



Evaluation Blood Pressure Status in Children with

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Abstract

Background: Enuresis has been defined as bed voiding at least twice a week for more than 3 consecutive months in individuals older than 5 years of age. Increased nocturnal enuresis could be possibly associated with dysfunction of autonomic nervous system. To observe autonomic nervous system function in enuretic children, the current study performed management of blood pressure.

Methods: In this study, primary non-monosymptomatic nocturnal enuresis and healthy children were enrolled and blood pressure was measured twice, in the morning and afternoon. Urinalysis, urine culture, and urinary system ultrasound were carried out for the patients. A diary on the daily fluid intake and volume of daily urine was required.

Results: The researchers observed that there was a significant difference between age variation (P value = 0.001) gender variation (P value = 0.030), educational level of patients' mothers and fathers (P value = 0.001) and record of hypertension in the family (P value = 0.001) between case and control groups.

Conclusions: In children affected by primary non-monosymptomatic nocturnal enuresis, nighttime Systolic Blood Pressure (SBP) were significantly higher, than healthy children. These circadian blood pressure provisions may reflect pathogenesis of primary non-monosymptomatic nocturnal enuresis and autonomic nervous system dysfunction.

Keywords: Children, Enuresis, Blood Pressure, Autonomic Dysfunction

1. Background

Repeated urine voiding in bed more than twice a week in 3 continuous months in a child, who is at least 5 years of age, is considered as enuresis (1). Diurnal enuresis defines wetting while awake and nocturnal enuresis refers to voiding during sleep. Children, who are never consistently dry throughout the night, are considered to have primary enuresis, whereas wetting resumption after more than 6 months of dryness is known as secondary enuresis (2, 3). Monosymptomatic enuresis has not association with daytime symptoms and non-monosymptomatic, more common enuresis, often has at least one subtle daytime symptom. Organic underlying abnormalities have been rarely associated with monosymptomatic enuresis (4, 5).

In adults, without considering gender, body size, or age, Hypertension (HTN) has been defined as blood pressure (BP) $\geq 140/90$ mmHg (6). This, as a functional definition, is related to BP elevation levels with the likelihood of subsequent cardiovascular events. However, cardiovascu-

lar events associated with HTN, such as stroke or myocardial infarction, usually do not occur in childhood (7). Normative distribution of BP, includes tables such as systolic and diastolic values for the 50th, 90th, 95th, and 99th percentile by gender, age, and height percentile, in healthy children (8). Hypertension, as average diastolic blood pressure (DBP) and/or systolic blood pressure (SBP), has been defined as ≥ 95 th percentile for gender, age, and height on ≥ 3 items (9). White coat HTN has been defined as medical setting BP levels ≥ 95 th percentile and out of office normal BP (10). The Fourth Report has recommended staging of ≥ 95 th percentile HTN (11). Furthermore, BP between 95th and 99th percentile and 5 mmHg as stage 1 HTN, and children with > 99 th percentile HTN plus 5 mmHg as stage 2 HTN have been categorized. Asymptomatic stage 1 HTN, without target organ damage, allows evaluation before treatment while more evaluation and pharmacologic therapy are needed (12, 13).

Since HTN could be the causes of voiding dysfunctions, such as NE, it has been suggested to evaluate the correlation

of HTN and NE. In the current study, the researchers considered HTN effectiveness in primary nonmonosymptomatic nocturnal enuresis in males and females.

2. Methods

Above 5-year-old children with primary non-monosymptomatic enuresis were enrolled and their blood pressure was measured in accordance with provided instructions. According to previous studies, sample size was estimated as equal to 110 children as case (primary non-monosymptomatic enuresis) and 220 children as control (healthy) groups.

2.1. Methodology

This was a case-control, hospital based study conducted at Amir Kabir pediatric hospital. Concordant with inclusion of every patient in the study, a child (above 5 years old) with the same gender, age, and demographic information was entered in the study, in case and control groups. Systolic and diastolic blood pressure was measured by a resident doctor, employing stethoscope and digital blood pressure monitor (CITIZEN REF CH-452). Patient were not allowed to eat for 1 hour and perform heavy activities for 30 minutes before the measurement. Firstly, a cuff was tied around the right arm and held the hand parallel to the heart. Age, gender, and height of the patient were considered in measuring blood pressure and diagnosing hypertension. The researchers employed a blood pressure monitor with an appropriate cuff. In a manner that the cuff's width covered 2/3 of the child's arm and its length tied around 80% of the arm. Usage of a small cuff may increasingly result in diagnosis of hypertension. In cases, for whom reassessment was needed, a one-minute interval between 2 measurements was considered or the experiment was repeated after holding the patient's hand upward for 5 to 6 seconds; in most cases the experiment was repeated twice and results were recorded. In case there was a difference in results of the two tests (6 mmHg in systolic and 4 mmHg in diastolic blood pressure) or the blood pressure was high in the first test, the patient was allowed to rest for 5 minutes and then the experiment was repeated. The blood pressure in children was assessed in accordance with various diagrams in the 2 genders and considering height, weight, and BMI. Blood pressure percentile in children with enuresis was compared with children without it by measuring blood pressure in 110 samples.

2.2. Inclusion and Exclusion Criteria

All children with primary non-monosymptomatic enuresis were selected in accordance to Nelson book

and diagnosis of pediatric nephrologist. Children with gastroenteritis or any other diseases that may effect blood pressure or children, who themselves or their parents lacked cooperation with blood pressure measurement were excluded.

2.3. Data Analysis

Statistical differences of the 2 groups were calculated by SPSS21 and through the t-test and chi-square tests.

3. Results

In total, 330 children were evaluated. There were 110 children in the case group, of which 43 (39.09%) were males and 67 (60.91%) females. There were also 220 children in the control group, of whom 163 (54.54%) were males and 167 (45.46%) females. Regarding demographic information as shown in [Table 1](#), including gender ($P = 0.030$), age ($P = 0.001$), economic condition ($P = 0.001$), and familial history of hypertension ($P = 0.001$), there were significant statistically differences, yet regarding place of residence, there were no significant differences ($P = 211$). Regarding mean and standard deviation (SD) of variables, as indicated by [Table 2](#), age, weight, BMI, and height, in the case group was significantly higher than the control group (0.001). Considering percentages and mean \pm SD of SBP and DBP, as shown by [Tables 3](#) and [4](#), in case and control groups, there were statistically significant differences ($P = 0.001$).

4. Discussion

This study investigated the correlation between blood pressure and enuresis dysfunction in children. In this study, the greatest frequency in the case group was between 9 and 11 years old.

In one study, titled "24 hours investigation of blood pressure in enuresis patients", which was performed by Bayrakci et al. during year 2013 in Turkey, children with primary enuresis were enrolled and their blood pressure was measured for duration of 24 hours and finally the results were compared with healthy children, however the current study lacked this 24-hour measurement. Urine analysis, level of electrolytes in the urine, urine culture, and ultrasound test of the urinary system were performed for all children. They concluded that, blood pressure during night was obviously higher in children with enuresis (14). In a study, entitled "Non-dipping phenomenon in children with monosymptomatic nocturnal enuresis" by Kahraman, a total of 45 children ranging in age from 6 to 15 years, affected by monosymptomatic nocturnal enuresis,

Table 1. Demographic Information of the Case (N: 110) and Control (N: 220) Groups^a

Variables	Case	Control	Total	P Value ^b
Gender				0.03
Male	43 (39.1)	120 (54.5)	163 (49.4)	
Female	67 (60.9)	100 (45.6)	167 (50.6)	
Age^c				0.001
6 - 8	43 (39.1)	134 (60.9)	177 (50)	
9 - 11	50 (45.5)	70 (31.8)	120 (38.5)	
12 - 14	17 (15.4)	16 (7.3)	33 (11.5)	
Economic condition^d				0.001
< 5,000,000	15 (13.6)	9 (4.1)	24 (7.3)	
5,000,000 - 10,000,000	53 (29.1)	27 (12.3)	80 (24.2)	
10,000,000 - 20,000,000	32 (29.1)	153 (69.5)	185 (56.1)	
> 20,000,000	10 (9.2)	31 (14.1)	41 (12.4)	
Living place				0.211
City	87 (79.1)	172 (78.2)	259 (78.5)	
Village	23 (20.9)	48 (21.8)	71 (21.5)	
Familial history of hypertension				0.001
Non	67 (60.5)	190 (86.4)	257 (77.9)	
Father	14 (12.9)	24 (10.9)	38 (11.5)	
Mother	29 (26.6)	6 (2.7)	35 (10.6)	

^aPresented as No. (%).^bP < 0.05 considered as significant value.^cPresented as years.^dPresented as IRR.**Table 2.** Mean and Standard Deviation of Demographic Information of Case (N = 110) and Control (N = 220) Groups^a

Variables	Case	Control	Total	P Value ^b
Age	9.2 ± 1.8	8.2 ± 1.6	8.7 ± 1.8	0.001
Weight	32.8 ± 9.0	24.6 ± 5.8	28.7 ± 8.6	0.001
BMI	18.1 ± 3.6	15.8 ± 2.0	17.0 ± 3.1	0.001
Height	132.4 ± 12.5	123.82 ± 9.6	128.02 ± 11.9	0.001

^aPresented as mean ± SD.^bP < 0.05 considered as significant value.

as case group and 22 age-matched healthy children as control group, were enrolled. By 30-minute intervals and during a 24-hour period via an ambulatory BP measurement device, they measured BP. They observed that monosymptomatic nocturnal enuresis patients, compared to the control group, had significantly higher measurements (15). A study, titled "Prevalence of hypertension in healthy children in schools of Pakistan and its relationship with body mass index, proteinuria, and hematuria", by Ajin, 2013, was performed to determine the prevalence of HTN in healthy children from Pakistani schools and its association with

high body mass index (BMI). They concluded that HTN was strongly correlated with obesity, asymptomatic proteinuria, and hematuria (16), and this was in concordance with the current study results.

4.1. Conclusion

Case group patients had higher blood pressure (90% to 95% prehypertension, and 65% to 99% during Hypertension) in comparison with the control group and as they had higher BMI, thus it could be concluded that hypertension with increased body mass may effect primary enuresis

Table 3. Percentages of Systolic Blood Pressure and Diastolic Blood Pressure in Case (N = 110) and Control (N = 220) Groups^a

Variables	Case	Control	Total	P Value ^b
Diastolic blood pressure				0.001
> 50%	29 (26.3)	99 (45)	128 (38.8)	
50% - 90%	45 (40.9)	110 (50)	155 (47)	
91% - 95%	27 (24.5)	8 (3.7)	35 (10.6)	
96% - 99%	9 (8.3)	3 (1.3)	12 (3.6)	
Systolic blood pressure				0.001
> 50%	34 (30.9)	97 (44.1)	131 (39.7)	
50% - 90%	52 (47.3)	108 (49.1)	160 (48.5)	
91% - 95%	19 (17.3)	11 (5)	30 (9.1)	
96% - 99%	5 (4.5)	4 (1.8)	9 (2.7)	

^aPresented as No. (%).^bP < 0.05 considered as significant value.**Table 4.** Mean and Standard Deviation of Systolic Blood Pressure and Diastolic Blood Pressure in Case (N = 110) and Control (N = 220) Groups^a

Variables	Case	Control	Total	P Value ^b
Systolic blood pressure	100.1 ± 8.7	94.3 ± 13.9	97.2 ± 12	0.001
Diastolic blood pressure	65.2 ± 10.0	60.8 ± 8.9	63.0 ± 9.7	0.001

^aPresented as mean ± SD.^bP < 0.05 considered as significant value.

in children. Considering different BMI in members of case and control groups, it is recommended to observe this factor in future studies to discover absolute impact of hypertension in primary non-monosymptomatic enuresis.

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Footnote

Conflict of Interests: The authors had no conflicts of interest to declare.

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