Original Article

Radiological estimation of adenoid weight; a reliable tool for assessment of candidacy for adenoidectomy

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Objective: To determine the sensitivity and specificity of clinical and radiological assessment of adenoid weight in children.

Methodology: This cross-sectional descriptive study was conducted at Social Security Hospital Islamabad, Pakistan from January 2008 to December 2010. Initial assessment was made by ENT surgeon. Clinical assessment score (CAS) was given as mild, moderate, moderately severe, severe hypertrophy. Then the size of adenoid was measured by lateral neck radiography. The AN ratio was calculated by radiologist. The weight were recorded by surgeon after adenoidectomy.

Results: We studied 55 children who were to undergo adenoidectomy. 30 (54.5%) were male and 25 (45.4) were female with age range of 3 to 12 years (mean 6.1 years). The mean AN ratios was 0.69 (range 0.54-0.75, SD ± 0.104). RAS had shown specificity and sensitivity of 89.4% and 91.6% for moderately severe and 90% and 94.8% for severe adenoid hypertrophy. CAS had approximately 85% of specificity and sensitivity for both moderately severe and severly hypertrophied cases.

Conclusion: Both clinical assessment and radiography could determine relationship between adenoid hypertrophy and associated symptoms and therefore are complementary. Between them, radiography can serve as a better planning tool. (Rawal Med J 2013;38:286-289).

Key Words: Adenoidal-nasopharyngeal ratio (AN ratio), adenoids, obstructive sleep apnea.

INTRODUCTION

Adenoidal hypertrophy and recurrent adenotonsillitis are common disorders which cause substantial morbidity in pediatric age group.[1] Severe upper airway obstruction due to adenoids causing obstructive sleep apnea (OSAS) and cardiorespiratory syndrome may necessitate urgent surgical removal of the adenoids.[1,2] Although regarded as a generally safe procedure, adenoidectomy and/or tonsillectomy can be complicated by reactions such as bleeding, adverse anesthetic events, dehydration, pain, and even death.[1] Hence, proper diagnosis of adenoid hypertrophy is essential to avoid those cases where surgery is not needed. Clinical assessment, alone can be misleading when a decision for adenoidectomy has to be taken.

The adenoidal-nasopharyngeal ratio (AN ratio) was used to measure adenoids in normal children.[3] This ratio is derived from linear measurements on lateral radiographs of the nasopharynx. Statistically derived standards for this AN ratio was obtained from measurements of infants and children of varying ages.[4] According to this method, the thickness of the soft palate (SP) in its superior anterior part and the airway column (AC) immediately posterior to it were measured and AC/SP ratio was calculated. The measurement was done about 1 cm below the upper end of the soft palate in children > 3 years of age and half a centimetre in younger children (Fig. 1).

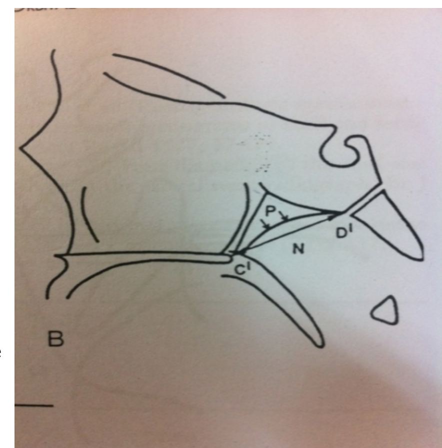


Fig. 1. Nasopharyngeal measurement. "N" is distance between "C"; posterior superioredge of hard palate and "D"; anteroinferior edge of sphenobasioccipital synchondrosis.

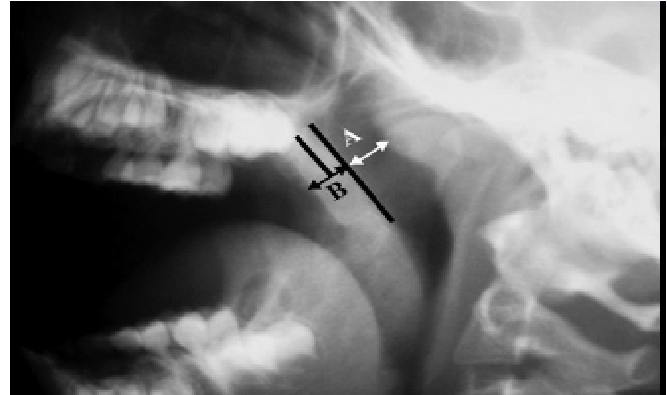
Degree of obstruction was graded as follows: AC/SP ? 1 (grade 0 or no obstruction), AC/SP= 0.50-0.99 (grade 1 or mild obstruction), AC/SP= 0.01-0.49 (grade 2 or severe obstruction), AC/SP= 0 (grade 3 or total obstruction). Nasal endoscopy in the assessment of adenoid hypertrophy was compared with lateral neck radiography and it was better tool for adenoid hypertrophy.[5] The aim of present study was to determine the sensitivity and specificity of radiological assessment of adenoid weight in children.

METHODOLOGY

In this study, children who had suffered from nasal obstruction and mouth breathing were selected to undergo adenoidectomy by ENT surgeon. Children with nasal obstruction due to other causes like septal deviation, allergic rhinitis, nasal injury, acute infections and congenital nasal deformities were excluded. The study was conducted in Social Security Hospital Islamabad, Pakistan from January 2008 to December 2010. 55 children were with age range of 3-12 years were included. Informed consent from parents of all children was obtained.

Initially clinical assessment was made by ENT surgeon. Clinical assessment score (CAS) was given as mild, moderate, moderately severe, severe hypertrophy. Mild: Adenoid occupying 25% or less of nasopharyngeal airway; Moderate: Adenoid occupying 25-50%; Moderately Severe: Adenoid occupying 50-75% or less and Severe: Adenoid occupying 75% or more. The size of adenoid was measured on lateral neck radiography where nasopharynx was exposed with the patient in the erect position and head fixed with radiograph cassette. The exposure were made with 100 kv and 50 mA. The exposure time varied between 0.4-0.6 milli second. The tube cassette distance was 180 cm. With this median plane is enlarged by 65%. The AN ratio was calculated by radiologist (Fig 2).

Fig. 2._Radiographic evaluation of adenid size by the method of Cohen and Konak. Thickness (mm) of "Airway column" (A) and "Soft palate" (B) is measured and A/B ratio is calculated in order to evaluate nasopharyngial airway patency.



The adenoid measurement were done as follows: A represents the distance from the point of maximum convexity of adenoid shadow to line B along the margin of basiocciput. The nasopharyngeal measurement N, is distance between the posterior border of the hard palate (P) aand anterio-inferior edge of the sphenobasioccipital synchondrosis (S). The AN ratio was calculated by dividing measurement for A by the value for N.

All measurements were made with a caliper to within ± 0.1mm. An overall impression of the size of adenoid and nasopharyngeal airway was scored by assessing the radiographic adenoid shadow incrementally as mildly enlarged (0), moderately enlarged (1), moderately severe enlarged (2) and severely enlarged (3). The nasopharyngeal airway was rated as mildly narrowed (0), moderately narrowed (1), moderately severe narrowed (2) and severely narrowed (3). These scores were combined to give the radiological assessment score (RAS). The average score was calculated for each case. Same ENT surgeon performed all adenoidectomies by standard curettage technique. Immediately after removal the tissue was washed and weighed using digital balance machine.

RESULTS

A total of 55 children were included in the study, 30 (54.5%) were male and 25 (45.4%) were female.

Their age ranged from 3 to 12 years (mean 6.1±1.42 years). The clinically assessed score (CAS) showed there were 3 (5.4%) cases with mild adenoid hypertrophy, 10 (18%) cases of moderate, 19 (34.5%) cases of moderately severe and 23 (41.8%) cases of severly adenoid hypertrophy. Where as radiologically assesssed score (RAS) categorized 2 (3.63%) cases as mild adenoid hypertrophy, 14 (25.4%) cases of moderate, 22 (40%) cases of moderatly severe and 17 (30.9%) cases as severly hypertrophied adenoids (Table 1).

Table 1. Radiological assessment of adenoids.

Degree of hypertrophy	% age of Nasopharyngeal airway involved
Mild	Adenoid occupying 25% or less
Moderate	Adenoid occupying 25-50%
Moderately Severe	Adenoid occupying 50-75%
Severe	Adenoid occupying 75% or more

But when adenoid weight was calculated postoperatively, we found that 1 (1.8%) case was mildly hypertrophied, 13 (23.6%) cases were moderately hypertrophied, 25 (45.4%) cases were moderatly severe and 16 (29%) were with severly hypertrophied adenoids.

The mean AN ratio was 0.69 (range 0.54-0.75±0.104). The mean value was 0.583 (range 0.499-0.621±0.0741) (Table 2).

Table 2. Mean AN ratio.

Adenoid Size	AN ratio	
	Range	Mean ± SD
Mild	0.499-0.621	0.593 ± 0.0771
Moderate	0.551-0.611	0.441 ± 0.0663
Moderately Severe	0.652-0.743	0.680 ± 0.1023
Severe	0.721-0.855	0.728 ± 0.1007

The sensitivity and specificity of all four categories were calculated both for radiologically assesssed score (RAS) and clinically assessed score (CAS). RAS found the specificity of 53% and sensivity of 36% for mild adenoid hypertrophy, whereas it showed specificity and sensitivity of 89.4% and 91.6% respectively for moderately severe and 90% and 94.8% for severe adenoid hypertrophy groups (Table 3).

Table 3. Specificity and sensitivity of scores.

Intensity of adenoid hypertrophy	Radiologically assesssed score (RAS) by AN ratio		clinically assessed score (CAS)	
	Specificity	Sensitivity	Specificity	Sensitivity
Mild	53%	36.3%	72%	66%
Moderate	51%	43%	71%	70%
Moderately Severe	89.4%	91.6%	85%	87%
Severe	90%	94.8%	86%	89%

CAS showed better specifivity and sensitivity for both mild and moderate cases i.e. 72%, 66% and 71%, 70% respectively. CAS has approximately 85% of specificity and sensitivity for both moderately severe and severly hypertrophied cases which is less than RAS.

DISCUSSION

We found a strongly significant correlation between intraoperative observation of adenoid size and lateral adenoid x-ray. Simple, accurate, and objective measurements for the radiographic assessment of adenoidal size in children may have important clinical applications. Several methods of adenoidal measurement have been reported. However, none has been widely accepted or implemented because the measurements have not expressed the maximal thickness of nasopharyngeal soft tissue,[1-4] have not consistently shown landmarks and have been impractical and too time consuming to be adapted for routine use.[6,7] Lateral x-ray had a great ability in diagnosis of adenoid hypertrophy but it has little effectiveness in determination of intensity.

In our study, it is noted that radiographs have more specificity and sensitivity for the children with severe and moderately severe hypertrophy which is more than 80 and 90 percent respectively. But these have shown only a little sensitivity and specificity for mild and moderate adenoid hypertrophy i.e. 53% and 36% respectively which is not remarkable enough to make a decision about surgery only on x-ray therefore some other modalities must be used for definite diagnosis of adenoid hypertrophy in mild and moderate cases. As shown in this study, clinical assessment is far better than x-ray in mild and moderate hypertrophied adenoid cases. The same suggestion is given by Modrzyasky M and others.[8-10]

The present study showed that the AN ratio

measured on simple lateral skull radiographs reliably expressed the adenoidal size and correlated well with the clinical assessment. This study will facilitate more accurate detection of those children most likely to benefit from adenoidectomy. The study showed that radiological method best correlated with the clinical finding. However some studies expressed that symptomatology had the overall highest correlation to endoscopic findings.[11,12] There was good agreement between the X-ray and endoscopic findings.

Lateral radiograph is a non-invasive procedure which is well tolerated by children, unlike a flexible endoscopy. Thus, it could be said that the ANR on lateral neck X-ray is a more reliable method for determining whether adenoidal hyperplasia is clinically significant or not, rather than the size of the adenoid or nasopharynx.[13,14]

CONCLUSION

Both clinical assessment and radiography could define the relationship between adenoid hypertrophy and associated symptoms and therefore are complementary. Between them radiography can serve as a better planning tool. The adenoidal-nasopharyngeal ratio (ANR) was proposed as a convenient and practical method to evaluate adenoidal enlargement. The present study disclosed that the AN ratio measured on simple lateral skull radiographs reliably expressed the adenoidal size and correlated well with the clinical assessment score and the weight of adenoids removed at operation.

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Conception and design: Naushaba Malik.
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Drafting of the article: Naushaba Malik
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