Should an otoendoscope be used as a pre-operative tool to avoid surprises in tympanomastoid surgeries?- a prospective study in a tertiary hospital.

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INTRODUCTION

Chronic Otitis Media is one of the most common conditions found in developing countries with tympano-mastoid surgeries being the most common surgery being performed by otologists in day-to-day practice. Conventionally, microscope which aids the surgeon with binocular vision has been used in assessment of anatomy, extent of disease, operative procedures as well as post-operative follow up. But with this binocular optical system, it is nearly impossible to 'look around the corners.' A widespread disease like chronic otitis media (mucosal type) can have several different features which might surprise the surgeon if adequate pre-operative assessment has not been made. A simple central perforation might harbour gross ossicular abnormalities beyond the perforated tympanic membrane or have extensive granulation complicating the per-operative surgical plan which can lead to extension of the surgical time or difficulty in making the ear disease free. It can also lead to situations where at a teaching institute, a trainee surgeon runs into a potentially difficult case that leads to increasing surgical time and resources, which in high volume centres can alter the subsequent surgical planning grossly. Alternate diagnostic tools like high resolution CT scans are expensive and potentially hazardous, and cannot be prescribed for all patients with mucosal type chronic otitis media. A high air-bone gap on the pre-operative Pure Tone Audiometry is an indirect proof of more disease but even that is not foolproof.

The availability of endoscopes of various angles of vision have expanded the surgeons' ability to look at the intricate corners of the middle ear thus aiding in better assessment of anatomy, extent of disease and thus helping in better planning of the operative procedure. Saravanappa et al[1] (2003) in a survey showed that only 2-10% surgeons use otoendoscope routinely and 7-38% use it occasionally. Even though the use of otoendoscopes has seen a rise globally, it is still not routinely used in tympanomastoid surgeries. A Canadian survey revealed that around 42% surgeons use endoscopes as an adjunct in cholesteatoma surgeries [2].

This study was done at a tertiary care hospital with the aim of comparing the diagnostic ability of conventional aural microscopy and otoendoscopy in the pre-operative assessment in cases of chronic otitis media mucosal variety. This was specifically targeted to assess and compare the ability of the diagnostic tools to delineate the middle ear structures and detect pathology preoperatively, in chronic otitis media. This pre-operative assessment was likely to have an implication in the surgical planning regarding the necessity of using ossicular reconstruction materials (artificial or autologous), gauging the expected surgical time according to the difficulty of the case instead of relying on a radiological investigation (CT scan).

MATERIALS AND METHODS :

A prospective analytical study was conducted at a tertiary care facility in West Bengal from January 2021 to June 2022. All patients attending the outpatient department of the hospital on fixed two days of every week in the study period with a clinical finding of chronic otitis media (COM) mucosal variety with large central perforation involving at least two quadrants of the pars tensa (as visualised during otoendoscopic examination) were included in the study. Patients less than 20 years of age, immuno-compromised patients, patients suffering from COM squamous variety, complications of COM, healed COM, aural polyp, revision cases and patients who didn't give consent for the study were excluded from the study.

After thorough history taking and clinical examination, all the patients were subjected to pre-operative evaluation by the same team of surgeons by using both microscope and endoscope (3mm, 0 degree, 30 degrees). All patients were evaluated after their ears were dry for at least 3 weeks. For patients with discharging ears, oral and topical antibiotics were prescribed as per institutional protocol and they were examined only after their ears were dry for 3 weeks without medications.

A total of 104 patients were included in the study. Among them 16 patients had bilateral ear disease. Out of these 16 patients, 6 patients had a perforation size which was inadequate for the introduction of 3 mm otoendoscope in one ear. So a total of 114 ears were examined and included in the study.

Parameters for evaluation:

1. Evaluation of external auditory Canal (EAC) and visualisation beyond bony hump if any.
2. Ossicular status assessment – A) visible landmarks of malleus, incus, incudo-stapedial joint and stapes. B) assessment of ossicular chain continuity
3. Mesotympanum
4. Hypotympanum
5. Retrotympanum
6. Epitympanic diaphragm

7. Protympanum
8. Eustachian tube function (dynamic assessment) – Endoscope kept near the Eustachian tube opening for 30 seconds and patient is asked to swallow and continue regular breathing. Intermittent fogging of endoscope is noted if any.
9. Squamous pathology detection – pars flaccida defect, retraction pockets of pars tensa with/without cholesteatoma flakes, granulation.

The results were interpreted by 2 otologists for confirmation of the findings. The data obtained was analysed statistically using standard statistical software.

RESULTS and ANALYSIS :

Out of 104 patients, 63 were males while the rest were females. Majority of the population belonged to the middle age group.

Table 1 (N=104)

Age Group	No. of Patients
20-30	27
31-40	35
41-50	30
51-60	8
61-70	4
Total	**104**

Table 1 denotes the age distribution of the patients included in the study. Most of the patients belonged to the age group of (31-40) years.

A total of 114 ears were included in the study out of which there were 71 left ears and 43 right ears.

Table 2 (N=114)

PRE-OPERATIVE PARAMETERS	AID FOR ASSESSMENT	
	MICROSCOPE	OTOENDOSCOPE
Evaluation of external auditory Canal (EAC) and visualisation beyond bony hump (complete annulus visibility)	97	114
Ossicular status assessment	12	30
Mesotympanum	66	114
Hypotympanum	42	110
Retrotympanum	12	106
Epitympanic Diaphragm	2	64
Protympanum	102	114
Eustachian tube function (dynamic assessment)	------	89
Squamous pathology detection	2	2

Table 2 denotes the frequency distribution of the various assessment parameters with respect to microscopy and otoendoscopy.

To compare the two diagnostic tools, aural microscopy was considered as the classical and the gold standard test for evaluation of chronic otitis media. Otoendoscopy which is a newer tool was compared with the gold standard. Comparison was done on various parameters as mentioned earlier on the same patient by the two tools. The results obtained were coded in a dichotomous fashion. For example, visibility beyond the bony hump of external auditory canal was evaluated by both microscopy and endoscopy and the result obtained was interpreted as "Yes" or "No". The obtained values were tabulated in a (2x2) contingency table. The gold standard test Otomicroscopy was placed along the Y-axis and Otoendoscopy along the X-axis. The paired normal data was evaluated statistically by Standard McNemar's Test. The value of Chi-square (X^2), p-value and Exact p-value was calculated. p-value less than 0.05 was considered significant.

Amongst the 114 ears examined, using a microscope it was not possible to look beyond the external auditory canal bulge in 17 ears, however during otoendoscopic evaluation, it was possible to look beyond the EAC hump in all the 114 ears. The difference was found to be statistically significant (X^2= 17, p= 0.00003, Exact p = 0.000015).

During ossicular status assessment of the 114 ears, proper microscopic visualisation of the malleus, incus, incudo-stapedial joint and stapes and assessment of their continuity was possible in only 12 out of 114 ears (10.53%), whereas using otoendoscope, it was possible in 30 ears out of 114 ears (26.32%). This was also found to be statistically significant (X^2 = 18, p = 0.00002, Exact p = 0.000007).

There was significant advantage in using otoendoscope over microscope during evaluation of the mesotympanum (100% vs 57.89% respectively) (X^2=48, p= 0, Exact p = 0.000).

During assessment of Hypotympanum and Retrotympanum, endoscopes clearly provided advantage over the microscope in looking around the corners and the hidden areas [110 ears (96.49%) vs 42 ears (36.84%) and 106 ears(92.98%) vs 12 ears(10.52%) respectively {(X^2=68, p =0, Exact p=0) & (X^2= 94, p= 0, Exact p = 0) respectively}.

Epitympanic diaphragm was visible in 56.1% of cases with the otoendoscope while it was only visible in 0.01% of cases with the microscope, which is grossly significant (X^2= 62, p = 0, Exact p =0).

During evaluation of the protympanum, proper visualisation and assessment was possible in only 102 ears (89.47%) using the microscope. When endoscopes were used as the assessment tool, all 114 ears could be evaluated. This difference was statistically significant (X^2= 12, p=0.00053, Exact p = 0.00048).

The indirect evidence of eustachian tube patency was obtained in 89 ears (78%) where there was fogging of the endoscope tip as the patient continued breathing normally. Obtaining such evidence was not possible through the microscope, thus it was outside the scope of any statistical purview.

There was no significant difference in identification of squamous pathology, as the incidental finding of squamous debris in cases which were exclusively thought to be mucosal disease while doing examination under microscope was similar to that using otoendoscopes, thus offering no added advantage in usage of otoendoscopes (X^2=0, p=1, Exact p=1).

DISCUSSION :

Transtympanic otoendoscopy as a means to diagnose middle ear pathologies at minimal risk to the patient had been suggested by Poe et al [3]. This study corroborates the same fact that it takes a few additional minutes to do the otoendoscopy but provides a lot of information that helps in proper planning of the management of the patient.

Pre-operative assessment under the microscope revealed that the

complete tympanic annulus could not be visualized in 14.91% of the patients, while it was visible with the endoscope in 100% of the cases. Fisher's exact t-test showed the test was statistically significant with p-value of <0.0001. Ayache [4] et al reported 27% annulus visibility under the microscope while 100% visibility under the otoendoscope was reported by them. Harugop [5]et al reported that under microscope, in 20% of cases, the annulus was not completely visible, a finding also reported by Furukawa[6] et al, who had 100% visualization of annulus through otoendoscopes.

Ossicular chain status was visible in 10% of our patients pre-operatively through the microscope, while in 26.31% of the patients, it was visible preoperatively through the otoendoscopes. The p-value was 0.00002, suggesting the finding was statistically significant. The findings are in corroboration with those of Harugop[5]et al, Prinja[7]et al, Júnior[8]et al who reported better visibility of the ossicular chain status through endoscopy. Yadav[9]et al reported that in addition to the better visibility of the ossicular chain status, otoendoscopes also helped in visualising the mucoepithelial junction on the medial aspect of the tympanic membrane perforation, which was medial to the margin of the perforation in about 30% cases. However, Farahani[10]et al reported the diagnostic ability of both microscope and otoendoscope in detecting ossicular chain erosion was similar and the otoendoscope had no advantage over the microscope in this regard. Evaluation of the different components of the middle ear, like hypotympanum, retrotympanum, epitympanic diaphragm and protympanum were all better with the otoendoscope in this study which was statistically significant as well. These findings are in concurrence to those reported by Marchioni[11] et al and Tarabichi[12]who reported better visibility of the retrotympanum & hypotympanum by endoscopic exploration in their study. The epitympanic diaphragm was better evaluated using the otoendoscope while it was almost impossible to see through the microscope, a finding which was similar to that reported by Marchioni[13]et al. That the protympanum was better seen through the otoendoscope has been reported by Jufas[14]et al. Evaluation of mesotympanum through both otoendoscope and microscope gave us different results with overwhelming majority in favour of the former despite the rectilinearity of vision in observing this area. This can be attributed to the fact that much of the mesotympanum was behind the edges of the perforation, which made it difficult to be visualised through the microscope.

In this study, finding squamous disease by both tools was not significant statistically. This might be due to the strict case selection procedure where only mucosal variety disease was considered for the study but still, there were two cases which were eventually found to have squamous disease in them. Our findings differ with that of Presutti[15]et al, who reported 37.5% cases of residual squamous disease after having full disease clearance under the operating microscope.

CONCLUSION :

To conclude, we can state that otoendoscopes can greatly enhance a surgeon's ability to correctly assess the middle ear in chronic otitis media. This pre-operative procedure can help in resource poor settings by proper estimation of logistics while keeping in mind the best interests of the patient from surgical point of view so as to give him a disease-free ear. In teaching institutes where a large number of trainee surgeons are being taught the nuances of intricate ontological surgeries, using an otoendoscope pre-operatively can go a long way in reducing on-table surprises, which can make life difficult for a novice surgeon, prolong surgical time and engage man-power, thus altering the logistics of planned surgery at high volume centres. Proper planning can be done prior to taking a case up for surgery so that residents who are learning the basic surgical steps do not run into difficult surgical situations inadvertently. This can aid in addressing the disease process and give better surgical outcome.

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