ORIGINAL RESEARCH

Otoendoscopy as a pre-operative assessment tool intympanoplasty

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ABSTRACT

Background: Endoscopy is performed by otorhinolaryngologists in the clinical setting as part of the otological examination to assess the extent of middle ear disease and assist in planning the surgical approach. This study is aimed at assessing the role of oto-endoscopes in evaluating the middle ear structures preoperatively in cases of mucosal type of chronic suppurative otitis media. **Method:** In this prospective study, 45 patients with CSOM were subjected to otoendoscopy using 0 and 30-degree Hopkins endoscope. The various middle ear structures and hidden spaces like facial recess, sinus tympani, hypotympanum and protympanic segment of the eustachian tube were visualized preoperatively. **Result:** Middle ear structures and blind niches were better evaluated preoperatively using otoendoscopes and a definitive operative plan was formulated. Adhesions and secretions at tympanic orifice of the Eustachian tube opening and congested middle ear mucosa were identified preoperatively to incorporate a better management plan. **Conclusion:** Preoperative otoendoscopy could be utilized to improve the evaluation of hidden middle ear recesses and structures, particularly if there is a potentially recrudescent pathology, thus providing better surgical outcome for patients.

Keywords: otoendoscopy, facial recess, endoscope, oval window, ossicular status, round window, incudostapedial joint.

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INTRODUCTION

In the management of ear disease, early knowledge of the extent of damage can aid in the planning of the appropriate surgical procedure.[1] Theotologist has a large range of technological support at their disposal, such as the otologic microscope and otoendoscope, to visualize and document the pathologies of the middle ear, these being essential for surgical intervention. Visual inspection supported by anamnestic information is the primary element in correctly formulating a diagnosis in otology.[2] Despite its continuous technical improvements, the basic optical principles and their limitations have remained the same over the past three decades.[3] In addition to microscopic techniques, the application of endoscopy has become an usual practice for clinical evaluation of the structures of the middle ear. The assessment of these structures has been facilitated by endoscopy [4].

A rigid endoscope can be used to visualize and evaluate the extent of middle ear disease, assess ossicular integrity and explore the hidden niches of the middle ear, i.e., sinus tympani, facial recess, attic, hypotympanum, protympanum, sinus tympani etc.

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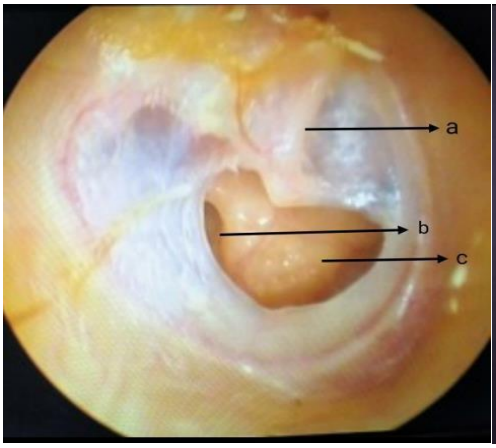

Image 1 a) Handle of malleus, b) Round window niche, b) Promontory, c) Hypotympanum c) Promontory seen on otoendoscopyseen on otoendoscopy

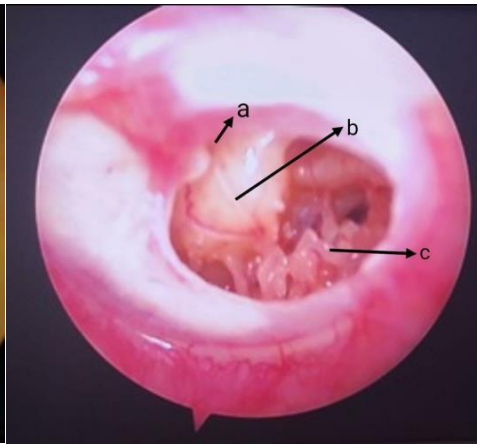

Image 2 a) Handle of malleus medialized,

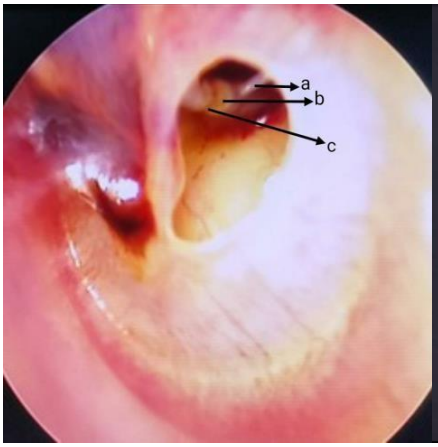

Image 3 a) Stapedius tendon, b) suprastructureof stapes, otoendoscopyb) Long process of incus necrosed, c) Lenticular process of incus seen on otoendoscopyc) Handle of malleus seen on otoendoscopy

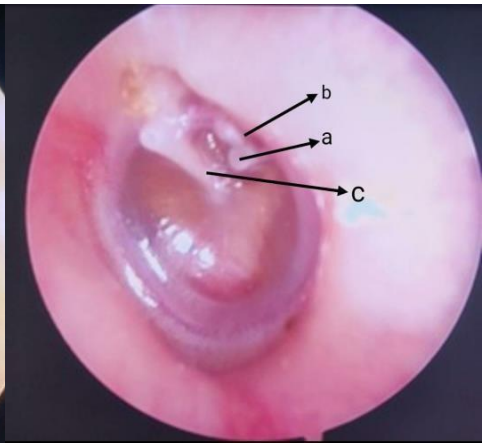

Image 4 a) Head of stapes,

The aim of our study was to evaluate the usefulness of otoendoscopy for diagnosis and planning middle ear surgeries so that the use of otoendoscopes in the outpatient setup is routinely used to correctly diagnose the middle ear pathologies and to formulate and incorporate the proper plan of management.

METHODOLOGY

The prospective study was conducted in the Department of Otorhinolaryngology and Head and Neck surgery, Chirayu Medical College and Hospital, Bhopal from January 2023 to February 2023. 45 patients who were diagnosed as CSOM with conductive hearing loss and in whom tympanoplasty was planned were included in the study.

Inclusion criteria

- Patients with inactive tubotympanic type of chronic suppurative otitis media
- Patients aged above 10 years

Exclusion criteria

- Patients below 10 years of age
- Patients with otitis externa

Preoperative endoscopic assessment of the middle ear was performed using 0 degree otoendoscope and findings of otoscopic examination were confirmed. Operative plan for the patient was formulated and appropriate surgical intervention was done. Data was entered in excel sheet and analysis was done using SSPS software.

RESULT

The mean age of patients was 30.2 years. Overall, 44,4% of patients were male and 55.5% of patients were female.

Table 1: Epidemiological study of the studied cases

Sex	[N (%)]
Male	20 (44)
Female	25(55)

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Structures visualized using 0 degree otoendoscope included handle of malleus and incudostapedial joint area in 43 (95.5%) patients. Long process of incus was visualized in 41 (91.11%), stapes suprastructure in 32 (71.2%) and stapedius tendon in 29 (64.5%) patients. In medial wall, oval and round window was completely visualized in 32 (71.2%) patients. Blind niches, which included facial recess, sinus tympani and hypotympanum were visualized in 28 (62.2%) patients.

Structures visualized using 30 degree otoendoscope included handle of malleus,

Incudostapedial joint area, long process of incus, stapes suprastructure and stapedius tendon in 43 (95.5%) patients. In medial wall, oval and round window were completely visualized in

43 (95.5%) patients. Blind niches, which included facial recess, sinus tympani and hypotympanum, were completely visualized in 43 (95.5%) patients.

Structures that were visualized during surgical examination of the middle ear (before elevating the tympanomeatal flap) included handle of malleus in 41 (91.1%), incudostapedial joint area in 32 (71.2%), long process of incus in 30 (66.6%), stapes suprastructure and stapedius tendon in 16 (35.5%) patients each. In medial wall, oval and round window was not visualized in 28(62.28%) patients, partially visualized in 7(15.55%) and completely visualized in 10 (22.22%) patients. In blind niches, facial recess, sinus tympani and hypotympanum were not visualized in 42 (93.33%) and partially visualized in 3 (6.66%) patients.

Intraoperative findings after elevation of TM flap included visualization of handle of malleus and incudostapedial joint area in 45(100%) patients each. Long process of incus was visualized in 45 (100.0%) cases and was seen necrosed in 7 (15.5%) cases. Stapes suprastructure was visualized in 45(100.0%) and stapedius tendon in 43(95.5%) cases. In medial wall oval and round window was partially visualized in 9 (20%) and completely visualized in 36 (80%) patients. In blind niches facial recess, sinus tympani and hypotympanum were partially visualized in 12 (26.66%) patients and completely visualized in 33 (73.33%) patients.

Table 2: Medial wall structures visualized with 0 and 30 degree endoscopes preoperatively

Medial wall		0 degree	30 degree
Oval window area	Completely visualized	32(71.2%)	43(95.5%)
	Partially visualized	13(28.8%)	2(4%)
	Not visualized	0	0
Round window area	Completely visualized	32(71.2%)	43(95.5%)
	Partially visualized	13(28.8%)	2(4%)
	Not visualized	0	0

Table 3: Blind niches observed with 0 and 30 degree endoscopes preoperatively

Blind niches		0 degree	30 degree
Facial recess	Completely visualized	28 (62.2%)	43 (95.5%)
	Partially visualized	17(37%)	2(4.5%)
	Not visualized	0	0
Sinus tympani	Completely visualized	28 (62.2%)	43(95.5%)
	Partially visualized	17(37%)	2(4.5)
	Not visualized	0	0
Hypotympanum	Completely visualized	28 (62.2%)	43 (95.5%)
	Partially visualized	17(37%)	2(4.5)
	Not visualized	0	0

Table 4:Ossicular chain status observed with 0 and 30 degree endoscopes preoperatively

Ossicular status	0 degree	30 degree
Handle of malleus	43(95.5)	43(95.5%)
Long process of incus	41 (91.11%)	43(95.5%)
Incudo-stapedial joint	42(93.33%)	43(95.5%)
Stapes suprastructure	32 (71.2%)	43(95.5%)
Stapedius tendon	29 (64.5%)	40(88%)

Table 5: Medial wall structures visualized intraoperatively before elevation of TM flap

Medial wall		Number	Percentage
Oval window area	Completely visualized	10	22.22%
	Partially visualized	7	15.55%
	Not visualized	28	62.28%

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Round window area	Completely visualized	10	22.22%
	Partially visualized	7	15.55%

Table 6: Blind niches visualized intraoperatively before elevation of TM flap

Blind niches		Number	Percentage
Facial recess	Completely visualized	0	0
	Partially visualized	3	6.66%
	Not visualized	42	93.33%
Sinus tympani	Completely visualized	0	0
	Partially visualized	3	6.66%
	Not visualized	42	93.33%
Hypotympanum	Completely visualized	0	0
	Partially visualized	3	6.66%
	Not visualized	42	93.33%

Table 7:Ossicular status visualized intraoperatively before elevation of TM flap

Ossicular status	Number	Percentage
Handle of malleus	41	91.1%
Long process of incus	30	66.6%
Incudo-stapedial joint	32	71.2%
Stapes suprastructure	16	35.5%
Stapedius tendon	16	35.5%

Table 8: Medial wall visualized intraoperatively after elevation of TM flap

Medial wall		Number	Percentage
Oval window area	Completely visualized	10	22.22%
	Partially visualized	7	15.55%
	Not visualized	28	62.28%
Round window area	Completely visualized	10	22.22%
	Partially visualized	7	15.55%
	Not visualized	28	62.28%

Table 9: Blind niches visualized intraoperatively after elevation of TM flap

Blind niches		Number	Percentage
Facial recess	Completely visualized	33	73.33
	Partially visualized	12	26.66
	Not visualized	0	0
Sinus tympani	Completely visualized	33	73.33
	Partially visualized	12	26.66
	Not visualized	0	0
hypotympanum	Completely visualized	33	73
	Partially visualized	12	26.66
	Not visualized	0	0

Table 10:Ossicular status visualized intraoperatively after elevation of TM flap

Ossicular status	Number	Percentage
Handle of malleus	45	100
Long process of incus	45	100
Incudo-stapedial joint	45	100
Stapes suprastructure	45	100
Stapedius tendon	43	95.5

DISCUSSION

In our study the structures visualized by using 0degree otoendoscope included handle of malleus and incudostapedial joint area in 42(93.33%) patients each. Long process of incus was visualized in 41 (91.11%), stapes suprastructure in 32 (71.2%) and stapedius tendon in 29 (64.5%) patients. In medial wall, oval and round window was completely visualized in 32(71.2%) patients. Blind niches, which included facial recess, sinus tympani and hypotympanum were

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completely visualized in 28 (62.2%) patients. The structures that were visualized using 30 degree otoendoscope included handle of malleus, Incudostapedial joint area, long process of incus, stapes suprastructure and stapedius tendon in 40 (88%) patients.

In medial wall, oval and round window were completely visualized in 43 (95.5%) patients. Blind niches, which included facial recess, sinus tympani and hypotympanum were completely visualized in 43 (95.5%) patients. Kumar et al. in their study of 50 cases (64 ears), found that 30 degree endoscope provided valuable information especially regarding the eustachian tube orifice, the protympanum and hypotympanum.[5]Kaushal et al studied 62 patients in his research dissertation and found that hypotympanum was visualized in only 16 (25.8%) cases by microscope whereas in 58 (93.5%) cases it was visualized by the otoendoscope.[6] Hence there is a statistically significant benefit with otoendoscope in assessing middle ear mucosa, the eustachian tube, protympanum and hypotympanum. The examination of ossicles in their study revealed that while there is no added benefit by otoendoscopy in assessing the malleus over the microscope (p value >0.05) there is a definite benefit of otoendoscope in visualizing the incus. In visualizing the incudostapedial joint the angled otoendoscope has a definite advantage over microscope due to the angled view. This was also demonstrated in their study that in 50 cases (80.6%) out of the 62 cases, the Incudostapedial joint could be visualized using the otoendoscope while only in 9 (14.5%) cases the Incudostapedial joint could be visualized by microscope.

Ghaffar et al conducted a study entitled 'Incorporating the endoscope into middle ear surgery' and found that a 30^0 endoscope can visualize the middle ear in almost all cases.[3] During endoscopy, the malleus, incus, and stapes can be visualized and palpated. The hidden structures of the middle ear - the sinus tympani, facial recess, attic, and hypotympanum - can also be easily visualized. They concluded that the advantages of otoendoscopy was that it provided a wide-angle view of the entire tympanic ring and ear canal at the same time without the need for repeatedly repositioning the patient. Majority of the middle ear structures that were visualized during microscopic examination of the middle ear (before elevating the tympanomeatal flap) included handle of malleus in 65 (92.8%), incudostapedial joint area in 51 (72.86%), long process of incus in 51 (72.86%), stapes suprastructure and stapedius tendon in 25 (35.71%) patients each. In medial wall, oval and round window was not visualized in 45 (64.28%) patients, partially visualized in 10 (14.28%) and completely visualized in 15 (21.43%) patients. In blind niches, facial recess, sinus tympani and hypotympanum were not visualized in 66 (94.28%) and partially visualized in 4 (5.71%) patients.

Thus, otoendoscopic examination was superior to examination under microscope in visualization of middle ear structures especially oval window area and blind niches (facial recess, sinus tympani and hypotympanum).

In majority of the cases post endoscopic operative plan formulated was Type 1 tympanoplasty in 27 cases (60% of the study population), followed by type 2 tympanoplasty in 11 cases (30 % of the study population)

In our study, intraoperative findings showed handle of malleus and incudostapedial joint area in 43(95.5%) patients each. Incudostapedial joint was seen dislocated in patients. Long process of incus was visualized in all 45(100.0%) cases and was seen necrosed in 9 (20%) cases. Stapes suprastructure was visualized in 45 (100.0%) and stapedius tendon in 43 (95.5%) cases. In medial wall oval and round window was partially visualized in 7(15.55%) and completely visualized in 10 (22.22%) patients. In blind niches facial recess, sinus tympani and hypotympanum were partially visualized in 12 (26.28%) patients and completely visualized in 33 (73.72%) patients.

Farahani et al studied 58 patients with chronic COM who were candidates for tympanoplasty with or without a mastoidectomy.[7]Their microscopic and endoscopic findings included visualization of malleus in 47 (81%) patients by each method, incus which was visualized in 39 (67.2%) patients by microscope and in 40 (69.0%) patients by endoscopic examination.

Stapes was visualized through microscope in 38 (65.5%) patients and through endoscope in 47 (81.0%) patients. Oval window was visualized through microscope and endoscope in 33 (56.9%) and 46 (79.3%) patients, respectively. Round window was visualized through microscope in 39 (67.2%) and through endoscope in 52 (89.7%) patients. Sinus tympani was visualized through microscope and endoscope in 3 (5.2%) and 23 (39.7%) patients respectively and hypotympanum in 14 (24.1%) and 32 (55.1%) patients respectively.

CONCLUSION

In our study after intraoperative examination, the findings of preoperative otoendoscopic examination matched closely in terms of ossicular chain status and visualization of hidden areas. The operative procedure executed finally matched with the preoperative otoendoscopic operative plan in all patients i.e. 27 patients underwent type 1 TP, 11 patients underwent type 2 TP and 7 patients underwent TP with atticotomy. Thus, preoperative otoendoscopy was utilized in our study population to improve the evaluation of hidden middle ear recesses and structures and providing a better surgical success outcome for the patient.

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