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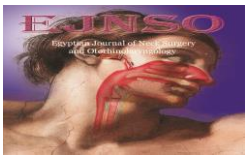

Assessment of adenoid size using flexible Nasoendoscopy and lateral neck radiography and Its relation to clinical symptoms

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Abstract:

Background: Enlarged adenoids commonly occur in pediatric patients and require medical attention. Various diagnostic methods have been proposed to assess adenoid enlargement, but there is no consensus on the optimal approach.

Aim: measure the reproducibility of flexible nasoendoscopy, compare the adenoid size using both lateral neck radiography and flexible nasoendoscopy and correlate both modalities concerning clinical symptoms.

Patients and methods: The study involved 66 children. Their age ranged from 3 to 14 years, with a mean of 7.68 ± 2.26. All patients had flexible nasopharyngoscopy by two physicians and lateral neck radiograph to measure the adenoid size. Then, the results were compared and correlated to the clinical symptoms.

Results: Moderate agreement between endoscopy rater A and radiological evaluator (weighted kappa = 0.516, $p < 0.001$) was observed for adenoid size, with 39.4% grade III and 34.8% grade IV agreement. However, 25.8% of cases had discrepancies, favoring endoscopist A's grade IV. A fair agreement between endoscopy rater B and radiological evaluator (weighted kappa = 0.283, $p = 0.018$) showed 42.4% grade III and 22.7% grade IV agreement, with 12.1% and 22.7% disagreements.

Conclusion: Our study concludes that both flexible nasopharyngoscopy and lateral neck radiography are complementary techniques for evaluating adenoid size and its correlation with symptoms.

Key words: Adenoids, Nasopharyngoscopy, Neck radiograph, Adenoid-nasopharyngeal ratio.

Introduction

Adenoids constitute the upper portion of Waldeyer's ring, situated at the entrance to the upper respiratory tract. [1] This location serves as a vital interface between inhaled microorganisms, antigens, and immune cells. [2] Despite the existence of various objective techniques such as mirror examination, palpation, lateral cervical radiography, and nasal endoscopy for diagnosing adenoid hypertrophy, the appropriateness of each diagnostic approach remains a topic of debate. [3]

The clinical assessment of adenoid hypertrophy proves challenging, particularly among young children. Subjective drawbacks such as inaccurate parental histories and

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challenges in evaluating young children's condition hinder effective clinical decision-making. [4]

In our study, we employed both flexible nasal endoscopy and lateral neck radiography to evaluate adenoid dimensions.

Patients and methods:

Study Design: A prospective study was conducted within the period from May 2020 to May 2021 at the ENT clinic of Assiut University Hospital. The study was approved by the ethical committee of the faculty of medicine, Assiut university, (approval number 17100740).

Study Population: The study included 66 children (39 males and 27 females) aged from 3 to 14 years suspected clinically of having enlarged adenoids (chronic mouth breathing, snoring, and hearing impairment). An informed consent was obtained from the parents ensuring their understanding of the study's purpose, procedures, and potential risks and benefits. Signed consent forms were collected and treated as permanent records, maintaining confidentiality and adhering to ethical guidelines. We exclude patients with recurrent adenoids, nasal obstruction due to anatomical abnormalities such as congenital choanal atresia, stenosis, or deviated nasal septum, and patients with craniofacial abnormalities, Down syndrome, and metabolic disease.

Methodology: Each participant underwent the following procedures:

A. **Comprehensive History Collection:**
   - Personal history; Parents were asked about the duration, onset, progression, and severity of symptoms, including snoring, mouth breathing, hyponasality, ear pain, and hearing loss.
   - Medical history; including tonsillectomy and medical treatment.

B. **Examination:** We looked for adenoid facies, and then the ears were examined to rule out acute otitis media and effusion. The external nose was examined to look for supra-tip skin crease then, anterior rhinoscopy with a speculum was done to check the state of the turbinates, septum, and presence secretion. All patients had tympanometry

C. **Lateral Nasopharyngeal X-ray:** This procedure was conducted with the patient standing, mouth closed, and neck slightly extended. Utilizing Fujioka's method [5], adenoid size (A) was determined by measuring the distance between the outermost point of the adenoid shadow and the spheno-basiocciput (line B). The size of the nasopharynx (N) was established by measuring the distance between line B and the posterior margin of the hard palate. The adenoid nasopharyngeal ratio (ANR) was calculated by dividing adenoid size by nasopharyngeal size, then multiplying by 100 to express the value as a percentage. Subjects were subsequently categorized into four groups based on ANR: Group X1 (0-25%), Group X2 (25-50%), Group X3 (50-75%), and Group X4 (75-100%).

D. **Flexible Nasoendoscopy (STORZ-telepack x LED – TP100):** The nose was packed with a nasal swab soaked with a mixture of 0.05% Xylometazoline HCl and 10% lidocaine for 10 minutes. The child was seated in an upright position and held by the mother. The endoscope was introduced along the nasal floor and then advanced through the middle meatus. The procedure was monitored and recorded During

maximum inspiration, the adenoid size was assessed and categorized into four grades: grade 0 (absent adenoid tissue), grade 1 (adenoid occupying 1-25% of the airway), grade 2 (26-50%), grade 3 (51-75%), and grade 4 (76-100%) (6). Images were evaluated by two different physicians. Finally, a comparative analysis between endoscopic and radiologic findings was conducted.

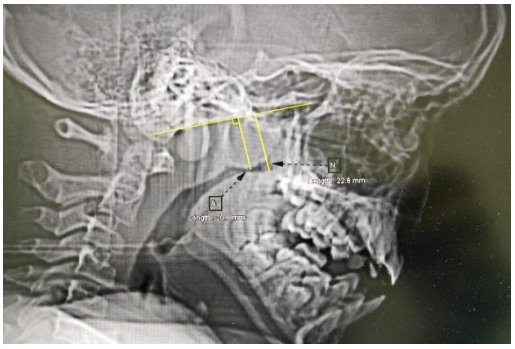

Figure 1 Calculation of the adenoid size using Fujioka method

Statistical analysis

Collected data were analyzed utilizing SPSS (version 20, IBM, Armonk, New York), a software package for social sciences. Continuous data were presented as mean ± SD, while nominal data were represented as frequency (percentage). The Chi^2-test served as the primary tool for comparing nominal data among various study groups, with a 95% confidence level and a P-value < 0.05 indicating statistical significance. Frequency tables and graphical representations were employed.

Additional statistical tests included the calculation of weighted kappa coefficients to assess rater agreement and the use of Z-score tests to analyze frequency differences between groups.

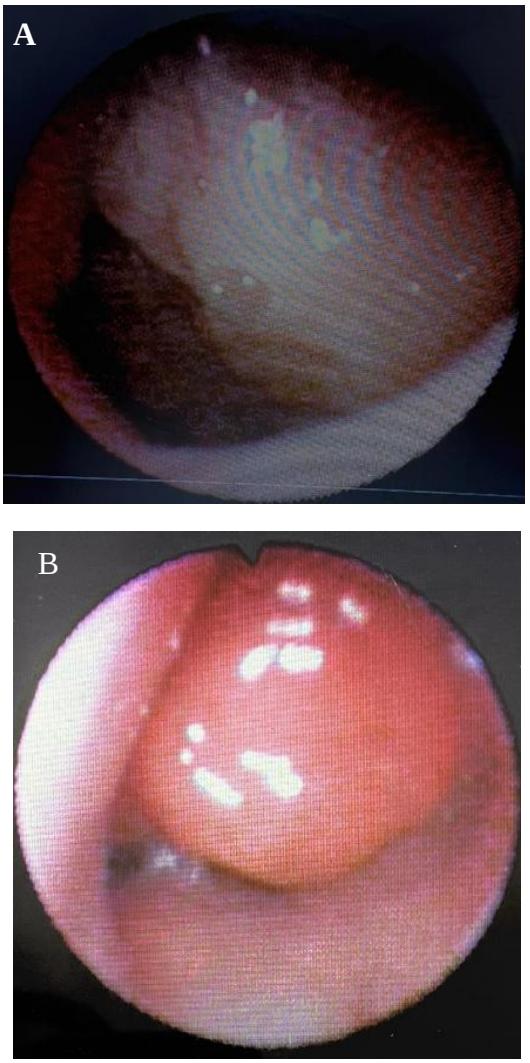

Figure 1 Grades of Adenoid Hypertrophy. A grade 3; B. grade 4.

Results

Demographics of enrolled participants (N= 66): The mean age of the participants was 7.68 years ± 2.26, ranging from 3 to 14 years. Among the subjects, 39 (59.1%) were males and 27 (40.9%) were females.

Endoscopic evaluation of adenoid size: We found 40 (60.6%) patients had adenoid grade III and 26 (39.4%) patients had adenoid grade IV as assessed by endoscopist A, while 39 (59.1%) and 27 (40.9%) patients had adenoid grade-III and IV respectively as assessed by endoscopist B.

Radiological assessment of adenoid size: Radiological findings indicated that 43 (65.1%) patients had grade-III adenoid hypertrophy, and 23 (34.8%) displayed grade-IV.

Agreement between the two endoscopy raters for the adenoid size (Table 1):

It was found that there was substantial agreement (weighted kappa=0.703, p < 0.001) between both endoscopists as both raters agreed in the detection of grade III in 26 (39.4%) patients and grade IV in 30 (45.5%) patients. They disagreed in 10 (15.2%) of cases where rater A diagnosed them as grade IV while rater B diagnosed them as grade III.

Agreement between both endoscopy raters and X-ray results (Table 2): There was moderate agreement between rater A and X-ray findings (weighted kappa = 0.516, p < 0.011), as they agreed in the detection of grade III in 26 (39.4%) patients and grade IV in 23 (34.8%) patients. Also, they disagreed with 17 (25.8%) patients, where rater A diagnosed them as grade IV and X-ray rater diagnosed them as grade III. It was found that there was fair agreement (weighted kappa = 0.283, p = 0.018) between rater B and x-ray rater in the evaluation of adenoid size as both raters agreed in detection grade III in 28 (42.4%) patients and grade IV in 15 (22.7%) patients. While, they disagreed in 15 (22.7%) cases, where rater B diagnosed them as grade IV and X-ray rater as grade III. Also, there was disagreement between them in 8 cases (12.1%) where rater B was diagnosed as grade III and x-ray rater as grade IV.

Relation between symptoms and adenoid size by X-ray (Table 3): For within-group comparison, grade III showed a significant difference (p<0.001) in the frequency of symptoms while grade IV cases had symptoms in 100% of cases except for nasality that was present in 18 (78%) cases with the insignificant difference (p=0.625). When we compared both grades, there was a significant reduction in middle ear effusion, sleep apnea, and nasality (p <0.001).

Relation between clinical symptoms and adenoid size by both endoscopy Raters (Table 4): When we compared both grades as assessed by endoscopy rater A, grade III showed a significant reduction in middle ear effusion, sleep apnea, and nasality (p < 0.001).While, when we compared both grades as assessed by endoscopy rater B, grade III showed only a significant reduction in middle ear effusion and nasality (p < 0.001).

Table 1 Agreement between endoscopy raters for the adenoid Size

		Rater A		Total
		Grade III	Grade IV	
Rater B	Grade III	26 (39.4%)	10 (15.2%)	36 (54.5%)
	Grade IV	0 (0%)	30 (45.5%)	30 (45.5%)
Total		26 (39.4%)	40 (60.6%)	66 (100%)
Weighted Kappa Agreement		0.703 (P < 0.011)		
Chi-square test		35.750 (P < 0.011)		

Table 2 Agreement between both endoscopy raters and X-ray raters for the adenoid Size.

		Rater A		Rater B	
Grade		III	IV	III	IV
X-ray rater	III	26 (39.4%)	17 (25.8%)	28 (42.4%)	15 (22.7%)
	IV	0 (0%)	23 (34.8%)	8 (12.1%)	15 (22.7%)
Total		26 (39.4%)	40 (60.6%)	36 (54.5%)	30 (45.5%)
Weighted Kappa Agreement		0.516 (P < 0.011)		0.283 (P = 0.018)	
Chi-square test		22.947 (P < 0.011)		5.561 (P = 0.019)	

Table 3 Relation between symptoms and adenoid size by radiological assessment

Symptoms	Adenoid Size		P-value*
	Grade III	Grade IV	
Snoring	43 (65.2%)	23 (34.8%)	= 0.019
Effusion	8 (25.8%)	23 (74.2%)	< 0.001
Mouth Breathing	34 (59.6%)	23 (40.1%)	= 0.041
Sleep Apnea	4 (14.8%)	23 (85.2%)	< 0.001
Recurrent AOM Attack	14 (37.8%)	23 (62.2%)	= 0.009
Nasality	0 (0%)	18 (100%)	< 0.001
P-value**	< 0.001	= 0.625	

*Z-score test was used to compare the frequency differences between group

Table 4: Relation between symptoms and adenoid size by both endoscopy raters.

	Rater A			Rater B		
Symptoms	Grade III	Grade IV	P-value*	Grade III	Grade IV	P-value*
Snoring	40 (60.6%)	26 (39.4%)	= 0.033	39 (59.1%)	27 (40.9%)	= 0.048
Effusion	8 (25.8%)	23 (74.2%)	< 0.001	7 (22.6%)	24 (77.4%)	< 0.001
Mouth Breathing	31 (54.4%)	26 (45.6%)	= 0.049	30 (52.6%)	27 (47.4%)	= 0.147
Sleep Apnea	0 (0%)	27 (100%)	< 0.001	8 (29.6%)	19 (70.4%)	= 0.001
Recurrent AOM Attack	12 (32.4%)	25 (67.6%)	= 0.016	11 (29.7%)	26 (70.3%)	= 0.010
Nasality	0 (0%)	18 (100%)	< 0.001	6 (33.3%)	12 (66.7%)	< 0.001
P-value**	< 0.001	= 0.039		< 0.001	= 0.014	

Discussion:

In the pediatric population, chronic adenoid enlargement presents as a common concern necessitating medical attention. While evaluating enlarged adenoids is a routine practice, its reliability in young children remains uncertain. The diagnostic procedures for diagnosing enlarged adenoids are varied and clinicians disagree on the ideal approach. [7] Among these, three widely utilized diagnostic methods include patient symptoms, lateral neck X-ray, and endoscopy. [8]

Clinical symptoms, such as nasality, mouth breathing, snoring, and otitis media, have been considered major indicators of the severity of enlarged adenoids by many physicians. In a cohort study by **Sina et al.,** the most prominent symptoms were found to be snoring, mouth breathing, and hyponasality, while the most prominent was mouth breathing. [9] We added recurrent episodes of otitis media to the previous symptoms and found that the most dominant symptom was snoring.

Lateral soft tissue neck radiographs have also been employed to assess adenoid size and airway patency. This approach, performed by pediatricians and ENT specialists, offers a convenient means of estimating adenoid tissue. Various methods have been proposed for evaluating adenoids on lateral cervical radiographs, including measuring adenoid thickness, the airway-to-soft palate ratio, and the adenoid-to-nasopharynx ratio. [5] In our study, we measured the adenoid-to-nasopharynx ratio, although the correlation between this ratio and clinical symptoms remains debatable.

Gangadhara et al. demonstrated the significance of the adenoid-nasopharynx ratio in evaluating adenoid enlargement in children and found that patients with snoring and mouth breathing had larger adenoids on radiographs. [13] **Marc et al.** found no correlation between lateral neck radiograph measurements and clinical symptoms. [14] While **Paradise et al., Fernbach et al.,** and **Mahboubi et al.** found varying degrees of correlation between the adenoid nasopharyngeal ratio and clinical symptoms. [15-17] In our study we found that patients with grade IV adenoid enlargement as revealed by radiological examination had significantly higher frequency of symptoms than patients with grade III.

Fiberoptic examination of the nasal cavity and nasopharynx has emerged as a valuable tool in assessing enlarged adenoids. Under proper conditions and using appropriate endoscopic techniques, this method offers objective and accurate results. [18] **Marc et al.** found a weak but significant correlation between airway obstruction assessed via fiberoptic rhinoscopy and clinical symptoms. Similarly, **Lourenço et al. and Cassanoa et al.** supported nasal endoscopy's efficacy for evaluating adenoid enlargement. [19-20] In agreement with that, we showed that patients with grade IV adenoid enlargement as assessed by endoscopy had a significantly higher frequency of symptoms.

Comparing radiographic and endoscopic measurements of adenoid size, **Lertsburapa et al.** established a positive correlation between the two methods. [3] **Mlynarek et al.** also found a limited correlation between adenoid enlargement assessed by video rhinoscopy and radiographic measurements. [21]

Caylakli et al. studied the A/N ratio and adenoid enlargement and reported a positive correlation with endoscopic findings, aligning with our results. [22] In our study, both radiography and nasal endoscopy synergistically contributed to understanding the relationship between

adenoid enlargement and related symptoms. **Marc et al.,** have shown that fiberoptic examination of the nasopharynx in children can be challenging and reliant on the physician's expertise [14], our study ensured consistency by involving two independent endoscopists.

Conclusion:

The findings from our study propose that radiography and nasal endoscopy offer complementary insights into understanding the relation between adenoid enlargement and its accompanying symptoms. While nasal endoscopy gains popularity, radiography remains a valuable diagnostic tool, it is easy to perform, cost-effective, non-invasive, and well tolerable, particularly among children.

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Conflicts of interest: No

Reference:

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