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# Clinical Study to Compare the Diagnostic Performance of Endoscopic and Microscopic Procedures in Identifying the Middle Ear Structures and Associated Disease in Patients with Chronic Otitis Media(COM)

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**ABSTRACT**
Chronic Otitis media (COM) is the term used to describe variety of signs, symptoms and physical findings that result from long term damage of middle ear by infection and inflammation. To compare the diagnostic performance of endoscopic and microscopic procedures in identifying the middle ear structures and associated disease in patients with Chronic Otitis Media(COM). This Observational study was conducted among 50 patients with complaints of ear discharge, hard of hearing and symptoms of Chronic Otitis Media (COM) posted for Tympanoplasty, mastoidectomy and Combined Approach Tympanoplasty (CAT). Duration of Study was Jan 2023-December 2023. Out of 50 study participants, 29 (58%) were Females and 21 (42%) were male. Maximum study subject 19 (38%) were from 16-25 years. All patients has symptoms and signs of COM. 31 (62%) having TTD and 11pts (22%) AAD with cholesteatoma, 8pts (16%)with retraction pocket. Examination of middle ear with Operating microscope and Endoscope yielded the following results. Promontory was visualized minimally in 5pts (10%), partially in 7pts (14%) and completely in 38pts (76%) by microscopy and by endoscopy visualized minimally in 4pts (8%), partially in 6pts (12%) and completely in 40pts (80%). Ossicular status could be ascertained minimally in 2pts(4%), partially in22pts(44%) and completely in 27pts (57%)by microscopy, whereas by endoscopy ossicular status was visualized partially in 24pts(48%) and completely in 26pts (52%). Mucosal disease was valuable partially in 25pts(50%) and completely in 25pts(50%) by microscopy and by endoscopy partially in 24pts (48%) and fully in 26pts (52%). ET area was visualized minimally in 5pts (10%), partially in 11pts (22%) and completely in 25pts (50%) by microscopy and endoscopy visualized minimally in 8pts (16%), partially in 10pts (20%) and fully in 32pts (64%).Facial recess could be visualized minimally in 18pts (36%) partially in 11pts (22%) and fully in10pts (20%) by microscopy, partially in 11pts (22%), fully in 37pts (74%). There is clear benefit of observational endoscopic ear examination, enabling improved visualization of the tympanic cavity and discovery of hidden, residual disease.

## INTRODUCTION

Middle ear examination and surgery is usually performed with an operating microscope. Microscopic techniques are accepted routine methods for diagnosis and management of Chronic Otitis Media. Despite its common application, using a microscope for these procedures is typically accompanied with limited visibility of various middle ear components including the hypotympanum, sinus tympani and epitympanum, as well as the posterior part of the mesotympanum[1]. The ability to use both hands is one of the main advantages of this procedure and the technique has improved the diagnostic performance of the procedure. In addition to microscopy techniques, the application of flexible and rigid endoscopy has become usual for clinical evaluation of the structures of the middle ear. The assessment of these structures has been facilitated by endoscopy. Advantages of endoscope are:

- It provides an excellent magnified image with a good resolution.
- With minimal effort it can be used to visualize the nook and corners of middle ear cavity.
- Magnification can be achieved by just getting the endoscope closer to the surgical field.
- Antero inferior recess of external auditory canal can be visualized using an endoscope.
- Middle ear cavity can be visualized easily using an endoscope. Even difficult areas to visualize under microscopy like sinus tympani can easily be examined using an endoscope. Permeatal approach is quiet adequate in routine procedures with the use of endoscope. Advent of endoscopes have revolutionized diagnosis and treatment of various disorders. Otology is no exception to it. Otoendoscopes are rigid endoscopes which have been used for diagnostic purposes in the field of otology.

**Commonly Used Otoendoscopes Include:**

- 7mm, 2.7mm and 4mm 0 degree Otoendoscopes
- 1.7mm, 2.7mm and 4mm. 30 degrees Otoendoscopes.

**Advantages of Using Rigid Endoscopes to Perform Ontological Examinations:**

- The entire ear drum can be clearly visualized with minimal manipulation.
- The image produced is of excellent resolution hence photographing these images provide excellent results.
- Fluid levels in middle ear cavity due to otitis media with effusion is clearly seen in otoendoscopy than in routine otoscopy.
- Every nook and corner of external auditory canal and middle ear cavity if tympanic membrane perforation is present can easily be examined with minimal manipulation of the endoscope.
- It is easy to clear the debris from the external auditory canal under visualization with an Otoendoscopes.

Because of some potential limitations of the endoscopic procedure including iatrogenic trauma, induced hyperthermia and one-handed application, the use of this procedure is relatively uncommon in clinical settings. Diagnostic performances of these two procedures, microscopy and otoendoscopy have been widely assessed in various studies in different settings Comparing microscopic and endoscopic diagnostic approaches has revealed the superiority and feasibility of the latter method in evaluating middle ear pathological changes and structural abnormalities. This study was conducted to compare the diagnostic performance of endoscopic and microscopic procedures in identifying the middle ear structures and associated disease in patients with Chronic Otitis Media(COM).

## MATERIALS AND METHODS

This Observational study was conducted among 50 patients with complaints of ear discharge, hard of hearing and symptoms of Chronic Otitis Media (COM) posted for Tympanoplasty, mastoidectomy and Combined Approach Tympanoplasty (CAT). Duration of Study was Jan 2023-December 2023.

**Inclusion Criteria:**

- Subjects having Chronic Otitis Media(COM) of both mucosal(TTD) with large/sub total.
- central pars tensaperforation and Squamosal (AAD) with/without Cholestaetoma.

**Exclusion Criteria:**

- Subjects of age below 15 yrs and above 60 yrs.
- Subjects with previous h/o ear surgery.
- Subjects with apparently normal Tympanic membranes.

**Methodology:** All subjects enrolled for study were explained in their own language and informed consent obtained. Evaluation of middle ear structures and disease was done using Operating microscope (OPMI-ZEIS) and Endoscopes(Storz Rigid Telescopes 2.7mm, 4mm diameter,18 cm of 0 and 30 degree).The middle ears were evaluated with respect to following points.

- Epithelialization of Promontory.
- Status of Ossicular chain.
- Mucosal disease and hypertrophy.
- Eustachean tubal opening and disease.
- Disease in Facial recess and Sinus Tympani.
- Extent of retraction pocket.
- Cholesteatoma in unsafe COM.

The extent of visualization of each finding by either microscope or endoscope is graded as follows.

- Not visualized.
- Minimally visualized.
- Partially visualized.
- Completely visualized.

Scores of visualization for each area are compared between microscope and endoscope in percentages.

## RESULTS AND DISCUSSIONS

The following data was obtained from the subjects enrolled for this study from the patients admitted in ENT wards in Government General Hospital, Kadapa, between Jan 2023 and Dec 2023. Of the 50 patients 29(58%) were female, remaining 21 (42%) male. Age was ranging between 16 and 65. Transcanal Myringoplasty procedure can be undertaken even in patients with narrow EAC thus avoiding post auricular incision[2]. Circumference of perforation cannot be confirmed in all cases before freshening the margins supplementation with endoscopic exposure improves success rate of perforation closure and hearing improvement. In microscopic transcanal approach the medial wall of TM Cannot be visualized, which prevents confirmation or absence of epithelial ingrowth. An endoscope in contrast enables visualization of medial wall of tympanic cavity and status of ossicles[2]. Minimally invasive endoscopic transcanal technique is adequate for management of limited cholesteatoma with long term results comparable to postaural methods[3]. Endoscope is even useful in post operative evaluation of mas to idcavities. Tiny residual cholesteatoma pearls can be removed endoscopically, where as large cholestaetoma needs surgery[4]. The degree of epithelization and condition of graft margins can be accurately assessed by rigid telescope. Intraoperative supplementation of operating microscope with angled endoscope to detect the completeness of cholestaetoma resection and learn whether a “second look “ procedure still needed[5]. Endoscopic visualization during canal wall up procedure sufficiently improves the residual disease removal as to become comparable to Canal Wall Down surgery[6]. Rosenberg S, Silverstein *et al.* discussed the use of endoscope in otology and neurology. In acoustic neuroma surgery with an objective of hearing conservation endoscope are useful to inspect lateral aspect of Internal Auditory Meatus for residual tumor. During vestibular neurectomy endoscopes can be used to view the IAM, help identifying the Cochleovestibular cleavage plane[7]. In the present study 50 patients suffering from COM were subjected to evaluation of findings in middle ear both by microscopy and endoscopy with reference to epithelialization of promontory, ossicular status, mucosal hypertrophy, disease in ET area, facial recess, Sinus tympani, extent of retraction pocket and cholesteatoma in AAD. All pts has symptoms and signs of COM. 31(62%) having TTD and11pts (22%) AAD with cholesteatoma, 8pts (16%)with retraction pocket. Examination of middle ear with Operating microscope and Endoscope yielded the following results. Promontory was visualized minimally in 5pts (10%), partially in 7pts (14%) and completely in 38pts (76%) by microscopy and by endoscopy visualized minimally in 4pts (8%), partially in 6pts (12%) and completely in 40pts (80%). Ossicular status could be ascertained minimally in 2pts (4%),partially in 22pts (44%) and completely in 27pts (57%)by microscopy, whereas by endoscopy ossicular status was visualized partially in 24pts (48%) and completely in 26pts (52%). Mucosal disease was evaluable partially in 25pts (50%) and completely in 25pts (50%) by microscopy and by endoscopy partially in 24pts (48%) and fully in 26pts (52%). ET area was visualized minimally in 5pts (10%), partially in 11pts (22%) and completely in 25pts (50%) by microscopy and endoscopy visualized minimally in 8pts (16%), partially in 10pts(20%) and fully in 32pts (64%). Facial recess could be visualized minimally in 18pts (36%) partially in 11pts(22%) and fully in 10pts (20%) by microscopy, partially in11pts(22%),fully in 37pts (74%).Microscopy visualized Sinus tympani minimally in 8pts (16%) and not visualized in rest 42pts (84%) where as endoscopy visualized minimally in 2pts (4%), partly in22pts (44%) and fully 25pts (50%). Extent of retraction pocket could be assessed partially in 6 of 8pts (75%), fully in 2 of 8pts (25%) by microscopy and completely in 8 of 8pts (100%) by endoscopy. Whereas microscopy visualized the extent of Cholesteatoma minimally in 3 of 11pts (27%), partially in 8 of 16pts (73%), endoscopy visualized partially in 2 of 11pts (18%), fu/ly in 9 of 11pts (82%). Analyzing the above results, it can be concluded that Endoscopic examination has no definite advantage in visualizing middle structures of promontory, ossicles and ETO. However the visualization of facial recess and sins tympani was found to be better with otoendoscopy. In AAD the endoscope is found to have an advantage over microscopic examination in assessment of the extent of retraction pocket and cholesteatoma.

**Similar Studies:** Karhuketo[8] Extension of Endoscopy and microscopy in examination of middle ear structures. Middle ears of 8 cadaver temporal bone block swere studied through ear canal 3 times in random order with both methods. There was a distinct difference between the results of two methods in favour of endoscopes. Variations between methods and trials were analogous. Tschabitsher[9] Anatomical structures were visualized by trans meatal/ transtympanic route with rigid endoscopes of different angles and a flexible endoscope in ET in 40 cadaver skulls without prior fixation. Rigidtransmeatal/trans tympanic endoscopes provided a full view of the entire tympanic cavity except epitympanum, access to which was barred by in cudomalleolar joint, malleolar

**Table 1: Disease Type Distribution**

| Type of Disease | No of patient | percentage |
|---|---|---|
| Tubotympanic(TTD) | 31 | 62% |
| Attico antral(AAD) with Cholesteatoma | 11 | 22% |
| Atticoantral (AAD) with retraction Pocket | 08 | 16% |

**Table 2: Comparison of Visualization of Various Areas of Middle Ear by Otomicroscopy and Endoscopy in Percentage Promontory**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | - | 10% | 14% | 76% |
| Endoscopy | - | 08% | 12% | 80% |

**Table 3: Ossicular Status**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | - | 02% | 44% | 54% |
| Endoscopy | - | - | 24% | 52% |

**Table 4: Mucosal Disease**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | - | - | 50% | 50% |
| Endoscopy | - | - | 48% | 52% |

**Table 5: Eustachean Tube Orifice**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | 18% | 10% | 22% | 50% |
| Endoscopy | 16% | - | 20% | 64% |

**Table 6: Facial Recess**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | 22% | 36% | 22% | 20% |
| Endoscopy | - | - | 36% | 74% |

**Table 7: Sinus Tympani**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | 84% | 16% | - | - |
| Endoscopy | 06% | 04% | 44% | 50% |

**Table 8:Extent of Retraction Pocket**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | - | - | 75% | 25% |
| Endoscopy | - | - | - | 100% |

**Table 9: Extent of Cholesteatoma**

| Method | Not Visualized | Minimally Visualized | Partly Visualized | Completely Visualized |
|---|---|---|---|---|
| Microscopy | - | 26% | 74% | - |
| Endoscopy | - | - | 18% | 82% |

**Table 10: Comparison of Complete Visualization of Middle Structures and Pathology by Otomicroscopy and Endoscopy**

| Middle Ear Structure | Microscopy | Endoscopy |
|---|---|---|
| Promontory | 76% | 80% |
| Ossicular status | 58% | 52% |
| Mucosal Disease | 50% | 52% |
| Eustachean tube orifice | 50% | 64% |
| Facial Recess | 20% | 74% |
| Sinus Tympani | 25% | 50% |
| Extent of Retraction Pocket | 25% | 100% |
| Extent of Cholesteatoma | 0% | 82% |

folds and tympanic chord, but epitympanum was well visualized through the flexible transtubal scope. Emila B, Karchier[10] studied 11 temporal bones fixed in formalin. Attico-antromastoidectomy and posterior tympanotomy were carried out under operating microscope. Then evaluation of visualization of tympanic cavity was performed through posterior tympanotomy.Thevisiblity of each anatomical area was assessed for microscope, 30/45 degree endoscope .The study determined the visiblity of Anterior epitympanic recess, ET orifice, foot plate, Sinus tympani and hypotympanum. Both 30/45 degree endoscopes provided excellent visualization of tympanic cavity recesses. Visualization of Sinus tympani, Prussak's space was statistically significantly better in the endoscopes in comparison to the microscope. However statistical analysis revealed no significant difference in visualization of ET orifice, hypotympanum between endoscope and microscope. Anita B Prakash M Bapna[11] undertook a comparatives study of post operative mastoid cavities with Hopkins telescope, Otoscope and microscope has shown better results with telescopic endoscope. Sinus tympani, facial recess and ET visualized with 30 degree, sino dural angle and tip cells with 70 degree scope. The degree of epithelialization and condition of graft margin could be accurately visualized. Mohammed Badr-El-Dine, Yasser G. Shewel, Ahmad A. Ibrahim and Mohammed Khalifa[5], Study was carried out on 60 ears with retraction pocket cholesteatoma. These cases were operated upon using either CWU or transcanal atticotomy techniques. Endoscope assisted surgery

was incorporated complementary to the microscope in all. The operation was performed using a Zeiss microscope. (Carl Zeiss Group, Oberkochen, Germany) and standard micro surgical instruments under continuous suction irrigation. Endoscopy was used interchangeably with the microscopic work in looking for and removing remnant or residual epithelial matrix in hidden areas of the middle ear. These areas included the sinus tympani, the anterior epitympanic recess, and the facial recess. CWU mastoidectomy was the standard technique and was used in 40 cases, whereas transcanal atticotomy was performed in 20 patient. One important parameter that was assessed in this study was the overall visibility of hidden areas of the middle ear (whether they were involved by cholesteatoma or not) by the endoscope versus a microscope. The facial recess was visualized by the endoscope in 100% of the ears compared with 90% by the microscope. This difference was statistically significant. The incidence of endoscopic visibility of the sinus tympani was 100% compared with 20% by the microscope, with a statistically significant difference (P.001). The anterior epitympanic recess in this study was visible by the endoscope in 66% of the cases (40 out 60 patients), whereas it was not visible by the operating microscope because excessive drilling and removal of the scutum and cog is needed to visualize it. This difference was statistically significant (P.001). They concluded that endoscopy helps explore hidden areas of the middle-ear cavity with a much lesser requirement for surgical exposure and the need to drill healthy bone., therefore, effective control over the disease can be achieved, thus establishing the concept of functional endoscopic ear surgery. Jalal Poorolajal[1], Diagnostic Performance of Endoscopic and Microscopic Procedures for Identifying different Middle Ear structures and remaining Disease in patients with Chronic Otitis Media: In this prospective cohort study, 58 patients with chronic COM, who were candidates for tympanoplasty with or without a mastoidectomy, were enrolled. Under general anesthesia, the middle ear was entered through a post auricular incision and the tympanomeatal flap was elevated. Before the surgical intervention, the middle ear was examined with an operating microscope (Karl Storz, Germany with Sony 3CCD Color Video Camera, Japan) in different positions and in Middle ear pathologies were explored with the identical technique and the status of the ossicular chain was assessed as well. The middle ear was evaluated using a zero and 30-degree rigid endoscope (Karl Storz Image 1 HD H3 3-chip Camera Head and Diameter 4mm, Work Length 18cm, Karl Storz Image lens, Germany) and all of the components of the middle ear were assessed. Conventional middle ear surgery, using a microscope, was performed and before the insertion of the tympanic membrane graft, the ear was reevaluated by endoscope According to the results, the epitympanum and posterior mesotympanum structures as well as most parts of the mesotympanum were significantly more visible through the endoscope than through the microscope. There was no significant difference in the evaluation of the ossicular chain mobility and the reflex of the round window between the microscopic and endoscopic approaches. In addition, according to the results, the diagnostic performance of both procedures was similar in identifying ossicular chain erosions. At the end of the microscopic surgery and before the insertion of the tympanic membrane graft, the ear was reexamined with the endoscope to detect any remaining pathology. In 4 of the 13 patients with a cholesteatoma, the cholesteatoma had remained in the sinus tympani and epitympanum . The conclusion of the study was that in cases in which visibility by microscopy is disturbed and the surgeon suspects that pathologies remain in the middle ear, endoscopy could be utilized efficiently to improve the visibility and assessment of additional hidden middle ear pits and structures, particularly if there were a potentially recrudescent pathology. Bowdler DA, Walsh RM. Department of Otorhinolaryngology, Lewisham Hospital, London[12]. Comparison of microscopy and endoscopy in CWU and CWD mastoidectomy. This study was conducted to compare the accessibility of particular anatomical sites in the middle ear cleft in five CWU and CWD temporal bone dissections, using 0 and 70 degree endoscopes and microscope. In all five CWU dissections, otoendoscopy gave good visualization of middle ear cleft where as microscopy failed to give adequate visualization of sinus tympani and protympanum. In all CWD dissections otoendoscopy allowed good visualization of all sites where as microscopy did not errmit visualization of sinus tympani. This study concluded that as sins tympani is the most common site of residual cholestaetoma, endoscope is essential adjunct to microscope in CWD and CWU surgeries.

## CONCLUSION

There is a growing body of literature, both in depth and breadth, on the use of endoscopic ear surgery. There is clear benefit of observational endoscopic ear surgery, enabling improved visualization of the tympanic cavity and discovery of hidden, residual disease. The aforementioned data signal the need for routine use of the endoscopes as an adjunct to operative microscopes in cholesteatoma surgery. Operative endoscopic ear surgery is still in its infancy and currently lacking high-quality outcomes data. Rigorous and standardized approaches to publication on operative endoscopic ear surgery are needed. Comparison cohorts, detailed audiometric and wound healing outcomes, operating room times, as well as and evaluation of quality of life measures should be included in reported outcomes going forward.

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