High Risk of Sleep Disordered Breathing in the Enuresis Population

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Abbreviations and Acronyms

DVISS = Dysfunctional Voiding and Incontinence Symptom Score
LUTS = lower urinary tract symptoms
MNE = monosymptomatic enuresis
NMNE = nonMNE
OSA = obstructive sleep apnea
OSA-18 = OSA QOL survey
PSQ-22 = Modified Pediatric Sleep Questionnaire
QOL = quality of life
REM = rapid eye movement
SDB = sleep disordered breathing

Study received institutional ethics approval.

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Purpose: Enuresis is 1 of the most common complaints facing pediatric urologists and it has significant implications with respect to quality of life. Although the pathophysiology is incompletely understood, there is growing evidence that sleep disordered breathing in children, including obstructive sleep apnea, has a fundamental role. There are also potentially fundamental differences between monosymptomatic enuresis, which may be a sleep disorder, and nonmonosymptomatic enuresis, which may relate to a primary bladder storage problem. We prospectively evaluated the incidence of obstructive sleep apnea in patients with enuresis and analyzed differences between patients with monosymptomatic and nonmonosymptomatic enuresis.

Materials and Methods: A total of 69 children with enuresis were given 3 validated questionnaires to complete, including the Dysfunctional Voiding and Incontinence Symptom Score, the Obstructive Sleep Apnea Quality of Life survey and the Modified Pediatric Sleep Questionnaire. The Dysfunctional Voiding and Incontinence Symptom Score quantifies patient dysfunctional voiding habits. The Obstructive Sleep Apnea Quality of Life survey evaluates patient quality of life in regard to obstructive sleep apnea and its effects. Modified Pediatric Sleep Questionnaire results describe the severity of patient sleep disturbances.

Results: The mean Obstructive Sleep Apnea Quality of Life Survey score was 43 and 54% of patients had positive Modified Pediatric Sleep Questionnaire results, indicating that obstructive sleep apnea was prevalent in our population. Those with enuresis and daytime incontinence were significantly more likely to have sleep disordered breathing than those with monosymptomatic enuresis ($p < 0.05$).

Conclusions: Our study confirms the link between sleep disordered breathing and enuresis. All pediatric health care providers should be aware of this risk. The risk may be magnified in patients with concomitant daytime incontinence.

Key Words: urinary bladder, urinary incontinence, enuresis, sleep apnea syndromes, questionnaires

ENURESIS is 1 of the most common pediatric urological complaints, affecting up to 15% of 5-year-old and 5% of 10-year-old children.[1] Despite its prevalence we are without a definitive treatment or clear etiology.[2] Although it is not a medical health risk, the psychological and emotional impact is substantial. Current treatment modalities include behavioral therapy such

0022-5347/11/1864-1710/0
THE JOURNAL OF UROLOGY®

Vol. 186, 1710-1714, October 2011
Printed in U.S.A.
DOI:10.1016/j.juro.2011.04.017

as optimizing bladder and bowel habits, alarm therapy and pharmacological remedies.[2,3]

The pathogenesis of enuresis is currently unknown but several theories exist.[4] Functional bladder capacity is implicated, especially in children with enuresis and daytime incontinence.[5] However, in patients with MNE there may be abnormal nocturnal urine production,[6] bladder relaxation and arousal.[7] Altered diurnal antidiuretic hormone secretion, central nervous system disturbances and psychological components are also implicated.[2]

Contemporary retrospective data suggest that OSA may be related to enuresis. Obstructive SDB occurs in approximately 3% of children and it is primarily caused by adenotonsillar hypertrophy.[8,9] Several retrospective reviews in the pediatric population described improvement in enuresis when patients were treated for OSA. Çinar et al achieved 63% complete resolution and 4% partial resolution of enuresis after surgical treatment for upper airway obstruction.[10] Basha et al noted similar results after adenoidectomy or tonsillectomy with total resolution of enuresis in 61.4% of patients.[11] Brooks and Topol reported that children with a respiratory disturbance index (the number of apneas plus hypopneas per hour of sleep) of greater than 1 were at higher risk for enuresis than those with a respiratory disturbance index of less than 1.[12] However, these findings are not universal. A recent prospective trial showed no improvement in enuresis after tonsillectomy.[13]

The pathophysiology of this relationship is not completely understood. However, increases in intrathoracic pressure during an apneic episode may result in right atrial stretch, and the release of atrial and brain natriuretic peptides, which increase sodium and water excretion. Ultimately this may result in antidiuretic hormone inhibition.[14] However, several studies have also shown a link between abnormal sleep patterns on electroencephalogram and enuresis.[15,16] Yeung et al noted an abnormal cortical arousal pattern during sleep studies.[7]

Several previous groups that examined relationships between OSA and enuresis did not assess the incidence of OSA in the enuretic population or distinguish between MNE and NMNE. We prospectively investigated the OSA prevalence in children who presented to a pediatric urology clinic with nocturnal enuresis. Our hypothesis was that OSA and SDB have a prominent role in patients with MNE and a lesser role in those with enuresis and intermittent daytime incontinence.

MATERIALS AND METHODS

After receiving institutional ethics approval consecutive patients who presented with enuresis to the pediatric urology clinic at Stollery Children's Hospital were asked to participate in this study. Patients were excluded from analysis if they had neurological disorders that caused a significant developmental delay, neuropathic bladder, recurrent urinary tract infections or a significant congenital bladder anomaly. Patients with craniofacial abnormalities that correlate with OSA, eg Down syndrome, were also excluded.

Patients were given 3 validated questionnaires upon presentation, including DVISS,[17] OSA-18 and PSQ-22. Questionnaire results were coded and the treating physician was blinded to results. The presence of intermittent daytime incontinence was determined by the history taken by the treating pediatric urologist, in which any degree of daytime incontinence was considered positive. Patients were then categorized as having enuresis with daytime incontinence.

Dysfunctional Voiding and Incontinence Symptom Score

We used DVISS to quantify daytime LUTS. This questionnaire, which was validated to determine the presence of daytime bowel and bladder symptoms,[18] consists of 10 questions, each with a score of 0 to 3. We used a total score of 7 or greater, which is associated with significant daytime symptoms, to determine the presence of enuresis with LUTS.

The determination of daytime incontinence was considered independent of the DVISS score, which was blinded. Due to the multiple variables assessed by DVISS, it is possible to have a positive DVISS score while being continent during the day.

OSA Quality of Life Survey

OSA-18 evaluates patient QOL secondary to OSA symptoms, eg snoring, frequent upper respiratory tract infections, mood swings, poor concentration, etc.[19] Each question has a score range of 1 to 7. The total score was calculated for each patient and we assigned a range in respect to effect on QOL, including small—less than 60, moderate—60 to 80 and severe—greater than 80.

Modified Pediatric Sleep Questionnaire

The PSQ-22 score evaluates sleep quality and symptoms related to sleep quality.[20] PSQ-22 consists of 12 sections of questions. If more than a third of the questions in the first 10 sections are answered yes, a positive test result is recorded, indicating that the patient has sleep problems.

We recorded and correlated additional demographics, including body mass index, family history and previous attempted therapies. Scores on the described surveys were recorded and analyzed using the t and chi-square tests.

RESULTS

We studied 69 patients who presented to a pediatric urology clinic with complaints of enuresis during 12 months. Of these children 39 were male and 30 were female. Average age at presentation was 9 years (range 5 to 17). A total of 15 patients (22%) reported a family history positive for NE and 1 (1.5%) reported a family history positive for OSA. Four pa-