



Original Article

A Cross-Sectional Study to Find the Association Between Adenoid Hypertrophy and Nocturnal Enuresis in Children at a Tertiary Care Centre in Tamil Nadu

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ABSTRACT

Background: Adenoid hypertrophy is a common cause of upper airway obstruction in children and is frequently associated with sleep-disordered breathing. Recent evidence suggests that nocturnal enuresis may occur more commonly in children with adenoid hypertrophy due to disturbed sleep patterns and altered hormonal regulation. However, data from South India remain limited.

Objectives: To determine the prevalence of nocturnal enuresis among children with adenoid hypertrophy. To assess the association between adenoid hypertrophy and nocturnal enuresis.

Materials and Methods: A hospital-based cross-sectional study was conducted in the Department of Otorhinolaryngology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Tamil Nadu, from February 2023 to February 2024. A total of 66 children aged 5–12 years with symptoms suggestive of adenoid hypertrophy were included using convenience sampling. Clinical evaluation, a structured questionnaire, and lateral neck X-ray were used to assess symptoms and grade adenoid hypertrophy. Data were analyzed using appropriate descriptive and inferential statistical methods.

Results: Mouth breathing (90.9%) and snoring (87.9%) were the most frequent symptoms. Nocturnal enuresis was present in 30 (45.5%) children. Severe adenoid hypertrophy was identified in 60.6% of participants. Among children with nocturnal enuresis, 73.3% had severe adenoid hypertrophy, whereas none of the children with mild hypertrophy had nocturnal enuresis. Improvement in enuretic symptoms was observed in 56.7% of affected children following treatment for adenoid hypertrophy.

Conclusion: Nocturnal enuresis was common among children with adenoid hypertrophy and showed a positive association with increasing severity of adenoid enlargement. Early recognition and appropriate management of adenoid hypertrophy may improve both upper airway symptoms and nocturnal enuresis, thereby enhancing the quality of life of affected children.

INTRODUCTION

Adenoid hypertrophy (AH) is one of the most common causes of upper airway obstruction in the pediatric population and represents a significant health concern because of its impact on respiration, sleep quality, craniofacial development, hearing, and overall growth. The adenoids are part of Waldeyer's lymphatic ring and play an important immunological role during early childhood. Recurrent upper respiratory tract infections, allergic inflammation, and chronic antigenic stimulation may lead to enlargement of adenoid tissue, resulting in nasal obstruction, mouth breathing, snoring, recurrent otitis media, and sleep-disordered breathing (SDB). Persistent airway obstruction due to AH may adversely affect physical, cognitive, and behavioral development if not recognized and treated promptly.[1,2]

Nocturnal enuresis (NE), commonly known as bedwetting, is defined as intermittent involuntary urinary incontinence during sleep in children aged five years or older. It remains one of the most frequent pediatric urological complaints, affecting the emotional well-being of children and their families. Although primary monosymptomatic nocturnal enuresis is often considered a benign developmental condition, growing evidence indicates that sleep disturbances, obstructive airway diseases, hormonal dysregulation, and autonomic nervous system dysfunction contribute significantly to its pathophysiology. Despite spontaneous resolution with age in many children, persistent enuresis can negatively influence self-esteem, academic performance, and social interactions, warranting comprehensive evaluation for underlying causes.[3,4]

Recent research has highlighted an important relationship between sleep-disordered breathing and nocturnal enuresis. Adenoid hypertrophy contributes to increased upper airway resistance, leading to fragmented sleep, intermittent hypoxia, and episodes of obstructive sleep apnea (OSA). These physiological disturbances may alter secretion of atrial natriuretic peptide and antidiuretic hormone, resulting in increased nocturnal urine production and impaired arousal from sleep. Consequently, children with significant adenoid enlargement may be at a greater risk of developing nocturnal enuresis than healthy children. Improvement in enuretic symptoms following adenoidectomy or adenotonsillectomy reported in several studies further supports this association.[5,6]

The coexistence of adenoid hypertrophy and nocturnal enuresis has attracted increasing attention in recent years. Clinical studies have demonstrated that children presenting with severe adenoid hypertrophy frequently experience poor sleep quality, daytime somnolence, behavioral disturbances, and bedwetting. Nevertheless, the exact strength of this association remains uncertain because of variations in study design, diagnostic criteria, and patient populations. Some investigators have reported a significant correlation between the severity of adenoid hypertrophy and the frequency of nocturnal enuresis, whereas others have suggested that additional factors such as obesity, allergic rhinitis, socioeconomic status, and genetic predisposition may also influence this relationship.[7,8]

India has a substantial pediatric population with a high burden of upper respiratory disorders; however, published evidence evaluating the association between adenoid hypertrophy and nocturnal enuresis remains limited, particularly from South India. Early identification of children at risk is clinically important because timely management of adenoid hypertrophy may not only improve airway function and sleep quality but also reduce episodes of nocturnal enuresis, thereby enhancing quality of life. Establishing this association may encourage multidisciplinary collaboration among otorhinolaryngologists, pediatricians, and pediatric urologists for comprehensive evaluation and management. Therefore, the present cross-sectional study was undertaken at a tertiary care centre in Tamil Nadu to determine the association between adenoid hypertrophy and nocturnal enuresis in children and to contribute region-specific evidence that may facilitate early diagnosis and appropriate therapeutic intervention.[9,10]

The present study was undertaken to evaluate the relationship between adenoid hypertrophy and nocturnal enuresis among children attending a tertiary care centre in Tamil Nadu. Specifically, the study aimed to determine the prevalence of nocturnal enuresis among children diagnosed with adenoid hypertrophy and to assess the association between the severity of adenoid hypertrophy and the occurrence of nocturnal enuresis, thereby contributing evidence for early diagnosis and appropriate clinical management.

MATERIALS AND METHODS

Study Design: Hospital-based cross-sectional study.

Study Population: Children of both sexes aged 5–12 years attending the Outpatient Department (OPD) of Otorhinolaryngology with symptoms suggestive of adenoid hypertrophy.

Sample Size: A total of 66 children.

Study Duration: February 2023 to February 2024

Study Place: Department of Otorhinolaryngology, Melmaruvathur Adhiparasakthi Institute of Medical Sciences and Research, Melmaruvathur, Tamil Nadu, India.

Sampling Technique: Convenience sampling of eligible children attending the ENT outpatient department.

Inclusion Criteria

- Children aged 5–12 years.
- Children presenting with symptoms suggestive of adenoid hypertrophy.
- Parents/guardians willing to provide written informed consent.

Exclusion Criteria

- Children with nasal pathology (e.g., nasal polyps, deviated nasal septum causing obstruction).
- Children with bronchial asthma.
- Children with urinary tract or renal pathology.
- Children whose parents/guardians refused consent.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for the Social Sciences (SPSS) software version 26.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as mean \pm standard deviation (SD), while categorical variables were presented as frequency and percentage. The association between categorical variables, including adenoid hypertrophy severity and nocturnal enuresis, was assessed using the Chi-square test or Fisher's exact test, wherever appropriate. Continuous variables between groups were compared using the independent Student's t-test for normally distributed data. A p-value of <0.05 was considered statistically significant, and all statistical tests were two-tailed.

RESULT

Table 1. Clinical Characteristics of Children with Adenoid Hypertrophy (n = 66)

Clinical Features of Adenoid Hypertrophy	Present, n (%)	Absent, n (%)
History of snoring	58 (87.9)	8 (12.1)
History of mouth breathing	60 (90.9)	6 (9.1)
History of daytime sleepiness	22 (33.3)	44 (66.7)
History of ear pain	30 (45.5)	36 (54.5)
History of nocturnal enuresis (bed wetting)	30 (45.5)	36 (54.5)
Dismorphic teeth	15 (22.7)	51 (77.3)

Table 2. Radiological Severity of Adenoid Hypertrophy and Treatment Profile (n = 66)

Radiological Severity and Treatment Profile		Number (n)	Percentage (%)
Severity on X-ray	Mild (<25%)	10	15.2
	Moderate (25–50%)	16	24.2
	Severe (>50%)	40	60.6
Treatment received	Medical	42	63.6
	Surgical	24	36.4

Table 3. Clinical Characteristics According to Presence of Nocturnal Enuresis (n = 66)

Clinical Characteristics by Nocturnal Enuresis	With Nocturnal Enuresis (n=30)	Without Nocturnal Enuresis (n=36)
History of snoring	28	30
History of mouth breathing	26	34
History of daytime sleepiness	12	10
History of ear pain	18	12
Dismorphic teeth	5	10

Table 4. Association between Severity of Adenoid Hypertrophy and Nocturnal Enuresis (n = 66)

Severity of Adenoid Hypertrophy	With Nocturnal Enuresis (n=30)	Without Nocturnal Enuresis (n=36)	Total
Mild (<25%)	0	10	10
Moderate (25–50%)	8	8	16
Severe (>50%)	22	18	40
Total	30	36	66

Table 5. Treatment Outcome among Children with Nocturnal Enuresis (n = 30)

Treatment Outcome in Children with Nocturnal Enuresis	Medical	Surgical	Total
Patients treated	9	21	30
Patients with relief of enuresis	5	12	17
Relief rate (%)	55.6	57.1	56.7

Figure 1. Clinical Characteristics of Children with Adenoid Hypertrophy

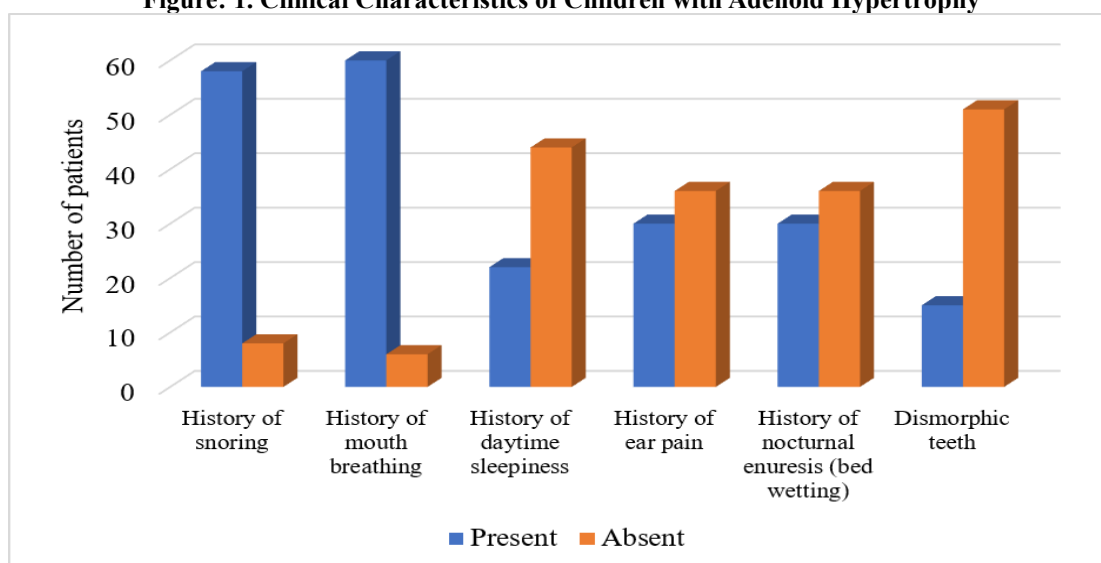
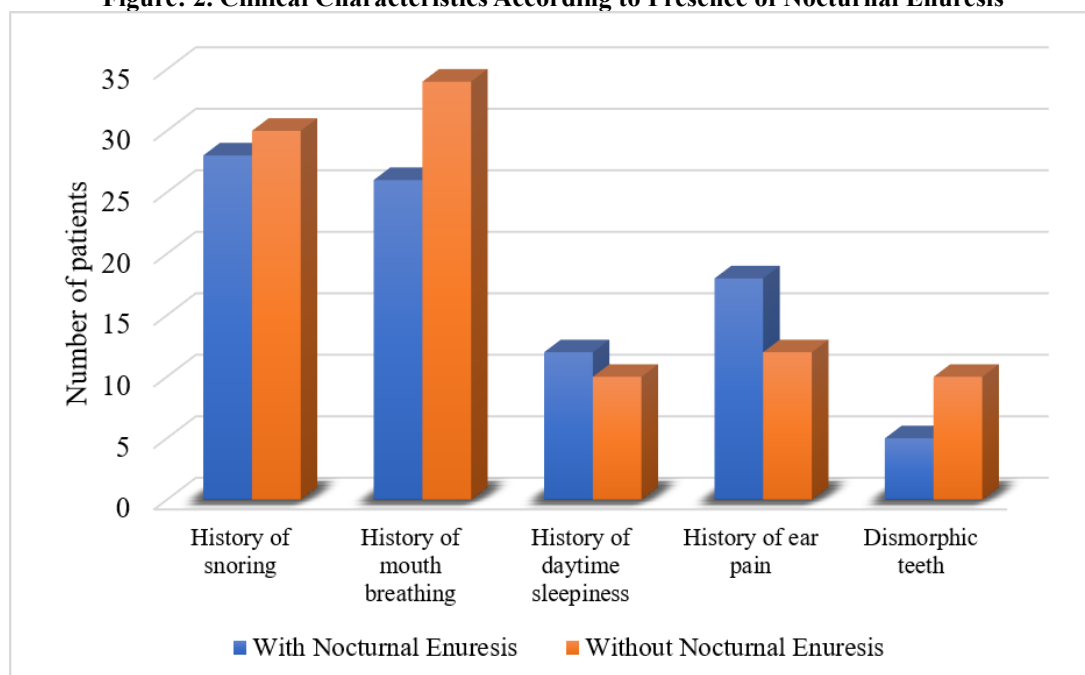


Figure 2. Clinical Characteristics According to Presence of Nocturnal Enuresis



A total of 66 children with adenoid hypertrophy were included in the study. History of mouth breathing was the most common presenting symptom, observed in 60 (90.9%) children, while only 6 (9.1%) did not have this complaint. History of snoring was reported by 58 (87.9%) children, with 8 (12.1%) having no history of snoring. Daytime sleepiness was present in 22 (33.3%) participants and absent in 44 (66.7%). Ear pain was reported by 30 (45.5%) children, whereas 36

(54.5%) did not complain of ear pain. Nocturnal enuresis (bed wetting) was present in 30 (45.5%) children and absent in 36 (54.5%). Dismorphic teeth, suggestive of chronic mouth breathing, were observed in 15 (22.7%) children, while 51 (77.3%) had no dental deformity. These findings indicate that mouth breathing and snoring were the predominant symptoms among children with adenoid hypertrophy.

Radiological evaluation using a lateral neck X-ray demonstrated that 40 (60.6%) children had severe adenoid hypertrophy (>50% obstruction), making it the most common radiological grade. Moderate adenoid hypertrophy (25–50% obstruction) was identified in 16 (24.2%) children, whereas 10 (15.2%) had mild hypertrophy (<25% obstruction).

Regarding treatment, the majority of patients (42; 63.6%) were managed medically, while 24 (36.4%) required surgical intervention. These findings suggest that although severe adenoid enlargement was common, conservative medical management remained the initial treatment modality for most children, with surgery reserved for selected cases based on symptom severity and clinical indications.

Among the 30 children with nocturnal enuresis, 28 (93.3%) had a history of snoring compared to 30 (83.3%) of the 36 children without nocturnal enuresis. Similarly, mouth breathing was reported in 26 (86.7%) children with nocturnal enuresis and 34 (94.4%) children without nocturnal enuresis. Daytime sleepiness was observed in 12 (40.0%) children with nocturnal enuresis compared with 10 (27.8%) children without nocturnal enuresis. Ear pain was more frequent among children with nocturnal enuresis (18; 60.0%) than among those without nocturnal enuresis (12; 33.3%). Dismorphic teeth were identified in 5 (16.7%) children with nocturnal enuresis and 10 (27.8%) children without nocturnal enuresis.

Overall, children with nocturnal enuresis appeared to have a higher frequency of snoring, daytime sleepiness, and ear pain, whereas mouth breathing remained common in both groups.

A significant trend was observed between the severity of adenoid hypertrophy and the occurrence of nocturnal enuresis. None of the 10 children with mild adenoid hypertrophy (0%) had nocturnal enuresis, while all belonged to the non-enuretic group. Among children with moderate hypertrophy, 8 (50.0%) had nocturnal enuresis and 8 (50.0%) did not. In contrast, among the 40 children with severe adenoid hypertrophy, 22 (55.0%) had nocturnal enuresis, whereas 18 (45.0%) did not.

These findings indicate that nocturnal enuresis was more commonly observed among children with moderate to severe adenoid hypertrophy, particularly those with severe airway obstruction, suggesting a positive association between increasing adenoid size and the occurrence of nocturnal enuresis.

Among the 30 children with both adenoid hypertrophy and nocturnal enuresis, 9 (30.0%) received medical treatment, while 21 (70.0%) underwent surgical treatment. Following treatment, relief from nocturnal enuresis was achieved in 5 of the 9 medically treated children (55.6%) and 12 of the 21 surgically treated children (57.1%). Overall, 17 of the 30 children (56.7%) experienced improvement in nocturnal enuresis after treatment.

DISCUSSION

In the present study, mouth breathing (90.9%) and snoring (87.9%) were the predominant clinical manifestations among children with adenoid hypertrophy. Daytime sleepiness was observed in 33.3%, ear pain in 45.5%, nocturnal enuresis in 45.5%, and dismorphic teeth in 22.7% of the study population. These findings indicate that upper airway obstruction caused by enlarged adenoids commonly manifests with nasal obstruction and sleep-related symptoms. Chronic mouth breathing and snoring are well-recognized consequences of adenoid enlargement and may contribute to altered craniofacial growth and impaired sleep quality.

Similar observations were reported by Uzun Çiçek et al.[11], who found that children with adenoid hypertrophy commonly presented with mouth breathing, habitual snoring, and sleep disturbances, with symptom severity increasing according to the degree of airway obstruction. Likewise, Geiger and Gupta[12] described nasal obstruction, mouth breathing, snoring, recurrent otitis media, and sleep-disordered breathing as the most frequent clinical manifestations of adenoid hypertrophy. Furthermore, Ahmad et al.[13] emphasized that persistent mouth breathing and snoring are important indicators of clinically significant adenoid hypertrophy requiring appropriate evaluation and management. The findings of the present study are therefore consistent with recent literature demonstrating that upper airway symptoms remain the hallmark clinical presentation of pediatric adenoid hypertrophy.

Radiological evaluation revealed that 60.6% of children had severe adenoid hypertrophy, 24.2% had moderate disease, and 15.2% had mild enlargement. Despite the high proportion of severe hypertrophy, 63.6% of children were managed medically, while 36.4% underwent surgical treatment.

These findings are comparable with those reported by Ahmad et al.[14], who stated that medical management, including intranasal corticosteroids and treatment of allergic inflammation, remains the initial therapeutic approach for many

children, whereas adenoidectomy is reserved for patients with persistent symptoms or significant airway obstruction. Similarly, Geiger and Gupta[15] reported that although severe radiological obstruction is frequently encountered, treatment decisions should be individualized according to symptom severity, associated complications, and response to conservative therapy. The predominance of severe radiological disease in the present study may be explained by the tertiary care referral setting, where children often present after prolonged symptomatic periods.

Among children with nocturnal enuresis, snoring (93.3%), mouth breathing (86.7%), daytime sleepiness (40.0%), and ear pain (60.0%) were more frequent than among children without nocturnal enuresis. These findings suggest that sleep-related symptoms may contribute to the development of nocturnal enuresis through repeated nocturnal arousals, intermittent hypoxia, and altered secretion of antidiuretic hormone.

A similar relationship was demonstrated by Uzun Çiçek et al.[16], who observed significantly greater sleep disturbances in children with coexisting adenoid hypertrophy and nocturnal enuresis than in children with either condition alone. Their study highlighted that sleep-disordered breathing, prolonged sleep latency, and fragmented sleep were strongly associated with nocturnal enuresis. Likewise, the systematic review by Adisu et al.[17] concluded that nocturnal enuresis is influenced by several sleep-related disorders and emphasized the importance of identifying reversible causes such as upper airway obstruction. The present findings therefore support the concept that nocturnal enuresis should be evaluated as part of the clinical spectrum of sleep-disordered breathing in children.

The present study demonstrated that nocturnal enuresis was absent in children with mild adenoid hypertrophy, whereas 50.0% of children with moderate hypertrophy and 55.0% of those with severe hypertrophy experienced nocturnal enuresis. This finding suggests a positive association between increasing severity of airway obstruction and the occurrence of nocturnal enuresis.

Comparable findings were reported by Uzun Çiçek et al.[18], who observed that children with more severe adenoid hypertrophy experienced greater impairment of sleep architecture and higher rates of nocturnal enuresis. Similarly, Neshat et al.[19] reported that enuresis occurred more frequently in children with severe adenoid hypertrophy than in those with mild disease and was significantly associated with obstructive sleep apnea and growth retardation. The proposed mechanism involves intermittent hypoxia and increased negative intrathoracic pressure, leading to elevated atrial natriuretic peptide secretion, reduced nocturnal antidiuretic hormone release, and increased nocturnal urine production. The present findings reinforce this pathophysiological relationship between severe upper airway obstruction and nocturnal enuresis.

Among children with nocturnal enuresis, improvement following treatment was observed in 55.6% of those managed medically and 57.1% of those undergoing surgical intervention, with an overall improvement rate of 56.7%. Although the proportion of improvement was comparable between the two treatment groups, the greater number of surgically treated children reflected the higher burden of severe disease requiring operative management.

These observations are in agreement with Wang et al.[20], who reviewed the relationship between obstructive sleep apnea and nocturnal enuresis and concluded that treatment of upper airway obstruction, particularly adenotonsillar surgery in appropriately selected patients, results in substantial improvement or complete resolution of bedwetting in many children. Similar conclusions have also been reported in recent pediatric sleep literature, where improvement in nocturnal enuresis after successful management of airway obstruction has been attributed to normalization of sleep architecture and restoration of hormonal regulation of nocturnal urine production. Therefore, the present study supports the growing evidence that effective treatment of adenoid hypertrophy may contribute to improvement in nocturnal enuresis.

CONCLUSION

The present cross-sectional study demonstrated a significant association between adenoid hypertrophy and nocturnal enuresis among children aged 5–12 years attending a tertiary care centre. Mouth breathing and snoring were the most common clinical manifestations of adenoid hypertrophy, while nearly half of the children also experienced nocturnal enuresis. Radiological assessment revealed that severe adenoid hypertrophy was the predominant finding, and nocturnal enuresis was more frequently observed in children with moderate to severe adenoid enlargement than in those with mild disease. Management of adenoid hypertrophy, whether medical or surgical, resulted in improvement of nocturnal enuresis in more than half of the affected children, suggesting that timely treatment of upper airway obstruction may alleviate bedwetting symptoms. These findings highlight the importance of screening children with nocturnal enuresis for underlying adenoid hypertrophy and sleep-disordered breathing. Early diagnosis and appropriate intervention can improve sleep quality, reduce enuretic episodes, and enhance the overall quality of life of affected children.

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