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Original Article

Severity and Types of Hearing Loss in Patients with Hypertrophic Adenoids

Daniel Akhtar[1], Muhammad Sikander Ghayas Khan[2]*, Ayesha Badar[3], Sultan Badar Munir[4], Saffa Nawaz[3], Ultamish[5], Nimra Nawaz[6]
[1]Clinical Coordinator, Department of Rehabilitation Sciences, The University of Lahore, Lahore, Pakistan.
[2]Head of Department, Department of Rehabilitation Sciences, The University of Lahore, Lahore, Pakistan.
[3]Lecturer, Department of Rehabilitation Sciences, The University of Lahore, Lahore, Pakistan.
[4]The University of Child Health Sciences The Children Hospital Lahore Pakistan.
[5]Consultant Audiologist, CI Center, AV HEARING AIDS, Rawalpindi, Pakistan.
[6]Consultant Speech and Language Pathologist, The University of Lahore, Lahore, Pakistan.
Corresponding Author: Muhammad Sikander Ghayas Khan, Head of Department; Email: sikander.ghayas@dhpt.uol.edu.pk
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ABSTRACT

Background: Hearing loss in children can significantly impact language development and social interaction. Hypertrophic adenoids are a common pediatric condition that can contribute to hearing impairments. Understanding the prevalence and severity of hearing loss in this demographic is crucial for effective management and intervention strategies.

Objective: The study aimed to determine the prevalence and severity of hearing loss among children with hypertrophic adenoids, assessing the demographic characteristics and the types of hearing loss observed in this population.

Methods: This observational cross-sectional survey was conducted over nine months at the Children's Hospital and Institute of Child Health, University of Lahore Teaching Hospital. The study included a sample size of 339 children aged 5-13 years, calculated based on a prevalence rate of 67.3% for mild hearing loss. Children with comorbidities like Down syndrome, Autism, ADHD, and other disabilities were excluded. Hearing assessments were conducted using an otoscope, a tympanometer, and a diagnostic audiometer (MAICO MA41 model). Data were analyzed using SPSS Version 25.0, focusing on the frequency and percentage of various types of hearing loss.

Results: The study included 183 males (54%) and 156 females (46%), with a higher representation from rural areas (60%, n=203). Tympanometric analysis revealed 51.9% (n=176) with Type A tympanograms, 43.1% (n=146) with Type B, and 5% (n=17) with Type C. Audiometric results showed that 53.1% (n=180) of participants had normal hearing levels, while 27.1% (n=92) experienced mild hearing loss, 16.2% (n=55) had moderate hearing loss, 3.5% (n=12) had moderately severe hearing loss, 1.5% (n=5) had sensorineural hearing loss, and 2.1% (n=7) had mixed hearing loss.

Conclusion: The study demonstrates a significant occurrence of mild to moderate conductive hearing loss in children with hypertrophic adenoids, particularly in rural settings. These findings highlight the need for regular auditory screening and early intervention strategies in this demographic to prevent long-term speech and language complications.

Keywords: Hypertrophic Adenoids, Hearing Loss, Children, Conductive Hearing Loss, Audiometry, Tympanometry, Sensorineural Hearing Loss, Pediatric Otolaryngology.

INTRODUCTION

Hearing loss, a condition that can affect one or both ears, varies in severity from mild to severe and can impact individuals of any age, though it is more common in those over 60. A specific type of hearing impairment is conductive hearing loss (CHL), characterized by normal bone conduction (BC) and air conduction (AC) thresholds (1). CHL often results from issues affecting the middle ear, tympanic membrane, or external ear canal and can be either temporary or permanent, depending on the location and nature of the lesion. The causes of CHL can affect either the middle ear or the outer ear, with common causes including impacted wax, foreign objects, otitis externa, trauma, stenosis, or narrowing of the ear canal (2).

Adenoids, which enlarge naturally as children grow, reaching their peak size between three and seven years, can contribute to conductive hearing loss. Between the ages of 3 and 5, the rapid growth of the nasopharynx's soft tissue can constrict the

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nasopharyngeal airway. However, as the nasopharynx opens, the soft tissues are largely spared (3). Factors like allergies and environmental toxins can induce adenoid hypertrophy, causing the adenoid tissue to enlarge when exposed to allergens and irritants. Exposure to smoking or pollution may increase the risk of adenoid hypertrophy, and in rare cases, it has been linked to lymphomas, sinus tumors, and HIV infection (4, 5, 6). Generally, adenoidectomy is considered a safe procedure with common short-term side effects such as nose or mouth bleeding, bad breath, sore throat, fever, nausea, and vomiting. Less common side effects include dysphagia, ear pain, and long-lasting alterations in voice quality (7, 8, 9). Medical intervention may be necessary for persistent adverse effects (10).

Research by Kishore Kumar Halder in 2022 investigated the impact of adenoidectomy on hearing in children with otitis media with effusion. Patients underwent sedated adenoidectomy procedures, followed by a post-operative PTA and tympanometry after three months. The study revealed significant hearing improvement and changes in tympanometric findings post-surgery, highlighting adenoidectomy's role in reducing middle ear effusion, improving hearing, and aiding speech and language development in children with enlarged adenoids (11).

A study by Vadisha Bhat et al. in 2019 aimed to identify asymptomatic cases of otitis media with effusion in patients with adenoid hypertrophy. It found that a significant percentage of subjects had otitis media with effusion but no symptoms, suggesting that an objective test such as impedance audiometry could be beneficial in identifying fluid in the middle ear for prompt treatment and prevention of potential issues (12).

In 2021, M. Sikander Khan and colleagues investigated the prevalence of hearing loss in patients with middle ear infections. Their findings indicated that a majority of the patients experienced some degree of hearing loss, ranging from mild to severe (13).

An alternative study conducted by David E. Tunkel MD in 2022 examined the frequency of otolaryngologic surgery in individuals with achondroplasia. The study found a significant proportion of patients undergoing pharyngeal surgeries, including adenoidectomies, and tympanostomy tube insertions, highlighting the need for careful monitoring and potential surgical interventions in this population (14).

Finally, a 2023 study by Qing Qing Zhang et al. focused on the impact of obstructive sleep apnea (OSA) on the middle ear cavities of children. The study compared tympanometry parameters between children with and without OSA, finding significant differences in acoustic compliance and negative pressure in the middle ear cavity. Interestingly, the study observed that surgical treatment for OSA led to a notable reduction in negative pressure in the middle ear cavity (15).

MATERIAL AND METHODS

The study, an observational cross-sectional survey, was conducted over a period of nine months, from April 2022 to January 2023, following the approval of the research synopsis by the ethical board. The setting for data collection was the Children's Hospital and the Institute of Child Health, University of Lahore Teaching Hospital. Utilizing the prevalence rate of 67.3% for mild hearing loss (16), the sample size was determined to be 339 children, calculated using an online sample size calculator (17).

In this study, a non-probability purposive sampling method was employed. The inclusion criteria encompassed boys and girls aged between 5 to 13 years. Children with comorbidities that could result in hearing loss, such as Down syndrome, Autism, ADHD, Cerebral Palsy, mental retardation, and other disabilities, were excluded. Additionally, all cases of conductive hearing loss (CHL) attributable to conditions like otosclerosis, tympanosclerosis, and ossicular dislocation were also excluded from the research.

The assessment tools used in this study included an otoscope, a standard, and a fully calibrated tympanometer, alongside a diagnostic audiometer, specifically the MAICO Company model MA41. Prior to the assessment, written consent was obtained from the family members of the children. The evaluation process involved examining the children's ears using an otoscope, assessing tympanic membrane function with a tympanometer, and determining the severity and types of hearing loss using a diagnostic pure-tone audiometer.

For the analysis of collected data, the Statistical Package for the Social Sciences (SPSS) Version 25.0 software was utilized. The frequency and percentage were the primary statistical methods used to ascertain the severity and types of hearing loss in children with hypertrophic adenoids. A significance level was set at $p < 0.05$.

In terms of ethical considerations, the study adhered to the ethical guidelines and standards for research involving human subjects. The confidentiality of participants' data was maintained throughout the study, and all procedures were conducted in compliance with the ethical principles laid down in the Declaration of Helsinki. The ethical approval for this study was obtained from the relevant institutional review board, ensuring that the research was conducted in an ethical and responsible manner.

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RESULTS

The study's results, as detailed in the demographic data (Table 1), revealed a distribution of ages among the participants. Of the total sample size, children aged 5-7 years constituted 26% (n=89), those aged 8-10 years accounted for 32% (n=107), and the largest age group was 11-13 years, making up 42% of the participants (n=143). Regarding gender distribution, males represented a slightly higher proportion at 54% (n=183), compared to females who constituted 46% of the sample (n=156).

Table 1 Demographic Table

Age	Frequency	Percentage %
5-7	89	26 %
8-10	107	32%
11-13	143	42%
Gender		
Male	183	54%
Female	156	46%

Table 2 Severity of Hearing Loss

Severity of HL	Frequency	Percent%
Normal (-10 to 25 dB)	180	53.1%
Mild (26 to 40 dB)	92	27.1%
Moderate (41 to 55 dB)	55	16.2%
Moderately Severe (56 to 70 dB)	12	3.5%

Table 3 Type of Hearing Loss

Type of HL	Frequency	Percent%
Normal Hearing Levels	180	53.1%
Conductive Hearing Loss	147	43.4%
Sensorineural Hearing Loss	5	1.5%
Mixed Hearing Loss	7	2.1%

In terms of the severity of hearing loss, as outlined in Table 2, the data indicated that more than half of the participants, precisely 53.1% (n=180), fell within the normal hearing range (-10 to 25 dB). Mild hearing loss (26 to 40 dB) was observed in 27.1% of the children (n=92), while moderate hearing loss (41 to 55 dB) was found in 16.2% (n=55). A smaller fraction, 3.5% of the participants (n=12), exhibited moderately severe hearing loss (56 to 70 dB).

The types of hearing loss, as presented in Table 3, showed that 53.1% of the children (n=180) had normal hearing levels. Conductive hearing loss was observed in 43.4% of the participants (n=147), indicating a significant prevalence of this type of hearing loss in the studied population. Sensorineural hearing loss was relatively rare, identified in only 1.5% of the children (n=5), while mixed hearing loss was found in 2.1% of the cases (n=7). This distribution of hearing loss types underscores the prominence of conductive hearing loss in the sample and highlights the variability in hearing loss severity among children with hypertrophic adenoids.

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DISCUSSION

The demographic analysis of our study indicated a diverse age range among the participants, with the largest group being those aged 11-13 years (42%, n=143), followed by the 8-10 years age group (32%, n=107), and the 5-7 years age group (26%, n=89). In terms of gender distribution, the study encompassed a slightly higher proportion of males (54%, n=183) compared to females (46%, n=156). An interesting observation was the higher prevalence of children from rural areas (60%, n=203) as opposed to urban areas (40%, n=136), possibly indicating a geographical disparity in the incidence of hypertrophic adenoids.

Comparatively, Inoshita A et al.'s 2018 study highlighted gender differences in craniofacial features and the severity of obstructive sleep apnea (OSA) in pre-adolescent groups, showing higher OSA indices in girls than in boys (18). This may suggest a potential correlation between craniofacial anatomical differences and the development of hypertrophic adenoids in different genders, although our study did not specifically investigate this aspect.

The medical history of the children in our study revealed that the majority (87.6%, n=297) had normal birth histories, while a minority (12.4%, n=42) had delayed birth histories. The tympanometric analysis displayed a predominance of Type A tympanograms (51.9%, n=176), followed by Type B (43.1%, n=146), and a smaller percentage of Type C tympanograms (5%, n=17). Hazem M. Abdel Tawab, MD's 2021 study also found a high prevalence of Type B tympanometry, particularly in the left ears (19). This similarity underscores the significance of tympanometry in diagnosing middle ear pathologies in children with hypertrophic adenoids.

In terms of auditory outcomes, a significant proportion of participants (53.1%, n=180) had normal hearing levels. However, there was a notable presence of mild conductive hearing loss (27.1%, n=92), followed by moderate (16.2%, n=55) and moderately severe hearing loss (3.5%, n=12). Additionally, a small percentage experienced sensorineural (1.5%, n=5) and mixed hearing loss (2.1%, n=7). Vadisha Bhat's 2019 study aligns with these findings, indicating a significant incidence of conductive hearing loss in patients with chronic otitis media with effusion (20).

The strength of this study lies in its comprehensive demographic, tympanometric, and audiometric data, providing valuable insights into the characteristics of hearing loss in children with hypertrophic adenoids. However, limitations include the lack of in-depth analysis of potential causative factors, such as environmental influences or genetic predispositions, which could provide a more holistic understanding of the condition. Additionally, the study's cross-sectional design limits the ability to infer causality or the progression of hearing loss over time.

For future research, it is recommended to incorporate a longitudinal approach to better understand the progression of hearing loss in children with hypertrophic adenoids. Investigating the impact of environmental factors, dietary habits, and genetic predisposition could also provide a more comprehensive understanding of the condition. Furthermore, expanding the geographic scope of the study to include more diverse populations could help in identifying potential regional differences in the prevalence and severity of hypertrophic adenoids and associated hearing loss.

CONCLUSION

In conclusion, this study highlights the significant prevalence and varying degrees of hearing loss among children with hypertrophic adenoids, with a notable occurrence of mild conductive hearing loss. The demographic distribution revealed a higher representation of older children and a slightly higher proportion of males, with a majority coming from rural areas. The findings underscore the importance of routine hearing assessments in children with hypertrophic adenoids, particularly in rural settings. The study also points to the potential need for targeted interventions and awareness programs to address and manage hearing loss in this demographic. The correlation between tympanometric findings and hearing loss severity further emphasizes the necessity of incorporating tympanometric screening in the routine evaluation of children with adenoid hypertrophy. The implications of this study are far-reaching, suggesting a need for more comprehensive, longitudinal research to understand the progression and causal factors of hearing loss in children with hypertrophic adenoids, and to develop effective strategies for prevention, early detection, and intervention.

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