Section: ENT

Original Research Article

DECODING ADENOID HYPERTROPHY: A RADIOLOGICAL APPROACH TO SNORING IN PAEDIATRIC PATIENTS

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Received *: 06/07/2025*
Received in revised form *: 19/08/2025*
Accepted *: 09/09/2025*

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DOI: 10.70034/ijmedph.2025.3.498

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 2713-2717

ABSTRACT

Background: Adenoid and tonsillar hypertrophy are common causes of upper airway obstruction in children, often leading to snoring and sleep-disordered breathing (SDB). Although the clinical impact of enlarged tonsils and adenoids is recognised, the relationship between radiological adenoid grading and clinical tonsillar assessment with snoring has not been fully explored. This study aimed to explore the correlation between radiological grading of adenoid hypertrophy and snoring in paediatric patients, and to assess the clinical grading of tonsillar hypertrophy.

Materials and Methods: This cross-sectional study included 84 children aged 5–15 years with airway obstruction symptoms. Adenoid size was measured on lateral neck radiographs using the adenoid-nasopharynx (AN) ratio, and tonsillar size was assessed clinically using the Brodsky classification. Snoring frequency was recorded and correlated with hypertrophy grade.

Results: Among the 84 patients, Grade I adenoid hypertrophy was observed in eight children (9.6%), with five (6%) snoring; Grade II in 33 children (39.8%), with 17 (20.5%) snoring; Grade III in 29 children (34.9%), with 20 (24.1%) snoring; and Grade IV in 14 children (16.9%), all of whom snored. Tonsillar hypertrophy was mostly moderate to severe, with Grade I in 3 children (3.57%), Grade II in 33 (34.92%), and Grade III in 59 (62.5%), with no cases of Grade IV. Overall, higher grades of adenoid and tonsillar enlargement were associated with an increased frequency of snoring.

Conclusion: Radiological adenoid assessment combined with clinical tonsillar grading provides a comprehensive evaluation of paediatric airway obstruction. Early recognition and management of hypertrophy can improve sleep quality and overall health.

Keywords: Adenoid hypertrophy, Airway obstruction, Pediatric, Sleep-disordered breathing, Snoring, Tonsillar hypertrophy.

INTRODUCTION

The nasopharynx contains lymphoid tissues called adenoids, while the oropharynx contains palatine tonsils. By capturing pathogens that enter through the mouth and nose, they contribute significantly to the immune system.[1,2] These tissues may obstruct the upper airway in children due to their larger size and potential for hypertrophy.[3] In children, adenoid hypertrophy is a frequent cause of mouth breathing, snoring, and nasal blockage.[4] Similarly, enlarged tonsils can narrow the oropharyngeal airway, causing blockage and breathing issues during sleep.[5]

Children who present with snoring should have their tonsils and adenoids evaluated, as enlargement of both structures often results in severe symptoms.[6] Snoring in children is not always benign; if untreated, it may indicate partial airway obstruction and be associated with behavioural issues, poor academic performance, and impaired development.[7,8] Treatment planning, whether medical or surgical, requires an understanding of the structural causes of

snoring. Although the clinical association between enlarged adenoids or tonsils and snoring is recognised, the relationship between radiological assessment of adenoid size and clinical grading of tonsillar hypertrophy with snoring is not fully understood.[9] In children with airway obstruction, examining this correlation can help guide treatment and improve diagnostic accuracy.[10]

Radiological evaluation is a reliable, non-invasive method for assessing adenoid size. The Adenoid-Nasopharynx (AN) ratio, calculated on lateral neck radiographs by comparing the maximal convexity of the adenoid shadow with the nasopharyngeal distance, provides an objective measure.[4] Adenoid hypertrophy is graded as Grade I (0–25%), Grade II (25–50%), Grade III (50–75%), and Grade IV (75–100%).[5] Tonsillar hypertrophy is clinically assessed using the Brodsky classification, which grades the palatine tonsils relative to the oropharyngeal airway.[2,6] Combining radiological adenoid assessment with clinical tonsillar grading offers a comprehensive evaluation of the upper airway and helps identify children at risk of snoring and sleep-disordered breathing (SDB).

The purpose of this study was to examine the relationship between radiological grading of adenoid hypertrophy and snoring in paediatric patients, along with clinical grading of tonsillar hypertrophy in the same cohort, to aid treatment planning and improve diagnostic accuracy.

MATERIALS AND METHODS

This cross-sectional observational study included 84 patients from August 2022 to August 2023 and was conducted at Kanyakumari Government Medical College. The Institutional Review Board of the college approved the study protocol, and written informed consent was obtained from each patient's parent or legal guardian.

Sample size Calculation: The required sample size was calculated as 65 based on a 30% prevalence rate, 95% confidence level, and 5% margin of error; however, 84 patients were included to improve the reliability and generalisability of the findings.

Inclusion criteria

Children aged 5–15 years with symptoms of airway obstruction, including mouth breathing, snoring, or recurrent upper respiratory infections, were included.

Exclusion criteria

The study excluded children with a history of oral surgery that could affect airway assessment, gastroesophageal reflux disease (GERD), lower respiratory infections, severe neurological conditions, long-term systemic illnesses, or congenital craniofacial abnormalities.

Methods: The data collected included the sizes of the adenoids and tonsils. Adenoid size was measured using lateral neck radiography, and the AN ratio was calculated using Fujioka's true lateral radiographic method by comparing the largest bulge of the adenoid to the nasopharyngeal distance. Adenoid hypertrophy was divided into four grades: Grade I (0–25%), Grade II (25–50%), Grade III (50–75%), and Grade IV (75–100%). Tonsillar hypertrophy was clinically assessed using the Brodsky classification, which grades the palatine tonsils based on their size in the oropharyngeal airway. For all patients, these measurements were recorded, and the severity of hypertrophy was compared with the presence or absence of snoring.

The collected data were entered into Microsoft Excel and analysed using SPSS v22. Categorical variables were expressed as frequency and percentage.

RESULTS

Among 84 children, 46 (54.8%) were males and 38 (45.2%) females; most were aged 6–10 years (47.6%), followed by 11–15 years (44%) and 5 years (8.3%). Nasal obstruction and recurrent sore throat were present in all patients. Snoring (66.7%) and mouth breathing (79.8%) were common, along with ear blocking (50%), earache (41.7%), hypo nasality (35.7%), and hearing difficulty (31%). Less frequent symptoms included nasal discharge (26.2%), headache (22.6%), ear discharge (16.7%), sneezing (13.1%), and allergy (8.3%). Post-nasal drip (8.3%), previous oral surgery (2.4%), and epistaxis (1.2%) were rare, while cough and GERD were absent [Table 1].

Table 1: Demographic and clinical features (N = 84)

Parameter	Category	N (%)
Age	5 years	7 (8.3)
	6–10 years	40 (47.6)
	11–15 years	37 (44)
Gender	Female	38 (45.2)
	Male	46 (54.8)
Clinical Features	Nasal obstruction	84 (100)
	Recurrent sore throat	84 (100)
	Mouth breathing	67 (79.8)
	Snoring	56 (66.7)
	Ear blocking sensation	42 (50)
	Ear ache	35 (41.7)
	Hypo nasality	30 (35.7)
	Hard of hearing	26 (31)
	Nasal discharge	22 (26.2)
	Headache	19 (22.6)

	Ear discharge	14 (16.7)
	Sneezing	11 (13.1)
	Allergy	7 (8.3)
	Post-nasal drip	7 (8.3)
	Previous oral surgery	2 (2.4)
	Epistaxis	1 (1.2)
	Cough	0
	GERD	0

Among the 84 patients, Grade I adenoid hypertrophy was observed in eight children (9.6%), with five (6.0%) experiencing snoring and three (3.6%) without. Grade II hypertrophy was observed in 33 children (39.8%), of whom 17 (20.5%) had snoring and 16 (19.3%) did not. Grade III was identified in 29 children (34.9%), of whom 20 (24.1%) reported snoring and 9 (10.8%) did not. Grade IV hypertrophy was present in 14 children (16.9%), all of whom (16.9%) exhibited snoring [Table 2].

Table 2: Distribution of adenoid hypertrophy grades and associated snoring

Adenoid Grade (X-ray)	N (%)	Snoring	
		Present	Absent
I (0–25%)	8 (9.6%)	5 (6%)	3 (3.6%)
II (25–50%)	33 (39.8%)	17 (20.5%)	16 (19.3%)
III (50–75%)	29 (34.9%)	20 (24.1%)	9 (10.8%)
IV (75–100%)	14 (16.9%)	14 (16.9%)	0

Grade I tonsillar hypertrophy was observed in three children (3.57%), whereas Grade II was observed in 33 children (34.92%). Most children (59 [62.5%]) had Grade III hypertrophy, and no cases of Grade IV hypertrophy were identified.

Adenoid hypertrophy was distributed across all grades, with 8.92% having Grade I, 30.35% Grade II, 35.71% Grade III, and 25% Grade IV. Tonsillar hypertrophy was mostly moderate to severe, with 3.57% of children showing Grade I, 34.92% Grade II, and 62.5% Grade III, and no cases of Grade IV [Table 3].

Table 3: Distribution of adenoid and tonsillar hypertrophy grades

Grade Type	Grade I	Grade II	Grade III	Grade IV
Adenoid Hypertrophy	8.92%	30.35%	35.71%	25%
Tonsillar Hypertrophy	3.57%	34.92%	62.50%	0%

DISCUSSION

In this study, most children were of school-going age, with a slight male predominance. Clinical presentation was dominated by nasal obstruction and recurrent sore throat, while snoring and mouth breathing were also frequent. Ear-related complaints such as ear blockage, earache, and hearing difficulty were common, and a considerable proportion presented with speech-related changes like hyponasality. Other features, including nasal discharge, headache, sneezing, and allergy, were less frequent, whereas post-nasal drip, epistaxis, and previous oral surgery were rare. None of the children reported cough or gastroesophageal reflux disease. Adenoid hypertrophy was clearly associated with snoring, and greater enlargement was linked to a higher prevalence of SDB in children.

Similarly, Dixit and Tripathi reported in a study of 50 children aged 3–12 years that snoring was the most common symptom (68%), with a higher AN ratio (>0.7) showing a significant association with more frequent and severe snoring, confirming its correlation with adenoid hypertrophy.[11] Aleid et al. found that a positive correlation was observed between the severity of adenoid hypertrophy and the frequency of snoring. Specifically, 41.3% of children with mild adenoid hypertrophy snored infrequently, whereas 13.1% snored frequently; among children without adenoid hypertrophy, 18.8% snored rarely, and 25% exhibited no snoring.[12] Adenoid size directly influences snoring frequency, indicating that larger adenoids contribute significantly to paediatric SDB.

In our study, tonsillar hypertrophy was predominantly moderate to severe, with most children presenting with Grade III enlargement, while Grades I and II were less common, and no cases of Grade IV were observed. Similarly, Fageeh found in a study of 109 paediatric patients aged three–14 years who underwent adenotonsillectomy that Grade I enlargement was observed in 5 children (4.6%), Grade II in 26 children (23.9%), Grade III in 48 children (44%), and Grade IV in 29 children (26.1%).[13] Deshmukh et al. assessed tonsillar hypertrophy in a study of 75 patients under the age of 20 years, including 50 cases and 25 controls, and distributed it across grades. Grade III hypertrophy was observed in 52% of patients, Grade IV in 34%, Grade II in 10%, and Grade I in 2%.[14]

Kara et al. found in a large study of primary school children aged 6 to 13 years, the prevalence of tonsillar hypertrophy was reported to be 11%.[15] Kurt et al. found that the assessment of tonsillar hypertrophy among the children showed that 5 (4.6%) had Grade I enlargement, 26 (23.9%) had

Grade II, 48 (44%) had Grade III, and 29 (26.1%) exhibited Grade IV hypertrophy.[16] Tonsillar hypertrophy in children is mostly moderate to severe, with Grade III being the most common across multiple studies.

The overall assessment of hypertrophy revealed that adenoid enlargement was distributed across all grades, whereas tonsillar hypertrophy was predominantly moderate to severe, with Grade III being the most common, and no cases of Grade IV were observed. Similarly, Akhtar et al. found that the radiological assessment of adenoid hypertrophy revealed that most patients had Grade II enlargement (46%), followed by Grade III (30%), Grade I (15%), and Grade IV (7%).[17] Razaq and Saloom found that adenoid hypertrophy was present across all grades, with Grade II and Grade IV each observed in 40 patients (33.3% of 120), while Grade I, representing minimal or no hypertrophy, also included 40 patients (33.3%).[18]

Ma I study included 120 paediatric patients aged 2–15 years and graded adenoid tissue according to size. Grade I was observed in 16 patients, Grade II in 44, Grade III in 54, and Grade IV in 6 patients.[19] Tran-Minh et al. found that among children with obstructive sleep apnoea syndrome, 36% exhibited Grade II tonsillar hypertrophy, while 48.2% presented with Grade III, and no cases of Grade IV were observed.[20] Alghamdi et al. found that among 216 pediatric patients, 32.9% exhibited Grade II tonsillar hypertrophy, while 55.6% presented with Grade III, and no cases of Grade IV were identified.[21] Both adenoid and tonsillar hypertrophy vary in severity, but moderate to severe tonsillar enlargement is more common than extreme cases.

Our study highlights that larger adenoids are strongly associated with increased snoring in children. Tonsillar hypertrophy is mostly moderate to severe, which supports clinical observations. Evaluating both adenoid and tonsillar sizes is essential for the proper management of paediatric SDB.

Limitations: This study had a relatively small sample size, used only lateral neck radiography, and lacked long-term follow-up. Clinical tonsil grading may have observer bias, and excluding children with certain health conditions limits its applicability to all paediatric populations.

CONCLUSION

Our study showed a clear association between adenoid hypertrophy and snoring, with larger adenoids linked to more frequent SDB in children. Tonsillar hypertrophy was predominantly moderate to severe, with Grade III being the most common, highlighting its role in airway obstruction. Radiological grading of the adenoids combined with clinical tonsillar assessment provides a comprehensive approach for identifying at-risk children. Early recognition and appropriate management of these hypertrophies can improve sleep quality, reduce complications, and enhance the overall health and development of affected children.

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