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**Original Article**

# Evaluation of hearing impairment in leprosy patients taking multidrug therapy

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Present descriptive study was carried out for the assessment of hearing capability in leprosy patients. After getting approval from Institutional ethical committee, the present descriptive study was carried out on 60 subjects. All the patients were indoor-patients at the Leprosy Rehabilitation Center Maharogi Sewa Samiti Anandvan Warora, and were on multidrug therapy described by World Health Organization from an average period of 6 months. Study Group I consisted of 30 diagnosed Leprosy patients taking multidrug therapy from an average period of 6 months. Group II (Control group) consisted of 30 normal healthy individuals of same age. Patients suffering from acute or chronic ear discharge, Presence of wax in external auditory canal, diabetes mellitus, hypertension, impaired renal function and patients having history of trauma were excluded from the study. All the subjects underwent Pure tone audiometry, Tuning Fork test to check the level of hearing loss and type of hearing loss and detailed clinical examination for cranial nerve function was done in all the patients of study group and control group. Audiometry findings in study group patients showed that 23 patients (76.66%; 45 ears) of the leprosy patients had sensory neural hearing impairment and 7 patients (23.33%) showed normal hearing. Out of these affected patients, 10 patients (43.47%; 19 ears) had mild sensory neural hearing impairment, 10 patients (43.47%; 20 ears) had moderate sensory neural hearing impairment. 2 patients (8.69%; 04 ears) had moderate to severe hearing impairment, 1 patient (4.34%; 02ears) showed severe sensory neural hearing impairment. In the absence of any local or systemic disease or drugs likely to have side effects on the cochleovestibular function, leprosy affects the cochleovestibular system, and effect on cochlearfunction is seen more often than effect on the vestibular system. Thus hearing loss which is seen in patients suffering from Hansen's disease is of cochlear origin.

**Key words :** Hansen's disease / Leprosy, Audiometry, Hearing impairment.

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## Introduction

Hansen's disease (leprosy) is a systemic disease which has a prediction for involving the skin, peripheral nerves and mucosa of the upper respiratory tract including nasal mucosa. Due to upper respiratory tract involvement, there is a possibility of ear involvement (Singh et al 1984). Earlier it was presumed that the audio-vestibular system was similarly affected. Any involvement of middle ear, internal ear or vestibulocochlear nerve would cause a change in hearing. Fifth and seventh cranial nerves and central nervous system involvement in patients suffering from Hansen's disease have been reported previously (Katoch et al 1984, Ramadan et al 2001). Alternatively vestibulocochlear nerve being sensory in nature could also be involved directly leading to hearing loss in patients suffering from Hansen's disease (Ramadan et al 2001).

Although skin patches are often the first sign of leprosy disease, many other diseases can cause similar patches. As per WHO criteria only when there is a loss of sensation in the skin patch, as compared with the skin surrounding the patch, can we be sure that the person is suffering from Hansen's disease. The diagnosis of Hansen's disease is mainly based on the clinical signs and the symptoms of the disease (Werner 1999). Trained leprosy health workers can observe and recognize these features.

In an endemic country or area, following two cardinal signs in a patient should make a clinician suspect of suffering from Hansen's disease: 1. skin lesion consistent with definite sensory loss, with or without thickened nerves. 2. Positive skin smears for AFB. The classification of Hansen's disease is based upon two basic criteria that are, the clinical manifestations and the results of skin smears. This is one of the available tools but is not being used for diagnostic purposes in present study. However, skin smear services are not generally available (Ishii 2003). As per the WHO criteria the clinical classification of Hansen's disease for the purpose of treatment is based on the number of skin lesions and nerves involved. According to WHO criteria Paucibacillary leprosy (PB) patients should have up to 5 skin patches, while patients with Multibacillary (MB) leprosy must have more than 5 skin patches.

Hearing loss is a natural consequence of old age (Presbyacusis). Hearing loss can either be conductive or sensory neural. Some people suffer from both, which is called mixed hearing loss. In view of the conflicting reports on the subject, the present study was undertaken to evaluate audio-vestibular status in patients suffering from Hansen's disease.

## Material and Methods

After getting approval from institutional ethical committee, the present study was carried out on 30 leprosy patients and 30 normal healthy individuals of same age and socioeconomic status. All the patients were indoor-patients at the Leprosy Rehabilitation Center Maharogi Sewa Samiti Anandvan Warora and were on multidrug therapy described by WHO from an average period of 6 months.

**Group I:** Study group consisted of thirty patients. Out of these 29 patients were clinically diagnosed as MB and 1 patient was diagnosed as PB leprosy. All the patients were admitted for treatment of leprosy.

**Group II:** Control group consisted of 30 normal healthy individuals of same age, sex and same socioeconomic status as that of Group I.

Patients having history of chronic or acute ear discharge, Presence of wax in External auditory canal, diabetes mellitus, hypertension, impaired renal function and patients having history of trauma were excluded from the study.

Pure tone audiometry test was performed on all the patients to assess the level of hearing and hearing loss in a soundproof audiometry room. Both air conduction and bone conduction threshold were obtained. Pure tone audiometry also helped for type and degree of hearing loss. Pure tone audiometry was done by using a clinical audiometer ALPS-Advance Digital Audiometer Model AD 2000. Pure tone Audiometry is the most common technique used for hearing assessment. Pure tones are delivered to the ear through headphone for air conduction and bone by vibrator for bone conduction. The frequency tested usually ranges from 250 to 8000 Hz.

**Interpretation of audiogram**

The pure tone average is the average of the hearing threshold level at 500, 1000 and 2000 Hz only. The deafness can be graded into several categories by air conduction threshold. 0 to 25 dB- Normal hearing, 26 to 40dB- Mild deafness, 41 to 55 dB- Moderate deafness, 56 to 70 dB- Moderate to severe deafness,71 to 90 dB- Severe deafness and above 90 dB - Profound deafness.

**Tuning Fork Test**

Also helped in determining the type and degree of hearing loss that is conductive type or sensory neural type of deafness. (Tuning fork of 256 Hz, 512 Hz and 1024 Hz were used) Detailed clinical examination for fifth cranial nerve function, Fifth nerve function was tested by examination for loss of sensation over the face and diminution or absence of corneal reflex. The integrity of the seventh nerve was tested by examining voluntary facial movement and acoustic reflex.

## Results

The study subjects included 15 males and 15 females with mean age of 46.3 $\pm$ 17.06 years (Table 1). Average duration of the disease in these patients was 14 months and average duration of treatment taken was 6 months. All the findings of study group and control group were tabulated and correlation of audiometry findings were made (Table 2 and 3). All analyses were performed with SPSS (Version 17.0). The Independent "t"-test was used. Comparisons were considered significant at $p<0.05$.

**Table 1 : Distribution of Age/Sex in Study Patients**

| Sex | Number of Patients | Mean age in Years with Standard Deviation (±) |
|---|---|---|
| Male | 15 | 39.2 + 15.93 |
| Female | 15 | 53.4 + 15.53 |
| Total | 30 | 46.34 + 17.06 |

**Table 2 : Severity of deafness in patients suffering from Hansen's disease**

| Severity of deafness | Audiometry Range | Number of patients affected Out of 30 | Percentage of Involvement |
|---|---|---|---|
| Normal | 0-25dB | 7 | 23.33% |
| Mild | 26-40dB | 10 | 43.47% |
| Moderate | 41-55dB | 10 | 43.47% |
| Moderate to Severe | 56-70dB | 02 | 8.69% |
| Severe | 71-90dB | 01 | 4.34% |

dB Decibel

**Table 3 : Audiometry Finding**

| Variant | Group I | Group II | Compression (p-value) |
|---|---|---|---|
| Right ear 30 (dB) | 35.28 +14.68 | 28.82 + 2.83 | 0.0214 |
| Left ear 30 (dB) | 42.41 + 14.64 | 29.34 + 2.18 | 0.0010 |
| Total ear 60 (dB) | 38.85+ 14.97 | 29.08+ 2.52 | 0.0000 |

Group-I : Patients suffering from leprosy and taking treatment.
Group-II: Control group- normal Patients.
dB Decibel

## Discussion

Except the fifth and seventh nerves, reported cases of cranial nerves involvement in the literature are rare, with only a few documented cases of eight cranial nerve involvement (Shehata et al 1970). Eustachian catarrh was also observed quite frequently in lepromatous leprosy and it was postulated that this was responsible for diminution in hearing acuity. This was detected in 28.3% of the cases by Sacheri (1963).

The relationship between hearing loss and Hansen's disease was not thought until following scientists (Decandio and Marino 1960) recorded specific involvement of cochlea and acoustic nerve in patients suffering from Hansen's disease. Investigators like (Sacheri et al 1963) detected high incidence of hearing loss in patients suffering from Hansen's disease. However, Cochrane and Davey (1964) stressed that eighth nerve is never affected in Hansen's disease. Usmanov et al (1965; a and b) observed vestibular involvement in only 3% of leprosy patients. Usmanov et al (1968) in another study reported 61% of perceptive type of deafness in leprosy patients. Abdel Latif (1967) reported sensoryneural hearing loss in 25% of leprosy patients.

Schuring and Istre (1969) did not observe any effects on middle or inner ear. While contrary to this Shehata et al (1970) reported that gradual progressive perceptive deafness and vestibular dysfunction in patients suffering from Hansen's disease is due to cranial nerve involvement. Jaffe (1971) stated that specific leprous changes of inner ear and eighth nerve are not known, while Luley and Gulati (1977) reported perceptive deafness in 40.6% of ear in leprosy patients. Singh et al (1984) also reported impaired hearing in 52% of patients suffering from Hansen's disease. Mann et al (1987) reported 44% of patients suffering from unilateral or bilateral perceptive deafness. Awasthi et al (1990) found Audiovestibular involvement in 16% of patients. Koyuncu et al (1994) found sensory neural hearing loss in 22% of patients suffering from Hansen's disease and Vestibular dysfunction in 11% of the patients. Ramadan et al (2001) observed higher frequency of cochlear nerve impairment in patients suffering from Hansen's disease. Gopinath et al (2004) in his study reported that auditory nerve involvement was seen in 10% of patients. Kumar et al (2006) noted multiple cranial nerve involvement in 44% of patients suffering from Hansen's disease but audiometric testing was not performed in this study.(da Silva et al (2008) found that 8.75% of patients suffer from hypoacusis. Wani et al (2009) reported that only 3% of patients showed auditory nerve involvement.

In our present study overall audiometry findings of 30 patients suffering from Hansen's disease showed that 23 patients (76.66%), had sensory neural hearing impairment and 7 patients had (23.33%) normal hearing. Except one patient, all the patients have bilateral hearing impairment. Out of these affected 23 patients, 10 patients

(43.47%) had mild sensory neural hearing impairment, 10 patients (43.47%) had moderate sensory neural hearing impairment, 2 patients (8.69%) had moderate to severe hearing impairment and only 1 patient (4.34% ) showed severe sensorineural hearing impairment (Table 2). On the contrary to our findings study conducted by Mann et al (1987) and Singh et al (1984) reported 52% and 44% of hearing impairments respectively.

The mean audiometry value of study group was 38.85±14.97 dB and for the control group it was 29.08±2.52 dB. When these values were compared there was significant difference with p-value of 0.000. The mean audiometry value for right ear of study group was 35.28±14.68 dB and for the control group right ear it was 28.82±2.83 dB showing significant difference with p-value of 0.0214. The mean audiometry value for left ear of study group was 42.41±14.64 dB and for the control group left ear it was 29.34±2.18 dB showing significant difference with p-value of 0.001 (Table 3).

Ototoxicity is a side effect caused by a number of drugs. These include antibiotics, diuretics, beta blockers, anticonvulsants, cytotoxic drugs and depot steroids. The Index Hand book of ototoxic drugs includes almost every group of drugs (Ballantyne 1979). The side effects of major antileprosy drugs like dapsone, clofazimine and rifampicin are manifold but ototoxicity has not been recorded in the literature (Jopling 1985). Study conducted by Awasthi et al (1990) also failed to reveal any adverse effect of these drugs on hearing status and vestibular function even after one year of therapy.

This suggests that hearing may be impaired due to eighth nerve involvement in Hansen's disease without any relation to the age of the patients or the duration of the disease. In the present study as much as 76.66% of the patients were suffering from perceptive loss of hearing. This percentage is rather high and shows the great tendency of the Hansen's disease to cause damage to eighth cranial nerve. This is in contrast to what has been previously reported in the literature.

## Conclusion

In the absence of any local or systemic disease or ingestion of drugs likely to have side effect on the vestibulocochlear function, leprosy affects the vestibulocochlear system and cochlear involvement is seen more often than involvement of the vestibular system. Hearing loss in patients suffering from Hansen's disease is of cochlear origin.

Involvement of the eighth nerve alone without any changes in its terminal fibers in the inner ear, or its central connections in the brain stem, is perhaps due to the fact that leprosy bacilli damage the Schwann cell enveloping the individual nerve fibers and not the naked axons or brain tracts. When the eighth nerve is involved, it is probably due to ischemia of the nerve which leads to gradual destruction of axons and ultimately hearing loss.

### Limitation and recommendation of the Study

Sample size must be increased to comment on causes of hearing impairment and comparing hearing impairment in different age groups of patients suffering from Hansen's disease. In present study hearing impairment was assisted by objective test like pure tone audiometry. More advanced subjective test like BERA and IMPEDANCE test can be performed to achieve accurate degree of hearing impairment.

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