PREVALENCE OF VESTIBULAR DYSFUNCTION IN HEARING IMPAIRED CHILDREN

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ABSTRACT

Background: The auditory and vestibular systems work together to process sensations of sound and movement. Auditory processing problems that may arise as a result of vestibular dysfunction include detecting likenesses and differences in words, attending to the teacher’s voice in the presence of background noise, difficulty following directions, expressive language and auditory sequential memory. Purpose of study: The aim of this study is to find out the prevalence of the vestibular dysfunction in hearing impaired children, as it is also evident in the older adults. Method: Fifty bilateral hearing impaired children were identified in the age group of 6-14 years. They were tested for the five tests Dix-Hall Pike maneuver, Rolls test, Fukuda’s walking test, Romberg’s test, and Sharpened Romberg’s test both. First three tests were for central vestibular dysfunction and next two were for peripheral vestibular dysfunction. Based on these the children were categorized under central, peripheral or both vestibular dysfunctions. Results: Out of 50, 44 children were diagnosed to have vestibular disorder. Thirty three children were positive for both central and peripheral vestibular disorders whereas 5 children had central vestibular disorder and 6 children had peripheral vestibular disorder. Conclusion: The result of this study concluded that there is presence of vestibular dysfunction in the hearing impaired children both central as well as peripheral. Keywords: Vestibular dysfunction, Hearing impaired children, Dix-Hall Pike maneuver, Rolls test, Fukuda’s walking test, Romberg’s test, Sharpened Romberg’s test.

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INTRODUCTION:

Vestibular function and balance skills of deaf children are of interest to physical therapists because the characteristics of these functions may differ from those of children with unimpaired hearing. The paired vestibular organs, housed within the temporal bone, include 3 orthogonal semi-circular canals (superior, posterior, and horizontal) and 2 otolith organs (the utricle and saccule). Together, the semicircular canals and otolith organs provide continuous input to the brain about rotational and translational head motion and the head’s orientation relative to gravity. This information from the vestibular organs and their central pathways allows for the maintenance of gaze and postural stability via the vestibulo-ocular reflex and vestibule spinal reflex, respectively.

Vestibular dysfunction is typically characterized by vertigo (i.e. an illusory sense of motion), nystagmas and imbalance owing to disturbances in gaze and postural stability. The vestibular apparatus and cochlea are closely related both anatomically and developmentally. A noxious influence prenatally, perinatal, or postnatal may cause damage to one or both systems. Hearing impairment and vestibular impairments can occur simultaneously or in isolation.

An estimated 20% of the general population is affected by a vestibular disorder. It has been reported that the occurrence of vestibular disorders in children is low compared to adults, the effects are significant. Vestibular disorders not only profoundly affect adults, but also children. Once thought to be exceptionally rare, pediatric vestibular disorders are receiving increasing attention from clinicians as an overlooked problem. In addition to impairments of motor development and balance, vestibular deficits may cause poor gaze stability that inhibits children from learning to read. Despite new awareness of pediatric vestibular disorders, children are currently not typically screened for them, and as a result frequently fail to receive medical treatment for their symptoms. Many of those who are deaf also suffer from vestibular dysfunction because along with cochlea, so does the vestibular system gets affected present in the inner ear. The vestibular system affects auditory-language processing. Ordinarily, the auditory and vestibular systems work together to process sensations of sound and movement. Auditory processing problems that may arise as a result of vestibular dysfunction include detecting likenesses and differences in words, difficulty following directions, difficulty with expressive language etc.

A previous research indicated that 58.8% of deaf children had hypoactive vestibular response. Nearly half (44.1 %) had no response to vestibular stimulation. Five (14.7%) showed abnormally low response and normal response was demonstrated by 14(41.2%) deaf children. A study on Sensory Integration and Learning Disorders at Los Angeles, CA, Western psychological services and concluded that because motor and learning problems have been associated with deficits in these areas, identifying the characteristics of vestibular function and balance skill in the deaf and discussing the relationship between them will be helpful to therapists. A study on Vestibular function in deafness and severe hardness of hearing, using rotary and caloric vestibular tests, it was found that there was absent nystagmus in 19 percent of deaf children and abnormal nystagmus in 22 percent and also found that normal vestibular function in most patients
with severe inherited hearing loss or deafness acquired in the prenatal or perinatal period. Vestibular function was abolished, however, in most cases of hearing loss acquired after birth.8

Another study showed a significance of etiology in motor performance of deaf children with special reference to meningitis. Along with this a study on the health rails and fukuda Vestibular tests with deaf and hearing subjects in CP children showed that severely deaf children, performed more poorly on locomotor tests than children with unimpaired hearing.9,10

A study on comparison of motor behaviour in deaf and hearing boys and concluded that deaf boys have less skill than hearing boys in dynamic balance. It stated, "This deficiency on the part of the deaf can be attributed to vestibular, cerebellar, or central nervous system impairment." The relationship between vestibular and balance deficiencies, however, was not specifically investigated. It also reported no significant differences in static equilibrium ability with regard to etiology of deafness.11

A study on Sensori-neural deafness and neuromuscular dysfunctions: Considerations for vocational evaluation and job placement and investigation of balance in those deafened by viral causes reported that 46 per cent had severe problems, 2 percent had moderate problems, and 52 per cent had standard balance, also it was seen that Static and dynamic balance skills of eight-year-old deaf and hearing children found that deaf children performed more poorly in static and dynamic balance skills than hearing children.12,13

Very few researches have been done amongst hearing impaired children but finding out vestibular disorders in them is very scarce. Therefore, this study aims to find out the prevalence and type of vestibular disorders in hearing impaired children in Pune region, India so that this can be a database for further study and research.

METHODOLOGY

Fifty children who fit the inclusion criteria were selected. These children were tested for Dix-Hall Pike maneuver, Rolls test, Fukuda’s walking test, Romberg’s test, Sharpened Romberg’s test to find out peripheral and central vestibular disorders. The first three tests were conducted to diagnose Peripheral vestibular disorder tests. And the last two were conducted to diagnose central vestibular dysfunction.

Inclusion criteria:

- Congenital hearing impaired children.
- Children of 6 to 14 years age including both the genders.

Exclusion criteria:

- Children of low Intelligence Quotient (IQ).
- Children of any congenital deformities.
- Children of any cardiac instability.
- Children of Cervical rib.
RESULTS:

Out of 50, 44 children were diagnosed to have vestibular disorder. Thirty three children were positive for both central and peripheral vestibular disorders whereas 5 children had central vestibular disorder and 6 children had peripheral vestibular disorder (Table 1). Eighteen Males and fifteen Females were diagnosed to have both central and peripheral vestibular disorders (Table 2). Three Males and two Females were diagnosed to have central vestibular disorder. Five Males and one Female were diagnosed to peripheral vestibular disorders (Table 3).

Table 1: Distribution of sample

<table>
<thead>
<tr>
<th>Type of affection</th>
<th>No. of sample affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both central and peripheral</td>
<td>22</td>
</tr>
<tr>
<td>Central</td>
<td>5</td>
</tr>
<tr>
<td>Peripheral</td>
<td>6</td>
</tr>
<tr>
<td>None</td>
<td>6</td>
</tr>
</tbody>
</table>

Table 2: Distribution of gender

<table>
<thead>
<tr>
<th>Gender</th>
<th>No. of sample affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>18</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
</tr>
</tbody>
</table>

Table 3: Distribution of gender in both disorders

<table>
<thead>
<tr>
<th>Gender</th>
<th>Disorder</th>
<th>No. of sample affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>Central</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Peripheral</td>
<td>5</td>
</tr>
<tr>
<td>Female</td>
<td>Central</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Peripheral</td>
<td>1</td>
</tr>
</tbody>
</table>

DISCUSSION:

Fifty congenital hearing impaired children were tested for vestibular function, 88 per cent were diagnosed to have vestibular dysfunction. Amongst these, 66 per cent were diagnosed for both central and peripheral vestibular dysfunction of which 54 per cent were males; 45 per cent were females were having both central and peripheral vestibular dysfunction. Eighteen per cent of children had only peripheral vestibular dysfunction of which males were 83 per cent and female were 16 percent. Fifteen per cent of children had only central vestibular dysfunction of which males were 60 per cent 40 per cent were female.
In a research on hearing impaired children the vestibular response was found to be absent or abnormal in 41 per cent and in same study later on was found to have abnormal vestibuar response in 49 per cent of hearing impaired children.\(^8\)

In another study the prevalence of hypoactive vestibular response in the hearing impaired children was found to be 58.8 per cent. Damage to cochlea could probably damage vestibular structures, thus vestibular dysfunction has high frequency in children with severe hearing impairment.\(^1\)

Loss of vestibular response was associated with severe diminition of air conduction hearing loss. According to research, loss of vestibular function in children is associated less often with genetic cause than with acquired deafness mainly due to meningitis.\(^8\)

The Ontogenic, anatomical and physiological proximity of the two organs, and an agent that has damaging effect on inner ear could also have detrimental impact on vestibular organ. It was found that vestibular dysfunction in hearing impaired children was attributed due to vestibular, cerebellar or central nervous system impairment.\(^11\)

**CONCLUSION:**

The prevalence of vestibular dysfunction is found to be high in children with hearing impaired. Further research is needed to find the factors responsible for vestibular dysfunction in this population.

**REFERENCES:**


7. Ayres AJ: Sensory Integration and Learning Disorders. Los Angeles, CA, Western Psychological Services, 1976


