

Chronic Otitis Media (Squamous Disease): Clinical Predictors for Hearing Outcome

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ABSTRACT

Introduction

Postoperative hearing outcome after tympanomastoid surgery may sometimes be disappointing. This study aims to identify the factors influencing hearing outcome in squamous type of chronic otitis media (COM).

Materials and Methods

Prospective descriptive study on consecutive patients undergoing tympano-mastoidectomy for squamous COM.

Results

Analysis of 40 ears revealed that 10% had discharge less than one year with majority (75%) having more than three years. Pars flaccida and postero-superior pars tensa retraction pockets were most common findings with frank cholesteatoma only in 10%. Though mean preoperative pure tone average was significantly better ($p=0.004$) in those with ear discharge less than one year, 50% required type IV tympanoplasty, irrespective of duration of discharge. Type IV tympanoplasty revealed significant worsening of hearing ($p=0.05$), unlike type I-III where intact stapes suprastructure showed a significant postoperative improvement ($p = 0.036$). Successful graft uptake with discharge free ear was noted in 97.5% by 12 weeks.

Conclusion

Majority of our patients availed otolaryngologist opinion after more than three years of onset of discharge. Significant ossicular erosion occurs early in the disease. Preoperative better audiogram is not a predictor of ossicular status. Lack of significant symptoms and subtle clinical finding in the tympanic membrane, overlooked by the patient as well as the primary health care provider are confounding factors for early referral and surgical intervention by otolaryngologist. There appears to be a considerable delay for the common person in reaching the services of otolaryngologist; a relevant issue which need to be addressed at a national level to reduce the burden of the disease.

Keywords

Chronic Otitis Media, Squamous Disease; Tympanoplasty; Hearing Improvement; Prospective Study

Global burden of illness from chronic otitis media (COM) affects from 65 to 330 million people with ear discharge, 90% being borne by developing countries in Asia, Africa and Western Pacific.¹ Squamous type of chronic otitis media, unlike mucosal type, has a subtle history of scanty ear discharge and insignificant hearing loss - due to cholesteatoma bridging the gap

of ossicular erosion,² along with findings most often as retraction pocket or frank cholesteatoma. These findings can be missed out unless one has specialized ENT training. This becomes a diagnostic challenge in the management of COM, as general health care (including ear health) is done by general practitioners or trained health care workers in many developing countries.³

Tympanomastoid surgery, the mainstay in the treatment for squamous type of COM, aims at complete eradication of disease to provide a safe and dry ear in addition to improving hearing status. Postoperative hearing outcome, which is directly proportional to the ossicular chain damage due to cholesteatoma,⁴ may

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sometimes be disappointing as there is possibility of a deceptively good audiogram preoperatively due to cholesteatoma bridging the gap between the eroded ossicles.

This study was undertaken to evaluate the clinical profile of squamous type of chronic otitis media and to identify preoperative clinical predictors of the hearing outcome in these patients.

Materials and Methods

This prospective descriptive study was conducted in the department of ENT at Pondicherry Institute of Medical Sciences at Puducherry in India over eighteen months, from June 2015 to April 2017. Clearance was obtained from Institutional Review Board and The Ethics Committee (Ref no: IEC: RC/15/29). All consecutive patients with COM squamous type aged between 5 and 60 years were included in the study. The exclusion criteria were restricted to patients with pure-tone evidence of absent cochlear function (although there were none that fell under this category). An informed consent / assent was taken before enrolment. They were all evaluated with a detailed history, complete clinical examination with otoscope and microscope, a preoperative pure tone audiogram and x-ray mastoids. HRCT temporal bones were done in five children and in two adults who had revision surgery. They were all

counseled pre-operatively regarding tympanomastoid surgery and related complications.

All patients were taken up for mastoid exploration under general anesthesia after pre anesthetic work up. The intra-operative findings like presence and spread of cholesteatoma, ossicular status, involvement of bony boundaries of tegmen and sinus plates, facial canal, semicircular canal, oval and round windows were documented. They were discharged from the hospital on the second post operative day. and were all followed up and assessed at 6th and 12th week post operatively.

All data were entered into a patient proforma which was transferred to an Excel sheet and then analyzed. Frequencies and proportions were given for discrete variables and mean were applied for continuous variable. Paired t test was done to compare pre and post operative audiogram. Results were compared after adjusting the independent variable ossicular involvement. Repeated measures ANOVA with Greenhouse-Geisser correction and Post hoc tests using the Bonferroni correction was used.

Results

The total number of patients who participated in the study was 38. Forty ears were included as one patient had bilateral disease and another patient had revision surgery. Among them, there were 24 males (60%) and

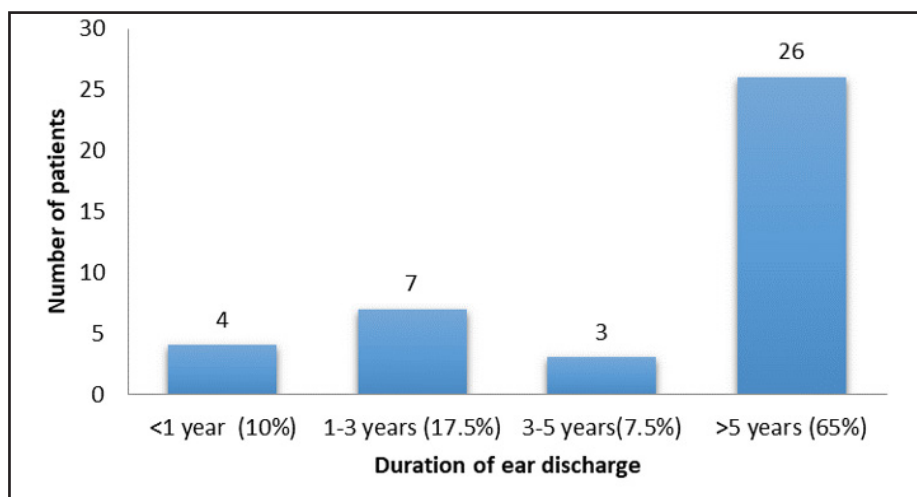


Fig. 1. Duration of ear discharge in years with the number of patients.

Table I: Distribution of findings on examination under microscope

FINDINGS	PARS TENSA	PERCENT	PARS FLACCIDA	PERCENT
Normal	12	30	8	20
Retraction	19 (posterosuperior quadrant)	47.5	26	65
Perforation	9	22.5	0	0
Granulation	0	0	2	5
Keratin flakes	0	0	4	10

16 females (40%) with age ranging from 5 to 65 years, five of them being less than 14 years of age. Twenty-six patients had ear discharge for more than 5 years.(Fig. 1)

On examination under microscope, retraction pocket was seen more frequently in pars flaccida (65%) than in pars tensa (47.5%). Keratin flakes and granulation tissue were noted only in patients with pars flaccida involvement, their frequency being much less(5-10%) (Table I)

Preoperative audiogram showed mean a pure tone average of 49.10dB HL with average air bone gap of 31.62dB HL. The preoperative audiogram was much better in patients who had ear discharge for less than one year (39.25dB HL), when compared to those with symptoms for more than a year (63.57dB HL). This difference was found to be statistically significant (p 0.004). (Table II)

Intraoperatively, mesotympanum and hypotympanum (62% each) were the most commonly involved areas with cholesteatoma, followed by attic and antrum mostly with granulations while facial and sinus recesses around 30% only. It was interesting to note that Eustachian tube

opening was not involved with disease in 90% patients! All our patients had an intact sinus plate, whereas the tympanic segment of the fallopian canal was eroded in 17% of them followed by the lateral semicircular canal (15%)

Ossicular involvement

Of the 40 ears in our study, 24 (60%) had all three ossicles involved. In those with two ossicle involvement (25%), incus-stapes combination was the most commonly observed. Five patients had single ossicular involvement all of which were incus. In only one patient, all three ossicles were found to be within normal limits. (Fig. 2)

It was noted that mean preoperative hearing loss for those with discharge less than one year was 39.25 dB as compared to that more than one year (63.57dB) which was statistically significant, intraoperative ossicular discontinuity was noted in 50% of the former group, suggesting possibility of cholesteatoma hearer. Among

Table II: Comparison of preoperative pure tone average with duration of disease

DURATION OF DISEASE	N	MEAN PTA BASELINE (DB HL)	P VALUE
1 year	4	39.25	0.004
>1 years	36	63.57	
Total	40	49.1	

Table III: Ossicular involvement in relation to duration of the disease

DURATION OF EAR DISCHARGE	NO. OF PATIENTS	INTRAOPERATIVE INCUS/ STAPES AFFECTED
1 year	4 (10%)	2 (50%)
1-3 years	7	6
3-5 years	2	2
>5 years	27 (67.5%)	26 (96%)

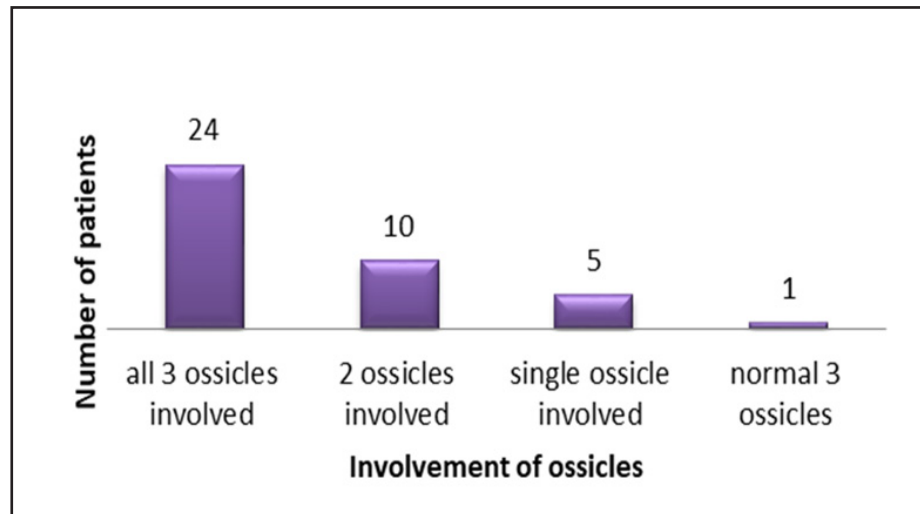


Fig. 2. Involvement of ossicles.

those with discharge more than one year more than 90% had ossicular erosion. (Table III)

The mean pure tone average in patients with normal stapes was 47.20 dB HL, and in those with abnormal stapes was 57.64dB HL (Table IV). This difference was found to be statistically significant using ANOVA with repeated measures with a Greenhouse-Geisser correction ($p = 0.036$). Thus, the presence of an intact stapes suprastructure showed a significant improvement in hearing post operatively.

The majority (47.5 %) had type IV tympanoplasty -where chonchal cartilage was placed over mobile footplate thus creating a well aerated cavum minor.

Type III tympanoplasty was done in 25%. Type I and type II were relatively uncommon. One of them had auto myringostapediopexy. (Fig. 3)

Type of tympanoplasty and hearing

Upon analyzing the type of tympanoplasty with hearing outcome, an improvement in postoperative hearing was seen in the group that underwent type I-III tympanoplasty with statistically significant pure tone average, $p < 0.03$, though air-bone gap did not significantly improve. In patients with type IV tympanoplasty, there was worsening in postoperative pure tone average with statistically significant increase in air-bone gap ($p < 0.05$).

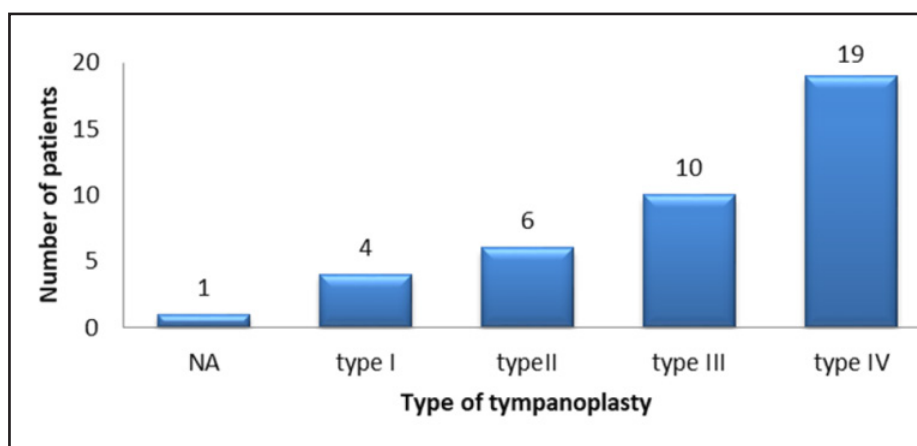


Fig. 3. Number of patients who underwent the different types of tympanoplasty.

Table IV: Status of stapes and difference in pre-operative audiogram and air bone gap

	STAPES CATEGORY	MEAN	STD. DEVIATION	N
Pure tone average	Normal	47.2	10.768	10
	Abnormal	57.64	13.042	14
	Total	53.29	13.007	24
Air bone gap	Normal	44.5	10.395	10
	Abnormal	54.43	15.639	14
	Total	50.29	14.336	24

ANOVA with repeated measures with a Greenhouse-Geisser correction ($p = 0.036$).

(Table V)

36 patients (90%) underwent modified radical mastoidectomy. Atticoantrostomy was done in three patients (7.5%) in view of limited disease. One patient (2.5%) had cortical mastoidectomy as there was no cholesteatoma in the middle ear or mastoid and patency of aditus was established.

Considering the postoperative outcome, one patient developed House Brackmann grade II facial palsy (2.5%) which recovered in a week with short term oral steroids. At 12th postoperative week postoperatively, majority had a well taken graft (97.5%) with adequate meatoplasty (92%) and a dry well healed mastoid cavity (75%). Among the 25% who had a discharging ear, on further follow up for another four weeks, all healed except one patient who then had revision surgery for inadequate meatoplasty.

Discussion

In our prospective descriptive study, it was noted that only 10% patients had discharging ears for less than one year while majority had more than five years. Besides, those in the latter group had statistically significant worse baseline pure tone average when compared to the former. However, it was also noted that among those in the latter group, 50% had intraoperative ossicular involvement suggesting that preoperative audiogram is likely to be due to cholesteatoma bridging the gap and not indicator of ossicular status. These findings have not been previously reported.

In the present study, tympanic membrane retraction pockets were the most common findings, while cholesteatoma flakes were not noted frequently. Retraction pockets specially in the posterosuperior quadrant, either isolated or associated with perforation,

Table IV: Status of stapes and difference in pre-operative audiogram and air bone gap

	PRE-OP PTA (MEAN DBHL)	POST OP PTA (MEAN DBHL)	PRE-OP ABG (MEAN DBHL)	POST OP ABG (MEAN DBHL)
Type I-III TYMPANOPLASTY	52.71	49.52	32.62	32.86
P value	0.039		0.858	
TYPE IV TYMPANOPLASTY	45.11	51.95	30.53	36.32
P value	0.082		0.053	

granulations or plastered TM was frequent in attic-antral variety in 72% of their patients.⁵

Mesotympanic and hypotympanic cholesteatoma were the most common spread noted in our study with attic and antrum less commonly involved, similar to other studies.^{5,6}

In our study, 85% had ossicular involvement, 60% with three ossicles and 25% had two ossicular involvement. Incus-stapes combination was the most frequently observed. In a large retrospective study of 915 patients with chronic otitis media, ossicular chain erosion was noted in 82% patients; the most common being incus erosion, followed by stapes and malleus.⁶ In another prospective study of COM, among 41 patients with squamous type, 90% were noted to have ossicular chain erosion, incus being the most vulnerable, followed by malleus and suprastructure of stapes. The pattern of multiple ossicle involvement was more common.⁷

In our study the mean pure tone average post operatively in patients with normal stapes was 47.20 dB HL, and those with abnormal stapes was 57.64dB HL. This difference was statistically significant using ANOVA with repeated measures with a Greenhouse-Geisser correction, indicating presence of an intact stapes supra-structure showed a significant improvement in hearing post operatively. Similarly, presence of stapes suprastructure has been cited as a major factor in determining amount of air bone gap reduction in patients with canal wall down procedures.⁸

However, in a systemic review and meta-analysis study with pooled results of nine articles of high relevance studies using the Austin-Kartush criteria, showed in patients with COM, with or without cholesteatoma, the malleus status is a significant predictor ($P < .001$) of postoperative hearing outcome, independent of the stapes condition.⁹ Among our patients undergoing type I to III tympanoplasty, it was noted that they had improvement in postoperative pure tone average. Type III-interposition has markedly increased hearing gain in mastoid obliteration among patients with cholesteatoma.¹⁰ However, in patients with type IV tympanoplasty, there was worsening in postoperative hearing with statistically significant air-bone gap.

Conclusion

Our prospective study of chronic squamous otitis media revealed that 97.5% healed with discharge free cavity within 12 weeks postoperatively. However, majority (90%) of patients presented with more than one year of discharging ears, 75% being more than three years, indicating a long delay in being evaluated and treated by otolaryngologists. Preoperative audiogram is not a predictor of ossicular status, with the chance of being cholesteatoma hearer. This is because ossicular discontinuity occurred among 50% of our patients with ear discharge less than one year which increase exponentially to more than 90% when discharge is more than one year, with significant persistent postoperative hearing loss. Lack of significant hearing loss and subtle clinical findings on the tympanic membrane are missed by general practitioners, who are most often the primary health care providers, and could be confounding factors to early specialist referral for definite surgical management in a resource-strained developing country like ours; which according to WHO, falls in the categorical group of having highest prevalence of COM. Continuing medical education regarding discharging ears with its clinical profile for community and general health care providers emphasizing red flags for early referral to otolaryngologist is mandatory for timely surgical intervention and avoid permanent hearing loss in addition to other otogenic complications.

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