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Winter is associated with failure in the alarm treatment of nocturnal enuresis

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Abstract *Objective:* To assess whether the winter season in Japan is associated with failure in the alarm treatment of nocturnal enuresis (NE).
Patients and methods: Consecutive patients with NE referred to our center between June 2009 and May 2010 were treated with the enuresis alarm (EA). The EA was used for 16 weeks with each child. Patients were divided into a success group and a treatment failure group. Pretreatment variables were collected, including age, sex, night-time urine volume, severity of enuresis, presence of nocturnal polyuria, presence of daytime incontinence, and treatment initiation season. These variables and initial success rates were retrospectively compared between the two groups. Chi-square, Student *t* tests, and multivariate regression analysis were used for statistical analysis.
Results: A total of 67 children with NE were evaluated, 37 (55%) in the success group and 30 (45%) in the failure group. None of the pretreatment variables differed significantly between groups except for season; winter season initiation was an independent risk factor for failure in multivariate regression analysis.
Conclusions: Winter was associated with failure in the EA treatment. We recommend that EA be introduced in the summer season in Japan to achieve an optimal success rate.

Introduction

Nocturnal enuresis (NE) is a common condition affecting approximately 11% of 7-year-old boys and 7% of 7-year-old girls in Japan [1]. The prevalence of NE gradually declines with increasing age, and the annual spontaneous resolution rate is about 17% [1]. Japan has four distinct seasons, and we have empirically observed that NE worsens in the winter

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season. However, in the summer season, the number of wet nights decreases in some children. However, we do not have accurate data regarding NE prevalence by season.

A standardization document from the International Children's Continence Society (ICCS) recommends an enuresis alarm (EA) as a first-line therapy in every child with NE [2]. Use of an EA results in dryness in about two-thirds of children (grade Ia evidence) [3]. Identifying variables that predict success or failure prior to treatment has been suggested as clinically important in enabling decisions about whether EA use will be empirically based. To assess whether the winter season in Japan is associated with initial failure of EA treatment of NE, we evaluated the pretreatment variables and initial success rate of EA in children with NE.

Patients and methods

The protocol of this study was approved by the Institutional Review Board (No. 1301-01). We retrospectively reviewed consecutive patients with NE referred to our center between June 2009 and May 2010. All patients were treated with EA. In addition to patients with monosymptomatic NE (MNE), patients with daytime symptoms were included in this study. A body-worn alarm device (Malem Medical, Nottingham, UK) was used each night for 16 weeks in each child. During EA treatment, the child was instructed to awaken as soon as possible when the EA sounded and void in the toilet. Reattaching the EA was not recommended. Parents were instructed to assist in waking a child who did not hear the EA and not to let the child turn the EA off and fall back to sleep. Parents recorded the time the EA rang each night. Initial success was evaluated according to ICCS standardization (non-response defined as a 0—49% decrease; partial response as a 50—89% decrease; and response as a 90% or greater decrease.). Dropout was defined as a discontinuation of EA treatment before 16 weeks. Patients were divided into a success group (response and partial response) and a treatment failure group (non-response and dropout). Pretreatment variables including age, sex, night-time urine volume, presence of nocturnal polyuria, presence of daytime symptoms, and treatment initiation season (summer vs winter) were recorded.

Night-time urine volume was calculated by weight of diapers plus first voided volume in the morning. An average volume was calculated from values for night-time urine volume for 28 nights before treatment. The presence of nocturnal polyuria was defined as an average night-time urine volume exceeding 130% of expected bladder capacity (30 + (age in years × 30) mL). The summer season was defined as lasting from March to September and the winter season from October to February.

These variables were compared between the two groups (treatment success and failure) using chi-square and Student *t* tests. In addition, sex, presence of nocturnal polyuria, daytime symptoms, and initiation seasons were analyzed using multivariable regression analysis between two groups to determine independent factors associated with EA treatment failure. Children with a response to first-line treatment were reevaluated for relapse 24 weeks after treatment withdrawal. We also assessed the monthly average temperature from June 2009 to May 2010 in the Yokohama region (139° east longitude, 35° north latitude).

Results

A total of 67 children with NE were included in this study. Mean age was 9.1 years (range 5—13 years). The median NE severity before treatment was 26 wet nights/4 weeks. Of the 67 families, 48 were able to comply with completing a night-time urine volume chart for 28 nights. The average of recorded nights for all patients was 27.01 nights. A total of 37/67 (55.2%) children met the success criterion, with 17/67 (25.3%) being classed as having a response and 20/67 (29.8%) as having a partial response. A total of 24/67 (35.8%) patients did not respond to the EA treatment. Finally, 6/67 (8.9%) discontinued EA (dropout).

The patients were divided into treatment success (37/67; 55.2%) and treatment failure (30/67; 44.8%) groups for further analyses. Of the pretreatment variables, only initiation season was significantly associated with EA treatment failure (Table 1). In the multivariate analysis, winter season (OR 3.13) was also an independent risk factor associated with treatment failure (Table 2).

Temperature analysis showed that in the winter, the monthly average lowest temperature in the Yokohama region was always below 10 °C for every month from December to April (the third month of the treatment) (Table 3).

Of the 17 children who met the response criteria, 13 were followed for 6 months after treatment cessation, and all of them had been treated in the summer season. Of these patients, 4/13 (30%) experienced a relapse.

Discussion

According to previous reports, the success rate of EA treatment is about 65% (range 30—87%) [4]. In this study, the success rate was 55.2%, quite close to other reported rates [3]. These success rates are influenced by inclusion criteria and by treatment parameters such as duration, how

Table 1 Results of comparisons between the treatment success and failure groups by chi-square and Student *t* tests.

Variables	Success group ($n = 37$)	Failure group ($n = 30$)	*p*
Age (years ± SD)	9.0 ± 1.6	9.3 ± 2.0	0.47
Male/female	28/9	15/15	0.054
Average night urine volume (mL ± SD)	229 ± 69	269 ± 114	0.08
Severity of enuresis (days/4 weeks ± SD)	22.3 ± 6.5	23.9 ± 5.6	0.29
Nocturnal polyuria (present/absent)	1/36	2/28	0.08
Daytime incontinence (present/absent)	7/30	7/23	0.88
Initiation seasons (summer/winter)	26/11	12/18	0.012[a]

[a] $p < 0.05$.