

Original Article

Monosymptomatic nocturnal enuresis caused by seasonal temperature changes

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Abstract: Background: Primary nocturnal enuresis is the most frequent urologic complaint among pediatric patients. Enuresis is believed to have a complex etiology involving genetic, somatic, and behavioral factors. We study the relationship between seasonal temperature changes effect and monosymptomatic nocturnal enuresis (MNE). Methods: Between 2011 and 2012, a total of 75 children with primary MNE selected from urology and pediatrics clinics were included in this study. All of the children underwent physical examinations, urine analyses, urinary ultrasounds, and direct urinary graphs. We evaluated the enuresis ratio for the summer (the hot season from June to September) and winter (the cold season from December to March) months in nightly, weekly, and monthly intervals via prepared questionnaires. Results: Of the 75 study participants, 45 were boys (60%) and 30 were girls (40%). The age range was 6-16 years (mean 10.3 ± 2.0 years). We observed a difference in the ratio of enuresis data between the summer and winter months in 29 males and 19 females, which totals 48 of the 75 MNE patients evaluated in this study. There was a statistically significant difference noted in monthly enuresis ratio in the summer and winter ($p < 0.0001$). We observed a significant difference in quality of life, and this difference caused considerable emotional discomfort for the patients. Conclusion: In the winter months, the nightly, weekly, and monthly ratios are higher in children with MNE. This increase causes a decrease in the quality of life of these children.

Keywords: Cold weather, seasonal temperature, monosymptomatic nocturnal enuresis, predisposing risk factor

Introduction

Primary nocturnal enuresis is the most frequent urologic complaint among pediatric patients [1]. Enuresis has a great impact on the quality of life for children, and this impact is not related to the age or sex of the child [2]. According to the International Children's Continence Society, enuresis nocturna has four categories; monosymptomatic, non-monosymptomatic, primary, and secondary enuresis (at least 6 months of a previous asymptomatic state) [3]. Monosymptomatic nocturnal enuresis (MNE) is better defined as regular voiding during sleep at an age when continence should have been attained, which is widely agreed to be five years of age, and also in the absence of daytime incontinence or voiding dysfunction [4]. Enuresis continues in 15% of children who are five years of age. An single case of enuresis

after the age of five is termed enuresis nocturna. The rate of enuresis nocturna is 5-10% in children seven years of age and 1-2% in children 15 years of age. The spontaneous healing rate is around 15% each year [5].

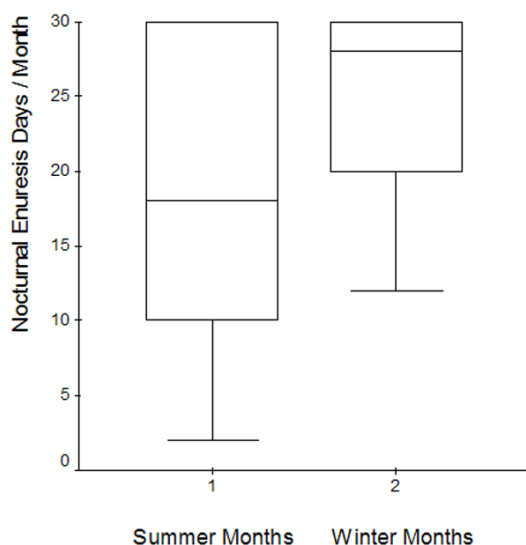
MNE is a common problem; however, the pathology and etiology of this problem has not been determined. There is limited data regarding its etiology. Enuresis is believed to have a complex etiology involving genetic, somatic, and behavioral factors [6]. Most of the projected hypotheses have controversial limited scientific observations that have not been proven via controlled studies. Enuresis is believed to be multifactorial. In this study each factor is believed to be independent in the process of enuresis.

In primary MNE cases, there are no studies that report the effects that seasonal temperature

Table 1. Data values for the cases of enuresis nocturna

		The frequency of enuresis days per month		The frequency of enuresis at night	
		Mean±SD	Min-Max	Mean±SD	Min-Max
The Cases of Enuresis Nocturna (n=75)					
M/F (45/30)	In the Summer Months	19.2±10.0	2-30	1.7±0.5	1-2.5
Age/years (10.3±2.0)	In the Winter Months	24.5±6.2*	12-30	1.9±0.6**	1-3.5

Paired Samples Test: *t: 8.76, p<0.0001; **t: 5.84, p<0.001.


Figure 1. The frequency of enuresis days per month in winter and summer.

changes may have in regards to enuresis. In this paper, we study the relationship between seasonal temperature changes and MNE during the hot season (from June to September) and during the cold season (from December to March).

Materials and methods

Between 2011 and 2012, a total of 75 children with primary MNE selected from urology, pediatric clinics were included in this study. Thorough physical examinations, including neurological examinations and urine analyses, were performed in this study. Exclusion criteria for the study were as follows: (1) any renal, urological, or neurological abnormalities, (2) receiving medication for nocturnal enuresis, (3) severe urgency or daytime bladder dysfunction, and (4) any systemic illness associated with polyuria. We differentiated between mono-symptomatic and poly-symptomatic enuresis via a

detailed individual history as well as family history that were recorded at the initial presentations. We also completed an Urination Disturbance Symptom Score form to evaluate a detailed urination story. Age, psycho-social, and socio-economic factors were also identified for each patient.

In this paper, we study the relationship between seasonal temperature changes and MNE during the hot season (from June to September) and during the cold season (from December to March). We tested the reliability of this questionnaire. The questionnaire included these questions: 1) Does enuresis ratio change in the summer and winter? (Yes, No), 2) What is the duration of complaints during weekly and monthly in summer? 3) What is the frequency of average episodes of enuresis at night in summer? 4) What is the duration of complaints during weekly and monthly in winter? 5) What is the frequency of average enuresis at night in winter?

In this paper, we study the relationship between seasonal temperature changes and MNE during the hot season (from June to September) and during the cold season (from December to March) via a second questionnaire called the Short-Form Health Survey (SF-36).

Statistical analysis

Paired Samples Tests were used to examine the significance of the numbers and the frequency of enuresis in the summer and winter months. Data are expressed as mean values SD. The correlations between the values of the data in cases of enuresis nocturna were tested by a Pearson Correlation Analysis. A *p* value of less than 0.05 was considered statistically significant. All analyses were performed using SPSS 11.5 (Statistical Package for Social Sciences, Chicago, USA).

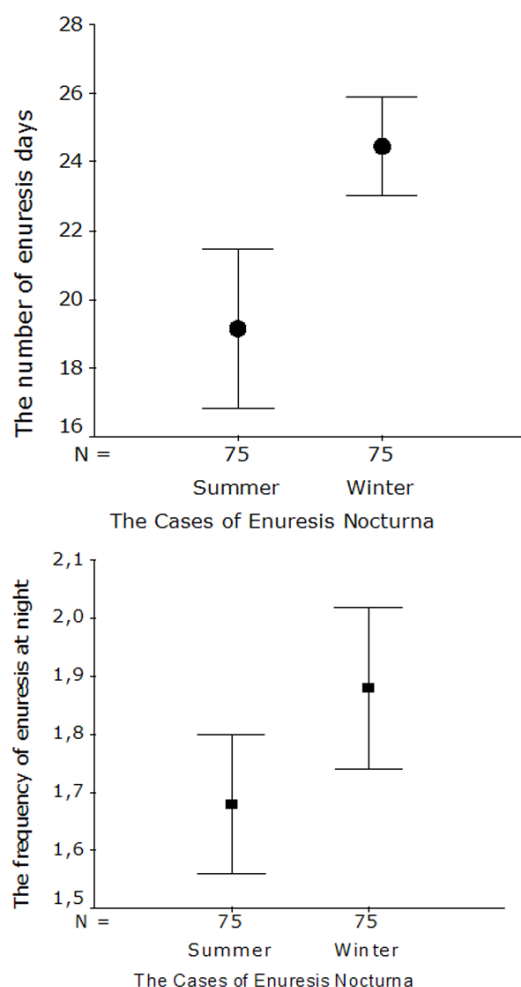


Figure 2. The numbers and frequency of Enuresis in summer and winter.

Results

Of the 75 study participants, 45 participants were boys (60%), and 30 participants were girls (40%). The age range was from 6-16 years (mean 10.3 ± 2.0 years). We observed a difference in the ratio of enuresis data between the summer and winter months in 29 males and 19 females, which totaled 48 patients of the 75 MNE patients evaluated in this study.

The monthly enuresis ratio in the summer and winter as well as the daily enuresis ratio of patients are shown in **Table 1**. There was a statistically significant difference noted in monthly enuresis ratio in the summer and winter ($p < 0.0001$) (**Figure 1**). The nightly enuresis ratio was significantly different and was noted to increase in winter months ($p < 0.001$) (**Figure 2**). This data shows that the monthly enuresis

ratio and the nightly enuresis ratio increase in winter months and were found to be statistically significant.

In the second questionnaire, we evaluated quality of life. A decrease in the quality of life due to MNE was reported in 47 patients (62.6%). There was a statistically significant difference noted regarding quality of life ($p < 0.0001$). Twenty-one patients among 48 patients that reported an increase in the ratio of enuresis during the winter also reported a decrease in the quality of life during the winter, which was determined to be a statistically significant difference ($p < 0.0001$). We observed mild enuresis in the summer months when compared with the average or severe enuresis seen in winter months for the 20 patients that reported a decrease in quality of life in the winter compared with the summer. We only observed an average enuresis in the summer months and severe enuresis in the winter months in one patient. We observed a significant difference in quality of life, and this difference caused considerable emotional discomfort for the patients.

Discussion

MNE is a symptom rather than a disease, and hereditary factors play an important role in the development of MNE [7, 8]. In a study by Hollman et al., genes that have a tendency to cause enuresis are related to the 8q, 12q and 13q chromosomes [9]. The number of siblings, birth order, education level of the family, income level of the family, male gender, and history of urinary infection are reported to be related to enuresis nocturna [10].

The etiology and pathogenesis of MNE is multifactorial, and it is believed that more than one factor affects each patient. There has not been only reason that could reveal the etiology in the studies; however, multifactorial etiologies have been observed in group studies. Most children with MNE do not have psychiatric, neurologic, or urologic problems, so they do not need medical treatments. Non-organic reasons such as emotional factors are at the fore front of enuresis research; however, 2-3% of enuresis is based on organic reasons [11]. Although many different theories, including urodynamic, behavioral, genetic, hereditary, developmental, hormonal, neurologic, sleep disturbance, and

psychological theories, can explain some selected cases, no one theory explains the true etiology and pathogenesis of MNE.

Antidiuretic hormone (ADH) secretion decreased functional bladder capacity, nocturnal polyuria and sleep pattern have been discussed to be potential main factors in the MNE development. It is thought that these.

On the bases of above-mentioned findings, in our study, we content that the winter season is a predisposing factor. In search of the reason of this predisposing factor, all of these proposed different pathophysiological factors should be studied.

ADH and seasonal analysis

In the patients that the not have abnormal hormonal functions, nocturnal ADH release is higher when compared with daytime release, which causes 50% less urination at night [12]. When the effect of hypothermia to ADH release is examined, cold-induced diuresis reduces ADH release [13, 14]. The reducing effect of cold weather in ADH release may be helpful for explaining the episodes ratio.

Reduced functional bladder capacity and seasonal analysis

In a considerable amount of children who are resistant to conservative treatment and irresponsive to desmopressine treatment, a reduced functional bladder capacity has been reported in many studies [15]. The most important observation in MNE is reduced nocturnal functional bladder capacity [16]. In a study of rats, exposure of cold, caused a significant decrease in bladder capacity [17]. Cold weather may increase the ratio of enuresis due to a functional decrease in bladder capacity.

In terms of our experience, there are no studies that evaluate the effect of cold weather on sleep patterns and nocturnal polyuria in previous publications.

Bladder instability has not been proven to have a higher ratio in children with MNE when compared with children who do not have MNE, cold weather may increase bladder contractility and increase enuresis. It is proven that bladder instability increases in cold weather and that temperatures change is lower at night in com-

parison with daytime [18], so seasonal cold weather may increase bladder contractions.

The observation of a decrease in the quality of life of children with MNE in this study is similar to other studies. In our study, we also reviewed the difference in the quality of life in the summer and in the winter. Decrease in the quality of life is more obvious in winter months when compared with summer months. In families who expect enuresis to heal spontaneously, winter months tend to cause stress for family members as well as for the children. We observed that this stress causes an increase in physician appointments.

Conclusions

In the winter months, In this paper, we study the relationship between seasonal temperature changes and MNE during the hot season (from June to September) and during the cold season (from December to March in children with MNE. This increase causes a decrease in the quality of life of these children. The predisposing factor of cold weather in winter months has not yet been determined; however, it could be a driving factor in revealing an underlying etiologic cause for MNE.

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Disclosure of conflict of interest

The authors of the paper do not have any direct financial relation with the commercial identities mentioned in the paper that might lead to a conflict of interest.

Abbreviations

MNE, Monosymptomatic nocturnal enuresis; SF-36, Short-Form Health Survey; ADH, Antidiuretic hormone.

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