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Objective Hearing Assessment in Children with Delayed Speech in Southern Nigeria: A Retrospective Analysis

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Abstract **Original Research Article**

Background: The aetiology of speech pathologies in children can be multifactorial, with hearing loss playing a major role. Objective hearing assessments, such as tympanometry, otoacoustic emissions (OAE} and auditory brainstem audiometry are crucial for diagnosing hearing impairment in children. ***Objective:*** To determine the presence and patterns of hearing loss in children with speech impairment in Southern Nigeria using objective hearing assessment parameters. ***Materials and Methods:*** We retrieved data from medical records children who presented to the audiology/speech therapy section of the ear, nose and throat department of a tertiary hospital in Southern Nigeria between January 2014 to December 2023. Children aged 0- 15 year who had speech impairment and objective hearing assessment were included in the study. Collected data included demographic information, tympanometry, otoacoustic emission, auditory Brainstem response (ABR) results. ***Results:*** A total of 122 children with speech impairment were included in the study. Male/ female ratio was found to be 1.7: 1. Most (69.7%) patients were aged between 0-5years. Normal tympanometry Type A were seen most (95%) of case while 54.9% had abnormal otoacoustic emission indicating cochlear dysfunction. ABR results were abnormal in 39.3% the cases showing deficient brainstem response. ***Conclusion:*** Hearing loss is prevalent among speech- impaired children in Southern Nigeria, with cochlear (sensory) hearing loss being predominant. Early hearing screening, and parental education are recommended to address this challenge.

Keywords: Hearing Loss, Speech Impairment, Tympanometry, Otoacoustic Emission, Auditory Brainstem Response.

INTRODUCTION

Speech and language development are important milestones in a child's overall development. Any delay in the acquisition of these skills can significantly impact social interaction, academic performance, and overall quality of life [1]. Hearing is the ability to perceive sounds by detecting vibrations and changes in the pressure of the surrounding medium through time [2]. It plays a critical role in speech development, as auditory input is essential for the acquisition and comprehension of language. Hearing loss, though a leading cause of speech impairment in children is often under-recognized, particularly in low- and middle-income countries such as Nigeria [3].

Universal neonatal hearing screening refers to all activities aimed at screening all newborns regardless of the presence of a risk factor for hearing loss [4]. The goal of the former is early identification and intervention to mitigate the impact of hearing impairment. Newborn hearing screening utilizes objective testing methods like otoacoustic emission and auditory brainstem response audiometry [5]. Otoacoustic emission (OAE) are sounds generated by healthy inner hair cells of cochlear which can be recorded by a microphone fitted into ear canal [6, 7]. Auditory brainstem response on the other hand evaluates the ascending auditory pathway from the cochlear to the brainstem following auditory stimulation. Universal neonatal hearing screening is not operational in sub-Saharan countries like Nigeria; hence diagnosis congenital hearing impairment is made late. Speech and

language delay is one the early manifestation of Hearing loss.

In Southern Nigeria, there is limited data on the relationship between hearing impairment and speech delay among children. Speech delay may arise from various factors, including hearing impairment, intellectual disabilities, neurological disorders, and environmental deprivation [8]. However, early identification of hearing loss and appropriate intervention are crucial to minimizing its negative effects on speech and language development. The aim of this study is to determine the prevalence and types of hearing loss among speech-delayed children in Southern Nigeria. This will greatly enrich the knowledge available to clinicians involved in management of hearing loss and speech impairment.

MATERIALS AND METHOD

This was a retrospective study conducted in tertiary hospitals in Southern Nigeria. Data was retrieved from the audiology/ speech therapy section of the hospital. This centre receives referral from health centres and general hospitals in the region. The study population consisted of children aged 0–15 years presenting with speech impairment between January 2014 and December 2023. Children with known neurological disorders (e.g., cerebral palsy), intellectual disability, or genetic syndromes were excluded. Data were retrieved from patients' case notes and register in audiology/ speech therapy section. Information obtained included age, gender, medical history, tympanometric, otoacoustic emission and auditory brain stem results. Retrieved was fed into Microsoft excel sheets and analyzed with SPSS version 20.

RESULTS

A total of 122 children with speech impairment were included in the study. There were 74 males and 48 females giving Male/ female ratio of 1.5: 1. Most (86.1%) patients were aged between 0-5years with mean age of 38.3months. Most (91%) gave their presenting complain as speech impairment while 9% gave hearing loss as their complaint. Normal tympanometry Type A were seen most (95%) of case while 50.8% had abnormal Distorted product otoacoustic emission (DPOAE) indicating abnormal cochlear function. ABR results were abnormal in 39.3% the cases showing deficient brainstem response.

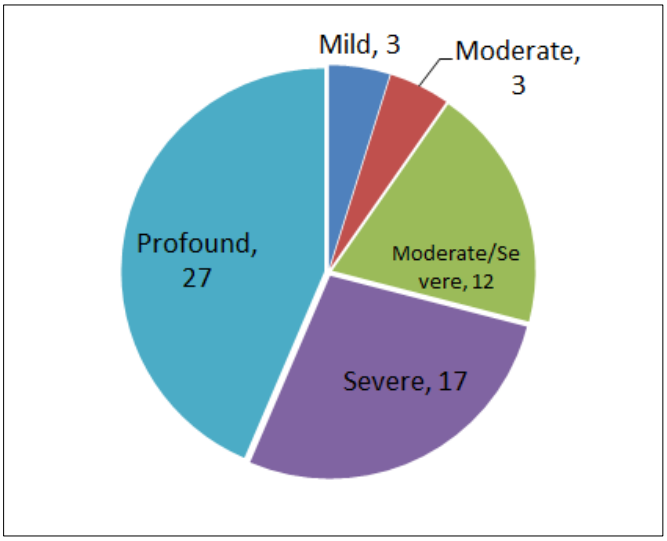

Figure 1: Severity of Hearing loss

Table 1: Age

Age in years	Frequency n	Percentage (%)
5	105	86.1
6- 10	11	9.0
11- 15	6	4.9
Total	**122**	**100**

Table 1.1: Distorted Product Otoacoustic Emission

Distorted Product Otoacoustic Emission	Frequency (n)	Percentage (%)
Failed	62	50.8
Passed	60	49.2
Total	**122**	**100**

Table 1.1.1: Auditory brainstem evoked response

Auditory brainstem Response	Frequency (n)	Percentage (%)
Normal	79	64.8
Abnormal	43	35.2
Total	**122**	**100**

DISCUSSION

Most of patients seen for speech delay were males. This agrees with findings of previous reports [9, 10]. This most likely due to slower maturation of the central nervous system among boys comparable to girls [11]. In this study, late diagnosis was a prevalent with mean age of presentation 36.8 months. Many of children being referred for audiological assessment only after significant speech delays were detected. This delay highlights a critical gap in early hearing detection and intervention programs, which are not widely implemented in resource poor settings like ours. In many high-income countries, Universal newborn screening which leads to early diagnosis and treatment of congenital hearing loss is practiced [12, 13]. This is however, not available in many developing countries, including Nigeria.

Our study showed that majority (50.8%) of the children with speech impairment had some degrees of hearing loss; this is consistent with previous reports in Nigeria [3-9]. Studies from different regions have estimated the prevalence of hearing impairment in speech-delayed children to range between 10% and 40% [14, 15].

Most of the children who presented with hearing loss had normal tympanogram indicative of normal middle ear function. This is similar to the findings of previous authors [16].

The types of hearing loss in our study varied, with cases of sensorineural hearing loss (SNHL) being the most prevalent, followed by conductive hearing loss (CHL) and mixed hearing loss. SNHL, more common than CHL in our study, is particularly worrisome as it often leads to permanent hearing loss. Several etiological factors, including congenital infections, genetic predisposition, and perinatal complications, contribute to SNHL in children [17, 18].

Majority of the children with hearing loss were profound in severity. Hearing loss, even if mild, can significantly impair speech and language development, particularly in the early years when children rely on auditory feedback for language learning. Rehabilitative measures such as hearing aids or cochlear implants will be needed to improve hearing which is necessary for speech acquisition [16].

Early identification of hearing loss is crucial to timely intervention. Universal newborn hearing screening is not practiced in Nigeria; hence diagnosis of hearing loss is usually delayed. Incorporating OAE and ABR testing into routine paediatric care could facilitate early detection and rehabilitation.

CONCLUSION

Objective hearing assessment is essential in evaluating speech delayed children in Nigeria. The proportion of hearing loss underscores the need for improved screen and intervention. Universal newborn screening should be prioritized to achieve good speech and language outcomes in affected children.

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