Section: Otorhinolaryngology

Original Research Article

A STUDY ON HEARING SCREENINGS FOR TYPICALLY DEVELOPING SCHOOL-AGED CHILDREN FROM RURAL CHITTOOR

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Abstract

Background: Auditory health challenges can impede educational outcomes in children. The aim is to investigate the prevalence of auditory challenges among school-going children in rural Chittoor. **Materials and Methods:** We assessed 181 children aged 7-15 years attending Government High Schools in Chittoor. Participants were divided into three age-based grades: Grade I (7-9 years), Grade II (9-12 years), and Grade III (12-15 years). Hearing evaluations were conducted at the District Early Intervention Center, Chittoor. Each child underwent an Otoscopic examination, followed by pure tone and immittance audiometry, using the Triveni Classic I audiometer, Maico MI24 impedance audiometer, and guidelines for pure tone and tympanometry screening. **Result:** Earwax Compaction: 23% had compacted earwax, with 55% exhibiting mild conductive hearing loss in the 250Hz-500Hz range. Post-intervention showed complete reversibility. Secretory Otitis Media (SOM): 11.6% were diagnosed with SOM. Among them, 5% maintained normal hearing, 52% had mild conductive impairment (250Hz-500Hz), and 43% faced moderate impairment (250Hz-2000Hz). Sensorineural Hearing Loss: In a subset of 62 children, 6.5% had moderate sensorineural loss, prominently at 500Hz, crucial for speech comprehension. **Conclusion:** The study accentuates the need for regular auditory screenings in rural school settings. Early detection and intervention can alleviate conditions like earwax compaction and SOM. The concerning prevalence of sensorineural hearing loss necessitates further studies on its prevention and management.

INTRODUCTION

Hearing impairment is a pervasive public health concern with profound implications for the affected individuals and society at large. According to the World Health Organization (WHO) in 2005, a staggering 278 million individuals globally suffer from disabling hearing impairment. Such a disability, in the context of children, refers to an average pure tone threshold of 31 dB HL or greater in the superior ear across the frequencies of 0.5, 1, 2, and 4 kHz. For adults, the same threshold is considered from 41 dB. However, it's crucial to note that even if the hearing loss is below these intensities, some children and adults might still face significant challenges, affecting their daily lives and interactions.[1]

Contrary to popular belief, hearing impairment isn't a condition exclusive to the aging population. A myriad of factors ranging from infections and diseases to congenital factors can lead to hearing impairment in children. In addition, certain environmental elements and specific medications have also been identified as potential culprits in inducing hearing loss in the younger generation. A predominant cause for this hearing deficiency, especially in children, can be attributed to middle ear diseases.[2]

The concept of "screening" plays a pivotal role in the early identification and subsequent management of these auditory challenges. Screening, by definition, is the methodological assessment of a population to identify potential candidates who are at a heightened risk of developing a specific condition. By separating individuals based on their likelihood of having or developing a condition, it facilitates early interventions. Essentially, the goal is to unveil a latent condition in a subset of the population that might otherwise remain undiagnosed. This proactive approach ensures that affected individuals can receive the necessary treatment, rehabilitation, or monitoring before the condition exacerbates. The foundational criteria for such screenings stem from the pioneering efforts of the World Health Organization. Their guidelines and frameworks have evolved over time, with contemporary methodologies and perspectives discussed extensively in works like that of Strong et al.[3]

At its core, the objective of hearing screening is manifold. It aims to pinpoint students who might have potential hearing losses, which, if unaddressed, could significantly hamper their intellectual, emotional, social, linguistic, and speech development. Emphasizing early identification and intervention is not just a matter of medical protocol but a strategy to forestall permanent hearing loss and associated educational impediments. It's pertinent to recognize that even mild hearing anomalies can have considerable educational and medical repercussions. Children's hearing levels can be impacted due to various reasons, with conductive and sensorineural causes being the most common.[4]

However, a concerning observation is that in places like Chittoor, situated in Andhra Pradesh, India, there is an evident lack of standardized hearing screening tests for newborns in public medical facilities. This gap in the medical infrastructure raises concerns about the future well-being of these children, particularly given the significance of early detection and intervention.[5,6]

Aim and Objectives

Against this backdrop, the primary aim of this study is to assess and identify hearing disabilities in typically developing school-going children within the rural precincts of Chittoor. The objectives are:

To understand the prevalence of hearing impairments among school-aged children in rural Chittoor.

To categorize the nature of hearing impairments (conductive vs. sensorineural) among the affected children.

To advocate for the establishment and reinforcement of standardized hearing screening protocols in public medical establishments, especially for newborns.

To underscore the importance of early detection and intervention in managing and potentially reversing certain types of hearing impairments.

MATERIALS AND METHODS

Participants: The research enlisted participants from government high schools in rural Chittoor. The study comprised 181 children aged between 7 and 15 years. This study was conducted at the District Early Intervention Centre, Government District Hospital and Apollo Institute of Medical Sciences and Research, Chittoor, Andhra Pradesh, India. To simplify categorization, the children were divided into three grade groups.

Grade I: Age 7 to 9 years

Grade II: Age 9 to 12 years

Grade III: Age 12 to 15 years

The distribution of participants across these grades, based on gender, is as detailed in the table below:

Gender	Grade I	Grade II	Grade III
Males	30	25	41
Females	30	35	20

Procedure: All auditory assessments were carried out at the District Early Intervention Center in Chittoor. The primary goal was to determine the nature, severity, and potential causes of hearing loss among the participants.

Otoscopic Examination: Prior to any auditory testing, an Otoscopic examination was conducted on each child to inspect the ear canal and eardrum.

Audiometry: Subsequent to the Otoscopic examination, participants underwent Pure Tone Audiometry, which was followed by Immittance Audiometry. The equipment utilized for these procedures included the Triveni Classic I audiometer for pure tone measurements and the Maico MI24 impedance audiometer for tympanometry.

The screening was done in adherence to established guidelines, detailed as follows:

Pure Tone Screening Guidelines: Daily biological checks were done on the pure tone screening apparatus.

Children aged 3 and older, both chronologically and developmentally, underwent the screening.

A pure tone sweep was executed at frequencies of 1000, 2000, and 4000 Hz at 20 dB HL.

For children who did not respond, a tone was presented multiple times, with a maximum of 4 repetitions.

Screenings were conducted exclusively in acoustically suitable environments.

Any child failing to respond at any frequency in either ear was deemed to have failed the test.

Immediate rescreening was carried out for those who failed the initial test.

Tympanometry was combined with pure tone screening, especially for younger age groups like preschoolers, kindergartners, and first graders.

Emphasis was placed on detecting high-frequency hearing loss, especially in environments with an educational focus on hearing loss prevention.

Tympanometry Screening Guidelines: Daily calibration of the tympanometry equipment was mandated.

Tympanometry was employed as a secondary screening process after pure tone screening.

Specific criteria for tympanometry screenings and referrals were adhered to. The recommended measurement was a 250 daPa tympanometric width. In scenarios where this width was unattainable, a static compliance of 0.2 mmhos was utilized as the criterion. An alternate failure criterion was a negative pressure range of >- 200 daPa to - 400 daPa, albeit

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with the caveat that this criterion should not be the sole determinant for a referral. The primary focus for tympanometry screenings was on younger children. Ethical Considerations: This study was approved by the Institutional Ethics Committee, Apollo Institute of Medical Sciences and Research, Chittoor, Andhra Pradesh, India.

RESULTS

This research aimed to explore the prevalent auditory challenges among school-going children in rural Chittoor. Upon evaluating 181 participants, various auditory health issues emerged:

Compaction of Earwax: Prevalence: Out of the total participants, 42 children, or roughly 23% of the sample, were dealing with compacted earwax. This is a significant proportion, suggesting a widespread issue.

Implications: Earwax, although a natural secretion, can sometimes accumulate excessively, blocking the ear canal. This blockage might cause discomfort, itching, and more importantly, hearing impairment, albeit temporary.

Hearing Assessment

Before Intervention: Out of these 42 children, nearly 45% (19 children) showed no hearing impairment despite the compaction, indicating a potential early stage or a lesser degree of blockage. The remaining 55% (23 children) experienced a mild conductive hearing loss, primarily detectable in the low-frequency range of 250Hz to 500Hz.

Post Intervention: Impressively, post the removal of the compacted earwax, all the children exhibited normal hearing ranges. This not only highlights the reversible nature of the hearing loss due to earwax compaction but also emphasizes the importance of regular ear check-ups and cleanings.

Table 1: Overall Prevalence of Auditory Health Issues

Issue	Number of Children Affected	Percentage of Total Sample (181 children)
Earwax Compaction	42	23%
Secretory Otitis Media (SOM)	21	11.6%
Sensorineural Hearing Loss	4 (out of 62 examined)	6.5% (of the 62 subset)

Table 2: Hearing Assessment for Earwax Compaction

Assessment Stage	Condition	Number of Children	Percentage of Affected (42 children)
Before Intervention	Normal Hearing	19	45%
	Mild Conductive Loss (250Hz - 500Hz)	23	55%
After Intervention	Normal Hearing	42	100%

Table 3: Hearing Assessment for Secretory Otitis Media (SOM)

Condition	Number of Children	Percentage of Affected (21 children)
Normal Hearing	1	5%
Mild Conductive Loss (250Hz - 500Hz)	11	52%
Moderate Conductive Loss (250Hz - 2000Hz)	9	43%

Table 4: Sensorineural Hearing Loss Assessment

Frequency Range Affected	Number of Children Affected	Percentage of Examined Subset (62 children)
500Hz	4	6.5%

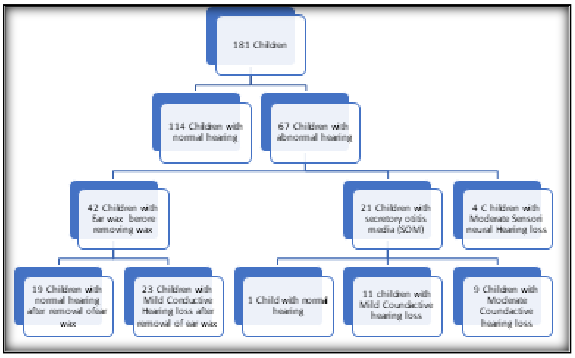

Figure 1: Distribution of Auditory Conditions Among School-Going Children: A Comparative Flowchart

Secretory Otitis Media (SOM):

Prevalence: 21 children, accounting for about 11.6% of the studied sample, had a diagnosis of SOM.

Implications: SOM is a condition where fluid accumulates behind the eardrum without any infection. This can be due to allergies, colds, or sinus infections. The accumulation of this non-infected fluid can impede the vibration of the eardrum and the ossicles, leading to conductive hearing loss.

Hearing Assessment: While a majority faced hearing loss, one resilient child (roughly 5% of those with SOM) managed to maintain a normal hearing range.

Over half, or 52% (11 children), showed mild conductive hearing impairment in the frequency range of 250Hz to 500Hz.

The remaining 43% (9 children) faced a more extensive range of hearing loss, from 250Hz to 2000Hz, indicating a moderate conductive hearing impairment.

Sensorineural Hearing Loss: Nature and Cause: Unlike the previous conditions, sensorineural hearing loss is rooted in problems with the inner ear or the nerve pathways to the brain. It's usually permanent, stemming from congenital factors, noise exposure, or other causes.

Prevalence and Assessment: Of the subset of 62 children who underwent an examination for this specific condition, a concerning 6.5% (4 children) were found to have moderate sensorineural hearing loss. This was predominantly noticeable around the 500Hz frequency, an essential range for understanding speech.

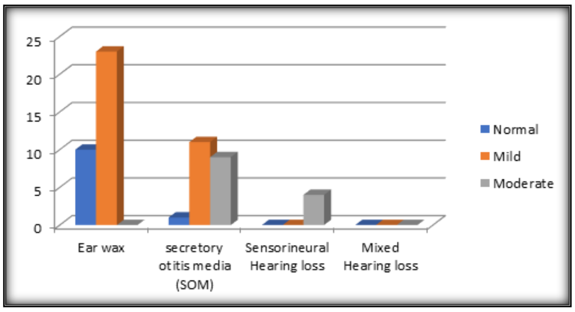

Figure 2: Prevalence of Ear Conditions by Severity: Ear Wax, Secretory Otitis Media, Sensorineural, and Mixed Hearing Loss

DISCUSSION

Hearing, an indispensable sensory function, is fundamental for effective communication, particularly during the formative years of childhood. In the environment of a school, where learning largely transpires through auditory communication, any hindrance in hearing can considerably impede a child's academic and social development. Our study, based in Chittoor's government schools, unraveled a concerning prevalence rate of 37.02% in hearing disabilities. Predominantly, these children presented with conductive hearing loss, with the primary cause being earwax accumulation.

The significance of early detection of hearing impairments in children, especially in developing regions, cannot be overstated. Olusanya (2001) delved into the options available for early detection in developing countries and highlighted the challenges faced, a sentiment echoed in our study which emphasizes the importance of early identification.[7] By identifying and intervening early, we can drastically reduce the possibility of associated speech and language complications that children might encounter in their subsequent years.

This emphasis on early identification finds alignment with studies conducted in diverse global regions. For instance, in the Northern regions of Quebec, a study by Julien et al. (1987) pinpointed chronic otitis media as a prime contributor to hearing deficits among Native children.[8] Similarly, a pilot project by Eriks-Brophy and Ayukawa (2000) in the Inuit regions of Nunavik discussed the advantages of sound field amplification, indicating that environmental and technological interventions can significantly benefit children with hearing challenges.[9]

Margolis and Heller (1987) emphasized the role of tympanometry as a screening tool, underscoring the importance of setting precise medical referral criteria.[10] This technique plays a crucial role in the early identification of middle ear problems, which can be a prevalent issue among school-going children, as seen in our study.

From a global standpoint, the burden of childhood hearing impairment remains heavy. Olusanya and Newton (2007) elucidated on the global implications of childhood hearing impairment, particularly focusing on disease control priorities in developing nations.[11] The importance of early identification was also emphasized by Yoshinaga-Itano et al. (1998), who delineated the stark differences in language development between children identified early with hearing loss compared to those identified later.[12]

In a broader health context, Strong et al. (2005) deliberated on the current strategies in screening for non-communicable diseases. Their discourse on the methodology emphasizes the universal significance of early and effective screening measures.[13] Davis et al. (2007) furthered this by exploring the cost-effectiveness and benefits of early screening for hearing disabilities, advocating for more comprehensive and accessible testing measures.[14]

CONCLUSION

The landscape of hearing impairment among children in Chittoor paints a picture that resonates globally. While earwax emerged as a dominant causative factor in our study, the broader implications of untreated hearing impairments underscore the need for robust, early, and comprehensive screening programs. As we move forward, both parents and professionals must collaborate to institute systematic hearing screening in primary schools, ensuring that our children's auditory health and, by extension, their academic and social futures remain bright.

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