



Study of Mastoid Antral Changes in Tubotympanic Chronic Supportive Otitis Media

Rishabh Padda¹, Lovneesh Kumar^{2*}, Sampan Singh Bist³, Vinish Agarwal⁴, Mahima Luthra⁵

¹Lowrence Road, Munilal Lane, Amritsar, Punjab.

^{2,3,4,5}Department of ENT, Himalayan Institute of Medical Sciences, Swami Rama Himalayan University, Swami Ram Nagar, Jollygrant Dehradun (Uttarakhand), India.

*Corresponding author's: Lovneesh Kumar

Article History	Abstract
Received: 06 June 2023 Revised: 05 Sept 2023 Accepted: 03 Nov 2023	<p>Background: Study of mastoid antrum findings in tubotympanic chronic suppurative otitis media. Objectives: To study mastoid antrum findings in tubotympanic CSOM and to determine predictors for performing antrotomy. Methodology: 71 patients with tubotympanic CSOM were selected from OPD and IPD. All patients were subjected to investigations like X-ray mastoid (Schuller's View), pure tone audiometry and Otoendoscopy. All patients were subjected to mastoid exploration (cortical mastoidectomy or antrotomy) with tympanoplasty. Pre-Operative findings on basis of history, examination and investigations were noted along with intra-operative findings of middle ear and mastoid antrum. Findings were tabulated and statistical tests were applied to determine significant predictors. Results: Mastoid antrum was found to be diseased in 21 patients with pathological findings like mucopus, granulations etc. Recurrent URTI, mastoid pneumatization pattern, pre operative middle ear mucosal status on otoendoscopy, degree of hearing loss and ossicular status were significantly associated with diseased antrum (P-value<0.05). Conclusion: Disease can be found in mastoid antrum in tubotympanic CSOM. Mastoid exploration in form of antrotomy should be done in all cases where certain predictors are present. The predictors for performing antrotomy in tubotympanic disease are presence of recurrent URTI on history, sclerotic mastoid on x-ray mastoid (Schuller's View), unhealthy middle ear mucosa on otoendoscopy, moderate and moderately severe hearing loss on pure tone audiometry and intra-operative ossicular necrosis and immobility.</p> <p>Keywords: Tubotympanic, CSOM, Sclerotic mastoid, Antrum, Audiometry, Ossicular necrosis</p>
CC License CC-BY-NC-SA 4.0	

1. Introduction

The tubotympanic type of Chronic suppurative otitis media occurs mainly due to advancement of infections from oropharynx and nasopharynx that is often preceded by an episode of AOM. Complications are rare in this type of CSOM (1). The mastoid air cell system acts as a buffer to pressure changes in the middle ear by increasing "the volume of the middle ear system. As a result, in presence of an aerated mastoid, even large middle ear pressure changes will not have much impact on the middle ear and tympanic membrane due to compensation by mastoid air cell system (2).

Many studies have proven the presence of pathologies including tympanosclerosis, granulation tissues and even cholesteatoma in mastoid antrum in tubotympanic CSOM (3-5). Since embryologically and functionally middle ear is considered as apart of middle ear cleft which spans from eustachian tube to mastoid antrum; we can consider the possibility of mastoid pathology and make a surgical intervention (3). Leaving the disease as such in mastoid antrum will amount to incomplete treatment and poor surgical results. Mastoid exploration can be done in form of a cortical mastoidectomy or a limited antrotomy. "Cortical mastoidectomy is a surgical procedure done to remove disease from the mastoid antrum, mastoid air cell system and aditus with preservation of intact bony external auditory canal wall, without disturbing the existing middle ear contents" (6).

Tympanoplasty has been defined by American Academy of Ophthalmology and Otolaryngology Subcommittee on Conservation of Hearing 1965 as a procedure to eradicate disease in middle ear and to reconstruct the hearing mechanism, with or without tympanic membrane grafting (7-9). There are no strict criteria that dictate whether to perform mastoidectomy along with tympanoplasty in safe and dry ears. Those arguing in favour of mastoid exploration for tubotympanic CSOM suggest that it increases mastoid aeration and helps in ascertaining aditus patency. Others believe that the potential risks during mastoid surgery like injury to other middle and inner ear structures outweigh its beneficial effects. This study aims to study mastoid antrum findings and determine predictors for antrostomy in cases of tubotympanic CSOM.

2. Materials And Methods

This study was conducted in a tertiary care hospital in Uttarakhand, India from 1st Jan 2020 to 1st Jan 2021. A total of 71 patients of tubotympanic CSOM were included in this. Patients with traumatic perforations and history of previous ear surgery were excluded from this study.

All patients were subjected to detailed history and complete ENT examination. Pre-operative investigations like pure tone audiometry, otoscopy/otoendoscopy and X-ray mastoid (Schuller’s View) were carried out on all patients and their findings were noted.

All patients were subjected to tympanoplasty along with mastoid exploration in form of antrostomy or cortical mastoidectomy. Aditus patency was ascertained using water test in all patients. Intra operative middle ear and mastoid antrum findings were recorded. All surgeries were performed by senior consultants.

Statistical Analysis

All findings were tabulated and statistically analysed using Microsoft Excel 2013 and SPSS version 26. Chi square tests were applied and significant findings were recorded.

3. Results and Discussion

P-value was calculated using Fischer’s exact and value <0.05 was significant. A wide array of pathologies can be found in mastoid antrum in tubotympanic CSOM like hyperplastic mucosa, granulation tissue, inflamed mucosa, glue, tympanosclerosis and mucopus (Figure 1). Table 1 represents the relation between site of perforation (pre-operative) and antral status. Table 2 gives the relation between status of ear ossicles (intra-operative) and antral status.

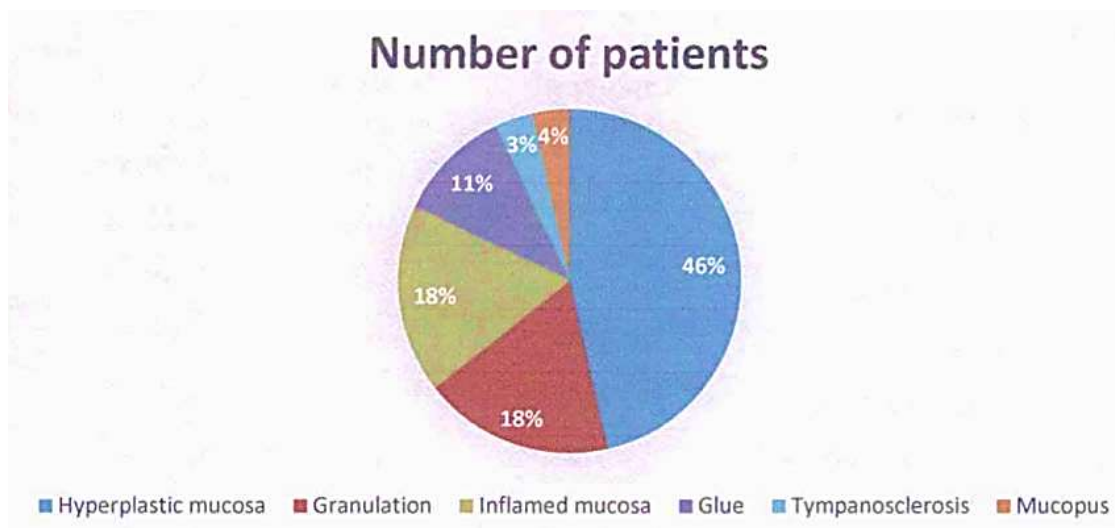


Figure 1: pathologies found in mastoid antrum in tubotympanic CSOM

Table 1: Relation between site of perforation (Pre-operative) and antral status (N=71)

Perforation site	Number of patients	Healthy antrum	Diseased antrum	p-value
All quadrants	33(46.48%)	23(69.7%)	10(30.3%)	0.75
Both Anterior	14(19.72%)	11(78.57%)	3(21.43%)	
Both Inferior	12(16.9%)	6(50%)	6(50%)	
Antero-inferior	4(5.63%)	3(75%)	1(25%)	
Both Posterior	3(4.22%)	2(66.67%)	1(33.33%)	
Three quadrants	3(4.22%)	3(100%)	0	
Postero-inferior	1(1.41%)	1(100%)	0	
Postero-superior	1(1.41%)	1(100%)	0	

Total	71	50	21
-------	----	----	----

Table 2: Relation between status of ear ossicles (Intra-operative) and antral status (N=71)

Ear Ossicles	Number of patients	Healthy antrum	Diseased antrum	p-value
Intact	61(85.92%)	47(77.05%)	14(22.95%)	0.02
Eroded	10(14.08%)	3(30%)	7(70%)	
Malleus handle	5(7.04%)	3(60%)	2(40%)	
Long process of Incus	2(2.82%)	0	2(100%)	
Stapes suprastructure	1(1.41%)	0	1(100%)	
Stapes suprastructure and incus long process	1(1.41%)	0	1(100%)	
All ossicles	1(1.41%)	0	1(100%)	
Total	71	50	21	

Table 3: Relation between degree of hearing loss (Pre-operative) and antral status (N=71)

Degree of hearing loss (dBHL)	Number of patients	Healthy antrum	Diseased antrum	p-value
Minimal	20.82%	2(100%)	0	0.035
Mild (26-40)	30(42.25%)	26(86.67%)	4(13.33%)	
Moderate (41-55)	26(36.61%)	14(53.85%)	12(46.15%)	
Moderately severe (56-70)	11(15.49%)	6(54.55%)	5(45.45%)	
Severe (71-90)	1(1.41%)	1(100%)	0	
Profound (>91)	10.41%	1(100%)	0	
Total	71	50	21	

The mean age of patients was 31.03 years. Maximum patients (i.e., 21) belonged to age bracket of 31-40 years (29.58%) followed by 18 patients in 11-20 years group (25.35%) followed by 17 patients in 21-30 years group (23.94%).

In this study around 64.79% patients were females while 35.21% patients were males. Around 57.57% patients belonged to the urban regions.

Ear discharge was the most common presenting complaint in 64 (90.14%) patients followed by hearing loss in 59 (83.10%) patients followed by tinnitus in 38 (53.52%) patients followed by otalgia in 21 (29.58%) patients. While headache was the least common presenting complaint and found in 19 (26.76%) patients

About 19 (26.76%) patients presented with duration of discharge more than 10 years followed by 17 (23.94%) patients who presented with history of 1-5 years of discharge followed by 15 (21.13%) patients who presented with discharge of less than one year duration followed by 13 (18.31%) patients who presented with discharge of 6-10 years duration.

While 7 (9.86%) patients presented with no complaint of ear discharge. Mean duration of ear discharge was 7.25 years.

In our study, we did not find any significant association of duration of ear discharge with with mastoid antrum status. However, studies conducted by Mufiah et al., (2) and Thakur et al., (3) have suggested that there are increased chances of finding diseased mastoid in cases with long duration of discharge. Study conducted by Ural et al. has suggested that CSOM is more common on the side of septal deviation (5). In a study conducted by Panigrahi and Pani in children has found significant association of incidence of CSOM with recurrent respiratory infections (9). In our study recurrent upper respiratory tract infections were significantly associated with antral status. This demands careful pre-operative assessment of nose.

In our study we did not find a significant association between active or inactive state of mucosal disease and antral status. Previous studies have different views regarding mastoid exploration in wet ears (6-11). Palukri et al. has suggested that mastoid must be explored in wet ears to clear pathology in antrum (6). Albu et al. have associated dry state of ear with better graft uptake (7). Sharma et al. advocated that 'mastoid exploration is not required in cases even with wet ears as there is no difference with regard to graft uptake between wet and dry ears (12). In our study we did not find any significant association between site and size of perforation with antrum status.

Our study was in contrast to the study of Chakraborty et al. where posterosuperior location of perforation and subtotal size of perforation was significantly associated with diseased antrum and aditus blockage (4). Our study was similar to study of Kabdwal et al. where size of perforation was not statistically associated with antral status of patient (13).

In a study conducted by Manjunath et al. myringosclerosis was associated with aditus blockage, thus a cortical mastoidectomy or a antrostomy was necessary to check for aditus patency (14). In our study aditus status was found to be strongly associated with antral status ($p=0.00$) therefore it is safe to assume that diseased antrum is associated with blocked aditus. However, in our study we did not find any significant association between antral status and myringosclerosis.

In our study middle ear mucosal status was strongly associated ($P=0.00$) with antral status. This is similar to studies conducted by George, Agarwal et al., Panigrahi et al., Lakhawat et al. and Gargava et al. who have made similar observations (3,4,8-13). In our study X-ray mastoid pneumatization was significantly associated with antral status ($pvalue<0.05$). Our results are similar to the studies of Sanjay et al. (4), Lakhawat et al. (10) and Harkare et al. (11) George (15), who have suggested that hypocellular and sclerotic mastoid increase the chances of antral disease. Thus, a cortical mastoidectomy or an antrostomy is helpful for better graft uptake and removal of disease.

In our study status of ear ossicles was significantly associated with antral status. Our results are consistent with a study conducted by George MV who found similar significant association with ossicular necrosis. He found intact ossicular chain in only 39% cases (3). However, in our study handle of malleus was most commonly eroded while in his study long process of incus was most commonly eroded. In another study conducted by Sanjeev Thakur et al. (2) ossicular erosion was found in 14.53% cases. In a study conducted by McGrew et al. (14) ossicular necrosis was present in 19% of patients with safe type of CSOM with long process of incus being most commonly involved. In a similar study conducted by Kabdwal et al. 23.33% patients had ossicular necrosis with long process of incus most commonly involved (9). In a study conducted by Lakhawat et al. 23% patients had ossicular necrosis with long process of Incus most commonly involved (10). In a study conducted by Singh et al. 30% patients with active mucosal CSOM had ossicular necrosis while no patient with inactive mucosal CSOM had ossicular necrosis (16). We employed water test to ascertain aditus patency.

Aditus blockage wherever found was removed and aditus was made patent. Aditus patency is necessary for maintaining aeration of mastoid and for better post-operative results in terms of graft uptake and dry ear (17). Cortical mastoidectomy or a simple antrostomy thus seems necessary for mastoid exploration and checking aditus patency. Status of aditus patency was strongly associated with ($P=0.00$) with antral status. Our results are similar to the results of Bahgat et al, Lakhawat et al., Sunil et al., George, Kapil et al., Thakur et al., Chakraborty et al., Elifet al., Harkare et al. and Gfindogdu and Toprak, who found similar significant association of aditus patency with mastoid disease (7-15,18). In the present study, while exploring mastoid antrum in patients with tubotympanic CSOM, we found 29.58% patients with diseased antrum. Some patients even had more than one pathology.

In a similar study conducted by George a combination of different pathologies was noted which included granulation tissue, tympanosclerosis, pus, osteitis, congested mucosa and even cholesteatoma. In similar study conducted on children by Gargava et al. had found mastoid inflammation in 74% patients and fluid in mastoid in 28% patients (11).

Our study was novel in many aspects. We have reviewed many studies which have different opinions regarding the need of concomitant mastoidectomy. Along with study of intraoperative mastoid antrum findings we have also determined the status of aditus patency. We have determined pre-operative and intra-operative predictors for need of antrostomy in tubotympanic CSOM. The advantage of these predictors is that they can easily be identified during routine pre-operative evaluation of the patient and during the course of surgery (18). There is no need of carrying out any other special investigation thus avoiding additional expenses. There is an array of pathologies that a surgeon can expect to find in mastoid antrum in supposedly safe disease. It is noteworthy that mastoid antrum pathologies i.e., unhealthy mastoid antrum is strongly associated with aditus blockage.

4. Conclusion

Age and gender of patient, presenting symptomatology, duration and nature of ear discharge, laterality of disease, type of mucosal CSOM, site and size of perforation, presence of myringosclerosis, status of handle of malleus (pre-operative), type of hearing loss and presence of Korner's septum were not the predictors for antrostomy. Presence of recurrent URTI, ossicular immobility and necrosis, unhealthy middle ear mucosa on otoscopy (granulations, congested, edematous), moderate and moderately severe hearing loss, sclerotic mastoid on X-ray. A wide array of pathologies can be found in mastoid antrum

in tubotympanic CSOM like hyperplastic mucosa, granulation tissue, inflamed mucosa, glue, tympanosclerosis and mucopus.

Conflict of interest

The authors declare that they have no conflict of interest.

Informed Consent

Informed consent was taken from the patients participating in this study.

References:

1. Sourabh Shankar C, Anil K M. Intra—Operative Findings in Middle Ear Cleft in Cases of Chronic Inactive Mucosal Otitis Media. *J Otolaryngol Rhinol.* 2020;6(4):1-6.
2. Mufiah S, Mackenzie I, Faragher B, Brabin B. Prevalence of chronic suppurative otitis media (CSOM) and associated hearing impairment among school-aged children in Yemen. *Oman Med J.* 2015;30(5):358-65.
3. Thakur SK, Ghimire N, Acharya R, Singh SK. The intraoperative pathological findings in cases of chronic suppurative otitis media with central perforation of tympanic membrane at a tertiary care centre in Eastern Nepal. *Asian J Med Sci.* 2017;8(1):42-7.
4. Sanjay K, Muthukumar R, Balasubramanian T. Endoscopic Tympanomastoid Exploration. *Online Journal of Otolaryngology.* 2012;2.
5. Ural A, Minovi A, Cobanoglu B. Upper airway obstructions and chronic otitis media: a clinical study. *Am J Otolaryngol.* 2014;35(3):329-31.
6. Palukri S, Rao PN. A study on outcome of cortical mastoidectomy with tympanoplasty in CSOM. *J Evid based Med Healthc.* 2015;2(45):8175-8177.
7. Albu S, Trabalzini F, Amadori M. Usefulness of cortical mastoidectomy in myringoplasty. *Otol Neurotol.* 2012;33(4):604-609.
8. Kabdwal N, Varshney S, Bist S, Bhagat S, Mishra S, Agarwal V. Pre and post operative evaluation of hearing in chronic suppurative otitis media. *Indian J Otol.* 2013 Oct 1;19(4):164-168.
9. Panigrahi D, R D, Pani S. Role of cortical mastoidectomy in outcome of myringoplasty in active and quiescent stage of tubotympanic type of chronic suppurative otitis media. *J Evol Med Dent Sci.* 2015 Aug 25;4(69):11931-11935.
10. Lakhawat R, Rawat DS, Aseri Y, Verma PC, Singh BK. A Prospective Longitudinal Study to Evaluate the Patency of the Aditus ad Antrum in Chronic Otitis Media Mucosal Type. *Indian J Otolaryngol Head Neck Surgery* [cited Aug 2020] doi10.1007/s12070-020-01991—x. 2020;8(2):1-6.
11. Gargava A, Verma P, Gupta A, Saxena S. Comparative Study between Tympanoplasty vs. Tympanomastoidectomy for the surgical outcome in tubotympanic Type CSOM. *Int J Heal Clin Res.* 2021;4(11):179-81.
12. Sharma A, Baisakhiya N, Garg LN, Singh G. Evaluation of role of mastoid surgery in the management of safe chronic suppurative otitis media. *Indian J Otolaryngol Head Neck Surg.* 2016;68(4):434-40.
13. Thakur SK, Ghimire N, Acharya R, Singh SK, Afaq A. The intraoperative pathological findings in cases of chronic suppurative otitis media with central perforation of tympanic membrane at a tertiary care centre in Eastern Nepal. *Asian J Med Sci.* 2017 Jan 3;8(1):4247.
14. McGrew BM, Jackson CG, Glasscock ME. Impact of Mastoidectomy on Simple Tympanic Membrane Perforation Repair. *Laryngoscope.* 2004 Mar;114(3):506-11.
15. George MV. The Mastoid Compartment of Middle Ear Cleft-A Clinic Pathological Study in Patients with Chronic Otitis Media-Mucosal Type. 2018;1(5):1-6.
16. Harkare VV, Khadakkar SP, Deosthale NV, Dhoke PR. Study of Preoperative Indicators of Ossicular Defect in Mucosal Type of Chronic Suppurative Otitis Media. *J Evol Med Dent Sci.* 2020;9(09):668-672.
17. Rathi A, Garg K. Study of outcome of tympanoplasty with and without mastoid antrum exploration in patients with mucosal CSOM. *Int J Otorhinolaryngol Head Neck Surg.* 2019;5(3):661.
18. Gfindogdu E, Toprak U. Comparison of the Aditus ad Antrum Diameter on CT between Patients with Chronic Otitis Media and Healthy Individuals. *Curr Med Imaging Rev.* 2019;15(10):990-993.