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Diagnostic efficacy of different methods in the assessment of adenoid hypertrophy

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Abstract

Objective: This study was designed for better understanding of the role of different methods of nasal endoscopy in the assessment of adenoid hypertrophy and comparing them with lateral neck radiography and patients' symptoms.

Subjects and method: From August 2007 until January 2009, in the otolaryngology ward of a tertiary referral center, 89 patients who had symptoms related to chronic mouth breathing participated in this study. History of the symptoms related to adenoid hypertrophy was obtained from them. In addition, all patients underwent nasal endoscopy and lateral nasopharynx x-ray. The clinician who did nasal endoscopy was blinded to information about clinical data and x-ray and vice versa. Afterward, the relationship between symptoms and each diagnostic procedure was evaluated.

Results: Patients had a mean age of 9.47 ± 4.68 years. In the evaluation of the relationship between symptoms grading and grading in lateral neck radiography, this relationship was significant about snoring. Furthermore, there was a significant relationship between the endoscopic size of adenoid and number of the episodes of acute otitis media. The sum of symptoms grading had a significant relationship with the size of adenoid in lateral neck x-ray, but not in nasal endoscopy.

Conclusion: The results of the present study indicated that both radiography and nasal endoscopy could define the relationship between adenoid hypertrophy and associated symptoms and therefore are complementary. Between them, despite the popularity of nasal endoscopy, radiography can serve as a better planning tool.

1. Introduction

The adenoid is one of the important parts of the Waldeyer ring that is located in the nasopharyngeal area. Because of its special location, especially regarding the posterior choanae and eustachian tube, it can be the etiology of many health problems of childhood.

An untreated adenoid hypertrophy may lead to obstructive sleep apnea, ear problems, failure to thrive, pulmonary hypertension, and craniofacial anomalies [1,2].

Therefore, adenoidectomy is a common surgical procedure of childhood, despite careful surgical selection of patients for operation nowadays [1,3].

However, in a patient with adenoid hypertrophy symptoms, diagnosis can be challenging. There are different recommendations for the diagnosis of adenoid hypertrophy such as lateral neck x-ray, videofluoroscopy, palpation, and nasal endoscopy [4-7]; but the role of each one is a controversial issue [4,6-16].

After widespread use of nasal endoscopy, some authors claimed that it could be a better modality for diagnosis [2,4,9,10,14,15,17].

This study was designed for better understanding of the role of different methods of nasal endoscopy in the assessment of adenoid hypertrophy and comparing them with lateral neck radiography and patients' symptoms.

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2. Subjects and method

2.1. Study subjects

From August 2007 to January 2009, in the otolaryngology ward of a tertiary referral hospital (Imam Khomeini hospital), 96 patients were selected among children who had symptoms related to chronic mouth breathing such as snoring, nasal obstruction, and sleep apnea (at least 3 months before diagnosis) and who did not have the following: tonsillar hypertrophy (grade II and more), age older 3 years, septal deviation, allergic rhinitis, choanal atresia, craniofacial anomaly, inflammatory disease of the airway (in the past 2 weeks), history of previous surgery, current medical treatment, and neuromuscular disorders.

Among 96 patients who participated in this study, 7 (7.2%) patients refused to undergo diagnostic nasal endoscopy and were therefore excluded from the study. The rest of the patients were 50 (56.2%) boys and 39 (43.8%) girls. The age distribution of patients is summarized in Fig. 1.

2.2. Ethical approval

The protocol of this study was approved by the Institutional Review Board of the Tehran University of Medical Science. Detailed information about the study was given to the participants' parents, and a written informed consent was obtained from each one. All aspects of the study were conducted according to the Declaration of Helsinki.

2.3. Variable measurement

Demographic data, history of snoring, recurrent pharyngitis, nasal obstruction, sleep apnea, and recurrent acute otitis media were recorded. History was taken from parents or children themselves if they were reliable. Each symptom (depending on severity) was categorized into 4 groups according to patients' or their parents' statements. The details of the classification are as follows: snoring (grade 0 = absent, grade 1 = 1–2 night[s] per week, grade 2 = 3–5 nights per week, grade 3 = 6–7 nights per week), nasal obstruction (chronic mouth breathing) (grade 0 = absent, grade 1 = one fourth to one half of a day, grade 2 = one half to three fourths of a day, and grade 3 = three fourths to all of the day), sleep apnea (grade 0 = absent, grade 1 = 1–2 night [s] per week, grade 2 = 3–5 nights per week, and grade 3 = 6–7 nights per week), otitis media (grade 0 = absent, grade 1 = 1–3 episode[s] per year, grade 2 = 4–6 episodes per year, and grade 3 = >6 episodes per year), and recurrent pharyngitis (grade 0 = absent, grade 1 = 1–3 episode[s] per year, grade 2 = 4–6 episodes per year, and grade 4 = >6 episodes per year). All symptoms scores were analyzed separately, and the relationship between the sum of all scores and other variables was also evaluated.

All patients underwent tympanometry.

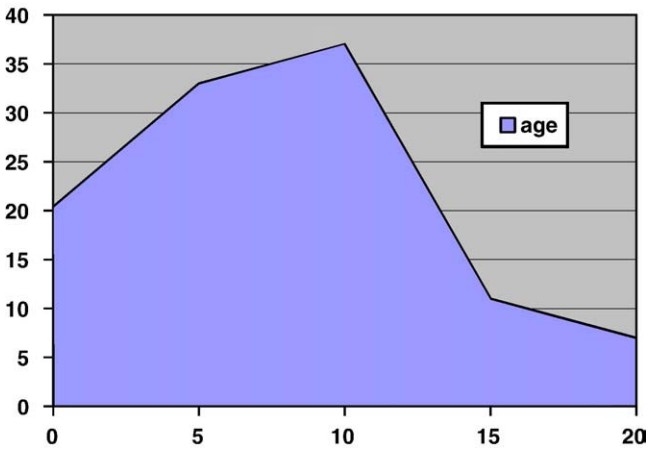

Fig. 1. Patients' age distribution.

3. Evaluation

3.1. Nasal endoscopy

Nasal endoscopy (using 2.7-mm Karl Störz [Germany] 0 rigid endoscope) was used to obtain a full choanal image by the same physician in all evaluations. Before performing nasal endoscopy, topical anesthesia and vasoconstriction were administered in all patients using a topical solution composed of 5% Xylocaine (Osveh, Teheran, Iran) and 0.5% phenyl ephedrine without any sedation.

The amount of obstruction was categorized using 2 methods: the first one was through dividing the amount of obstruction to the full choanal surface that was expressed in 4 grades (grade 0 = 0–25%, grade 1 = 25–50%, grade 2 = 50–75%, grade 3 = 75–100%). The second method was according to the anatomical relationship between surrounding anatomical structures such as torus tubarius, vomer, and the soft palate (grade 0 = none, grade 1 = torus tubarius, grade 2 = torus tubarius and vomer, and grade 3 = vomer and soft palate) [13].

Nasal endoscopy was recorded using a DVD recorder. Afterward, only images of the adenoid were captured with a camera (Störz telecam). Pictures used for the calculation of the occupied parts were the pictures of the adenoid in which a full view of choana could be seen. A special software was designed to calculate the occupied portion of choana with adenoid to the full surface of it using images in which all parts of adenoid could be evaluated. This software can be downloaded for free from our Web site (www.tums.ac.ir).

4. Radiography

Lateral nasopharyngeal x-ray was done in all patients in the supine position during nasal inspiration with their necks slightly extended and the mouths closed in a distance of 1 m from the radiation tube. All films were obtained with the same radiologist in the same institute and on the same day of nasal endoscopy. Adenoid thickness compared with the

rest of the airway was defined as the perpendicular distance from the pharyngeal tubercle to the highest convexity of the adenoid tissue (method of Cohen and Konak) [4]. Afterward, the ratio of airway to adenoid thickness was calculated from the above-mentioned adenoid tissue and the superior surface of the soft palate using Photoshop 8 (Adobe System Cooperation, USA). The amount of obstruction was categorized into 4 grades (grade 0 = 0–25%, grade 1 = 25–50%, grade 2 = 50–75%, and grade 3 = 75–100%).

5. Blinding

The clinician who did nasal endoscopy and evaluated the endoscopy pictures was blinded to information about clinical data and x-ray. In addition, adenoid size measurements were performed by a different person who was blinded about other data.

5.1. Statistical method

One-way analysis of variance (ANOVA), Pearson χ^2, Fisher exact test, nonparametric tests, Kruskal-Wallis test, and Spearman correlation with stepwise linear and multiple regression analysis were used to evaluate data using software SPSS version 12.0 (SPSS, Chicago, IL). A value for $P < .05$ was considered statistically significant.

6. Results

Of 96 patients who participated in this study, 7 (7.2%) refused to undergo diagnostic nasal endoscopy and were therefore excluded from the study. The mean age of the rest of the patients, 50 (56.2%) boys and 39 (43.8%) girls, was 9.47 ± 4.68 years, ranging from 4 to 18 years of age.

After taking of the complete history of patients, they were divided into different categories according to the severity of their symptoms. The distribution of the grading of patients' symptoms at the time of evaluation is summarized in Table 1.

The tympanometry of patients during the adenoid evaluation is demonstrated in Fig. 2.

The grading of adenoid occlusion in lateral neck radiography is summarized in Table 2.

Furthermore, the same grading in the endoscopic assessment of adenoid is shown in Table 3:

Table 1
Distribution of patients' symptoms grading

Grading symptom	Grade 0	Grade 1	Grade 3	Grade 4
Snoring	7 (7.9%)	13 (14.6%)	30 (33.7%)	39 (43.8%)
Nasal obstruction	18 (20.2%)	36 (40.4%)	25 (28%)	10 (11.2%)
Sleep apnea	47 (52.8%)	21 (23.6%)	15 (16.9%)	6 (6.7%)
Otitis media	58 (65.2%)	22 (24.7%)	8 (9%)	1 (1.1%)
Recurrent pharyngitis	5 (5.6%)	33 (37.1%)	26 (29.2%)	25 (28.1%)

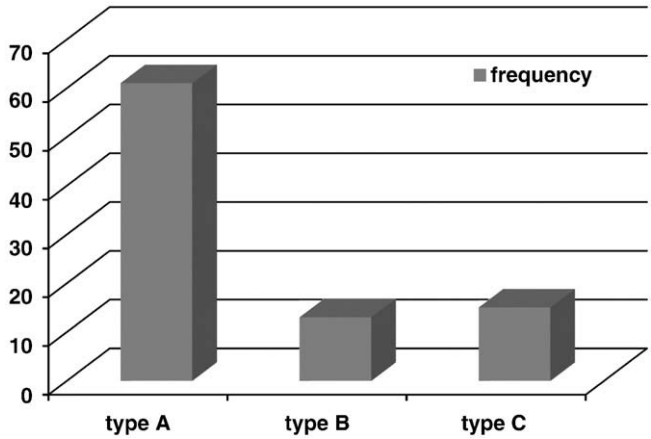

Fig. 2. Distribution of the pattern of tympanometry among patients.

Distribution of adenoid grading according to the method of Sanjay et al [13] was as follows: 24 (27%) patients in grade 1 (torus tubarius), 44 (49.4%) patients in grade 2 (torus tubarius and vomer), and 21 (23.6%) patients in grade 3 (vomer and soft palate).

We could not find a significant relationship between age, sex, and adenoid grading in different methods of adenoid assessment (1-way ANOVA).

In the evaluation of the relationship between symptom grading and grading in lateral neck radiography, snoring showed a significant relationship (Fisher exact test, P value = .003), a near-significant relationship was found for nasal obstruction (Fisher exact test, P value = .052) and recurrent pharyngitis (Pearson $\chi^2 = 0.051$), but sleep apnea and otitis media did not have a significant relationship. Lateral neck x-ray did not show a significant association with the type of tympanometry.

The nonparametric correlation was significant between adenoid size in lateral neck radiography and snoring (Spearman ρ correlation coefficient = 0.252, P value = .017) and recurrent pharyngitis (Spearman ρ correlation coefficient = 0.302, P value = 004).

In endoscopic evaluation of the adenoid, the size of adenoid had a significant relationship with the number of the episodes of acute otitis media (Fisher exact test, P value = .04), but not with other evaluated symptoms; and also, the nonparametric correlation was not significant.

Adenoid size in endoscopy had a significant relationship with the type of tympanometry (Pearson $\chi^2 = 0.004$).

Moreover, there was no significant relationship between symptoms and endoscopic assessment of adenoid size using the method of Sanjay et al [13] (nonparametric tests, Kruskal-Wallis test, and Pearson χ^2); and also, the same is true in type of tympanometry.

The sum of symptoms grading had a significant relationship with lateral neck x-ray (1-way ANOVA, P value = .006), but not with findings in nasal endoscopy.

The difference between different grading of lateral neck radiography in relationship to sum of symptoms scores was

Table 2
Distribution of adenoid size in lateral radiography

	n	Mean	SD	SE	95% Confidence interval for mean		Minimum	Maximum
					Lower boundary	Upper boundary		
25–50%	9	45.78	3.492	1.164	43.09	48.46	41	50
50–75%	32	65.97	7.567	1.338	63.24	68.70	51	75
75–100%	48	85.92	7.062	1.019	83.87	87.97	77	100
Total	89	74.69	15.159	1.607	71.49	77.88	41	100

significant (post hoc tests) in the lowest and highest groups. The results are summarized in Table 4.

Correlation was only significant between adenoid size in lateral neck radiography and sum of symptoms scores (1-way ANOVA, P value = .0) and not in endoscopy.

The linear regression analysis was significant (ANOVA, P value = .00) between lateral neck radiography and snoring, otitis media, and recurrent pharyngitis.

We can design an equation to predict the size of adenoid using scores of snoring, otitis media, and recurrent pharyngitis (R^2 = 0.28).

Predicted adenoid size in lateral neck x-ray = (6.837 × snoring score) + (5.475 × otitis media score) + (4.248 × recurrent pharyngitis) +33.587.

7. Discussion

The adenotonsillar hypertrophy is a common disease of childhood and consequently one of the commonest surgical procedures of that period. However, the best method of adenoid hypertrophy diagnosis is a debatable topic. Many studies have been performed to propose the ideal method [6,9,15]. Lateral neck x-ray and nasal endoscopy are common methods of adenoid hypertrophy assessment [5,10]. Therefore, this study was designed to review the relationship between different methods of evaluating adenoid hypertrophy and symptoms scores.

Despite the wide use of different diagnostic tools in the assessment of adenoid hypertrophy, clinical diagnosis is based on common presentations such as snoring, chronic mouth breathing, sleep apnea, and otitis media. Compared with other researches [4], we added recurrent pharyngitis to the list of symptoms scores and evaluated the relationship between diagnostic tools and a wide range of scores (0-20).

Subjective symptoms in the process of clinical decision making have their own difficulties; difficulty of taking history from a child and inaccuracy of some reports of parents are 2 examples.

Among different symptoms, snoring, otitis media, and recurrent pharyngitis had a significant linear relationship with adenoid hypertrophy in x-ray. Some reports have shown a poor correlation between symptoms and radiography [4]. This difference in our data may be due to various selected symptoms in this report. This study confirmed adenoid view as a reliable diagnostic test in the evaluation of adenoid hypertrophy, which is compatible with some similar reports [18].

Nasal endoscopy (using 2.7-mm rigid endoscopy) can be a tolerable diagnostic tool in children if the procedure is clearly defined for them. Many studies have claimed that nasal endoscopy is the ideal tool for evaluating adenoid hypertrophy and overweight radiography in association with adenoid hypertrophy symptoms [10,14,16,17]. We tried to compare 2 popular methods of grading nasal endoscopy. It seems that calculation of the occupying parts is a better method of grading than the method of Sanjay et al [13] who used the relationship between adenoid and surrounding tissues.

Furthermore, we designed a special software to calculate the occupied parts of choana by adenoid to surpass difficulties and inaccuracy of common softwares. Different methods of adenoid calculation may have affected final results in similar studies [2,4,6,14].

To choose between rigid endoscopy and flexible endoscopy that is usually recommended by many reports, rigid endoscopy (pediatric size) can be a feasible method in children older than 3 years, with a better quality of pictures; but the mean age of our patients was older than similar

Table 3
Distribution of adenoid size in endoscopy

	n	Mean	SD	SE	95% Confidence interval for mean		Minimum	Maximum
					Lower boundary	Upper boundary		
25–50%	9	47.5	3.69	1.84	41.62	53.38	42	50
50–75%	16	67.86	6.65	1.45	64.83	70.88	51	75
75–100%	64	86.22	6.95	1.60	83.87	88.57	77	100
Total	89	77.36	13.48	1.72	73.91	88.81	42	100

Table 4
Different grading of lateral neck radiography in relationship to sum of symptoms scores

Lateral neck x-ray grading	*P* value	95% Confidence interval	
		Lower boundary	Upper boundary
25–50%	.005	0.9519	0.1391
50–75%	.223	0.4340	0.0767
75–100%	.005	0.1391	0.9519

studies, which may also explain the use of rigid rather than flexible nasal endoscopy in this study [5,6,9,13]. In our study, nasal endoscopy had a significant relationship with recurrent otitis media and tympanometry. Therefore, endoscopy can be a good option in evaluating recurrent acute otitis media. This relationship was not found in the report of Wang et al [11]. However, the definite pathophysiology of this disease is uncertain.

8. Conclusion

The results of the present study indicated that the methods of radiography and nasal endoscopy could define the relationship between adenoid hypertrophy and associated symptoms and therefore are complementary. Between them, despite the popularity of nasal endoscopy, radiography still has its diagnostic role.

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