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CLINICAL AND AUDIOLOGICAL FACTORS WITH OSSICULAR CHAIN CONTINUITY IN SUBJECTS WITH CHRONIC OTITIS MEDIA A COMPARATIVE STUDY

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ABSTRACT

Background: Myringoplasty is the recommended course of therapy for patients who have both a tympanic membrane perforation and chronic otitis media (COM). However, myringoplasty and ossiculoplasty are performed in conjunction and referred to as tympanoplasty when ossicles are involved. Determining the kind of tympanoplasty requires a preoperative evaluation of ossicular status. Subjects with a small air-bone gap and a brief illness duration exhibit osseous chain continuity.

Aim: The purpose of this study was to evaluate the association between the ossicular chain status and preoperative audiological, clinical, and other variables.

Methods: The present investigation analyzed 200 participants with mucosal chronic otitis media (COM). Based on the results of the studies and clinical examination, each individual received a preoperative evaluation and diagnosis. Results were developed after operational findings were compared.

Results: According to the study, 30%, 28%, and 18% of participants had ear discharge for less than a year, one to five years, and six to ten years, respectively. 80% of research participants had good results for hearing loss. Regarding the relationship between ossicular chain status and PTA (pure-tone average), [p=0.02]. Ossicular chain deficiency was detected in 19.36% of patients and the majority of participants were in the moderate group followed by mild hearing loss in 31% and 24% of subjects respectively.

Conclusion: Most people with severe hearing loss had ossicular chain discontinuity followed by profound hearing loss. On a pure-tone average, most patients had mild to fairly severe conductive hearing loss. The likelihood of ossicular discontinuity is shown to rise with the air-bone gap.

Keywords: chronic otitis media, hearing loss, ossicular continuity, PTA, tympanosclerosis

INTRODUCTION

A cholesteatoma may or may not accompany the persistent or sporadic purulent discharge from the perforated TM (tympanic membrane), which is a hallmark of chronic otitis media (COM), a clinical disease that manifests as an infection in the middle ear cleft. Exposure to microorganisms from the external auditory canal or Eustachian tube is the most frequent cause of recurrent or chronic mucoid otorrhea, often known as active COM. Although ossicular chain discontinuity is identified after surgery, many preoperative factors can aid in predicting the existence of ossicular erosion and may be useful in the design of subsequent ossicular repair.[1]

Assessing the ossicular state prior to surgery is essential because it aids in determining the type of prosthesis and tympanoplasty that are needed. Subjects with an air conduction threshold loss of less than 40 dB on pure tone audiometry, no

low-frequency loss, a shorter air-bone gap of less than 25 dB, no aural polyp, no myringosclerosis or tympanosclerosis, no granulation tissue, and a shorter disease duration are typically found to have osseous chain continuity.[2] Wullstein coined the term "tympanoplasty" in 1953 to describe surgical techniques for restoring the middle ear hearing mechanism that had been destroyed or compromised by long-term middle ear disease. In 1956, Wullstein also described six methods of tympanoplasty, from fenestration of the lateral semicircular canal to ossicular chain building and tympanic membrane repair. Surgical results are influenced by surgical treatment factors such ossiculoplasty, graft sources (dura, perichondrium, cartilage graft, and temporalis fascia), and technique like postaural, endaural, and parameter. No single approach is preferred while performing tympanoplasty.[3]

The degree of hearing loss increases with pathologies that interact with the ossicular chain. Hearing loss of about 60 dB can result from a complete interruption of the ossicular chain. The most popular and recognized explanation for ossicular erosion is long-term middle ear inflammation brought on by an excess of cytokines. As a result, chronic otitis media is an inflammatory response accompanied by a malfunctioning wound healing system. The middle war's inflammatory process is more dangerous. It is closer to the ossicular chain the longer it lasts.[4]

The current study sought to evaluate the relationship between preoperative audiological, clinical, and other factors regarding the ossicular chain status in the mucosal type of chronic otitis media, given the necessity to comprehend specific audiological and clinical factors as preoperative predictors of ossicular chain status.

MATERIALS AND METHODS

Assessing the association between preoperative audiological, clinical, and other parameters regarding the ossicular chain status in the mucosal type of chronic otitis media was the goal of the current cross-sectional prospective clinical investigation. The research participants came from the Institute's ENT Department. Prior to their involvement in the study, all individuals gave their written and verbal informed consent.

Both male and female participants with chronic otitis media were evaluated for the research. Subjects between the ages of 10 and 60, those with a verified clinical diagnosis of mucosal type chronic suppurative otitis media, and those who provided consent for research participation and follow-up were all required to be included in the study.

Subjects with a history of trauma, those with other ENT issues requiring surgery, those who did not finish follow-up, those who refused to participate in the study, those under the age of ten or older than sixty, and those with squamosal type COM were all excluded from the study.

Following the research subjects' final inclusion, preoperative evaluation and diagnosis were determined by comparing the results of the operational procedures with the clinical examination and laboratory tests. The individuals' age, gender, and place of residence were the factors that were noted for each participant.

Intraoperative ossicular chain status, middle ear mucosa, cholesteatoma, tympanosclerosis or myringosclerosis, presence of granulation, and length of illness were among the characteristics considered as predictors of response variables. The audiologist used the audiometer in the soundproof room to calculate the pure tone average, or PTA.

The Modified Hughson–Westlake technique was used to calculate the pure-tome average. PTA 1 was defined as the average of 500, 1000, and 2000, while PTA 2 was defined as the average of 2000, 4000, and 8000. In order to develop a therapeutic approach, all patients with mucosal type chronic otitis media who presented with ear discharge had their clinical, audiological, and radiological data documented.

Tympanoplasty was then carried out on each participant by a single, highly qualified surgeon. All individuals received conventional postoperative treatment. Following the stabilization of their condition, the subjects were released.

SPSS was used to statistically analyze the collected data for assessment of descriptive measures, one-way ANOVA (analysis of variance), and chi-square test. The results were expressed as mean and standard deviation and frequency and percentages. The p-value of <0.05 was considered statistically significant.

RESULTS

Assessing the association between preoperative audiological, clinical, and other parameters regarding the ossicular chain status in the mucosal type of chronic otitis media was the goal of the current cross-sectional prospective clinical investigation. 200 participants with the mucosal form of chronic otitis media (COM) were evaluated in this study. The research participants, who ranged in age from 10 to 60, had an average age of 28.27. 39% of the participants were between the ages of 10 and 20,

followed by 26%, 14%, 13%, and 8% of individuals who were between the ages of 21 and 30, 31 and 40, 41 and 50, and 51 and 60. Sixty-eight percent of the individuals had unilateral ear discharge, and thirty-two percent had bilateral ear discharge. In 7% of patients, foul-smelling discharge was observed.

According to symptoms, 80% of research participants had hearing loss, with 9% experiencing fluctuating hearing loss and 71% experiencing non-fluctuating hearing loss. The period of discharge was less than one year for 30% (n=60), 28% (n=56), 18% (n=36), 10% (n=20), 10% (n=20), 2% (n=4), and 2% (n=4) of the research participants, respectively (Table 1).

When evaluating the average air-bone gap among study participants, the majority (n = 60) had an average of 31–40 dB, followed by 27% (n = 54) with an average of 21–30 dB, 26% (n = 52) with an average of 11–20 dB, 9% (n = 18) with an average of 1–10 dB, and 7% (n = 14) with an average of 41–50 dB. According to Table 2, the lowest average air-bone gap was 51–60 dB, seen in 1% (n=2) of research participants.

Regarding the relationship between PTA 1 and ossicular chain status in research participants, it was observed that 9.09% (n=2) and 90.91% (n=20) of PTA1 category normal people had discontinuous and entire ossicular chains, respectively. 48 patients had mild PTA1, with 4.17% (n=2) and 95.83% (n=46) exhibiting intact and discontinuous ossicular chains. In 62 participants with moderate PTA1, discontinuous and intact ossicular chains were observed in 19.36% (n=12) and 80.64% (n=50) of the subjects. 38 research participants had moderately severe PTA1, whereas 31.58% (n=12) and 68.42% (n=26) had discontinuous and intact ossicular chains, respectively.

In 50% (n=10) of participants with discontinuous and unbroken ossicular chains, 20 subjects had severe PTA1. In 40% (n=4) and 60% (n=6) of the research participants, respectively, profound PTA1 was seen in 10 people with discontinuous and intact ossicular chains. With p=0.02, this association was statistically significant. Regarding the relationship between PTA2 and ossicular chain status in research participants, the findings indicated that 8.69% (n=4) and 91.31% (n=42) of PTA2 category normal people had discontinuous and entire ossicular chains, respectively. Of the 46 patients with PTA2 mild, 4.34% (n=2) and 95.66% (n=44) had discontinuous and unbroken ossicular chains. 52 participants had moderate PTA2, with discontinuous and unbroken ossicular chains seen in 23.07% (n=12) and 76.93% (n=40) of the patients.

38 research participants had moderately severe PTA2, whereas 46.15% (n=12) and 53.85% (n=14) had discontinuous and entire ossicular chains, respectively. 16 participants had severe PTA2, whereas 37.50% (n=6) and 62.50% (n=10) of the subjects had discontinuous and intact ossicular chains, respectively. 14 participants with discontinuous and intact ossicular chains, respectively, had profound PTA1 in 42.85% (n=6) and 57.15% (n=8) of the research participants. With p=0.01, this link was statistically significant (Table 4).

Regarding the examination of intraoperative results in research participants, 79% (n=158) of those with incudo-stapedial joint discontinuity had intact joints, whereas 21% (n=42) had discontinuous joints. Of the 168 research participants, 84% had entire ossicular chain continuity, whereas 16% had discontinuous ossicular chain continuity (n = 32) study subjects respectively as shown in Table 5.

Additionally, it was observed that there was a correlation between the study participants' granulation to ossicular chain status and tympanosclerosis/myringosclerosis. Granulation tissue was absent in 1.85% (n=2) of the discontinuity subjects and present in 98.14% (n=106) of the ossicular chain intact subjects, while it was present in 43.47% (n=40) of the discontinuity subjects and 56.52% (n=52) of the intact chain subjects. With p=0.000, the difference was statistically significant. Tympanosclerosis/myringosclerosis was found in 26.32% (n=10) of participants with intact ossicular chains and 73.68% (n=28) of those with discontinuous ossicular chains.

8.64% (n=14) of participants with discontinuous ossicular chains and 93.65% (n=148) of subjects with intact ossicular chains did not have tympanosclerosis or myringosclerosis. With p=0.000, this difference was statistically significant (Table 6).

DISCUSION

200 participants with the mucosal form of chronic otitis media (COM) were evaluated in this study. The research participants, who ranged in age from 10 to 60, had an average age of 28.27. 39% of the participants were between the ages of 10 and 20, followed by 26%, 14%, 13%, and 8% of individuals who were between the ages of 21 and 30, 31 and 40, 41 and 50, and 51 and 60. Sixty-eight percent of the individuals had unilateral ear discharge, and thirty-two percent had bilateral ear discharge. In 7% of patients, foul-smelling discharge was observed. According to symptoms, 80% of research participants had hearing loss, with 9% experiencing fluctuating hearing loss and 71% experiencing non-fluctuating hearing loss. In 30% (n=60), 28%

(n=56), 18% (n=36), 10% (n=20), 10% (n=20), 2% (n=4), and 2% (n=4) of the study participants, the discharge length was less than one year.

These recordings resembled those from studies by Bayat A et al. (2019) and Harkare VV et al. (2020), in which the authors evaluated participants with COM and included comparable demographic and clinical data to the current study. According to the study findings, the majority of the study participants had an average air-bone gap of 31–40 dB, with 30% (n=60) having this value, followed by 27% (n=54) having an average of 21–30 dB, 26% (n=52) having an average of 11–20 dB, 9% (n=18) having an average of 1–10 dB, and 7% (n=14) having an average of 41–50 dB. One percent (n=2) of the research participants had the lowest average air-bone gap, which was between 51 and 60 dB. These findings were in line with research by Carrillo MD7 in 2006 and Varshney S et al. in 2010, where authors revealed air-bore gap averages comparable to the current study in their separate investigations. Regarding the relationship between PTA 1 and ossicular chain status in research participants, 9.09% (n=2) and 90.91% (n=20) of PTA1 category normal people, respectively, had discontinuous and unbroken ossicular chains. 48 patients had mild PTA1, with 4.17% (n=2) and 95.83% (n=46) exhibiting intact and discontinuous ossicular chains. Of the 62 patients with moderate PTA1, 19.36% (n=12) and 80.64% (n=50) had intact and discontinuous ossicular chains. 38 participants with discontinuous and intact ossicular chains had moderately severe PTA1 in 31.58% (n=12) and 68.42% (n=26) of the research participants, respectively.

In 50% (n=10) of participants with discontinuous and unbroken ossicular chains, 20 subjects had severe PTA1. In 40% (n=4) and 60% (n=6) of the research participants, respectively, profound PTA1 was seen in 10 people with discontinuous and intact ossicular chains. With p=0.02, this association was statistically significant. These results were consistent with the findings of the current study and the findings of Thangaraj PS et al. (2017) and Singh BR et al. (2018), who revealed a substantial association between PTA 1 and ossicular chain status.

Regarding the relationship between PTA2 and ossicular chain status in research participants, it was observed that 8.69% (n=4) and 91.31% (n=42) of PTA2 category normal people had discontinuous and entire ossicular chains, respectively.

Of the 46 patients with PTA2 mild, 4.34% (n=2) and 95.66% (n=44) had discontinuous and unbroken ossicular chains. 52 participants had moderate PTA2, with discontinuous and unbroken ossicular chains seen in 23.07% (n=12) and 76.93% (n=40) of the patients. 38 research participants had moderately severe PTA2, whereas 46.15% (n=12) and 53.85% (n=14) had discontinuous and entire ossicular chains, respectively. 16 participants had severe PTA2, whereas 37.50% (n=6) and 62.50% (n=10) of the subjects had discontinuous and intact ossicular chains, respectively. 14 participants with discontinuous and intact ossicular chains, respectively, had profound PTA1 in 42.85% (n=6) and 57.15% (n=8) of the research participants. With p=0.01, this association was statistically significant.

These findings were consistent with those of Ghosh NC et al. (2020) and Karimi-Yazdi A et al. (2011), who found that PTA2's association with the ossicular chain was strong and comparable to the findings of their respective investigations. According to the analysis of intraoperative results in study participants, 79% (n=158) of those with incudo-stapedial joint discontinuity had intact joints, whereas 21% (n=42) had discontinuous joints. Ossicular chain continuity was discontinuous in 16% (n=32) of the individuals and entire in 84% (n=168) of the subjects. These results came from earlier research by Rasheed RA et al. (2013) and Gupta A et al. (2014) in 2019. where authors' findings for ossicular chain continuity and incudo-stapedial joint discontinuity were similar to those of this investigation.

According to the study's findings, there was a correlation between the ossicular chain status and tympanosclerosis/ myringosclerosis in the participants. Granulation tissue was absent in 1.85% (n=2) of the discontinuity subjects and present in 98.14% (n=106) of the ossicular chain intact subjects, and 43.47% (n=40) of the discontinuity subjects and 56.52% (n=52) of the intact chain subjects. The difference, p=0.000, was statistically significant. According to the assessment, 26.32% (n=10) of the participants with complete ossicular chains and 73.68% (n=28) of the subjects with discontinuous ossicular chains had tympanosclerosis/myringosclerosis. Of the individuals with discontinuous ossicular chains, 8.64% (n=14) had no tympanosclerosis or myringosclerosis, whereas 93.65% (n=148) had entire ossicular chains. With p=0.000, this difference was statistically significant. These results were consistent with those of Balasubramanian C et al. (2017) and Orji FT et al. (2016), who observed similar correlations between ossicular chain status and granulation and tympanosclerosis/ myringosclerosis in their respective investigations.

CONCLUSIONS

Taking into account its limitations, the current study comes to the conclusion that most people with severe hearing loss

experience ossicular chain discontinuity followed by profound hearing loss. On a pure-tone average, most patients had mild to fairly severe conductive hearing loss. The likelihood of ossicular discontinuity is shown to rise with the air-bone gap.

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S. No	Discharge duration (years)	Number (n=200)	Percentage (%)
1.	**<1**	60	30
2.	**1-5**	56	28
3.	**6-10**	36	18
4.	**11-15**	20	10
5.	**16-20**	20	10
6.	**21-25**	4	2
7.	**26-30**	4	2
8.	**Total**	200	100

Table 1: Duration of ear discharge in study subjects

S. No	Air-bone gap average (dB)	Number (n=200)	Percentage (%)
1.	**1-10**	18	9
2.	**11-20**	52	26
3.	**21-30**	54	27
4.	**31-40**	60	30
5.	**41-50**	14	7
6.	**51-60**	2	1
7.	**Total**	200	100

Table 2: Assessment of Air-bone gap average (dB) in study subjects

S. No	PTA 1 category	Ossicular chain status				Total n (%)
		Discontinuity		Intact		
		n=42	%	n=158	%	
1.	**N (normal)**	2	9.09	20	90.91	22 (100)
2.	**M (mild)**	2	4.17	46	95.83	48 (100)
3.	**MD (moderate)**	12	19.36	50	80.64	62 (100)
4.	**MS (moderately severe)**	12	31.58	26	68.42	38 (100)
5.	**S (severe)**	10	50	10	50	20 (100)
6.	**P (profound)**	4	40	6	60	10 (100)
7.	**Total**	42		158		100%
8.	**p-value**	**0.02**				

Table 3: Correlation of PTA 1 to ossicular chain status

S. No	PTA 2 category	Ossicular chain status				Total n (%)
		Discontinuity		Intact		
		n=42	%	n=158	%	
1.	**N (normal)**	4	8.69	42	91.31	46 (100)
2.	**M (mild)**	2	4.34	44	95.66	46 (100)
3.	**MD (moderate)**	12	23.07	40	76.93	52 (100)
4.	**MS (moderately severe)**	12	46.15	14	53.85	26 (100)
5.	**S (severe)**	6	37.50	10	62.50	16 (100)
6.	**P (profound)**	6	42.85	8	57.15	14 (100)
7.	**Total**	42		158		100%
8.	**p-value**	0.01				

Table 4: Correlation of PTA 2 to ossicular chain status

S. No		Intact		Discontinue		Total
		n	%	n	%	
1.	**Incudostapedial joint discontinuity**	158	79	42	21	100
2.	**Ossicular chain continuity**	168	84	32	16	100

Table 5: Analysis of intraoperative findings in study subjects

Parameter	Tympanosclerosis/myringosclerosis and granulation				Total n (%)	p-value
	Discontinuity		Intact			
	n	%	n	%		
Granulation						
Present	40	43.47	52	56.52	92 (100)	**0.000**
Absent	2	1.85	106	98.14	108 (100)	
Total	42	100	158	79	200 (100)	
Tympanosclerosis/myringosclerosis						
Present	28	73.68	10	26.32	38 (100)	**0.000**
Absent	14	8.64	148	93.65	162 (100)	
Total	42		158	79	100	

Table 6: Correlation of Tympanosclerosis/myringosclerosis and granulation to ossicular chain status in study subjects