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Pre and Intraoperative Factors Affecting Degree of Hearing in Tubotympanic Otitis Media

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Abstract

Objective: chronic suppurative otitis media (CSOM) defined as a chronic inflammation of the middle ear and mastoid cavity associated with recurrent ear discharges or otorrhoea through a tympanic membrane perforation. CSOM classified into two categories: tubotympanic (TT) and attico-antral disease. CSOM display different degree of hearing loss (HL). There are many factors affecting HL in TT OM as site and size of perforation, Eustachian tube (ET) dysfunction and others. Accordingly, this work designed to highlight the factors affecting the degree of HL and its aggravating factors in CSOM of TT type.

Methods: fifty patients of COM of TT type recruited in this work. Patients < 15 or > 60 years, cases of atticoantral type, complicated cases of TT CSOM, traumatic rupture of TM, congenital or pre-existing HL and cases of previous history of ear operations were excluded from the present study. All patients were subjected to the following: thorough history taking, questionnaire of socio-demographic factors, otoscopic examination, video – otoscopy, tuning fork tests, pure tone audiometry and tympanometry, X-ray mastoid, X-ray nasopharynx soft, lateral view, CT petrous bone (axial and cronal) and finally collecting intra-operative findings.

Results: HL was present in all 50 patients, 44 of them with conductive HL and 6 with mixed HL. Nineteen patients with mild degree HL, 20 with moderate degree HL and 11 with severe degree HL.

Conclusion: degree of hearing loss in TT otitis media is multifactorial. The most important factors that may define the degree of hearing loss are the duration of disease, site of TM perforation, tympanosclerosis, ET function, ossicular chain condition, patency of aditus ad antrum and presence or absence of Korner's septum.

Keywords: Chronic otitis media; Tubotympanic otitis media; Hearing loss; Conductive hearing loss

Introduction

Hearing in humans plays a central role in social communication, while also serving as a warning and orientation system that functions in all spatial directions [1].

Otitis media (OM) is an inflammation of the middle ear cleft, with or without intact tympanic membrane. Hippocrates first described it as early as in 450BC, and it continues to present itself even today as one of the most perplexing universally observed medical problems and a leading cause of hearing loss (HL) [2].

The prevalence of chronic suppurative OM (CSOM) founded as a byproduct of surveys for HL of which it is the major cause. Prevalence of CSOM and its relation with socio-demographic factors also related to prevalence of HL. In children, undetected HL can influence and cause significant delays in speech, cognitive, educational and psychological development [3].

CSOM classified into tubotympanic (TT) and atticoantral disease .The TT disease characterized by the presence of intermittent and mainly mucoid or mucupurulet discharge, central perforation in the pars tensa of varying size and position Atticoantral disease most commonly involves the epitympanum. The typical feature of atticoantral disease is the presence of cholesteatoma. Marginal and attic perforation are the typical picture of this disease, which expose the anatomical structures of the attic, antrum and mastoid air cells system [4].

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Table 1: Age distribution in study group.

Age group	NO. of patients	Percent %
15:24 y	22	44%
25:34 y	15	30%
35:44 y	8	8%
>45 y	5	16%
Total	50	100%

Table 2: The relation between the age and degree of hearing loss.

Age distribution	Degree of hearing loss						χ2*	P*
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
15-24y	11	57.9%	9	45%	2	18.2%	7.640	0.266
25-34y	6	31.6%	4	20%	5	45.5%		
35-44y	1	5.3%	5	25%	2	18.2%		
> 45y	1	5.3%	2	10%	2	18.2%		

χ2: Pearson Chi-Square value. P: Statistical significance.
Table 2 showed no statistical significance between age distribution and degree of hearing loss.

Table 3: The relation between sex and the degree of hearing loss.

Sex distribution	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Male	10	52.6%	10	50%	5	45.5%	0.144	0.931
Female	9	47.4%	10	50%	6	54.5%		

Table 3 showed no statistical significance between sex distribution and degree of hearing loss.

Table 4: The Relation between side of presentation distribution and degree of hearing loss.

Side of distribution	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Right	8	42.1%	7	35%	3	27.3%	3.001	0.558
Left	9	47.4%	7	35%	6	54.5%		
Bilateral	2	10.5%	6	30%	2	18.2%		

Table 4 showed no statistical significance between side of presentation and degree of hearing loss.

Table 5: The Relation between smoking and degree of hearing loss.

	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Smoking	5	26.3%	5	25%	3	27.3%	0.021	0.990

Table 5 showed no statistical significance between smoking and degree of hearing loss.

CSOM produces mild to moderate conductive HL in more than 50% of cases. This results from disruption of the eardrum and ossicles assembly (conductive HL) or from hair cell damage by bacterial infection that has penetrated the inner ear (sensory HL), or both (mixed HL). At a recent WHO meeting of experts from 15 African countries, CSOM considered the most common cause of persistent mild to moderate hearing impairment among children and young people in developing countries [5].

There are many factors affecting HL in TT OM as site and size of perforation, Eustachian tube (ET) dysfunction and other [6].

Table 6: Relation between presenting symptoms and degree of hearing loss.

	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Ear pain	3	15.8%	8	40%	7	63.6%	7.154	0.028*
Ear discharge	19	100%	18	90%	11	100%	3.125	0.210
Ear itching	10	52.6%	13	65%	5	45.5%	1.241	0.538
Tinnitus	9	47.4%	19	95%	10	90.9%	13.838	0.001*

Table 6 showed that patient's symptoms including ear pain and tinnitus showed statistical significance with degree of hearing loss.

Table 7: Relation between duration of disease and degree of hearing loss.

Duration of disease	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
< 1y	1	5.3%	0	0%	0	0%	13.098	0.011*
1-5y	10	52.6%	4	20%	0	0%		
> 5y	8	42.1%	16	80%	11	100%		

Table 7 showed statistical significance between duration of presenting symptoms and degree of hearing loss.

Table 8: Relation between housing and the degree of hearing loss.

Housing	Degree						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Semipaka	1	5.3%	3	15%	1	9.1%	1.039	0.595
Paka	18	94.7%	17	85%	10	90.9%		

Table 8 showed no statistical significance between housing and degree of hearing loss.

Table 9: Relation between family number and degree of hearing loss.

Family NO.	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Medium	17	89.5%	7	35%	2	18.2%	18.046	< 0.001*
Large	2	10.5%	13	65%	9	81.8%		

Table 9 showed a statistical significance between family No. and degree of hearing loss. Hearing loss is proportionate to family No.

Table 10: Relation between education level and degree of hearing loss.

Education level	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
None	0	0%	4	20%	2	18.2%	8.930	0.178
Primary	6	31.6%	9	45%	6	54.5%		
Secondary	10	52.6%	6	30%	3	27.3%		
Tertiary	3	15.8%	1	5%	0	0%		

Table 10 showed no statistical significance between education level and degree of hearing loss.

This work designed to highlight the factors affecting the degree of HL and its aggravating factors in CSOM of TT type.

Methods

Patients

The study designed as a prospective clinical one. Fifty patients

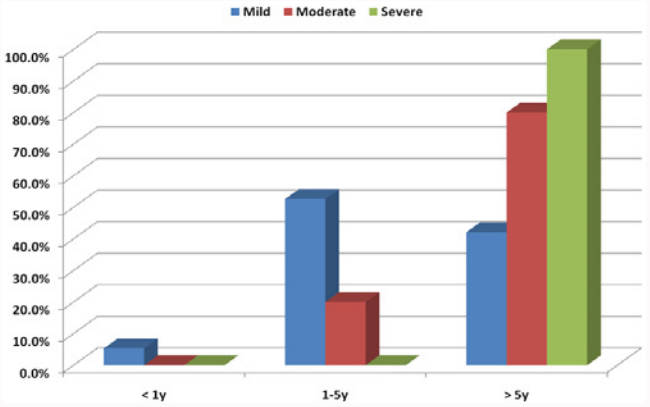

Figure 1: Relation between duration of disease and degree of hearing loss. The degree of hearing loss was proportionate to the duration of the disease.

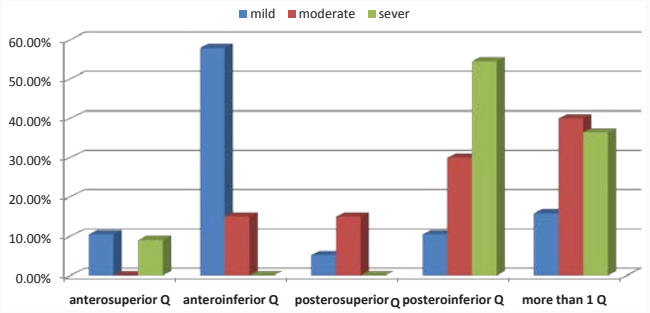

Figure 2: Relation between site of perforation and degree of hearing loss. Posteroinferior Q perforation of TM was proportionate and associated with increased degree of hearing loss than other perforation sites.

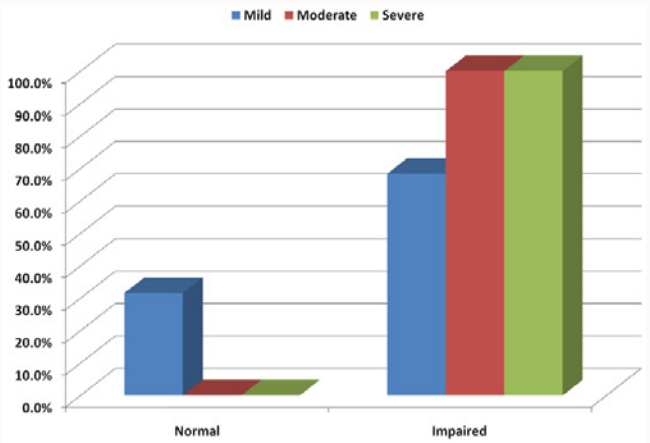

Figure 3: Relation between ET function and degree of hearing loss. The impaired E.T function is proportionate to increased degree of hearing loss.

suffering from CSOM of TT type in the Otorhinolaryngology Department from during 2014 to 2015 recruited for the present study.

Inclusion Criteria: (1) Age between 15 to 60 years. (2) Patients of CSOM of TT type.

Exclusion Criteria: (1) Age < 15 and > 60 years. (2) Cases of atticoantral type cholesteatoma. (3) Complicated cases of CSOM. (4) Traumatic rupture of tympanic membrane. (5) Congenital pre-existing HL. (6) Cases of previous history of ear operations.

Methods

Patients classified according to age into four groups: group (a) 15:24y, group (b) 25:34y, group(c) 35:44y, group (d) >45.

The perforation site was classified into 5 groups: group (a) anterosuperior quadrant (Q), group(b) anteroinferior Q, group(c) posterosuperior Q , group(d) posteroinferior Q, group (e) more than one Q.

The perforation size was classified according to percent of perforation surface area in pixels to total surface area of tympanic membrane in pixels, using Canvas Area Draw program, into 3 groups: group (a) <25%, group (b) 25:50%, group (c) >50%.

ET function evaluated using Toynbee's test. The impedance audiometer programmed to artificially increase or decrease the air pressure at the middle ear and measuring air pressure changes after patient swallows. Neutralizing middle ear pressure after five swallows considered normal. Residual pressure or pressure built up after patient five swallows considered impaired ET function.

HL degree was classified into (26-40 dB) mild HL, (41-60 dB) moderate HL, (61-80 dB) severe HL, (81 dB or greater) profound HL.

All patients subjected to the following: Thorough history taking. Questionnaire of socio-demographic factors. Otoscopic examination. Video - otoscopy. Tuning fork tests. Pure tone audiometry and tympanometry. X-ray mastoid. X-ray nasopharynx soft, lateral view. CT petrous bone (axial and cronal). Collecting intra-operative findings.

The local ethics committee approved this study and a written informed consent obtained from all patients.

Statistical analysis: statistical analysis done to show pre and intraoperative factors affecting degree of hearing in TT type of CSOM. The data analysis carried out using SPSS program version 16.0.0. The criterion for statistical significance was set at $P < 0.05$.

Results

HL was present in all the 50 patients, 44 of them with conductive HL and 6 of them presented with mixed HL. Nineteen patients with mild degree HL, 20 with moderate degree HL and 11 with sever degree HL.

Demographic profile

Age: The age group of patients in the study ranged from 15 to 60 years with maximum involvement in the youngest age group (15:24y) by 22 patient (44% of total patient number) (Table 1) with no statistical significance between age distribution and degree of HL (Table 2).

Sex: Sex distribution in the study was equal, 25 males and 25 females, with no statistical significance between sex distribution and degree of HL (Table 3).

Side of presentation: The most common side of presentation was left ear by 22 patients (44%) followed by right ear by 18 patients (36%) and bilateral ears presentation by 10 patients (20%) with no statistical significance between side of presentation and degree of HL (Table 4).

Special habits: Of 50 patients, 13 were smokers, with no statistical significance between smoking and degree of HL (Table 5).

Table 11: Relation between other family member of the same problem and the degree of hearing loss.

Other member of same problem	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
	4	21.1%	11	55%	7	63.6%	6.764	0.034*

Table 11 showed a statistical significance between presence of other family member of same problem and degree of hearing loss.

Table 12: Relation between perforation site and the degree of hearing loss.

Site of perforation	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Anterosuperior Q	2	10.5%	0	0%	1	9.1%	21.621	0.006*
Anteroinferior Q	11	57.9%	3	15%	0	0%		
Posterosuperior Q	1	5.3%	3	15%	0	0%		
Posteroinferior Q	2	10.5%	6	30%	6	54.5%		
More than one Q	3	15.8%	8	40%	4	36.4%		

Table 12 showed a statistical significance between perforation site and degree of hearing loss.

Table 13: Relation between perforation size and degree of hearing loss.

Size of perforation	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
< 25%	6	31.6%	4	20%	2	18.2%	4.788	0.310
25-50%	11	57.9%	8	40%	5	45.5%		
> 50%	2	10.5%	8	40%	4	36.4%		

Table 13 showed no statistical significance between perforation size and degree of hearing loss.

Table 14: Relation between perforation condition and degree of hearing loss.

	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Condition								
Dry	13	68.4%	12	60%	6	54.5%	0.626	0.731
Wet	6	31.6%	8	40%	5	45.5%		
if wet								
Intermittent	4	80%	9	100%	4	80%	1.852	0.396
Continuous	1	16.7%	0	0%	1	20%		

Table 14 showed no statistical significance between perforation condition and degree of hearing loss.

Patient's symptoms: The most common patient's symptoms were ear discharge in 48 patients (96%) followed by tinnitus in 38 patients (76%), ear itching in 28 patients (56%) and ear pain in 18 patients (36%). Patient's symptoms including ear pain and tinnitus showed statistical significance with degree of HL (Table 6).

Duration of disease: The most common presenting duration, more than 5 years in 70% of patients (35 patients) followed by duration between 1-5 years in 14 patients (28%) and less than one year in 1 patient (2%). There was statistical significance between duration of presenting symptoms and degree of HL (Table 7). HL degree was proportionate to the duration of disease (Figure 1).

Socioeconomic profile

Housing: Of 50 patients only, five patients reported to live in

Table 15: Relation between tympanosclerosis and degree of hearing loss.

Tympanosclerosis	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
	2	10.5%	6	30%	10	90.9%	20.058	< 0.001*

Table 15 showed a statistical significance between tympanosclerosis and degree of hearing loss. Tympanosclerosis is proportionate to degree of hearing loss.

Table 16: Relation between nasal factors and degree of hearing loss.

Nasal factors	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
allergic rhinitis	7	36.8%	12	60%	5	45.5%	2.130	0.345
Sinusitis	2	10.5%	7	35%	2	18.2%	3.521	0.172
Polyposis	0	0%	0	0%	0	0%	-	-
Deviated septum (D.S)	3	15.8%	5	25%	1	9.1%	1.318	0.517
if D.S:								
c shaped	0	0%	1	20%	1	100%	7.857	0.097
s shaped	2	40%	0	0%	0	0%		
Spur	3	60%	4	80%	0	0%		
if obstructing								
affecting same side	1	50%	4	100%	1	100%	2.917	0.233
affecting opposite side	1	50%	0	0%	0	0%		

Table 16 showed no statistical significance between previously mentioned nasal factors and degree of hearing loss.

Table 17: Relation between adenoid and degree of hearing loss.

Adenoid	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
	6	31.6%	7	35%	1	9.1%	2.558	0.278

Table 17 showed no statistical significance between adenoid and degree of hearing loss.

Table 18: Relation of ET function and degree of hearing loss.

E.T. function test	Degree						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Normal	6	31.6%	0	0%	0	0%	11.124	0.004*
Impaired	13	68.4%	20	100%	11	100%		

Table 18 showed a statistical significance between E.T function and degree of hearing loss.

Table 19: Relation between mastoid size and degree of hearing loss.

Mastoid size	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Contracted	1	5.3%	4	20%	2	18.2%	1.962	0.375
not contracted	18	94.7%	16	80%	9	81.8%		

Table 19 showed no statistical significance between mastoid size and degree of hearing loss.

Semipaka (floor is of brick) houses. None of them reported to live in Kachha (floor, wall, roof all non-brick) houses. The rest of them, 45 patient lived in Paka (floor, wall is of brick) houses. There was no statistical significance between housing and degree of HL (Table 8).

Family size: Medium size families (4persons/room) were the most common presentation in 26 patients by 52%. None of the patients

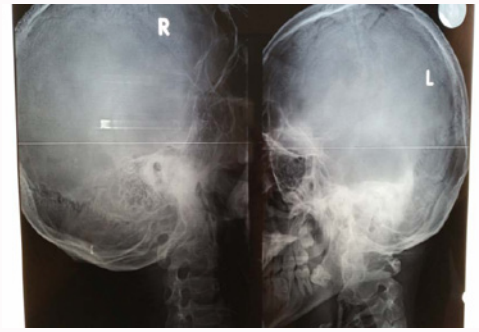

Figure 4: X-ray mastoid of 22years old male patient with LT side TT otitis media showing pneumatized mastoid on RT side while LT side appears opacified.

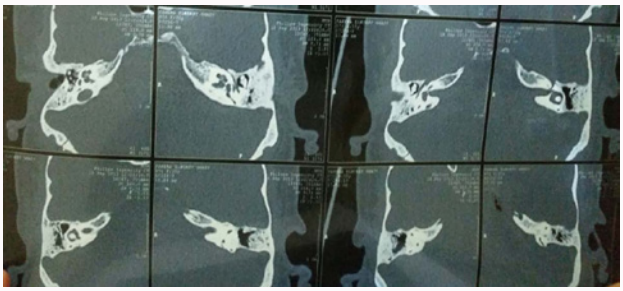

Figure 5: CT temporal bone axial cuts of 38 years old female with bilateral TT otitis media showing bilateral opacified mastoid.

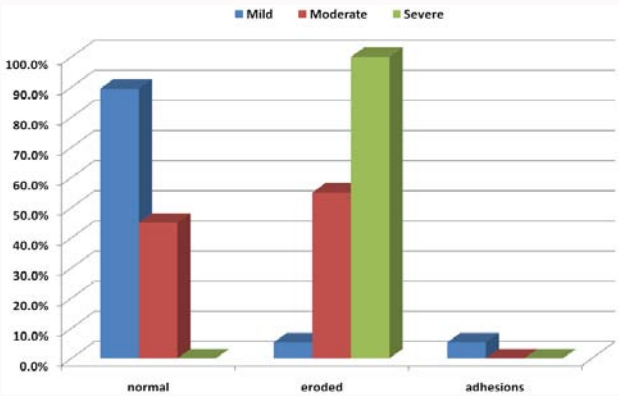

Figure 6: Relation between intraoperative ossicular chain condition and degree of hearing loss. Ossicular erosions or adhesions are proportionate to increased degree of hearing loss.

reported small sized family. There was a statistical significance between family No. and degree of HL. HL was proportionate to family No (Table 9).

Education: Primary education showed the highest incidence in education level (21 patients by 42%), while tertiary education showed the lowest incidence (4 patients by 8%). There was no statistical significance between education level and degree of HL (Table 10).

Other family member: Of 50 patients, 22 had other family member (1st and 2nd degree) complaining of CSOM. There was statistical significance between presence of other family member of same problem and degree of HL (Table 11).

TM perforation

Site: The highest incidence of perforation site was in perforations

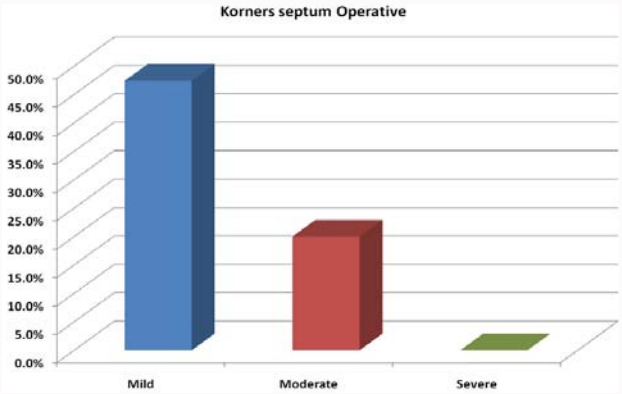

Figure 7: Relation between intraoperative Korner's septum detection and degree of hearing loss. The presence of Korner's septum was proportionate to increase degree of hearing loss.

Table 20: Relation between mastoid pneumatization on CT and degree of hearing loss.

Mastoid on CT	Degree						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Pneumatized	1	5.3%	0	0%	0	0%	1.665	0.435
Sclerosed	18	94.7%	20	100%	11	100%		

Table 20: showed no statistical significance between mastoid pneumatization on C.T. and degree of hearing loss.

Table 21: Relation between intraoperative ossicular chain condition and degree of hearing loss.

Ossicular chain condition	Degree						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Normal	17	89.5%	9	45%	0	0%	26.851	< 0.001*
Eroded	1	5.3%	11	55%	11	100%		
Adhesions	1	5.3%	0	0%	0	0%		

Table 21 showed a statistical significance between intraoperative ossicular chain condition and degree of hearing loss.

Table 22: Relation between intraoperative middle ear mucosa condition and degree of hearing loss.

middle ear mucosa condition	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Normal	16	84.2%	14	70%	2	18.2%	19.423	0.001*
Inflamed	2	10.5%	5	25%	3	27.3%		
Adhesions	1	5.3%	1	5%	6	54.5%		

Table 22 showed a statistical significance between intraoperative middle ear mucosa condition and degree of hearing loss.

located in more than one Q in 15 patients (30%) followed by anteroinferior Q and postroinferior Q perforation each in 14 patients (each 28%), posterosuperior in 4 patients (8%) and finally anterosuperior in 3 patients (6%). There was statistical significance between perforation site and degree of HL (Table 12). Posteroinferior Q perforation of TM was proportionate and associated with increased degree of HL more than other perforation sites (Figure 2).

Size: In this study, the commonest size of perforation group was group (b) 25:50% of total surface area of TM in 24 patients (48%) followed by group (c) > 50% of total surface area (28%) and finally

Table 23: Relation between ET. Opening and degree of hearing loss.

ET.orifice	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
Patent	18	94.7%	14	70%	8	72.7%	4.193	0.123
Occluded	1	5.3%	6	30%	3	27.3%		

Table 23 showed no statistical significance between patency of E.T opening and degree of hearing loss.

Table 24: Relation between aditus communication & aeration and degree of hearing loss.

Patency of aditus ad antrum	Degree						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
	18	94.7%	18	90%	6	54.5%	9.266	0.010*

Table 24 showed that absence of patency of aditus ad antrum was proportionate to increase degree of hearing loss.

Table 25: Relation between intraoperative Korner's septum detection and degree of hearing loss.

Korners septum detection Intraoperative	Degree of hearing loss						χ2	P
	Mild		Moderate		Severe			
	No	%	No	%	No	%		
	9	47.4%	4	20%	0	0%	8.748	0.013*

Table 25 showed a statistical significance between Korner's septum detection intraoper ative and degree of hearing loss.

group (a) < 25% of total surface area (24%), with no statistical significance between perforation size and degree of HL (Table 13).

Condition at time of examination: Of 50 patients, there were 31 patients with dry ears and 19 patients with wet ears. Of the 19 patients with wet ears, there were 17 with intermittent discharge and 2 with continuous discharge. There was no statistical significance between perforation condition and degree of HL (Table 14).

Tympanosclerosis: Eighteen patients of 50 had tympanosclerosis with statistical significance between tympanosclerosis and degree of HL. Tympanosclerosis is proportionate to degree of HL (Table 15).

Nasal factors

Of 50 patients, twenty-four patients had allergic rhinitis (symptoms or signs), 11 patients had sinusitis (symptoms or signs), none of them had nasal polyposis, nine patients of the whole sample had deviated septum (2 c-shaped, 2 s-shaped and 7 spurs) only six of them were obstructing same side of CSOM. There was no statistical significance between previously mentioned nasal factors and degree of HL (Table 16).

Nasopharyngeal factors

Of 50 patients, 14 patients (28%) had adenoid with no statistical significance between adenoid and degree of HL (Table 17).

ET function

ET function test was impaired in 44 patients (88%) in the affected side, with statistical significance between E.T function and degree of HL (Figure 3). The impaired E.T function is proportionate to increase in degree of HL (Table 18).

X-ray

One hundred % of patient showed opacified mastoid of the affected side in x-ray mastoid Schuller's view (Figure 4). Fourteen patients showed opacified soft tissue density encroached on airway of x-ray nasopharynx soft lateral view.

Computerized Tomography (C.T)

Mastoid size: Mastoid contracted in seven patients (14%), with no statistical significance between mastoid size and degree of HL (Table 19).

Mastoid pneumatization: Of 50 patients, 49 of them (98%) showed sclerosed mastoid (Figure 5) with no statistical significance between mastoid pneumatization on C.T. and degree of HL (Table 20)

Intraoperative factors

Ossicular condition: Intraoperative ossicular chain examination revealed erosion of ossicles in 23 patient (46%) and adhesions between ossicles in 1 case (2%). There was statistical significance between intraoperative ossicular chain condition and degree of HL (Figure 6). Ossicular erosions or adhesions were proportionate to increase in degree of HL (Table 21).

Middle ear mucosa condition: Of 50 patients, middle ear mucosa was inflamed in 10 patients (20%), adhesions in 8 patients (16%) and rest of patients showed normal middle ear mucosa. There was statistical significance between intraoperative middle ear mucosa condition and degree of HL. So inflamed middle ear mucosa or adhesions were proportionate to increased degree of HL (Table 22).

ET opening: ET opening was patent in 40 patients (80%) with no statistical significance between patency of E.T opening and degree of HL (Table 23).

Patency of aditus ad antrum: Patency of aditus ad antrum was absent in eight patients (16%). The absence of patency of aditus ad antrum was proportionate to increase degree of HL (Table 24).

Intraoperative Korner's septum: Only in 13 patients, Korner's septum was detected intraoperative (26%). There was statistical significance between Korner's septum detection intraoperative and degree of HL (Figure 7). The presence of Korner's septum was proportionate to increased degree of HL (Table 25).

Discussion

The goal of this study was to highlight the factors affecting the degree of HL in CSOM of TT type and its aggravating factors.

Demographic profile:

Age: In this study, the highest incidence of age groups was the youngest (15-24y) that could explain by low immunity and recurrent chest infections. Same observation reported in studies reported by Nepal et al. [7], (Agrawal et al. [8], Shyamala and Reddy [9] and Nahata et al. [10].

Sex: Sex distribution in the study was equal, 25 male and 25 female. This distribution differed from Nahata et al. [10] and Ibekwe et al. [11] studies where the number of females group was higher than the number of males (male: female ratio was 3:4). In addition, this distribution differed from Afolabi et al. [12] and Nepal et al. [7] studies where a male preponderance reported. This can explained by literacy levels differences by different geographical locations.

Side: Unilateral presentation (80%) was common than bilateral presentation (20%), with predominance of left side incidence than right side. Same results seen in Ibekwe et al. [11] study. This differs from Nahata et al. [10] study where bilateral presentation was more common, where they explained that by presence of high incidence

hypertrophied adenoid in their sample responsible of bilateral disease. In our study, only 14 patients had hypertrophied adenoid.

Special habits: There was no statistical significance between smoking and degree of hearing loss in our study. This can explain by decrease number of smokers (13 patients) among cases of the sample. Up to the author's best knowledge, there are no studies discussed the relation between smoking and degree of hearing loss in TT OM.

Presenting symptoms: Ear discharge was the most common presenting symptom. Same results reported in Kumar et al. [13] and Nahata et al. [10] studies.

Presenting symptoms duration: In our study, the degree of hearing loss was proportionate to duration of presenting symptoms. This can explained by increased duration of disease gives more chances for deterioration of middle ear state e.g. ossicular necrosis, ossicular adhesions and middle ear mucosa adhesions. Same results shown in Maharjan et al. [14] study.

Socioeconomic profile

Housing: There was no statistical significance between housing and degree of hearing loss. This could be explained by patient shyness to admit housing in Kachha (floor, wall, roof all non-brick) or Semipaka (floor is of brick) which make their both incidence only 10% of the sample.

Family size: Medium sized family was the most common finding between patients sample. Same results seen in Shaheen et al. [15] study. There was statistical significance between family size and degree of hearing loss. This can be explained by that overcrowding is a good environment for recurrent infections whether URTI or recurrent acute ear infections.

Education: Although high association between maternal education level and CSOM of children with CSOM seen in Shaheen et al. [15] study. There was no statistical significance between education level and degree of hearing loss.

Other family member: Statistical significance between presence of other family members (1st and 2nd degree) of same problem and degree of hearing loss that could explained by sharing the same environment conditions.

TM Perforation

Site: Posteroinferior Q perforations of TM were proportionate and associated with increase degree of hearing loss more than other perforation sites. This can explained by direct impaction of sound energy into the middle ear. In posteroinferior Q, perforations lies over the round window, which cancel the hydraulic advantage produced by TM on oval window? So sound energy reaches the two windows more or less at the same time by equal force and equal time. The resultant cancellation of the vibratory movement of the cochlear fluid results in the maximum HL even in small perforations overlying posteroinferior Q. Same results was found by Durko and Latkowski [16] study in 145 patients of CSOM of TT type with intact, mobile ossicles. In addition, same observation found in Berger et al. [17] study. Also in Nahata et al. [10] study, they found that posterior perforations have the greatest hearing loss. These results did not agree by Vose et al. [18] in their study where they found perforation site not affecting degree of hearing loss.

Size: In this study, there was no correlation between perforation size and degree of hearing loss. Saeed and Ghamdi [19] reported same results in a series of 183 patients. In addition, this study agreed with Malik et al. [20] where they observed that there was no relation between the size of perforation and the degree of hearing loss. However, the present study result did not agree with results of Berger et al. [17], Voss et al. [18], Ibekwe et al. [11] and Nahata et al. [10] studies, where they found a proportionate relation between sizes of the perforation, the degree of hearing loss.

Tympanosclerosis: In our study, there was statistical significance between tympanosclerosis and degree of hearing loss. This result agreed with Gibb and Pang [21] and with Pal and Sengupta [22] studies. Tympanosclerosis interferes with the transmission of sound vibrations across the middle ear structures and decreasing mobility of the remaining part of the perforated TM. In addition, association of posteroinferior Q perforations and blocked Aditus with tympanosclerosis can explain its effect on degree of hearing loss.

Nasal factors

In our study, we could not approve correlation between nasal factors as allergic rhinitis, sinusitis, polyposis and deviated septum and degree of hearing loss, although, high association between sinonasal pathology and chronic ear diseases proved in Yeolekar and Dasgupta [23] study. It should considered that the effect of allergic rhinitis on the ET function proved, yet there is still no evidence on the AR effect in development of the CSOM [24].

Nasopharyngeal factors

Although, there was proved relation between AR on the ET function, there was no statistical significance between adenoid and degree of hearing loss. This could explained by small percent of adenoid hypertrophy in the sample (28%) as the sample age started by 15 years.

ET function

ET considered as the most important item in the pathogenesis of middle ear disease. Its dysfunction defined as an inadequate dilatory function leading to secondary ear pathology. It may be due to mechanical or functional causes [25]. In this study, impaired ET function was proportionate to degree of hearing loss that could explained by loss aeration of middle ear cavity leading to more deterioration of middle ear disease.

Ossicles: Ossicular chain erosions whether on CT or intraoperative was proportionate to degree of hearing loss. This can explained by losing the conductive pathway through ossicular chain. This result was in agreement with Kumar et al. [13] study where they found in addition, malleolar erosion had greater degree of hearing loss than non-malleolar erosion.

Korner's septum: the presence of Korner's septum was proportionate to degree of hearing loss whether on CT or intraoperative. This could link to disturbed aeration of middle ear cavity.

Patency of aditus ad antrum: In this study, absence patency of aditus ad antrum was proportionate to increased degree of hearing loss. Absence of patency of aditus ad antrum is a major cause of middle ear pathology deterioration and increasing degree of hearing loss.

Conclusion

Degree of hearing loss in TT otitis media is multifactorial. The most important factors that may define the degree of hearing loss are

the duration of disease, site of TM perforation, tympanosclerosis, ET function, ossicular chain condition, patency of aditus ad antrum and presence or absence of Korner's septum.

Conflict of Interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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