



Infection and Ossicular necrosis in atticoantral disease

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ABSTRACT

In view of probable role of infection in middle ear to ossicular necrosis a prospective study was done on 50 patients at tertiary care centre, where the intraoperative specimen collected during Mastoidectomy was sent for culture sensitivity for any microorganisms. Ossicular status was also noted during surgery and we tried to correlate if there is any relationship between infection in middle ear and ossicular necrosis. In our study we found that there was a significant relationship between presence of microorganism and ossicular necrosis.

INTRODUCTION

Sound perceived by the external ear is transmitted by tympanic membrane to the ossicles and finally to the inner ear through the oval window. During this process of transmission the acoustic transformation theory comes into play. The acoustic transformation theory states that coupling of sound from low impedance sound energy in the ear canal through the tympanic membrane and ossicles to the relatively high impedance fluid within the cochlea. This occurs with three lever systems: the tympanic membrane lever, the ossicular lever and the hydraulic lever⁽¹⁾. As a result of these three lever systems, the acoustic transformer theory predicts a middle ear gain of approximately 27 to 34 dB⁽²⁾. There is a chance that ossicular necrosis occurs because of presence of infection in the middle ear which leads to formation of Active granulation tissue and vascular bone erosion⁽³⁾

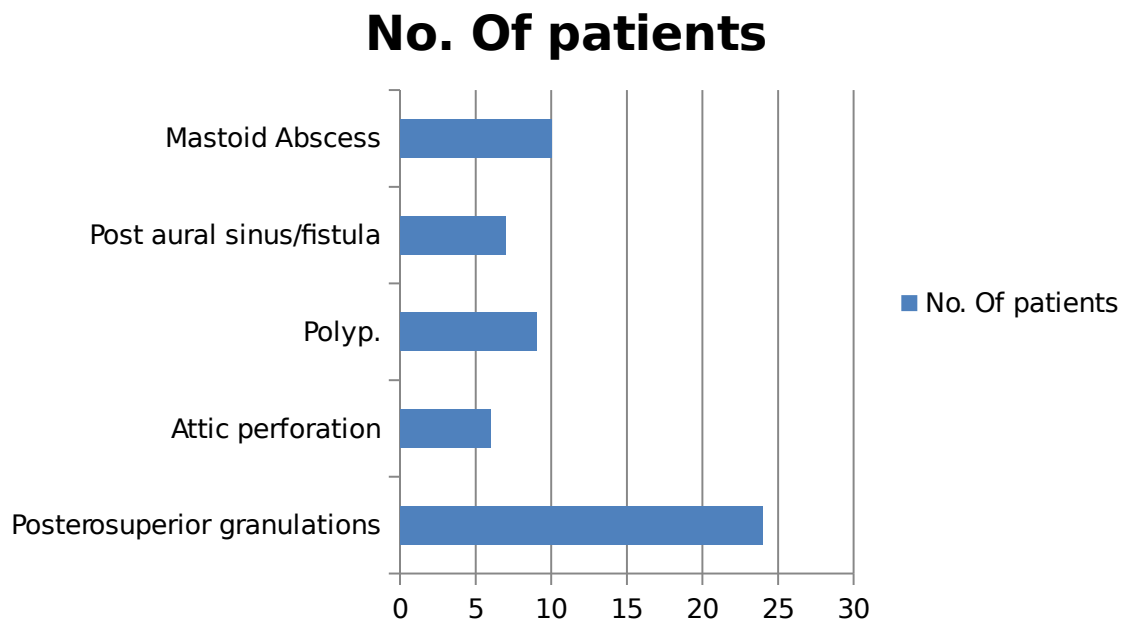
MATERIALS AND METHODOLOGY

Study conducted over a period of 3 years at tertiary care centre in Hyderabad. Patients who attended the regular out patient department were thoroughly examined and assessed by a carefully prepared proforma for history taking and examination. Those patients who had atticofurrow disease were included in this study. Patients who had otosclerosis, malignancy of ear, otitis externa and those who did not give consent for surgery were excluded from the study. Patients were subjected to endoscopic examination and audiometry to confirm our findings and assess the hearing loss. These patients after taking proper consent were then subjected to mastoidectomy. The specimen obtained during surgery was sent for microbiological study as per protocol. The intraoperative status of ossicles was noted and required tympanoplasty was done as per the need.

STATISTICS

Table 1: Distribution by Ear findings

Ear findings	No. Of patients	Percentage
Posterosuperior granulations	24	48%
Attic perforation	6	12%
Polyp.	9	18%
Post aural abscess/fistula	7	14%
Mastoid abscess	10	20%



Posterosuperior granulations were found in a majority of patients on clinical examination while attic perforation was found in 6 patients, polyp in 9 cases postaural fistula in 7 patients and Mastoid abscess in 10 patients..

Table 2: Distribution by operative hearing loss

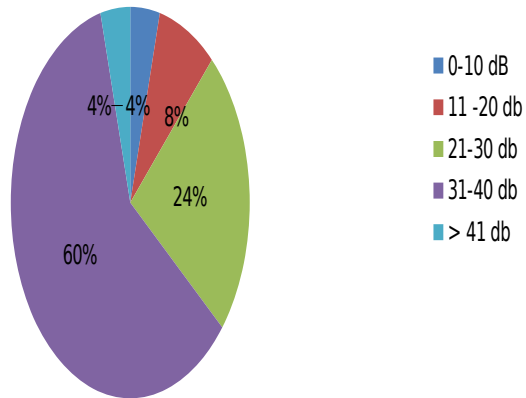
Type of hearing loss	No. Of patients	Percentage
Conductive	47	94%
Sensorineural	0	0
Mixed	3	6%
Total	50	100%

94% of the patients had only conductive type of hearing loss while 6% had mixed loss. There was no case of sensory neural hearing loss.

Table 3 : Level of hearing loss

A-B gap	No. Of patients	percentage
0-10 dB	2	4%
11-20 dB	4	8%
21-30 dB	12	24%
31-40 dB	30	60%
> 41 dB	2	4%
Total	50	100%

Pie chart showing distribution of patients based on their hearing loss

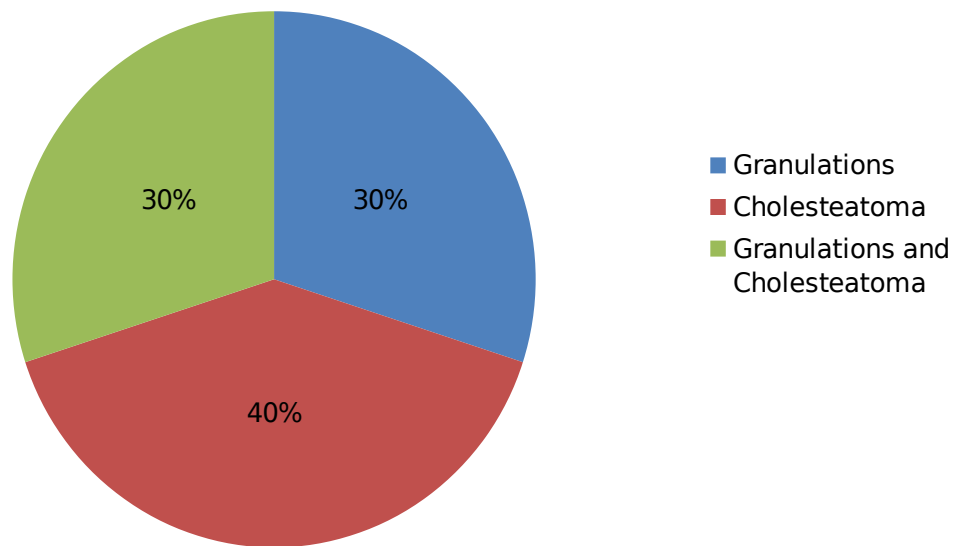


More than half the patients studied had moderate hearing loss with an air bone (AB) gap of 31 to 40 dB . This was followed by a AB gap of 21 to 30 dB in 24% of patients. There were 4 cases with AB gap between 11 to 20 dB. Only 2 cases with AB gap between 0 to 10 dB and >41dB were found.

Table 4: Pathology in the middle ear, attic, aditus and antrum (n = 50)

Pathology	No of cases	Percentage
Granulations	15	30%
Cholesteatoma	20	40%
Granulations and Cholesteatoma	15	30%
Total	50	100%

Pie chart showing the different pathologies

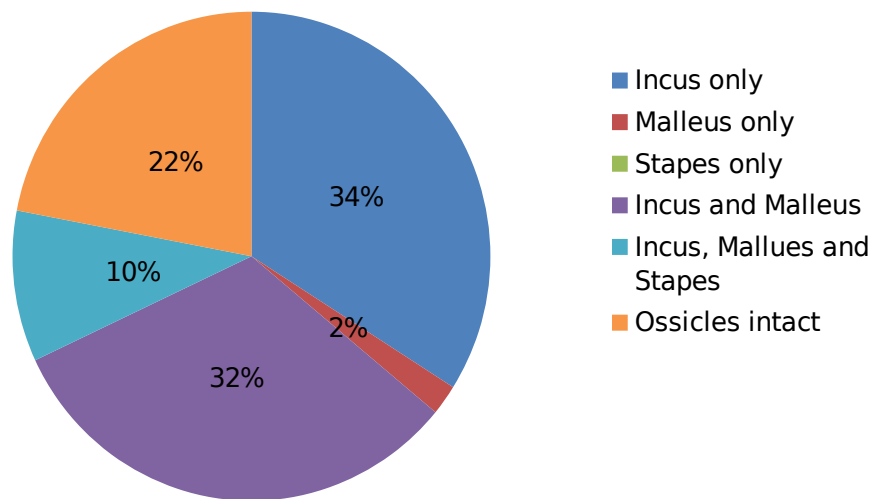


15 cases (30%) during surgery were found to have Granulations only , 15 cases (30%) were found to have a combination of Granulation and cholesteatoma while 20 patients (40%) had cholesteatoma only.

Table 5 : Ossicular status (n = 50)

Ossicles necrosed	No of cases	Percentage
Incus only	17	34%
Malleus only	1	2%
Stapes only	Nil	Nil
Incus and Malleus	16	32%
Incus, Mallues and Stapes	5	10%
Ossicular chain intact	11	22%
Total	50	100%

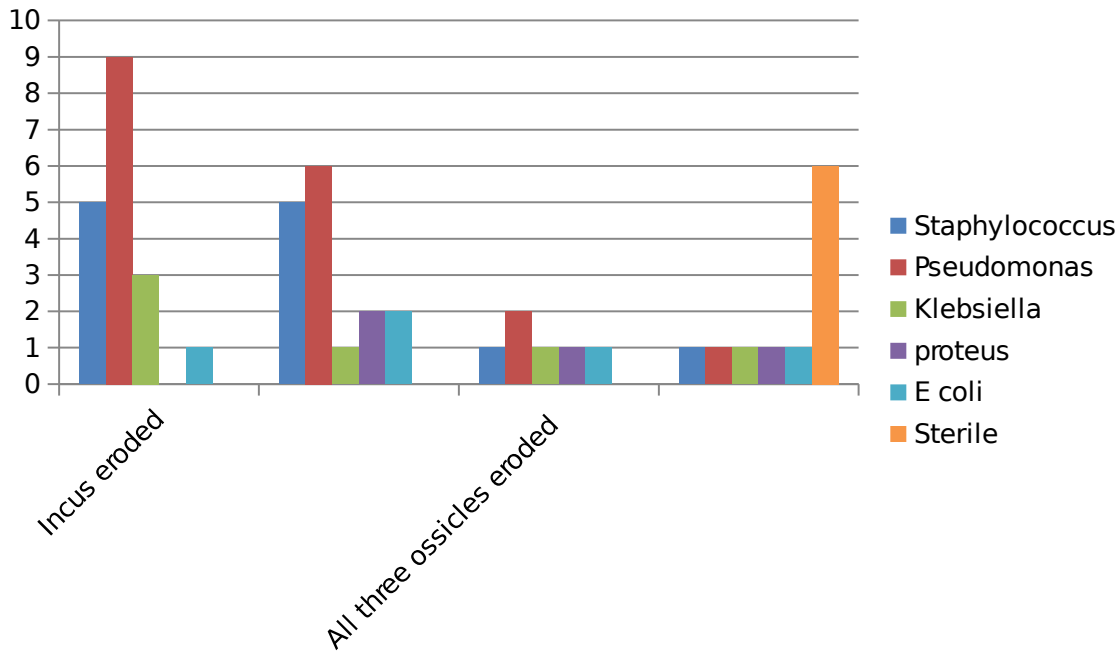
Pie chart showing the ossicular status



During surgery it was observed that 17 patients (34%) of the patients had only incus necrosed, 16 patients (32%) of patients had both incus and malleus involved. All the 3 ossicles were involved in 5 patients (10%) of patients. 11 patients (22%) had intact ossicular chain. There was only 1 case (2%) where only malleus was involved while no case of only stapes involvement was noted.

Table 12: Ossicles involved versus microorganisms isolated

	Incus eroded	Incus and Malleus involved	All three ossicles involved	Ossicular chain intact
Staphylococcus species	5	5	1	1
Pseudomonas species	9	6	2	1
Klebsiella species	3	1	1	1
Proteus species	Nil	2	Nil	1
E coli	1	2	1	1
Sterile culture	Nil	Nil	Nil	6
Total	18	16	5	11



Based on Table 12, a 2 X 2 table is prepared to know the relationship between Infection and ossicular involvement in atticoantral disease

	Ossicles involved	Ossicles not involved
Micro organism present	39	5
Micro organism not present	0	6

Based on the above chart odds ratio is not defined because of "0" value in one of the columns.

Chi square test is performed with Fischer exact method (as some of the values are less than or equal to 5 and also the total sample size is equal to 50). It reveals $p < 0.0001$ which indicates a significant relationship between Microorganism presence and ossicular involvement . Yates corrected value for the test is 19.28 .

RESULTS

On clinical examination posterosuperior granulations were found in almost half the patients (48%), this is followed by Mastoid Abscess in 20% , polyps in 18%, postaural fistula in 14% and attic perforation in 12% this is in contrast to the study done by [Chowdhury MA et^{\(4\)}](#) al which showed 67% attic perforations , post auricular sinus 25% followed by subperiosteal abscess in 18%.

94% of the patients had only conductive type of hearing loss while 6% had mixed loss. There was no case of sensory neural hearing loss. More than half the patients studied had moderate hearing loss with an air bone (AB) gap of 31 to 40 dB . This was followed by a AB gap of 21 to 30 dB in 24% of patients. There were 4 cases with AB gap between 11 to 20 dB. Only 2 cases with AB gap between 0 to 10 dB and >41dB were found.

15 cases (30%) during surgery were found to have Granulations only , 15 cases (30%) were found to have a combination of Granulation and cholesteatoma while 20 patients (40%) had cholesteatoma only. These observations partly correlate with study done by D Shrestha et al ⁽⁵⁾ which showed 27% of patients had Granulations only while 61% had cholesteatoma and 12% had granulation along with cholesteatoma.

During surgery it was observed that 17 patients (34%) of the patients had only incus necrosed, 16 patients (32%) of patients had both incus and malleus involved. All the 3 ossicles were involved in 5 patients (10%) of patients. 11 patients (22%) had intact ossicular chain . There was only 1 case (2%) where only malleus was involved while no case of only stapes involvement was noted. In a similar study

done by D Shrestha et al ⁽⁵⁾ 9.67% had all ossicles necrosed while 13.97% had Malleus and incus necrosed, 50.53% had only Incus necrosed. In both the studies it was found that incus was the most common bone to get necrosed. Our findings that Stapes was most resistant and incus was most susceptible ossicle are slightly in contrast to study done by [Saurabh Varshney](#) et al ⁽⁶⁾ where Malleus was found to be the most resistant ossicle to erosion whereas incus was found to be the most susceptible.

Overall 78% of patients had necrosed ossicles as compared to 93.25% in A. Anglitoiu et al ⁽⁷⁾ Pseudomonas followed by staphylococcus were found to be the organism commonly involved in ossicular destruction in the intra operative specimens. This is partly in correlation with the study done at Japan which states that apart from Pseudomonas and staphylococcus, Proteus is also found to be much more frequently associated with ossicular destruction.” The purpose of this study is to investigate the differences in the destruction of ossicles in chronic ear disease caused solely (mono-infection) by one of the most common three bacteria, namely Staphylococcus aureus, Pseudomonas aeruginosa or Proteus strain. It seems to us that vascular bone erosion caused by active granulation tissue, the process triggered initially by infection, is the main mechanism for destruction of ossicles both in cholesteatomatous and in non-cholesteatomatous ears. From the histological point of view the ossicles in ears with Staphylococcus aureus and Proteus strains can be so destroyed that their use for autografts is questionable.”⁽³⁾ . It was found that 100% of cases which had ossicles necrosed had presence of microorganism i.e., 39 cases which had ossicular necrosis had presence of microorganism .

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PMCID: PMC3266081 Ossicular Chain Status in Chronic Suppurative Otitis Media in Adults
[Saurabh Varshney](#) [Ashutosh Nangia](#), [S. S. Bist](#), [R. K. Singh](#), [N. Gupta](#), and [S. Bhagat](#)
<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3266081/>
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