar, who stated that 2ry enuresis was more common in children with NMNE than those with MNE [5]. Abrams et al. suggested that 2ry enuresis was mostly associated with organic causes [8]. In our study, group 2 was significantly higher in increased voiding frequency and straining than other groups, group 3 was significantly higher in urge incontinence and wetting during nap than other groups, while there was no statistically significant difference between the studied groups as regard constipation, encopresis, holding maneuvers, dribbling, giggle incontinence, encopresis + constipation, urge incontinence + increased voiding frequency and intermittency in agreement with Naseri and Hiradfar and supported by Panayi et al. [5,9]. Our results can be explained by Wenske et al. and Wenske et al. [10,11].

In the current study, the studied groups showed no significant difference as regards constipation, encopresis, holding maneuvers, dribbling, giggle incontinence, encopresis + constipation, urge incontinence + increased voiding frequency, and intermittency, this may be referred to the limited number, which was studied in each group and most of these symptoms were presented in group 3 only.

We agree with Naseri and Hiradfar who observed that constipation was significantly more in NMNE with daytime incontinence [5]. Also, Van Batavia et al. and Naseri disagree with the current study, since they reported that the prevalence of constipation was high among children with NE and closely related to LUT symptoms [15,12]. Naseri reported that intermittent daytime UI was common in NMNE with daytime wetting [12]. Our results could be explained by Franco et al. [13].

In agreement with Naseri, the studied groups showed no significant difference in urine culture [12]. We disagree with Loening-Baucke who demonstrated that patients with day wetting were more at risk to have UTI [14]. Also, we agree with Van Batavia et al. who reported that patients presented with urinary incontinence tend to void infrequently (1–3 times per day) and often presented with urinary tract infections or incontinence and had a large bladder capacity in some patients [15]. E.coli was the most common organism in culture 12.5% in group 2 and 11.5% in group 3. Klebsiella pneumonia was present in 12.5% of group 2 and 7.7% of group 3. Proteus mirabilis and Staph aureus were presented by the same frequencies in group 3.

We agreed with Nimri et al. who published UTIs are generally caused by Escherichia coli and other members of the family Enterobacteriaceae [16]. Also, different studies were done in different areas in Egypt by Bakr and Amin and showed that E.coli then Klebsiella then Enterococcus Faecalis then coagulase –ve staphylococci are the causes of UTIs. Frequencies were different from our results since these studies were performed in different areas and on different numbers of patients [17,19].

The current study demonstrated that the studied groups have highly significant difference as regards normal ultrasound findings. Despite high frequencies of BWT, which was more common in group 3, there was no difference between them in other bladder ultrasound findings (PVUR, increased bladder wall thickness, and decreased bladder volume), this may refer to the limited number for each group included in our study.

We agree with Naseri and Hiradfar who stated that BWT was the most common finding in all groups but disagree with Naseri and Hiradfar who illustrated that PVUR >15cc was more in patients with MNE [5]. The first step in UDS is a detailed record of urine output and fluid intake over 24-hour periods, which is called a frequency/volume chart (FVC) or bladder diary, but parents were not cooperating in filling this chart. In a study by Sehgal et al. abnormal voiding symptoms help to identify 71% of children with NE [18]. Additional 8 patients were captured by voiding chart, so the sensitivity increased to 81%.

In agreement with Naseri, the studied groups showed a highly significant difference in each of normal UDS and OAB + detrusor hyperactivity (more in group 1), and OAB (more in group 2) while there was no statistically significant difference between them as regards detrusor hyperactivity [12]. Regarding the VCUG, this study showed normal findings of VCUG with highest frequencies in MNE (group1) then group 3 and lastly group 2. Abnormal VCUG in the form of irregularity of bladder wall, widening of bladder neck and bladder diverticulum were reported with highest frequencies in NMNE without daytime incontinence (group 2) then group 3 then group1.

Limitation of the study: the small sample size, some parents weren't cooperative, and some refused to do the test.

CONCLUSIONS

The first step of evaluation is carefully history taking, good physically examination and voiding diary followed by urinalysis, urine culture, frequency/volume chart (FVC), ultrasonography and uroflowmetry. VCUG must be limited to unexplained and resistant cases of urinary incontinence especially in girls with NMNE with daytime incontinence.

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