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Research Article

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Correlation of Adenoid-Nasopharyngeal Ratio and Otitis Media with Effusion among Children-A Cross-Sectional Study

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ABSTRACT

Background: Adenoid hypertrophy is a common childhood disease leading to pathologies of middle ear cleft. A mere digital X-ray can diagnose adenoid hypertrophy and combining it with tympanometry provides information regarding the level of eustachian tube obstruction. The Adenoid-Nasopharyngeal Ratio (ANR), obtained using simple arithmetic calculation provides the degree of nasopharyngeal obstruction.

Methods: A study was done at a tertiary care hospital in Mandya on 144 children in the age group 5-15 years. The study subjects were subjected to digital X-ray and impedance audiometry. Fujioka method was employed to measure nasopharyngeal and adenoid dimensions.

Results: In this study, tympanometric type B curves were found to be maximum in ANR between 0.901-1 indicating the highest occurrence of otitis media with effusion (OME) in ANR between 0.901-1.

Conclusion: The ANR and impedance audiometry used here indirectly quantifies the causation of middle ear pathology by adenoids. Also, these are non-invasive, economical, easily available and safely performed at the outpatient department. Thus, paves the way for timely and appropriate diagnosis and initiation of treatment, thereby preventing the progression to hearing loss.

Key-words: Adenoid-nasopharyngeal ratio (ANR), Adenoid hypertrophy, Impedance audiometry, Otitis Media with Effusion (OME), Tympanometric type B Curve

INTRODUCTION

Adeno-tonsillar enlargement, also known as palatine tonsil enlargement, can coexist with adenoid enlargement, a common immunological condition in children [1]. Adenoids that are repeatedly exposed to upper respiratory tract infections develop hyperplasia, which results in mouth breathing, snoring, nasal blockage, and hyponasal speech [2]. It has been demonstrated that the adenoid tissue can infect or have a mass effect on otitis media [3,4]. A middle ear clinical syndrome known as otitis media with effusion (OME) is characterised by effusion behind an intact tympanic membrane without any indications of acute inflammation [1,5].

90% of OME episodes end on their own in three months or less, but thirty to 40% of children have OME again, and 5-10% of episodes continue for a year or more [6,7]. 6.1% of elementary school youngsters in India have OME [1,8]. The frequency of OME's correlation with adenoid hypertrophy varies according to the study regions.

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In India, 36% of cases have been associated with OME and adenoid hypertrophy [9]. Children with OME-related hearing loss may experience behavioural issues, linguistic delays, auditory difficulties, and poor academic performance [3,10]. In addition to providing a straightforward numerical measure of nasopharyngeal blockage, the Adenoid—Nasopharyngeal Ratio (ANR) can also predict the extent of middle ear impairment when used in conjunction with tympanometry [9].

MATERIALS AND METHODS

Study setting- Department of Otorhinolaryngology, Mandya Institute of Medical Sciences, Mandya.

Study Design- Cross-sectional study

Study Period- The study was done 6 months after the approval from IEC, MIMS.

Study Population- Children with a clinical diagnosis of adenoid hypertrophy.

Sample size: 144.

Method of Data Collection (study tools)- Children between 5-15 years who attended the outpatient department of Otorhinolaryngology of MIMS, Mandya with symptoms such as snoring, mouth breathing, nasal obstruction, recurrent upper respiratory tract infections or decreased hearing were subjected to An X-ray of the child's nasopharynx lateral view, with their head held erect [2,10,11]. If Adenoid hypertrophy was noted, the size of the nasopharynx and adenoid were measured separately on the X-ray. Fujioka method was used to derive the adenoid-nasopharyngeal ratio (ANR) [2,12].

Inclusion criteria- Children between 5-15 years who presented to the outpatient department of Otorhinolaryngology of MIMS, Mandya with symptoms such as nasal obstruction, mouth breathing, snoring or decreased hearing with X-ray nasopharynx suggestive of adenoid hypertrophy and an intact tympanic membrane.

Exclusion Criteria- Children who have a previous history of ear discharge, cleft palate, ear discharge, or other craniofacial abnormalities, who didn't co-operate for tympanometric evaluation, who underwent tonsillectomy, adenoidectomy or ear surgeries.

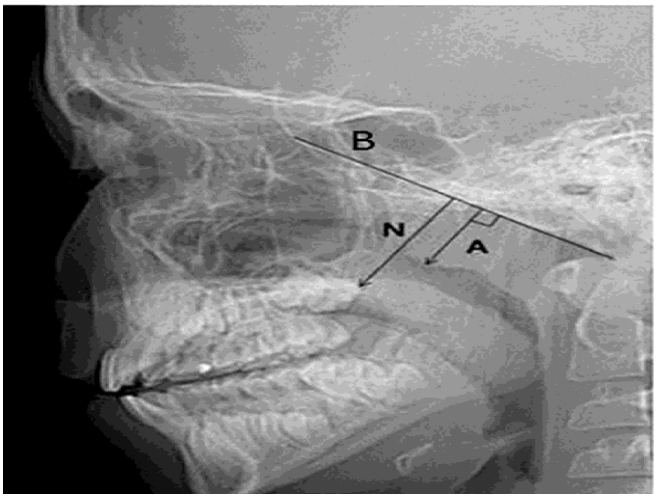

Fig. 1: Lateral nasopharynx X-ray. Fujioka method [13]

ANR= A/N

B: Line drawn along the sphenobasiocciput,
N: The distance between superior/posterior edge of the hard palate and anterior/inferior edge sphenobasioccipital synchondrosis,
A: Line running perpendicular from the point of maximum convexity along inferior margin of adenoid shadow to point of intersection with B.

Parents, who consented to participate in the study were given information on the necessity for additional research to determine the impact of adenoid hypertrophy on the middle ear, and they underwent a through ENT history and then an examination. Tympanic membrane perforations and acute otitis media were ruled out by otoscopy, which was used to determine the patency of the tympanic membranes. The same audiologist performed impedance audiometry on each child. Classification of tympanometry patterns was based on Jerger's classification as A, As, Ad, B (flat), and C [14].

Statistical Analysis- An MS Excel spreadsheet was filled out with data. The data was analyzed using the statistical package for social sciences, or SPSS. Utilizing the 3X3 Fisher Exact test, a strong correlation between OME and ANR was discovered.

Ethical approval- The above study was approved by the Institutional Ethics Committee, Mandya. Every informed consent was obtained from their parents before the study.

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RESULTS

This study had 144 participants comprising 288 ears assessed. More than half (57%) were aged more than 10 years. About 59% were males and 41% were females amounting to male: female ratio of 1.4:1.

Maximum number of study subjects had grade III adenoid hypertrophy (47%), followed by grade IV (43%) and grade II (10%). Tympanometric curves B and C were used as indicators of OME. Total (22) 74 (26%) ears had B-type curves and 54 (19%) ears had C-type curves. Tympanometric type B curve was more frequently found with grade IV adenoid hypertrophy.

Maximum frequency of ANR (Fig. 2) was found between 0.901-1 (37%), followed by 0.701-0.8 (27%) and 0.601-0.7 (17%). The correlation of ANR concerning OME is shown in Fig. 3, wherein statistically significant results were observed in the left ear (p=0.041).

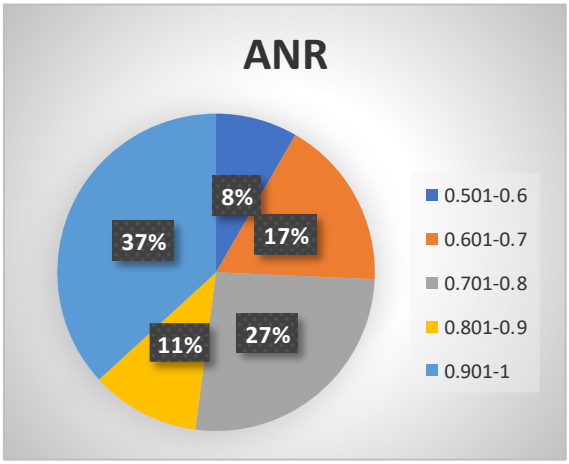

Fig. 2: prevalence of adenoid nasopharyngeal ratio

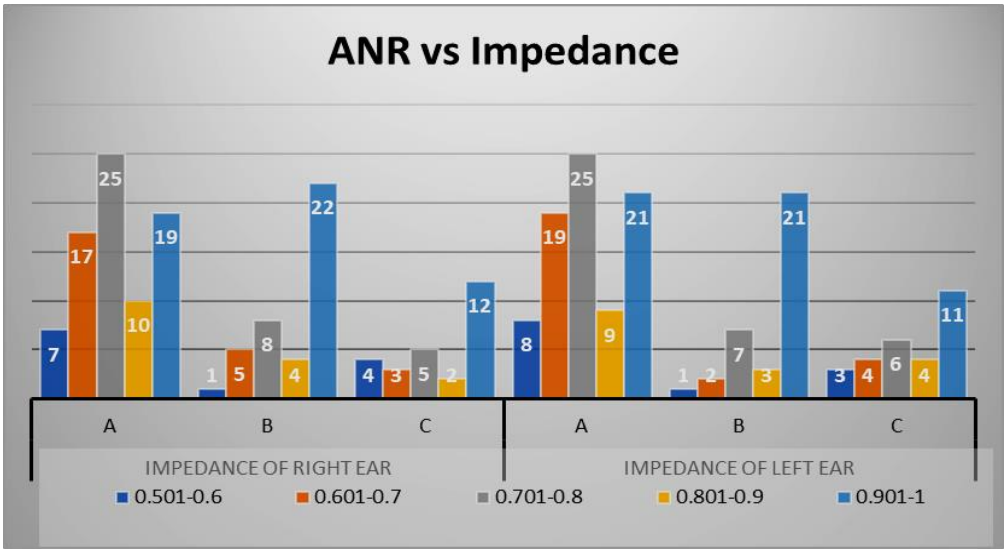

Fig. 3: Graph showing the relation between ANR and type of tympanometry curve

DISCUSSION

The study was conducted in a Tertiary health centre in Mandya, Karnataka for 6 months. When assessing children who may have adenoid hypertrophy, the lateral X-ray of the nasopharynx is a useful tool because it correlates with objective measurements of the condition [15]. Although the lateral X-ray is an effective tool in assessing the adenoid, endoscopic findings correlate to the maximum [16]. However, the present study uses lateral X-rays of the nasopharynx for assessing adenoids and also the volume of the nasopharynx was measured.

There is a significant correlation in the development of OME between patients with adenoid hypertrophy [1]. To explain this, there is a school of thinking that suggests OME may be caused by a mix of factors, such as bacterial and adenoidal biofilm, adenoid local immune

modulation, and IgE-mediated allergic reaction, rather than the direct mechanical blockage of the Eustachian tube opening by adenoids. [2,17,18]. However, the present study correlates adenoid hypertrophy with OME contradicting the above studies.

The adenoid-nasopharyngeal ratio is a reliable indicator of the nasopharyngeal airway in children with obstructive adenoids [19]. Similar findings were noted in our present study with a significant correlation between ANR and the impedance curves.

In our investigation, like in the previous studies, grade III adenoid hypertrophy was common and statistically significant with OME [20].

In this study, B-type curves were maximum in ANR 0.901-1(43 out of 74) followed by 0.701-0.8(15 out of 74) and C-type curves were also maximum in ANR 0.901-1(23 out of 54) followed by 0.701-0.8(11 out of 54). Thus, the maximum pathological tympanometry curves are observed in these ANRs and show a statistically significant correlation between the ANR and tympanometry curve.

CONCLUSIONS

From this study, at least one child out of every two with enlarged adenoids may also be burdened with asymptomatic (98%) or symptomatic (2%) OME. Thus, active screening of children with adenoid hypertrophy for OME plays a pivotal role in the management to achieve the best results. It can be concluded that an ANR of more than 0.701 can be considered significant and should alert the treating physician to warrant attention towards middle ear effusion. This study also shows the feasibility of outpatient techniques such as digital X-ray and tympanometry which can easily diagnose the cases of OME. Another important independent risk factor for OME in children is adenoid hypertrophy.

CONTRIBUTION OF AUTHORS

Research concept- Ravi D, Balaji NK, Manasa B Anand
Research design- Ravi D, Balaji NK, Manasa B Anand
Supervision- Ravi D, Balaji NK
Materials- Ravi D, Balaji NK, Manasa B Anand
Data collection- Ravi D, Balaji NK, Manasa B Anand
Data analysis and Interpretation- Ravi D, Balaji NK, Manasa B Anand
Literature search- Ravi D, Balaji NK, Manasa B Anand
Writing article- Ravi D, Balaji NK, Manasa B Anand
Critical review- Ravi D, Balaji NK
Article editing- Ravi D, Balaji NK, Manasa B Anand
Final approval- Ravi D, Balaji NK

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