Effect of Acquired Immune Deficiency Syndrome on Hearing Function- a Case Study

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Abstract: Acquired Immune Deficiency Syndrome (AIDS) resulting from Human Immunodeficiency Virus (HIV) is a condition that alters the immune system along with its effects on different body systems. Otologic and audiologic symptoms are also reported in such individuals. Multiple causes are responsible for these symptoms in different individuals. Hence a comprehensive profiling of audiological findings is necessary for each individual to identify the possible cause of hearing related problems. The present study hence highlights the detailed audiological evaluation and re-evaluation in an individual with long standing HIV infection. Battery of test including pure tone audiometry, speech audiometry, tympanometry, acoustic reflex testing and oto acoustic emissions were carried out. First evaluation and a re-evaluation after six months suggested a gradually progressing sensorineural hearing loss in the individual. The possible explanations of these findings are discussed in the study. The outcome of the study suggests the need for detailed and continual audiological evaluations in the population.

1. Introduction

Acquired Immune Deficiency Syndrome (AIDS) resulting from Human Immunodeficiency Virus (HIV) is a condition that alters the immune system along with its effects on different body systems. Along with various complications of AIDS, otologic and audiological symptoms are also reported in the literature. This includes otalgia, vertigo, tinnitus and hearing loss (Westhuizen et al, 2013, Khoza& Ross, 2002) Attempts have been made to study the effect of AIDS on hearing function and to delineate the possible causes of the problems. Assuiti et al (2013), reviewed such attempts and reported the ototoxic nature of the antiretroviral medication as one of the common cause of hearing loss in individuals with AIDS who are under treatment. They also reported the opportunistic diseases and direct virus action on the system as other feasible causes for hearing related problems in individuals with AIDS. Meningitis, which is the infection to the meninges layer of brain and spinal cord is found to be one such frequent opportunistic disease in individuals with AIDS (Jennifer, Claire & Jeffrey,2014) out of which Cryptococcus meningitis being the most common one.

The ill functioning of hearing system thus cannot be related to any single cause and it is difficult to make a general statement regarding the population as the causes for otological symptoms reported are various and as the population is heterogeneous. This warrants the need for understanding the problems of each individual with AIDS discretely and to select appropriate management programs based on individual findings. Hence, the present study was carried out to assess the hearing function in a case with AIDS.

2. Case Presentation

A 41 year old male was referred to the Department of Audiology, JSS hospital, Mysore for detailed Audiological re-evaluation from the Department of ENT. Otoscopic evaluation at the Department of ENT suggested normal external auditory canal and tympanic membrane appearance. Detailed case history was taken at the Department of Audiology before carrying out the routine evaluations. The case complained of reduced hearing sensitivity in both the ears since a year which is gradually progressive in nature. No other otological complaints were reported. Case history also revealed that he was diagnosed as having HIV infection 2 years back. No other significant otological complaints were reported. The case had undergone audiological evaluation six months back in the same department. Those reports were also noted.

3. Audiological evaluations

Detailed audiological evaluation was carried out twice for the individual in the department. The battery of tests included pure tone audiometry, speech audiometry, immittance evaluation and otoacoustic emissions. Pure tone audiometry was carried out using a calibrated Inter acoustics AD 629 audiometer. Modified Hughson Westlake procedure was followed to identify thresholds at
each frequency. Pure Tone Average was calculated in both the ear as the average of hearing thresholds at 500 Hz, 1000 Hz and 2000 Hz. Speech audiometry comprised of Speech Recognition Threshold (SRT), Speech Identification Scores (SIS) and Uncomfortable level (UCL) testing. Interacoustics AT- 625 immittance meter was used to carry out the immittance evaluation and acoustic reflex threshold testing. Immittance evaluation included Static Compliance (SC), Peak Pressure (PP) and Ear Canal Volume measurements. Based on these measurements, the type of tympanogram is identified. Ipsilateral and contra lateral Acoustic Reflex Thresholds (ART) were also measured in both the ears. Transient Evoked Oto Acoustic Emission (TEOAE) and Distortion Product Oto Acoustic Emission (DPOAE) were carried out using Interacoustics Oto Read instrument at 500Hz, 1000Hz, 2000 Hz and 4000Hz. The audiogram obtained for the subject on the first and second visit is given in figure 1 and figure 2 respectively. The results of pure tone audiometry and speech audiometry in the first and second evaluations are given in table 1 and immittance evaluation results are given in table 2.

Figure 1. Audiogram showing the pure tone thresholds of right and left ear over 250 Hz to 8kHz during the first visit

Figure 2. Audiogram showing the pure tone thresholds of right and left ear over 250 Hz to 8kHz during the second visit
Moreover, the slope of the audiogram also was observed to be more in the recent evaluation.

5. Discussion

The audiological evaluations results clearly suggest the presence of significant hearing loss in the present client and its progressive nature. Efforts were made in some previous studies also to identify the cause of hearing loss in individuals with AIDS. The various possibilities being opportunistic infections which take benefit of the compromised immune system of the body, otoxic nature of the anti retro viral treatment and the direct action of virus on the hearing system (Assuiti, Lanzoni etal, 2013). Opportunistic diseases include meningitis, middle ear infections and infection that directly affect the central nervous system, majorly caused by cytomegalovirus (Shahab, Osbone & Butler, 1994; Meynardl et al, 1997). Otoxic nature of anti retro viral treatment and treatments given for opportunistic diseases are also reported in the literature (Chandrasekhar, Connelly etal, 2000; Wenzel, Gotz, Lenarz & Stover,2008). Previous studies have reported direct action of virus on the peripheral auditory system and central nervous system too (K Hanna, Nuesch etal,2006; Moluneux, Tembo, Kayira etal, 2003 & Klemm & Wollina, 2004).

The detailed medical reports were hence studied in the present case and it was observed that the patient had an attack of meningitis after four months of identification of HIV infection. Hearing loss was reported by the patient after a year of this attack. Meningitis is well known for its effect on hearing. Post meningitis ossification of cochlea and suppurrative labyrinthitis due to the spread of infection from subarachnoid space through the cochlear aqueduct is considered to be the major causes of hearing loss after a meningitis attack (Nadol, 1978, Brrokhouse , Auslander & Meskan, 1988). Post meningitis ossification is reported to be rapid and it is complete within few months after infection (Axon, Patrick etal, 1998). Hence, the hearing loss observed is likely to be of sudden onset and static in nature. However, in the present case a gradually progressive pattern of hearing loss was noted. Thus it may be inferred that the post meningitis ossification might not be the cause of hearing loss in the present client. Labyrinthitis the second potential reason for hearing loss in the client which also prove to be less likely as labyrinthitis is generally associated with hearing loss, tinnitus and giddiness. However, in the present case hearing loss was the only symptom thus ruling out the possibility of labyrinthitis as a cause for loss of hearing function. Otoxicity may be considered as a potential cause in the present

<table>
<thead>
<tr>
<th>Procedure</th>
<th>1st evaluation</th>
<th>2nd evaluation</th>
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<tbody>
<tr>
<td>Right ear</td>
<td>Left ear</td>
<td>Right ear</td>
</tr>
<tr>
<td>PTA (dB)</td>
<td>26.6</td>
<td>38.3</td>
</tr>
<tr>
<td>SRT (dB)</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td>SIS (%)</td>
<td>85</td>
<td>80</td>
</tr>
<tr>
<td>UCL (dB)</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

4. Interpretation of test findings

Recent audiogram suggests moderate degree of hearing loss in both the ears. The audiogram was also noted to be of sloping pattern with an Air Bone Gap equal to or less than 10 dB at all the frequencies tested. SRT and PTA were in good correlation and the SIS scores also were fair. UCL was obtained at 95dBHL. Immittance evaluation revealed an absence of any middle ear pathology in both the ears. Acoustic reflexes were absent even at the maximum permissible levels of the instrument. TEOAE and DPOAE evaluation was carried out to understand the Outer Hair Cell (OHC) functioning in both the ears. Both TEOAEs and DPOAEs were observed to be absent in both the ears at all the frequencies. This suggests the ill functioning of outer hair cells in both the ears. The provisional diagnosis made after the detailed audiological evaluation was bilateral moderate sloping sensorineural hearing loss.

Attempt was made to compare the present audiological evaluation with the previous one which was carried 6 months back. Pure tone audiometry and immittance evaluation reports were available. The tympanogram obtained was ‘A’ type in both the ears and the ARTs were obtained at low frequencies. This suggests an absence of middle ear pathology and the diagnosis made was bilateral mild sensorineural hearing loss. Comparison of results exposed a gradually progressive condition in the client as the severity of hearing loss increased and as the ARTs gradually faded.
case as the patient was undergoing anti retro viral therapy and it is known for its ototoxic effect as mentioned earlier. Furthermore, a direct action of virus on the peripheral auditory system may also be suspected in the present case, as it is reported that the virus can progressively infect and damage the cells in the ear and myelin sheaths of nerve cells (Casula et al, 2005; Schouten et al. 2006 & Mirza et al. 2014).

6. Conclusion

Acquired Immune Deficiency Syndrome is known to alter the immune system along with its effects on different body systems including the hearing system. The present case report illustrates the audiological finding on a case with HIV infection with reported hearing loss. Detailed audiological evaluations and correlation of the results with the previous audiological findings revealed a gradually progressive sensorineural hearing loss in the present case. As opportunistic diseases, ototoxicity and direct action of virus on peripheral hearing structures are reported in such patients, an attempt was made to speculate the causes in the present case as well. The possibility of meningitis as a plausible cause of hearing loss in the present case is ruled out as the pattern of progression of the hearing loss in the present case is observed to be different from the pattern of progression seen in cases with hearing loss as a consequence of meningitis. Labyrinthitis also seemed to be a less likely cause of hearing loss based on the symptoms presented. Ototoxic nature of the anti retro viral therapy and/or the direct action of virus on the cochlea may be considered as the plausible causes of hearing since the subject is under anti retro viral therapy and as it is a long standing infection. Detailed hearing evaluation of individuals to identify hearing related difficulties and continuous monitoring of auditory function to understand the nature of the problem is hence warranted in such clinical population. The severity, type and nature of the problem are reported to be largely variable in the population. Hence, it is important to understand the individual hearing profile in detail which will further assist the hearing care professional to understand the underlying cause of hearing deficit and to select appropriate management options for each individuals exclusively.

7. Reference