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PROSPECTIVE STUDY OF OTOMYCOTIC CASES WITH HIGH PREVALENCE OF TYMPANIC MEMBRANE PERFORATION

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ABSTRACT: To determine the prevalence of tympanic membrane perforation among patients of otomycosis and to evaluate clinical features and hearing loss.A total of 108 patients with otomycosis were recruited. Detailed history, otoscopic examination, and clinical evaluation were performed. Pure tone audiometry was conducted. Patients with CSOM or non-fungal active infections were excluded. Data were recorded and analysed to assess the frequency of TM perforation and related outcomes.Total tympanic membrane perforations observed in this study is 40 out of 108 study group. Prevalence of TM perforation is 37%. And P value is 0.078, especially in humid climates and in cases involving Aspergillus and Candida species. And mild to moderate conductive hearing loss, with varied symptoms like, otalgia, itching, and otorrhea, and responds to conservative line of management.Tympanic membrane perforation is common in patients with otomycosis and often be overlooked without meticulous otoscopic examination and proper canal clearance. Early identification allows timely management, prevents complications, and reduces the need for surgical intervention. This study reinforces the clinical importance of routine, careful evaluation in fungal otitis externa.

Keywords: Otomycosis, tympanic membrane perforation, Candida, Aspergillus, itching

List of abbreviations:

- **AIDS** – Acquired Immune Deficiency Syndrome
- **CSOM** – Chronic Suppurative Otitis Media

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- **EAC** – External Auditory Canal
- **ENT** – Ear, Nose and Throat
- **OM** – Otomycosis
- **OPD** – Out-Patient Department
- **PTA** – Pure Tone Audiometry
- **SD** – Standard Deviation
- **TMP** – Tympanic Membrane Perforation
- **TM** – Tympanic Membrane

Statements and Declarations

Funding-The authors did not receive any support from any organizations for the submitted work.

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Availability of Data and Material- Data sharing not applicable to this article as no datasets were generated or analysed during the current study.

Ethical Approval–Ethical approval was waived by the Institutional Research Committee BMCRC in view of prospective nature of study and all procedures being performed were part of routine care.

Code Availability- Not Applicable

Author Contributions-All authors contributed to the study conception and design. Material preparation and analysis were performed by Dr. DIVYA KIRAN and Dr. PALUKURI TEJASWINI. Data collection was done by Dr. PALUKURI TEJASWINI. The first draft of manuscript was done by Dr. DIVYA KIRAN and other author commented on previous version of manuscript. All authors read and approved the final manuscript.

Introduction:

Otomycosis is a fungal infection of external auditory meatus that can present as acute, subacute, or chronic. It occurs most frequently in tropical and subtropical regions, with higher rates in hot, humid, and dusty environments.[1] Globally, it accounts for 9% to 30% of cases among patients seen in otolaryngology clinics for otitis externa or ear discharge.[2]

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Although otomycosis is seldom life-threatening, it poses a significant challenge for both patients and ENT specialists due to the need for prolonged treatment and regular follow-up, with recurrences remaining common despite therapy.[3]

The condition often develops in the presence of excess moisture and warmth in the ear canal, or following extended use of topical antibiotics for bacterial infections. These factors can disrupt the protective cerumen layer, cause skin maceration, raise the canal's pH, and alter the normal microbial balance, favoring the growth of fungi or other untreated organisms.[4] Underlying conditions such as diabetes or a compromised immune system may also contribute.[5]

Patients with early-stage otomycosis typically experience intense itching, which can progress to pain, hearing impairment, and in some cases, perforation of the tympanic membrane.[6]

The external auditory canal normally hosts a variety of microorganisms, including species of Aspergillus, Candida (yeast-like fungi), Staphylococcus aureus, Staphylococcus epidermidis, various Streptococcus species, Micrococcus, Corynebacterium, Bacillus, Pseudomonas aeruginosa, Escherichia coli, Haemophilus influenzae, and Moraxella catarrhalis.[7] These commensal organisms remain non-pathogenic as long as the balance between bacteria and fungi is preserved.

Tympanic membrane perforation is an uncommon but recognized complication of otomycosis.[8] In one clinical study, it occurred in approximately 11% of cases, with a higher frequency observed when the infection was caused by Candida albicans.[9]

Hence present study was done to assess the prevalence of tympanic membrane perforation among patients with otomycosis.

Aims and objectives:

To clinically study the prevalence of tympanic membrane perforation in otomycosis cases presenting to the department of ENT, Ballari Medical College and Research Center, Ballari.

Materials and methods:

Study site: This study was conducted in the Department of ENT, Ballari Medical College and Research Center, Bellary.

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Study population: Patients of both gender attending OPD of Department of ENT, Ballari Medical College and Research Center, Bellary with otomycosis with tympanic membrane perforation.

Study design: The current study was a hospital based prospective observational study.

Sample size:

$N=Z\alpha 2\ X\ (1-P)/d2$

N=Sample size

Zα=Confidence interval of 95% with value ->1.96

P = Expected proportion in a population based on previous studies -0.47

d = Absolute error decided by researcher - > 0.094

N =1.962x 0.47(1−0.47)0.0942 = 108 , N=SAMPLE SIZE =108

Sampling method: All the suitable patients were enlisted into the study successively by convenient sampling till the sample size was attained.

Study duration: The present study was conducted during the period of 18months.

Inclusion criteria:

1. Otomycosis patients with symptoms like inflammation, itching, scaling, tympanic membrane perforation, hearing loss, ear discharge, dry matted masses of hyphae or white cheesy material
2. Patients with written consent given

Exclusion criteria:

1. Unwilling patients.
2. Patients with other ear problems like CSOM.
3. Patients with other active ear infection other than fungal TMP other than fungal causes, haemorrhage.

Ethical consideration:

Study was approved by institutional human ethics committee. Informed written consent was obtained from all the study participants and only those participants willing to sign the informed consent were included in the study. The risks and benefits involved in the study and voluntary nature of participation were explained to the participants before obtaining consent. Confidentiality of the study participants was maintained.

Methodology:

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Written informed consent was obtained from all patients included in the study. A detailed history was taken, and a thorough clinical examination was performed for each participant. Clinical otoscopic examination and pure tone audiometry of the ears were conducted. Follow up was done at 3months and 6months.

Statistical methods:

Descriptive analysis was carried out by mean and standard deviation for quantitative variables, frequency and proportion for categorical variables. Data was also represented using appropriate diagrams like bar diagram, pie diagram and box plots.

Statistical analysis was made with IBM SPSS 21.0 software and P value of <0.05 was considered significant.t test, Chi square test and fisher exact test was used.

Results:

Table 1: Distribution of Study Subjects based on Age:

Age (years)	Frequency	Percentage
<=20	9	8.3
21-30	24	22.2
31-40	31	28.7
41-50	17	15.7
51-60	14	13.0
>60	13	12.0
Mean Age	39.84±14.53	
Total	108	100.0

Above table shows, the 31–40 age group was the most represented (31 individuals, 28.7%), closely followed by the 21–30 group (24 individuals, 22.2%). The youngest category (≤20 years) included the fewest participants (9 individuals, 8.3%), while the older categories showed moderate numbers: 41–50 years (17 individuals, 15.7%), 51–60 years (14 individuals, 13.0%), and over 60 years (13 individuals, 12.0%). The overall mean age stood at 39.84 ± 14.53 years.

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Chart 1: Bar chart illustrating Distribution of Study Subjects based on Age:

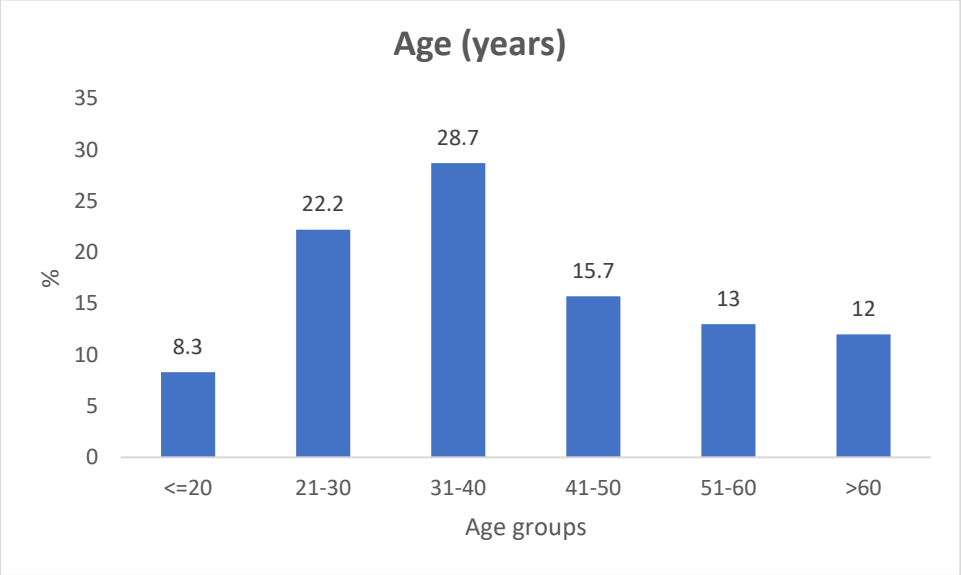


Table 2: Distribution of Study Subjects based on Gender:

Gender	Frequency	Percentage
Female	53	49.1
Male	55	50.9
Total	108	100.0

Above table shows, the sample of 108 subjects displayed an almost even gender split, comprising 55 males (50.9%) and 53 females (49.1%).

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Chart 2: Pie chart illustrating Distribution of Study Subjects based on Gender:

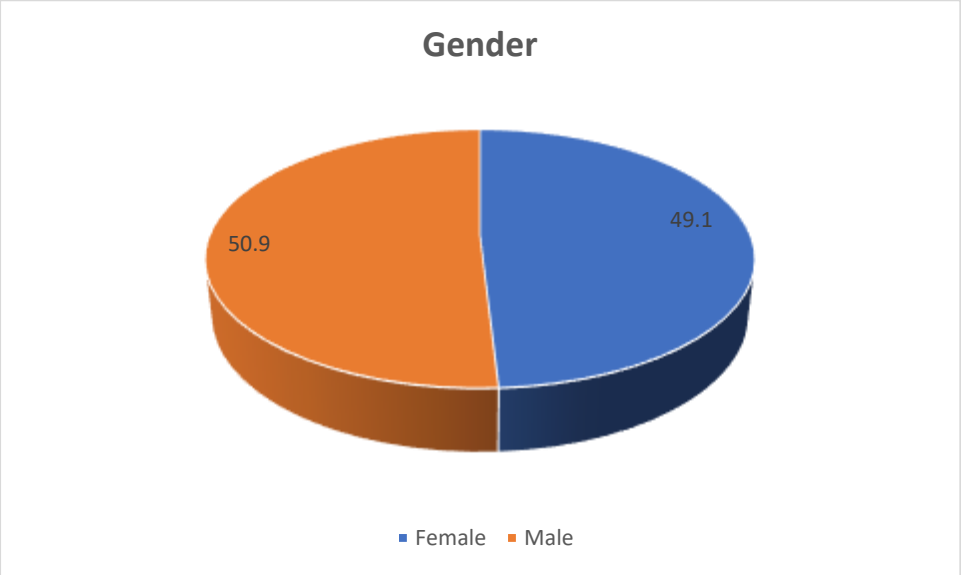


Table 3: Distribution of Study Subjects based on History/Chief Complaints:

History/Chief Complaints		Frequency	Percentage
Itching	**Absent**	47	43.5
	Present	61	56.5
Pain	**Absent**	47	43.5
	Present	61	56.5
Active Ear Discharge	**Absent**	52	48.1
	Present	56	51.9
Previous H/O Ear Discharge	**Absent**	50	46.3
	Present	58	53.7

In this group of 108 participants, itching and pain were the most frequently reported symptoms, each present in 61 cases (56.5%) and absent in 47 (43.5%). Active ear discharge

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occurred in 56 subjects (51.9%) and was absent in 52 (48.1%), whereas a prior history of ear discharge was noted in 58 subjects (53.7%) and absent in 50 (46.3%).

Chart 3: Bar chart illustrating Distribution of Study Subjects based on History/Chief Complaints:

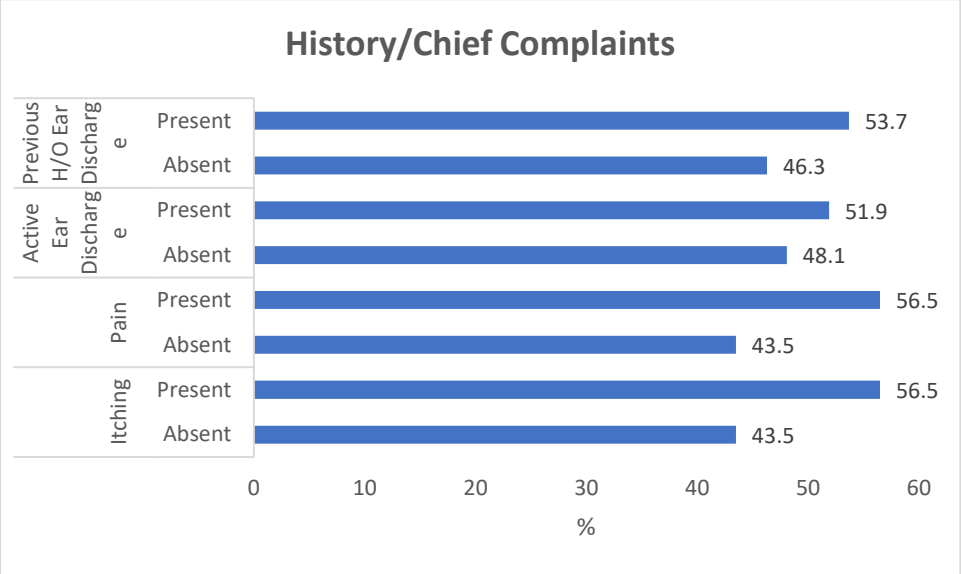


Table 4: Distribution of Study Subjects based on PTA:

PTA findings	Frequency	Percentage
10-19dB	10	9.3
20-29dB	62	57.4
30-39dB	30	27.8
40-49dB	6	5.5
Mean PTA	26.73±6.43	
Total	108	100.0

Above table shows, hearing thresholds measured by Pure Tone Audiometry (PTA) revealed that most participants—62 individuals (57.4%)—fell within the 20–29 dB range,

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indicating mild hearing loss. The next largest group was 30 subjects (27.8%) in the 30–39 dB range, followed by 10 subjects (9.3%) in the 10–19 dB range and only 6 subjects (5.5%) in the 40–49 dB range. The average PTA across the sample was 26.73 ± 6.43 dB.

Chart 4: Pie chart illustrating Distribution of Study Subjects based on PTA:

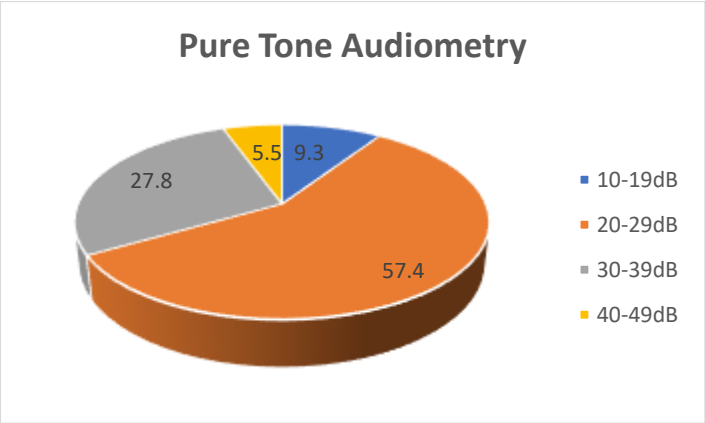


Table 5: Distribution of Study Subjects based on Ear Findings

Ear Findings	Frequency	Percentage
Intact	68	63.0
Small Central Perforation	31	28.7
Medium Central Perforation	9	8.3
Total	108	100.0

Above table shows, at the start of the study, 68 subjects (63.0%) had an intact tympanic membrane. Small central perforations were found in 31 cases (28.7%), and medium central perforations in 9 cases (8.3%). Large perforations were absent at baseline.

Table 6: Distribution of Study Subjects based on TM Findings at 1 Month

TM Findings at 1 Month	Frequency	Percentage
Intact	58	53.7
Small Central Perforation	40	37.0

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Medium Central Perforation	10	9.3
Total	108	100.0

Above table shows, one month after baseline, the number of intact tympanic membranes dropped to 58 subjects (53.7%). Small central perforations rose to 40 subjects (37.0%), and medium central perforations increased modestly to 10 subjects (9.3%).

Table 7: Distribution of Study Subjects based on TM Findings at 3 Months

TM Findings at 3 Months	Frequency	Percentage
Intact	53	49.1
Small Central Perforation	36	33.3
Medium Central Perforation	18	16.7
Large Central Perforation	1	0.9
Total	108	100.0

Above table shows, at the 3-month mark, intact TMs were present in 53 subjects (49.1%). Small central perforations were seen in 36 subjects (33.3%), medium perforations in 18 subjects (16.7%), and large central perforations emerged in 1 subject (0.9%).

Table 8: Distribution of Study Subjects based on TM Findings at 6 Months

TM Findings at 6 Months	Frequency	Percentage
Intact	50	46.3
Small Central Perforation	28	25.9
Medium Central Perforation	25	23.1
Large Central Perforation	5	4.6
Total	108	100.0

Above table shows, by six months, intact tympanic membranes were observed in 50 subjects (46.3%). Small central perforations declined to 28 subjects (25.9%), while medium

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central perforations rose sharply to 25 subjects (23.1%), and large central perforations increased to 5 subjects (4.6%).

Chart 5: Cluster bar chart illustrating Distribution of Study Subjects based on TM Findings:

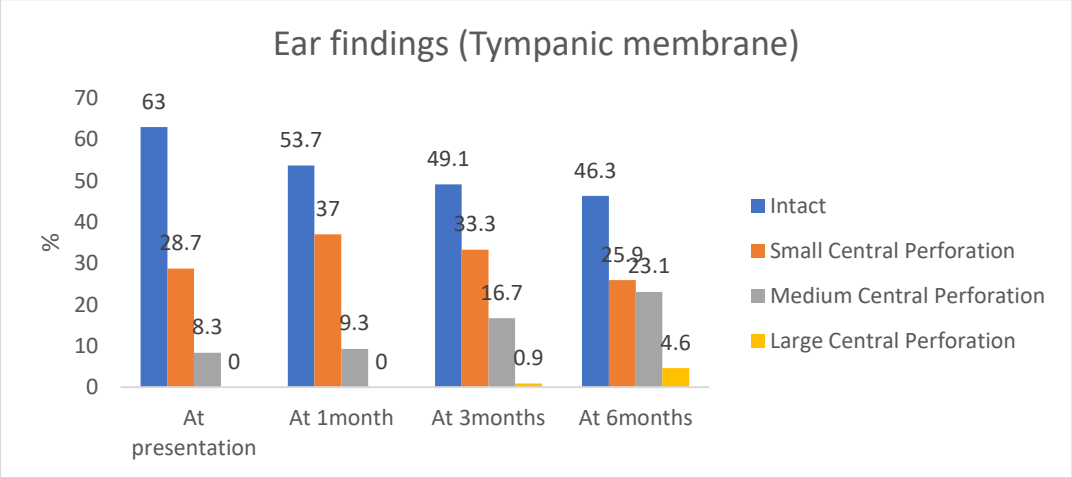


Table 9: Distribution of Study Subjects based on Recurrence at 1 Month

Recurrence at 1 Month	Frequency	Percentage
Absent	60	55.6
Present	48	44.4
Total	108	100.0

Above table shows, at one month, recurrence was absent in 60 subjects (55.6%) but present in 48 subjects (44.4%).

Table 10: Distribution of Study Subjects based on Recurrence at 3 Months

Recurrence at 3 Months	Frequency	Percentage

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Absent	56	51.9
Present	52	48.1
Total	108	100.0

Above table shows, three months into follow-up, recurrence was absent in 56 subjects (51.9%) and present in 52 subjects (48.1%).

Table 11: Distribution of Study Subjects based on Recurrence at 6 Months

Recurrence at 6 Months	Frequency	Percentage
Absent	47	43.5
Present	61	56.5
Total	108	100.0

Above table shows, at the six-month evaluation, recurrence affected the largest proportion yet—61 subjects (56.5%)—while it remained absent in 47 subjects (43.5%).

Chart 6: Cluster bar chart illustrating Distribution of Study Subjects based on Recurrence:

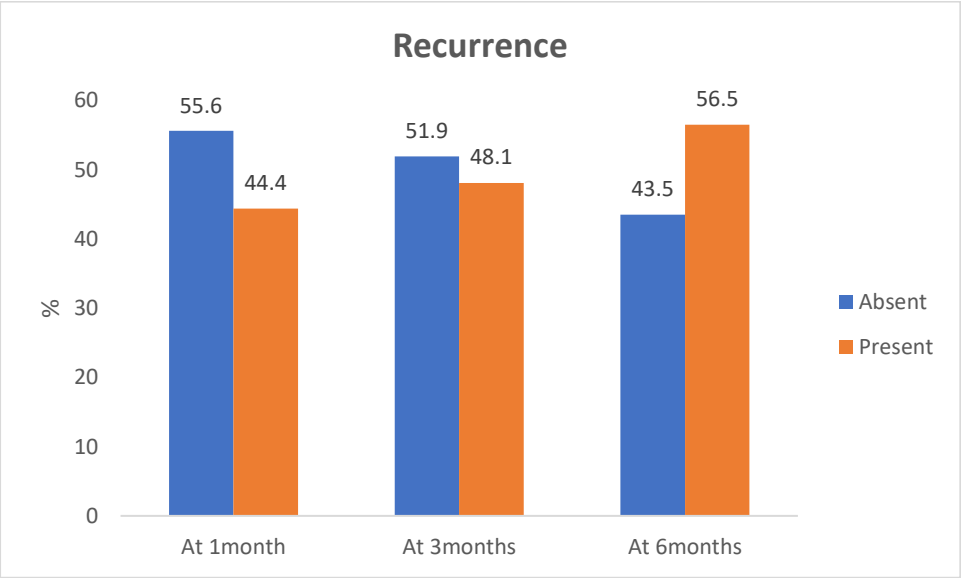


Table 12: Comparison of TM Findings at 1 Month and PTA

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TM Findings at 1 Month	PTA (Mean± SD)	F Value	p Value
Intact	23.05±4.68	45.36	**<0.001***
Small Central Perforation	29.68±4.62		
Medium Central Perforation	36.3±5.64		

Above table shows, hearing levels at one month were strongly linked to tympanic membrane condition ($F = 45.36$, $p < 0.001$). The best mean PTA was recorded in those with intact TMs (23.05 ± 4.68 dB), followed by small central perforations (29.68 ± 4.62 dB), with the highest thresholds (worst hearing) in medium central perforations (36.3 ± 5.64 dB).

Table 13: Comparison of TM Findings at 3 Months and PTA

TM Findings at 3 Months	PTA (Mean± SD)	F Value	p Value
Intact	23.04±4.35	25.65	**<0.001***
Small Central Perforation	28.19±4.99		
Medium Central Perforation	34.22±6.34		
Large Central Perforation	35		

Above table shows, by three months, PTA values continued to increase (worsen) as perforation size grew ($F = 25.65$, $p < 0.001$). Intact TMs showed the lowest mean PTA (23.04 ± 4.35 dB), followed by small perforations (28.19 ± 4.99 dB), medium perforations (34.22 ± 6.34 dB), and large perforations (35 dB).

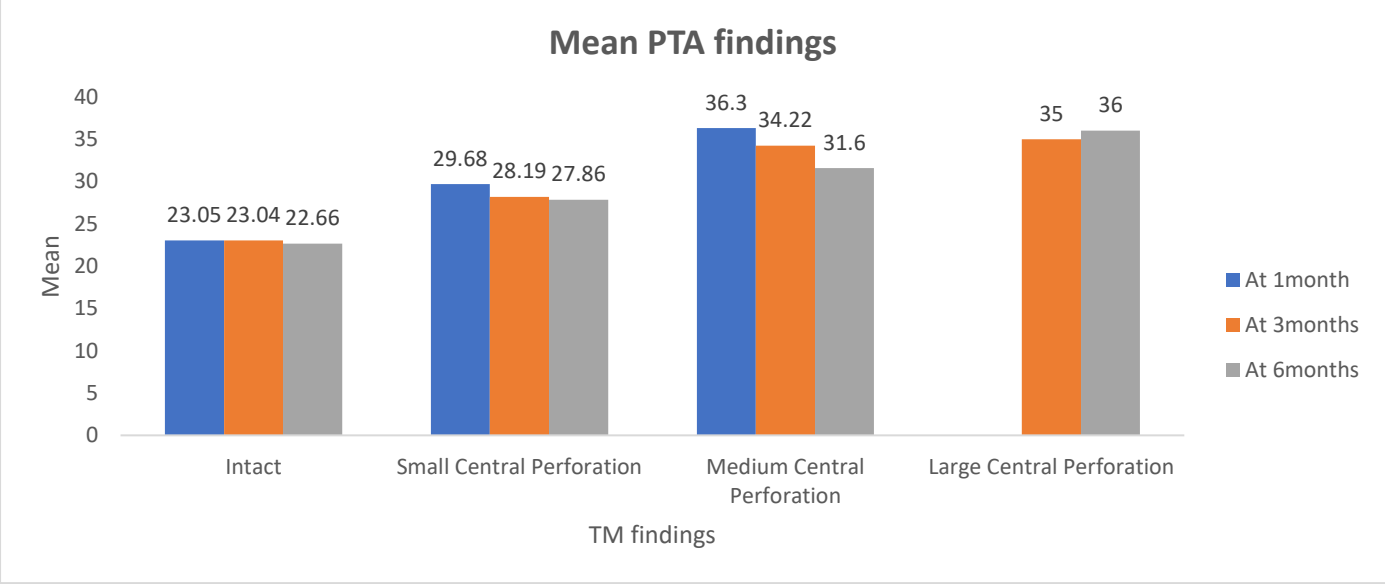
Table 14: Comparison of TM Findings at 6 Months and PTA

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TM Findings at 6 Months	PTA (Mean± SD)	F Value	p Value
Intact	22.66±4.05	26.8	**<0.001***
Small Central Perforation	27.86±5.27		
Medium Central Perforation	31.6±5.71		
Large Central Perforation	36±6.21		

Above table shows, at six months, the relationship between TM status and hearing remained very strong ($F = 26.8$, $p < 0.001$). Participants with intact TMs had the most favorable mean PTA (22.66 ± 4.05 dB), followed by small central perforations (27.86 ± 5.27 dB), medium perforations (31.6 ± 5.71 dB), and large perforations (36 ± 6.21 dB).

Chart 7: Cluster bar chart illustrating Comparison of TM Findings and PTA:



Discussion:

Otomycosis is a common superficial fungal infection affecting the external auditory canal, often encountered in primary care and otolaryngology settings. It occurs globally but is

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particularly common in warm, humid environments. Recent years have seen a rise in its incidence, largely attributed to widespread use of topical antibiotic ear drops. Key risk factors include regular swimming, immunosuppression (such as diabetes mellitus or AIDS), pregnancy, prior canal wall down mastoidectomy, tympanic membrane perforation, hearing aid use, and self-inflicted trauma (e.g., from cotton swabs). The condition is primarily diagnosed clinically, with Aspergillus and Candida species representing the predominant fungal culprits. These fungi account for about 9% of otitis externa cases, though this proportion is increasing, likely due to greater reliance on topical antibiotics. Management typically involves thorough local debridement combined with antifungal therapy, which may be topical or systemic. Tympanic membrane perforation is an uncommon but recognized complication of otomycosis. In one clinical study by Ram Kumar, the rate of tympanic membrane perforation among otomycosis patients was reported as 11%, with Candida albicans-associated cases showing a higher tendency for this complication.

A prospective observational study was done among 108 patients with otomycosis with tympanic membrane perforation attending the department of Otorhinolaryngology in Ballari Medical College and Research Center satisfying inclusion and exclusion criteria during the study period of 18months after obtaining informed consent.

Age:

The 31–40 age group was the most represented (31 individuals, 28.7%), closely followed by the 21–30 group (24 individuals, 22.2%). The youngest category (≤20 years) included the fewest participants (9 individuals, 8.3%), while the older categories showed moderate numbers: 41–50 years (17 individuals, 15.7%), 51–60 years (14 individuals, 13.0%), and over 60 years (13 individuals, 12.0%). The overall mean age stood at 39.84 ± 14.53 years.

In a study done by Deekshith Shetty et al[82] showed that 19.2% of patients aged 21 to 30years and 41 to 50years each, 30.8% were aged 31 to 40years, 7.7% were aged 51 to 60years and 23.1% patients were aged 61 to 70years.

In a study done by Aurobindo B et al[83] showed that 12.5% of patients were aged 10 to 19years and 60 to 70years each, 15% were aged 50 to 59years, 17.5% were aged 50 to 59years, 20% were aged 20 to 29years and 22.5% were aged 30 to 39years.

In a study done by Teharia et al[85] showed that 5% of patients had aged less than 10years, 20.8% were aged 11 to 20years, 29.2% were aged 21 to 30years, 17.5% were aged 31 to

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40years, 12.5% were aged 41 to 50years, 9.2% aged 51 to 60years and 5.8% aged more than 60years.

In a study done by Hannah Tan et al[87] showed that the mean age of the patients was 51.8years (SD 19.8).

Gender:

The sample of 108 subjects displayed an almost even gender split, comprising 55 males (50.9%) and 53 females (49.1%).

In a study done by Deekshith Shetty et al[82] showed that 30.8% of patients were males whereas 69.2% were females.

In a study done by Aurobindo B et al[83] showed that 55% of patients were males whereas 45% were females.

In a study done by Suryakant Tiwari et al[84] showed that 55.6% of patients were males whereas 44.4% were females.

In a study done by Teharia et al[85] showed that 58.3% of patients were males whereas 41.7% were females.

In a study done by Hannah Tan et al[87] showed that 50.6% of patients were males whereas 49.4% were females.

Clinical features:

In this group of 108 participants, itching and pain were the most frequently reported symptoms, each present in 61 cases (56.5%) and absent in 47 (43.5%). Active ear discharge occurred in 56 subjects (51.9%) and was absent in 52 (48.1%), whereas a prior history of ear discharge was noted in 58 subjects (53.7%) and absent in 50 (46.3%).

In a study done by Deekshith Shetty et al[82] showed that 69.2% of patients had no ear pain whereas 30.8% of patients had pain in the ear.

In a study done by Aurobindo B et al[83] showed that 90% of patients had pruritis, 75% had otalgia, 50% had aural discharge and 30% had aural fullness.

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In a study done by Suryakant Tiwari et al[84] showed that 85.2% of patients had itching in the ear, 51.8% had pain in the ear, 74.1% had ear discharge, 22.2% each had impaired hearing and blocked of ear and 7.4% had tinnitus.

Pure tone audiometry:

Hearing thresholds measured by Pure Tone Audiometry (PTA) revealed that most participants—62 individuals (57.4%)—fell within the 20–29 dB range, indicating mild hearing loss. The next largest group was 30 subjects (27.8%) in the 30–39 dB range, followed by 10 subjects (9.3%) in the 10–19 dB range and only 6 subjects (5.5%) in the 40–49 dB range. The average PTA across the sample was 26.73 ± 6.43 dB.

Ear findings:

At the start of the study, 68 subjects (63.0%) had an intact tympanic membrane. Small central perforations were found in 31 cases (28.7%), and medium central perforations in 9 cases (8.3%). Large perforations were absent at baseline.

In a study done by Deekshith Shetty et al[82] showed that 50% of patients had small central perforation, 34.6% had medium central perforation and 15.4% had large central perforation.

In a study done by Aurobindo B et al[83] showed that 2 patients developed tympanic membrane perforation.

In a study done by Suryakant Tiwari et al[84] showed that 66.7% had small central perforation, 22.2% had medium central perforation and 11.1% had large central perforation.

In a study done by Teharia et al[85] showed that 9.1% of patients showed tympanic membrane perforations.

In a study done by Hannah Tan et al[87] showed that 3.2% of patients had TMP, 37.6% had pinhole TMP, 34.4% had less than 25% TMP, 15.1% had 25 to 50% TMP, and 9.7% had more than 50% perforation.

One month after baseline, the number of intact tympanic membranes dropped to 58 subjects (53.7%). Small central perforations rose to 40 subjects (37.0%), and medium central perforations increased modestly to 10 subjects (9.3%).

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At the 3-month mark, intact TMs were present in 53 subjects (49.1%). Small central perforations were seen in 36 subjects (33.3%), medium perforations in 18 subjects (16.7%), and large central perforations emerged in 1 subject (0.9%).

By six months, intact tympanic membranes were observed in 50 subjects (46.3%). Small central perforations declined to 28 subjects (25.9%), while medium central perforations rose sharply to 25 subjects (23.1%), and large central perforations increased to 5 subjects (4.6%).

In a study done by Hannah Tan et al[87] showed that 44.1% of patients showed persistent tympanic membrane perforation.

Although the link between tympanic membrane (TM) perforation and otomycosis has been recognized as a clinical issue for many decades, its exact incidence has never been accurately determined. Reported rates of TM perforation in patients with otomycosis vary widely.[95,96] This variability may stem from the challenges in diagnosing perforation caused by fungal otitis externa, as it relies primarily on clinical examination. Thorough removal of fungal debris and epithelial material under microscopic guidance is essential to fully visualize the TM. Furthermore, perforations are often very small, which makes them hard to detect. These difficulties suggest that many cases may go unrecognized or be misdiagnosed. In addition, some earlier studies attributed TM perforations to chronic otitis media without considering the possibility that the fungal infection itself could be the underlying cause.[35,97] Differences in diagnostic criteria for otomycosis, along with variations in how findings are documented and recorded, can also greatly affect the reported rates. Certain studies have noted that TM perforation tends to occur more frequently in immunocompromised individuals compared to those with normal immune function.[46,98] Another contributing factor to the broad range of reported incidences could be the limited sample sizes used in some investigations.[8,9,20,39,96] Nevertheless, several clinical studies have consistently reported comparable perforation rates, indicating that TM perforation secondary to otomycosis occurs in more than 10% of cases. Therefore, it should not be regarded as a rare complication.

Recurrence:

At one month, recurrence was absent in 60 subjects (55.6%) but present in 48 subjects (44.4%). Three months into follow-up, recurrence was absent in 56 subjects (51.9%) and

present in 52 subjects (48.1%). At the six-month evaluation, recurrence affected the largest proportion yet—61 subjects (56.5%)—while it remained absent in 47 subjects (43.5%).

In a study done by Hannah Tan et al[87] showed that the recurrence rate of TMP was 5.8% after a median follow up period of 92.1days.

The standard treatment approach for otomycosis typically involves mechanical debridement of the ear canal combined with the application of topical antifungal agents. However, when a tympanic membrane (TM) perforation is present, two major concerns arise: antifungal solutions can irritate the middle ear structures and may pose ototoxic risks to the cochlea.

Direct application of antifungal drops using a dropper often leads to stinging or burning sensations.[99] Clotrimazole, the most frequently used antifungal medication, is essentially insoluble in water. The solvents commonly found in dermatologic formulations—such as propylene glycol, isopropyl alcohol, and polyethylene glycol—provide effective drying but tend to irritate the middle ear mucosa, resulting in discomfort like burning or stinging. To minimize these adverse effects, various authors have suggested alternative topical delivery methods. One approach involves placing an ear wick soaked in an antifungal solution or cream, which prolongs contact with the ear canal skin and helps reduce the leakage of irritating substances into the middle ear. Another method includes using a gauze wick impregnated with a combination of hydrocortisone, clotrimazole, framycetin, and gramicidin.[94] Some clinicians have also recommended self-application of clotrimazole solution using cotton-tipped applicators (Q-tips).[99]

In addition, otolaryngologists must remain cautious about the potential ototoxicity of certain antifungal agents.[100] These medications can potentially reach the inner ear through diffusion across the round window membrane.[101] Certain antimycotic drugs have been associated with sensorineural hearing loss, possibly due to damage to the inner hair cells in the organ of Corti. It is important to note that, beyond the active antifungal ingredient, most commercially available otic antifungal drops contain alcohol, various solvents, acids, and antiseptics, which can contribute to toxicity. Animal studies evaluating commonly used topical antifungals by assessing hair cell loss after repeated middle ear instillation over several days have indicated that clotrimazole, miconazole, and tolnaftate appear to be safer options compared to nystatin when treating otomycosis in the presence of a perforated tympanic

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membrane.[102] In contrast, gentian violet has been linked to the risk of significant inner ear damage. Transient sensorineural hearing loss has also been reported in association with the use of certain otic preparations containing cresylate.[20]

The prognosis for otomycosis accompanied by tympanic membrane (TM) perforation is generally favorable.[98] In most instances, particularly with small perforations, the defect tends to heal spontaneously or with appropriate medical management.[94] Restoring the normal environment and conditions in the deeper portion of the external auditory canal appears to be a key requirement for successful closure of the perforation.[90]

However, the risk of a persistent TM defect remains considerable and should not be overlooked. Some reports have documented relatively high rates of non-healing perforations in these cases.[20,90,94]

When spontaneous closure does not occur, such persistent perforations are typically addressed through tympanoplasty, which yields highly satisfactory outcomes.[94] In reported experiences, complete closure of the perforation was successfully achieved in all operated patients. The only instance of residual hearing impairment occurred in a case involving near-total destruction or disintegration of the tympanic membrane.

The timing of surgical intervention varies across different studies. Some clinicians proceed with tympanoplasty if healing has not occurred within one month of conservative treatment, while others advocate for a longer observation period of at least three months before recommending surgery.[90]

TM findings and PTA:

Hearing levels at one month were strongly linked to tympanic membrane condition ($F = 45.36$, $p < 0.001$). The best mean PTA was recorded in those with intact TMs (23.05 ± 4.68 dB), followed by small central perforations (29.68 ± 4.62 dB), with the highest thresholds (worst hearing) in medium central perforations (36.3 ± 5.64 dB).

By three months, PTA values continued to increase (worsen) as perforation size grew ($F = 25.65$, $p < 0.001$). Intact TMs showed the lowest mean PTA (23.04 ± 4.35 dB), followed by small perforations (28.19 ± 4.99 dB), medium perforations (34.22 ± 6.34 dB), and large perforations (35 dB).

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At six months, the relationship between TM status and hearing remained very strong ($F = 26.8$, $p < 0.001$). Participants with intact TMs had the most favorable mean PTA (22.66 ± 4.05 dB), followed by small central perforations (27.86 ± 5.27 dB), medium perforations (31.6 ± 5.71 dB), and large perforations (36 ± 6.21 dB).

Conclusion:

This study highlights that tympanic membrane (TM) perforation is a fairly common—rather than rare—complication of otomycosis (fungal otitis externa). Otolaryngologists and primary care physicians should remain alert to this possibility during evaluation of fungal ear infections, as early recognition directly impacts treatment choices and patient guidance.

The key management difficulty arises from delivering topical antifungals safely when a perforation exists. Standard ear drops often leak into the middle ear, causing intense pain, burning, or stinging—effects worsened by irritant solvents like propylene glycol, isopropyl alcohol, or polyethylene glycol in many preparations. Some antifungals also pose ototoxicity risks, potentially diffusing through the round window to damage inner ear hair cells and cause

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temporary or (rarely) permanent sensorineural hearing loss. Despite these challenges, most TM perforations—particularly smaller ones—resolve favorably with medical treatment. Healing is promoted by meticulous debridement of fungal debris, restoration of a normal canal environment, and use of gentler antifungal delivery methods (e.g., medicated wicks, clotrimazole-soaked gelfoam, or cotton-tip application) to limit middle ear exposure.

In cases where perforations persist despite conservative care, tympanoplasty offers reliable success, typically achieving complete closure and good middle ear function. Any residual hearing loss is uncommon and usually confined to cases with near-total TM destruction. Overall, while otomycosis with TM perforation requires careful avoidance of middle/inner ear irritation and toxicity, the majority of patients achieve good outcomes with optimized medical therapy; persistent defects respond well to surgery. Increased awareness among clinicians can lead to earlier detection, safer management, and improved results.

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