

## AUDIOVESTIBULAR PROFILE IN UNILATERAL CHRONIC SUPPURATIVE OTITIS MEDIA

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*Audiological tests including middle ear impedance test and vestibular function tests were administered to seventyfive patients of unilateral chronic suppurative otitis media. These patients were selected so as to exclude the influence of hereditary, drugs, systemic illness and the factors of aging. The subjects were subdivided into 3 groups : group 1 cases with central perforation; group 2 with marginal and group 3 with attic perforation respectively. On pure tone audiometry, 19 diseased ears (25.3%) showed sensorineural hearing loss of 40 dB or more at 4 KHz and 8 KHz. The difference in the mean bone conduction threshold of diseased and the non-diseased ears was statistically significant at 4 KHz and above. Results of specialised tests of hearing suggested cochlear pathology being responsible for sensorineural hearing loss. Electronystagmographic recording of saccades and bithermal caloric induced nystagmus revealed canal paresis on the diseased side in 4 patients (5.3%). These 4 patients had 15 years history of otorrhoea.*

### Introduction

Sensorineural hearing loss in chronic suppurative otitis media is well documented. It is hypothesised that in CSOM toxins enter through semipermeable round window membrane causing damage to organ of Corti Paparella<sup>1</sup>, Morizona<sup>2</sup>.

English et al<sup>3</sup> reported that bone conduction thresholds were found to decrease with the severity and duration of the disease. Fradis et al<sup>4</sup> observed similar results and opined that treatment with ear drops containing ototoxic agents may contribute in causing sensorineural hearing loss by diffusion through round window membrane. Walby et al.<sup>5</sup> noted an abnormality in bone conduction in study of 87 patients with unilateral complicated chronic suppurative otitis media. However, from their study of cochlear histopathology they did not find greater loss of specialised sensorineural structures in infected ears than those in control ears. They concluded that alteration in the mechanism of sound

transmission was a more plausible explanation for the hearing loss in chronic suppurative otitis media.

The findings of Dumich and Harna<sup>6</sup> indicate that clinically significant sensorineural hearing loss is uncommon in patients who have chronic otitis media.

Several authors alluded to the possible relationship between otitis media and vestibular disorders.

Maters and Marsh<sup>7</sup> recognised vestibular disorders as a possible sequelae to otitis media. Schaaf<sup>8</sup> investigated the frequency of vestibular disorders in developmentally delayed preschoolers and found that children with history of otitis media were found to have a significantly higher incidence of vestibular disorders than those without such a history. Bhatia and Deka<sup>9</sup> reported in their study of vertigo cases that 3.6% of vertigo results from middle ear disorders with conductive deafness.

The present study was designed to evaluate the audio-vestibular functions in unilateral chronic

suppurative otitis media cases and determine the effects of the disease on inner ear functions as compared to the uninvolved ear.

## Material and Methods

Audiovestibular functions of 75 patients of both sexes and below 40 years of age with unilateral chronic suppurative otitis media, attending the Otolaryngology services of Nehru Hospital attached to the Postgraduate Institute of Medical Education & Research, Chandigarh, India were studied.

The subjects above the age of 40 years were not selected so as to exclude the possible effects of aging process. The lower age limit was 12 years. Patients with positive fistula sign were not included for this study.

In order to establish the diagnosis, detailed history of the illness and a complete E.N.T. examination was carried out in each patient with particular reference to the ear findings.

Nose and throat were examined to exclude any associated pathology.

Drum head was inspected in both ears and suction under microscope was carried out, if necessary to establish the type of tympanic membrane pathology. Based on the findings of tympanic membrane, patients were divided into three groups.

Group I 25 patients with Central perforation (safe pathology)

Group II 25 patients with marginal or posterosuperior perforation of tympanic membrane.

Group III 25 patients with attic pathology.

Tuning fork tests (Rinne's, Webere's and absolute bone conduction tests) were done using 256, 512 and 1024 frequencies in each patient. The findings of any spontaneous or positional nystagmus were also noted if present.

## 1. Audiological Evaluation

### A. Subjective Audiometry

- 1) Pure Tone Audiometry (PTA) (Madsen OB 822)
- 2) Speech Audiometry
  - a) Speech Reception Thresholds (SRT)
  - b) Speech Discrimination Score (SDS)
- 3) Tone Decay
- 4) Short Increment Sensitivity Index (SISI)

## B. Objective Audiometry

- 1) Impedance Audiometry (American Electromedics Corporation Tympanometer Model 86 AR)

## 2. Vestibular Tests :

1. Dundas Grant's Cold Air Caloric Test in case of dry ear.
2. Alternate Hot and Cold Caloric Tests using sterile normal saline for wet ear.
3. ENG Recording of the resultant nystagmus.

The data of audiovestibular tests were analysed statistically using student 't' test.

## Observation and Results

Out of the 75 patients, 48 were males and 27 females. Their age ranged from 12-28 years (23.1 year mean age).

1. *Audiological Findings* : Hearing loss was classified according to the American National Standard Institute (ANSI 1961). Hearing loss upto 40 dB was considered as mild, 41-55 dB moderate, 56-70 dB moderately severe, 71-90 dB severe and above 90 dB profound.

## Conductive Deafness

56 patients (74.7%) showed pure conductive deafness. Gradewise distribution revealed mild hearing loss in 30 cases, moderate in 22 cases and moderately severe in 4 cases only.

2. *Sensorineural Deafness* : 19 diseased ears (25.3%) showed sensorineural deafness of 40 dB or above at 4 KHz and 8 KHz. Of these 19 ears, 6 were from Group I, 4 from Group II and 9 from Group III.

On comparison amongst three groups, there was no significant difference in the values of mean bone conduction threshold.

Gradewise distribution showed mild hearing loss in 17 cases, moderate in one and moderately severe in one (Table I).

Table I						
Hearing Loss by Bone Conduction (Classification ANSI, 1961)						
Group	Mild (40dB)	Mode- rate (41-55dB)	Moderately severe (56-70dB)	Severe (70-90 db)	Pro- found (90dB)	Total
I	6	—	—	—	—	6
II	3	1	—	—	—	4
III	8	—	1	—	—	9
Total	17	1	1	—	—	19

The difference in mean bone conduction threshold values between diseased and non-diseased ears at 4 KHz and 8 KHz was 5 dB in Group I, 3.6 dB in Group II and 6.9 dB in Group III. These values were statistically significant. On analysis of the combined groups, the difference in bone conduction thresholds at 4 KHz and 8 KHz were highly significant ( $P < 0.001$ ) (Table II).

Table II					
Mean bone conduction thresholds at high frequencies (4 KHz and 8 KHz) : Comparison between the diseased and non-diseased ears					
Groups	Diseased Ears		Non-diseased Ears		t p
	Mean	S.D.	Mean	S.D.	
I	22.8	10.1	17.8	3.9	2.309 < 0.05
II	18.75	4.5	15.1	3.7	3.050 < 0.01
III	24.9	12.7	18	3.2	2.634 < 0.05
All Groups	22.2	9.1	16.95	3.6	4.619 < 0.001
S. D. = Standard Deviation					
Mean = Mean threshold of hearing in dB					

The difference in mean speech reception threshold between the diseased and non-diseased ear was highly significant in all three groups ( $P < 0.001$ ).

Groupwise analysis of speech discrimination scores revealed highly significant difference in the scores of Group I and Group II ( $P < 0.001$ ) and significant in Group III ( $P < 0.05$ ).

Tone decay of more than 15 dB was not seen in any patient.

Modified short increment sensitivity index (SISI) remained high in all cases, ranging from 80-100%.

Impedance audiometry revealed Type 'B' tympanogram with absent acoustic reflex on diseased ears and type 'A' tympanogram with normal acoustic reflex on non-diseased ears. The above mentioned tests revealed cochlear pathology as a cause of sensorineural hearing loss.

It is standard practice to set the normal limits of unilateral weakness at 20%. A directional preponderance of more than 30% is considered pathologic.

The difference in mean values of MSS between diseased ears and non-diseased ears was

1.491°/sec. for hot and 1.91°/sec for cold. Though the mean value of MSS was lower in the diseased ears as compared to non-diseased ears, the difference was statistically not significant ( $P > 0.05$ ) in any of the groups (Table III & IV).

Table III					
Analysis of Maximum speed of slow component on hot caloric stimulation, diseased and non-diseased ears responses being compared					
Groups	Diseased Ears		Non-diseased Ears		t p
	Mean	S.D.	Mean	S.D.	
I	16.81	5.95	19.51	7.08	1.460 > 0.05
II	15.08	7.17	16.68	8.00	0.745 > 0.05
III	16.02	7.55	16.19	7.69	0.079 > 0.05
All Groups	15.97	6.9	17.46	7.6	1.257 > 0.05

Table IV					
Analysis of Maximum speed of slow component on cold caloric stimulation, responses from the diseased and non-diseased ears being compared					
Groups	Diseased Ears		Non-diseased Ears		t p
	Mean	S.D.	Mean	S.D.	
I	20.13	6.62	20.3	6.52	0.091 > 0.05
II	16.15	5.42	17.4	6.2	0.759 > 0.05
III	16.38	7.16	17.67	6.94	0.647 > 0.05
All Groups	17.55	6.38	18.46	6.56	0.861 > 0.05

Of the 75 patients, only 4 patients (5.3%) had unilateral weakness of more than 20% on the disease side. The directional preponderance above 20% was not seen in any of patients (Table V).

Table V				
Groupwise distribution of unilateral weakness and directional preponderance				
Groups	Unilateral weakness		Directional Preponderance	
	Upto 20%	Above 20%	Upto 20%	Above 20%
I	25	—	25	—
II	21	4	25	—
III	25	—	25	—
All Groups	75	4	75	—

## **Discussion**

A sound knowledge of the potential relationship between chronic suppurative otitis media and audiovestibular functions is necessary in order to have a rational basis for effective management of the disease. The close anatomical relationship between the middle and the inner ear makes it easy for the disease to spread to the inner ear.

In the present study, the audiovestibular function of the diseased ears were compared with those of the non-diseased ears which acted as controls.

Clinical and audiological assessment of our patients revealed that all the 75 diseased ears had conductive hearing loss. These findings are in conformity with that of Dumich et al.<sup>6</sup>.

19 diseased ears (25.3%) showed sensorineural hearing loss of cochlear variety of 40 dB or above at 4 KHz and 8 KHz. On comparison of mean bone conduction threshold of diseased and nondiseased ears the difference was statistically significant in these 19 cases ( $P < 0.01$ ).

Intergroup comparison of mean bone conduction threshold revealed difference of no statistical significance, which means sensorineural deafness in chronic suppurative otitis media is not related to type of tympanic membrane perforation.

Other authors have observed a higher incidence of sensorineural hearing loss in CSOM cases (34% in Rice's<sup>10</sup> series. These authors did not take consideration of age factor in evaluating cochlear functions. The lower incidence of 25.3% in the present series may be due to the fact that patients above age of 40 years were excluded from the study.

Sensorineural hearing loss especially at higher frequencies in chronic suppurative otitis media was also observed by many other authors, Paparella et al<sup>1</sup>, Morizona<sup>2</sup>, English et al<sup>3</sup> Walby et al<sup>5</sup>. Dumich et al<sup>6</sup> assumed that a number of factors have adverse effect on bone conduction threshold like duration at the disease, size of tympanic membrane perforation, frequency of otorrhoea and severity of the disease.

Paparella et al<sup>1</sup> noted an increasing bone conduction thresholds with increasing duration of the disease. This was found to be true in this study.

Paparella et al<sup>1</sup> extensively studied the pathological changes in the inner ear in cases of chronic suppurative otitis media and they

concluded that abnormal or missing hair cells localised to the basal turn was the cause of hearing loss.

They also hypothesised that the loss of hair cells occur due to toxins and enzymes which are absorbed from the round window. Support of this theory comes from the findings of increased permeability of the round window membrane in experimentally produced otitis media (Gycollea et al<sup>12</sup>).

Impedance audiometry revealed type 'B' tympanogram and absence of acoustic reflex in all the diseased ears. This shows that the middle ear mechanisms are disturbed in chronic otitis media. The non-diseased ears showed type 'A' tympanogram.

Cold air caloric test showed a normal brisk response, however, the mean latent period of nystagmus on cold air stimulation of the diseased ear was shorter and the duration of nystagmus was longer when compared with normal ears. These differences however, were statistically not significant.

ENG records of alternate Hot and Cold caloric tests was studied. These did not show any significant difference in the responses of the diseased and the normal ears. The latent period of nystagmus, however, was significantly shorter on cold stimulation of the diseased ears.

This indicate that chronic suppurative otitis media has little effect on vestibular functions and caloric responses can be more easily produced in presence of tympanic membrane perforation. These findings are in contrast to the findings of Schaaf<sup>8</sup> who reported that patient with history of otitis media had a significantly higher incidence of vestibular disorders.

However, on further study of the maximum speed of slow component in the form of unilateral weakness and directional preponderance, 4 patients showed unilateral weakness of more than 20% on the diseased side. These four patients had a prolonged history of otorrhoea for more than 15 years, which might be responsible for unilateral weakness in these cases.

It can thus be concluded that while majority of the cases of chronic suppurative otitis media have little effect on the vestibular function, long duration of the disease may have an adverse effect.

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## COURSE NEWS

The first micro ear surgery workshop of the Jorhat Academy of ENT Surgeons, Assam was successfully held on 30th Nov. and 1st Dec. '96 at Jorhat Christian Medical Centre, Jorhat. Dr. Probodh Karnik from Mumbai and Dr. K. Zuman from Itanagar conducted the workshop.

Dr. Karnik presented a lively talk on 'Vertigo' in the Doctors' Club, Jorhat in the evening. A booklet on 'Middle Ear Reconstruction' was published on the occasion. Dr. A. K. Saikia, Organising Secretary and Dr. P. C. Barua, President of Jorhat Academy proposed the vote of thanks.