

Original Research Article

Assessment of size of adenoid-comparison of adenoidal nasopharyngeal ratio and nasal endoscopy in children with chronic adenoiditis

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ABSTRACT

Background: Adenoid hypertrophy (AH) is a common cause of upper airway obstruction in paediatric patients and can have a significant influence on the health of the child. Children who have hypertrophic adenoids often exhibit nasal obstruction, snoring, sleep apnea, otitis media with effusion and craniofacial abnormalities. The main objective of this study was to know the association between size of adenoids and occurrence of otitis media with effusion (OME) and to correlate the grades of AH by lateral nasopharyngeal radiograph and nasal endoscope.

Methods: This was an observational cross-sectional study of 100 children who were diagnosed as chronic adenoiditis were studied clinically with relevant investigations. The digital X-ray nasopharynx lateral view and nasal endoscopic results of all the patients were analyzed and graded.

Results: Mean Adenoidal-nasopharyngeal ratio for which OME was present was 0.72 which corresponds to X-ray grade 2. It was also found that 80.6% of X-ray grade 3 adenoids had OME and 100% of cases of endoscopic grade 4 adenoids had OME in either or both ears. 36 cases with grade 3 X-rays, 69% were in endoscopic grade 3 and 19.4% cases were shown to have complete choanal obstruction (grade 4).

Conclusions: There is significant association between the size of adenoids and OME. The X-ray nasopharynx provides a more convenient method and nasal endoscopy is the gold standard method for determining whether the AH is clinically significant or not.

Keywords: Adenoidal-nasopharyngeal ratio, Otitis media with effusion, Transnasal endoscopy, X-ray nasopharynx lateral view

INTRODUCTION

The nasopharyngeal tonsil, commonly called as “adenoids”, is situated at the junction of the roof and the posterior wall of nasopharynx. Nasopharynx is the uppermost part of the pharynx and also called as the “epipharynx” or postnasal space. A fully-grown adenoid is shaped like a truncated pyramid with its base at the junction of the roof and the posterior wall of the nasopharynx and its apex pointing towards the nasal septum. Adenoid is subjected to physiological

enlargement in childhood. Recurrent attacks of rhinitis, tonsillitis and upper respiratory tract infections may cause adenoiditis and hyperplasia. The absolute size of the adenoid and the available space in the nasopharynx are the major factors which determine the severity of symptoms.¹ The ratio of these two sizes can provide a simple arithmetic measure of nasopharyngeal obstruction.

OME due to AH is one of the most common chronic otological problems dealt by otorhinolaryngologists. It is defined as the chronic accumulation of mucus within the

middle ear and sometimes the mastoid air cell system. It is common practice to attribute the occurrence of OME to adenoid hypertrophy conventionally especially to larger sizes of it and adenoidectomy is traditionally employed as the treatment for OME. One of the studies has shown that the growth of the adenoid outstrips that of the nasopharynx in children between 3 to 5 years of age with resultant reduction in the nasopharyngeal airway. Subsequently growth of the nasopharynx increases while adenoids remain relatively unchanged and thus the airway increases.

Concerns have been raised in the literature regarding the best way to diagnose adenoid hypertrophy in children.² The inaccuracy of patient history reported by some parents and difficulties in approaching young children are examples of subjective drawbacks in the process of clinical decision making.³ Although different objective modalities have been proposed for the diagnosis of AH (including mirror examination, palpation, lateral neck radiography, or nasal endoscopy), the role of each of these diagnostic methods is still controversial, and currently there is no comprehensive guideline for assessing adenoidal enlargement.

Objective methods for diagnosing AH are valuable in providing information about the need for surgery as well as assessing the outcome of patients after treatment. Traditionally, soft-tissue nasopharynx lateral radiographs have been shown to be effective in the assessment of adenoid size and airway patency. They are simple, readily available, and reproducible. Many different radiographic methods have been described in the evaluation of the size of the adenoid tissue, nasopharyngeal soft-tissue size, and airway width on lateral neck radiographs.⁴ In a comparative study among four different methods of adenoid measurement on lateral neck X-rays, Wormald et al, concluded that the Cohen and Konak method showed the highest positive predictive value and described this method as a useful diagnostic tool in children with adenoid hypertrophy.⁵ Mean adenoidal depth and mean nasopharyngeal depth were calculated as per Yusuf et al method.⁶ Mean ANR was calculated by dividing adenoidal depth by nasopharyngeal depth. ANR was first described by Fujioka et al, in 1979 as a reliable method of expressing the size of adenoids and patency of nasopharyngeal airway wherein a comparison of the amount of lymphoid tissue in the nasopharynx to the size of nasopharyngeal compartment was made. An ANR of greater than 0.7 is subjectively judged to have enlarged adenoids. There are some disadvantages associated with lateral neck films, including the exposure of the child to radiation, the lack of standardization in technique and film interpretation, and generation of a two-dimensional image from a three-dimensional structure. Furthermore, rotation of the skull and inspiration or phonation during X-ray examination could result in film misinterpretation.⁷

Nasal endoscopy has been considered as the standard method for the assessment of adenoid size in several

studies.⁷⁻⁹ It provides a direct anatomical view of the nasopharynx for determining the size of the adenoid and the degree of obstruction of the choanal opening. Nasal endoscopy gives objective and highly accurate results that correlate more closely with the severity of the adenoid hypertrophy than the lateral neck X-ray.^{7,8,10} Although nasal endoscopy is a reliable and safe diagnostic method, it also has a number of disadvantages. This procedure requires the co-operation of the child and may be difficult to perform in young children. Furthermore, assessment of the size of the adenoid tissue and choanal obstruction during endoscopy are generally determined based on the subjective analysis of the clinicians and can reveal discrepancies.

METHODS

This study was conducted in the department of otorhinolaryngology, government medical college Thrissur, Kerala for a period of one year from October 2016 to September 2017. This was an observational cross-sectional study of 100 children who presented with snoring, mouth breathing, nasal obstruction, nasal discharge, recurrent respiratory infections, hard of hearing and diagnosed as chronic adenoiditis were studied clinically with relevant investigations. All new cases in the age group of 3-12 years with clinical and radiologic features of AH were included. Those excluded are patients with previous adenoidectomy, cerebral palsy, genetic syndrome, ear discharge, tympanic membrane (TM) perforation, cleft palate, and congenital ear deformities. Detailed history and clinical examination including otoscopy to see the status of TM were done. The digital X-ray nasopharynx lateral view of all the patients were analysed to calculate the ANR and corresponding X-ray grades were noted. The adenoidal measurement represents the distance from the point of maximal convexity of the adenoid shadow (A1-Figure 1) antero-inferiorly to the anterior margin of the basi-occiput (A-Figure 1).

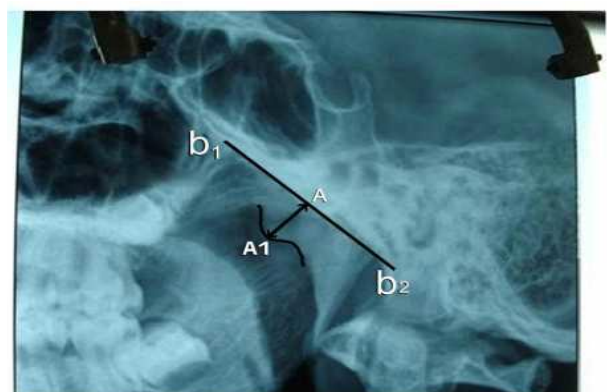


Figure 1: Adenoidal measurements of x-ray nasopharynx: A represents distance from A1, point of maximal convexity, along inferior margin of adenoid shadow to line b1b2, drawn along straight part of anterior margin of basi-occiput.

The nasopharyngeal measurement represents the distance between the posterior border of the hard palate and speno-basi-occiput-synchondrosis (b1-b2 Figure 1). ANR was graded as follows:

- Grade 0 (0.0-0.25) no adenoid enlargement
- Grade 1 (0.26-0.50) minimal enlargement
- Grade 2 (0.51-0.75) moderate enlargement
- Grade 3 (0.76-1.00) gross enlargement.

Student t test was done to compare mean ANR with the presence of OME and statistically significant difference with a p value 0.024 (<0.05) was obtained.

All children underwent a transnasal endoscopy after application of topical anesthesia (lignocaine 2%) at both nostrils. Transnasal endoscopy was done just before the surgery in some children who were posted for adenoidectomy under general anaesthesia. The degree of obstruction by the adenoid tissue over the posterior choanae was estimated using the grading system proposed by Clemens and McMurray.

- Grade I: Adenoid tissue filling one-third of the vertical portion of the choanae.
- Grade II: Adenoid tissue filling from one-third to two-thirds of the choanae.
- Grade III: From two-thirds to nearly complete obstruction of the choanae.
- Grade IV: Complete choanal obstruction.

RESULTS

Majority of the children were in the age group 3-5 years and 5-7 years in this study (Figure 2). There was male preponderance (M:F = 1.6:1) (Figure 3). Most of the cases presented with snoring and mouth breathing (n=75), nasal obstruction (n=68), recurrent respiratory infections (n=58) and hard of hearing (n=62) (Figure 4).

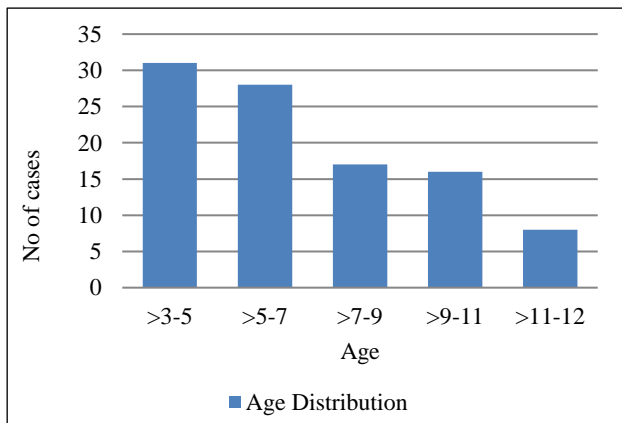


Figure 2: Age distribution of present study.

In the present study, almost equal number of children presented with (48%) and without (52%) features of adenoid facies (Figure 5). Concomitant involvement of

tonsil was seen in 87% of cases indicating common etiological factor acting on both adenoids and tonsils. On otoscopic examination the appearance of TM varied from normal (19%) to dull and retracted (47%) and dull and bulging (34%), may be because of different pathological stages of OME (Figure 6).

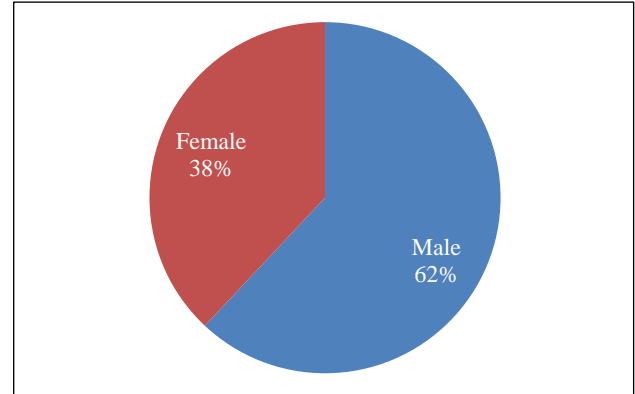


Figure 3: Sex distribution of present study.

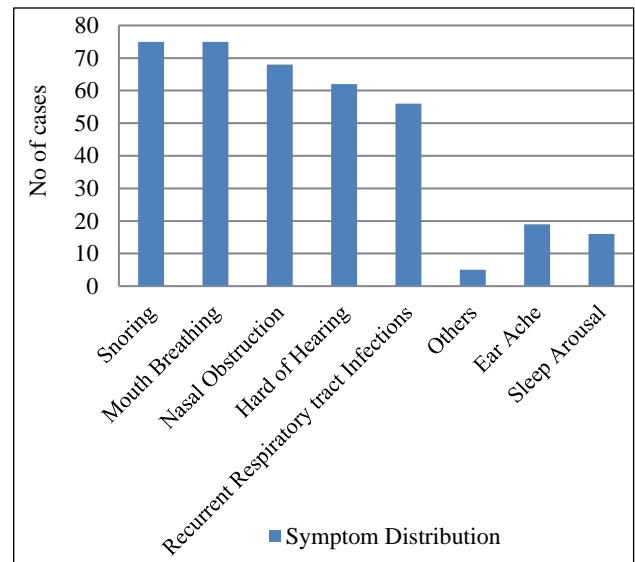


Figure 4: Symptomatology of present study.

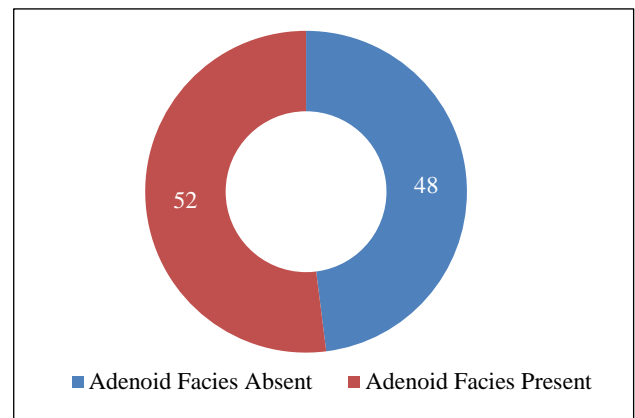


Figure 5: Association with adenoid facies.

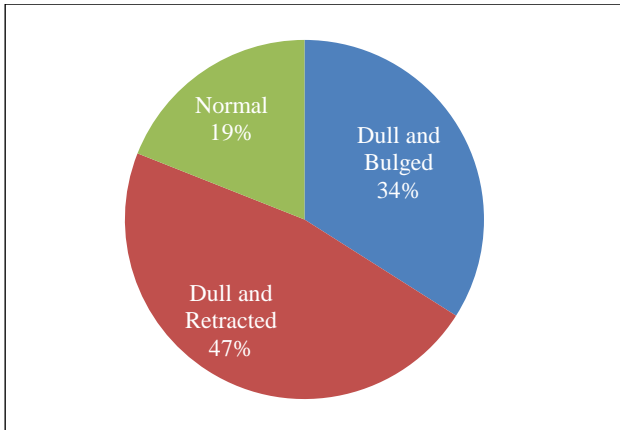


Figure 6: Appearance of tympanic membrane.

Table 1: Comparison of adenoidal-nasopharyngeal ratio with OME.

OME	No. of cases	Mean(+/-SD)
Present	62	0.7223 (+/-0.105)
Absent	38	0.6768 (+/-0.081)

Table 2: Distribution of clinical cases in various X-ray grades.

ANR	X-ray Grade	No. of cases
0-0.25	0 (no enlargement)	0
0.26-0.50	1 (minimal enlargement)	1
0.51-0.75	2 (moderate enlargement)	63
0.76-1.00	3 (gross enlargement)	36

Table 5: Adenoid hypertrophy: X-ray and endoscopic grades.

X-ray grade	Endoscopic Grade				Total
	1	2	3	4	
1	1 (100%)	0	0	0	1
2	11 (17.5%)	31 (49.2%)	21 (33.3%)	0	63
3	0	4 (11.1%)	25 (69.4%)	7 (19.4%)	36
Total	12	35	46	7	100

Table 6: X-ray grading and mouth breathing.

X-ray Grades	Mouth breathing		Total
	Absent	Present	
1	1(100%)	0	1
2	22(34.9%)	41(65.1%)	63
3	2(5.6%)	34(94.4%)	36
Total	25	75	100

On comparing the endoscopic and X-ray grades it was seen that out of the 36 cases with grade 3 X-rays, 69% were in endoscopic grade 3 (>2/3rd filling the vertical

Table 3: OME and X-ray grades.

X-ray grades	OME (either or both ears)	No OME	Total cases
Grade 0	0	0	0
Grade 1	1 (100%)	0	1
Grade 2	32 (50.8%)	31 (49.2%)	63
Grade 3	29 (80.6%)	4 (19.4%)	36
Total	62	38	100

Table 4: OME and endoscopic grades.

Endoscopic grades	OME (either or both ears)	No OME	Total cases
Grade 1	5 (41.7%)	7(58.3%)	12
Grade 2	19 (54.3%)	16(45.7%)	35
Grade 3	31 (67.4%)	15(32.6%)	46
Grade 4	7 (100%)	0(0%)	7
Total	62	38	100

Mean ANR for which OME was present was 0.72 (Table 1) which corresponds to X-ray grade 2 (Table 2). Out of the 100 X-rays analyzed, majority of cases had grade 2 adenoid enlargement (63%) followed by grade 3 (36%) (Table 2). It was also found that 80.6% of X-ray grade 3 adenoids had OME (Table 3) and 100% of cases of endoscopic grade 4 adenoids had OME in either or both ears (Table 4).

Student t test was done to compare mean ANR with the presence of OME and statistically significant difference with a p value 0.024 (<0.05) was obtained.

height) and 19.4%cases were shown to have complete choanal obstruction, i.e. grade 4 (Table 5).

Table 7: Endoscopic grading and mouth breathing.

Endoscopic grades	Mouth breathing		Total
	Absent	Present	
1	7 (58.3%)	5 (41.7%)	12
2	10 (28.6%)	25 (71.4%)	35
3	7 (15.2%)	39 (84.8%)	46
4	1 (14.3%)	6 (85.7%)	7
Total	25	75	100

Whereas out of the 63 cases with X-ray grade 2, 49.2% cases were in endoscopic grade 2 (>1/3 of vertical height of choana) and 33.3% cases were in endoscopic grade 3 (Table 5). 94.4% of children with X-ray grade 3 adenoids were mouth breathers, and 65.1% of grade 2 were also mouth breathers (Table 6). 85.7% of endoscopic grade 4 and 84.8% of grade 3 were mouth breathers (Table 7).

DISCUSSION

This study showed close association between size of adenoids and occurrence of OME, as maximum number of cases corresponds to higher grades of AH (X-ray grades 2 and 3 and endoscopic grades 3 and 4). Mean ANR for which OME present was 0.72, which corresponds to X-ray grade 2 and shows statistically significant association of OME to adenoid size. In this study the ANR was maximum at an average of 0.7364 in age group of 5-7 years and 0.7312 in 7-9 years, in whom the signs and symptoms of adenoid hypertrophy were more common. ANR gradually decreases to 0.683 in children of 9-11 years of age which correlates with the study by Fujioka M et al.¹

The study done by Farhad et al, also demonstrated a high prevalence of adenoid size 3+ among patients having unilateral and bilateral OME, accounting for 16% and 37% of all cases with OME accordingly. Another recent study done in Nigeria in 2010 by Orji FT et al, on children with OME also found a significant association between type B tympanogram and the presence of significant (grade 4) nasopharyngeal obstruction.¹¹

However, a significant percentage of cases with smaller grades of adenoid hypertrophy also shows presence of OME which essentially points to the role of other etiological factors as well. It is possible that such adenoid, even though of small size, encroached laterally to obstruct the ET of the involved ear. Such lateral encroachment was reported to be significant in influencing development of OME. Wright and his colleagues studied on the importance of endoscope in the assessment of adenoid enlargement in lateral direction rather than anterior direction which will be missed by routine X-ray of the postnasal space.¹² The current findings were in agreement with Lourenco et al, who found that the mouth breather children who showed small adenoid by X-ray were mostly had moderate size adenoid when examined by endoscopy, those with moderate size adenoid by the X-ray were mostly considered large by endoscope and lastly those with large adenoid seen by X-ray were seen also large by endoscope.² This is what made Wormald et al, to indicate in doubtful cases nasal endoscopy under local anesthesia to provide definitive evaluation of nasal cavity and the state of post nasal space.⁵

In present study, author found that 17.5% of patients who were in X-ray grade 2 were in endoscopic grade 1 and 33.33% patients in X-ray grade 2 were in endoscopic

grade 3. These differences were probably due to many factors which may include the lack of standardization of X-ray, the 2-dimensional views by X-ray rather than the 3-dimensional views by endoscope, and the effects of positional changes and respiratory movement of the patient. All these are examples of factors that may influence the findings and evaluation of the adenoid size by plain X-ray. Cohen et al, also support the inaccurate assessment of the adenoid size by plain X-ray, since they found that X-ray examination of the postnasal space to determine the adenoid size and the postnasal airway was poorly correlated with the size of adenoids at operation.¹³

On the other hand, nasal endoscope was a reliable, safe and easily tolerated with 3-dimensional view. In this study, evaluation by endoscope was more accurate than evaluation by X-ray. These results were supported by Yilmaz et al, and Kindermann et al, and their colleagues in their assessment of the adenoid size.^{14,15}

In this study, author observed that, more than 80% of cases with higher endoscopic grades (3 and 4) are mouth breathers. Similarly, 94.4% of children with X-ray grade 3 and 65.1% of X-ray grade 2 were also mouth breathers which show that both the modalities are equally relating well with the symptoms.

CONCLUSION

There is significant association between the size of adenoids and occurrence of OME. The proportion of OME increases with the severity of nasopharyngeal obstruction by AH. Mean adenoid size of 0.72 (X-ray grade 2) according to ANR was mainly seen among patients having unilateral or bilateral OME. So, an ANR of 0.72 should be considered as significant pathological enlargement and these children should be routinely sent for hearing evaluation. Although both X-ray and nasal endoscopy are equally good in assessing the size of adenoids, the digital X-ray nasopharynx lateral view is a more convenient method and nasal endoscopy is the gold standard method to determine whether the AH is clinically significant or not.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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