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Original Research Article

A Prospective Observational Study to Determine Correlation Between Clinical History, Otoendoscopic Examination & Impedance Audiometry in Cases of Fluid in the Middle Ear

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Abstract:
The tympanic membrane (TM) undergoes a number of pathological changes in middle ear disease which can be detected by a video otoendoscope. Middle ear disease is also accompanied by changes in middle ear pressure which can be assessed by tympanometry. The objectives of this study were to find the correlation between video otoendoscopy and tympanometry in cases of fluid in the middle ear and to deduce which of the two is more efficient and reliable for early diagnosis. 191 patients with OME were included over 10 months. Detailed history and clinical examination with otoendoscope and tympanometry and otoscope were done. The results were collected and correlation between otoendoscopy and tympanometry was determined and their individual sensitivity, specificity and diagnostic accuracy was calculated. Our study found that there is good correlation between tympanometry and video-otoendoscopy. Tympanometry remains superior to Otoendoscopy in detecting AOM with respect of sensitivity and specificity. On the other hand, tympanometry is more precise in detecting the presence or absence of OME. It also shows that tympanometry plus otoendoscopy together greatly increase the chances of detecting AOM and OME. Using both these modalities together:

1. Reduces overdiagnosis and unnecessary treatment. Increases the probability of correct diagnosis of other conditions with symptoms that otherwise could be attributed to AOM.
2. Improve diagnostic accuracy
3. Reduces financial costs associated with misdiagnosis
4. Promote consistency in diagnosis
5. Helps in monitoring and documentation of the progression of the disease process for patients being considered for surgical treatment. Thus, we can conclude that instead of using only otoscopy for diagnosing AOM or OME, we should utilize both otoendoscopy as well as tympanometry at the first visit itself for early diagnosis of AOM and early detection of OME before development of any sequalae which can be missed if these modalities are not used.

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Introduction

Otitis media with effusion (OME) is defined as collection of fluid in the middle ear, often extending into the mastoid air cells. This may be secondary to a severe upper respiratory tract infection (URTI). It may also follow on from or precede, ASOM. Symptoms of OME usually involve hearing loss in 97%, aural fullness in 77%, pulsatile or crackling tinnitus in 60% and sometimes balance disturbance. OME is said to be chronic when the fluid accumulation persists beyond 12 weeks. It is a relatively common childhood condition and is seen less often in adults [24]. OME occurs commonly during childhood, with as many as 90% of children (80% having single ear involvement) having at least one episode of OME by age 10 [18].

Early diagnosis of acute middle ear infection is important for early initiation of treatment and thus preventing future complications and cost implications.

Impedance audiometry is a relatively objective measure of the functional state of the tympanic membrane and middle ear. It is the measurement of compliance changes at the tympanic membrane as air pressure is altered in the external auditory canal.

Otoendoscopy uses endoscopic technology to project the image of the tympanic membrane onto a monitor visible to both the physician and the patient. It produces a larger, clearer, well focused image of the TM which allows for analysis of the image any

time after image acquisition. Otoendoscopy is the endoscopy of the ear which involves placing a rigid endoscope into the ear to examine both the exterior and middle portions of the ear.

Type of otoendoscope -0,30, 45, and 70degree endoscope. Commonly used are 0- and 30-degree oto-endoscopes.

All patients having ASOM or OME (by clinical history, otoendoscopic examination) would be undergoing impedance audiometry.

A type B tympanogram with flat curve and normal canal volume is considered diagnostic of OME. Compared with all other types of tympanograms it has sensitivity of between 50 and 73 % and a specificity of between 50 and 98 % in detecting OME confirmed surgically.

Methods

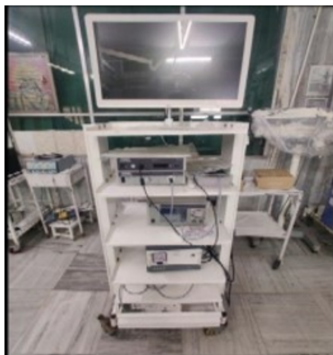
The prospective study was carried out in Department of ENT & Head – Neck Surgery, Medical College Vadodara from September 2022 to July 2023. 191 patients were examined with suspicion of fluid in middle ear with intact tympanic membrane. Patients attending E.N.T. department OPD15, Medical College Baroda and S.S.G. Hospital, Vadodara with complaints of earache/aural fullness/hearing loss/pulsatile or crackling tinnitus/ severe upper respiratory tract infection (URTI) without any complications and no history of trauma and ear surgery.

1. A detailed ENT and systemic examination were taken. Patients with clinical suspicion of OME, undergone for otoscopic examination followed by video otoendoscopy and then tympanometry.
2. All these patients were subjected to otoscopy examination using otoscope of HEINE model mini 3000 company. Signs of AOM are - Bulged TM, Congested TM, Cartwheel appearance. Signs of OME are- air bubbles or fluid level in the middle ear cavity. Retraction of tympanic membrane was taken as positive signs of OME.

Figure 1: Otoscope

3. These patients (clinically or according to otoscopic findings) underwent Tuning fork tests done with the help of Forgesy Stainless steel tuning fork of 256,512 and 1024 Hz frequency to know the level of deafness. Tuning fork tests such as Rinne, Weber and Absolute bone conduction tests carried out to determine the type of hearing loss. All these patients underwent Pure tone audiometry with MAICO MA 53 audiometer at frequencies of 500,1000,2000 and 4000 Hz to determine the air conduction thresholds, bone conduction thresholds and air bone gap values done to keep records of hearing.
4. All these patients underwent for Otoendoscopy examination using rigid 0-degree otoendoscope KARL STORZ of 3 mm diameter and 14 cm

length using high-definition camera of STORZ company.



STORZ CAMERA SYSTEM

Figure 2: Storz camera system

LIGHT SOURCE CABLE

Figure 3:Light source cable

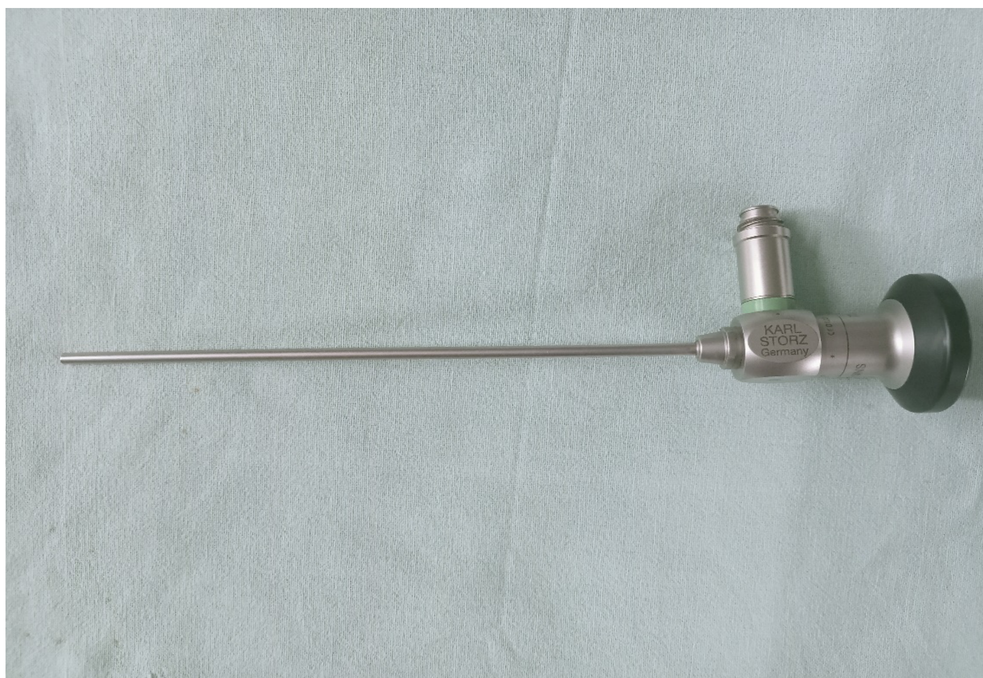


Figure 4: Zero degree otoendoscope

5. These patients underwent for tympanometry using Impedance audiometer model MI 34 and made company MAICO. The tympanograms were done by trained audiologist, S.S.G. Hospital Vadodara but all using 226 Hz probe tone using Maico company of Impedance audiometer. The tympanograms were classified using Jerger’s classification as

1. Type A
2. Type B (flat curve and normal canal volume)
3. Type C.

Type B tympanogram with flat curve was taken as conclusive evidence for the presence of fluid in the middle ear space.

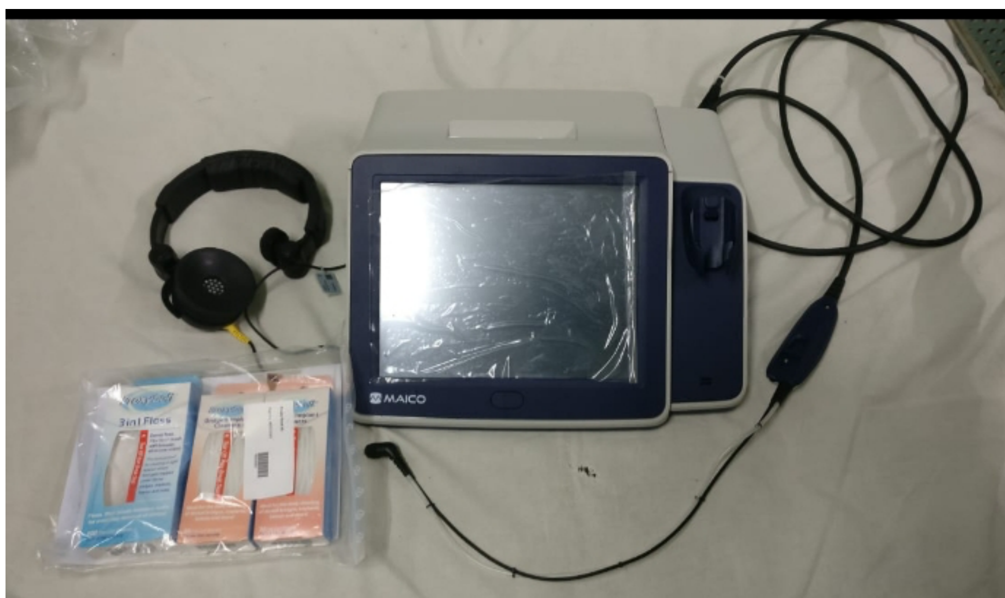


Figure 5: Impedance audiometer maico MI 34

Results

A total of 191 patients (85 males and 106 females) were included in this study aged between 0 and 60 years. Majority of patients were of age group 40-59 years (36%)

Table 1: Age-distribution of patients in the study group

Age Distribution (Years)	Number of Patients in The Study Group
0-19	31
20-39	67
40-59	68
≥60	25
TOTAL	191

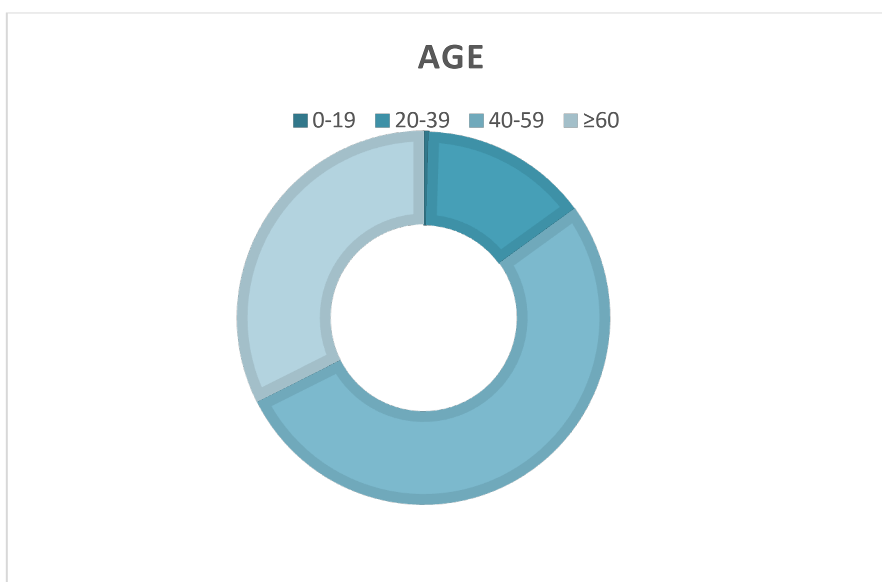


Chart 1: Age-distribution of patients in the study group

- Majority of patients were of age group 40-59 years (36%).

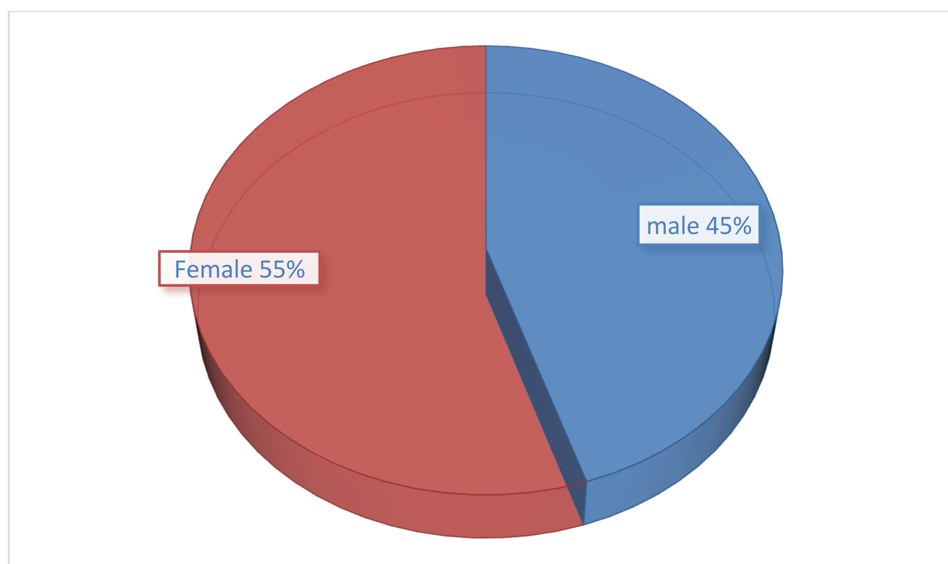


Chart 2: Gender - Distribution of patients in the study group

Out of 195 patients, 85 patients were Males (45%) and 106 were females (55%)

Male: Female ratio was 1:1.24 **Tympanogram Types in Left Ear**

Table 3: Types of Tympanograms in study population in left ear

Tympanogram Types	Frequency	Percentage
Type A	78	41%
Type As	47	24%
Type Ad	11	6%
Type B	33	17%
Type C	13	7%
Type Cs	9	5%

Tympanogram Types In Right Ear

Table 4: Types of Tympanograms in study population in right ear

Tympanogram Types	Frequency	Percentage
Type A	70	37%
Type As	43	23%
Type Ad	20	10%
Type B	33	17%
Type C	17	9%
Type Cs	8	4%

Presenting Complaints

Table 5: Presenting complaints of patients in the study group

Presenting Complaints	Number Of Patients
1.Earache	47
2.Ear fullness	26
3.Hearing loss	109
4.Pulsatile or crackling tinnitus	37
5.Ear Itching	11

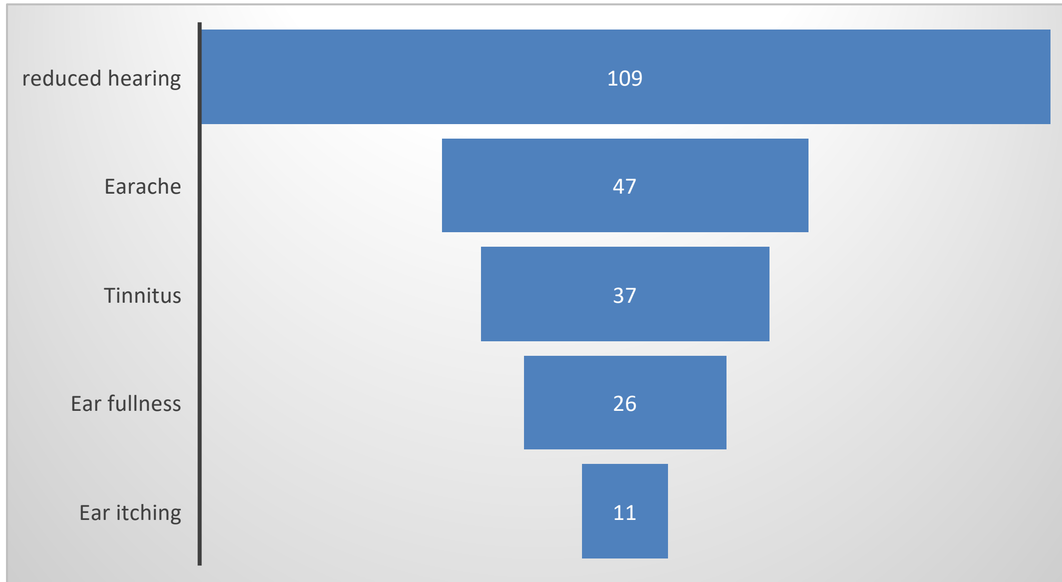


Chart 3: Distribution of Presenting complaints in the study group

Correlation Between Otoendoscopic Findings and Type B Tympanogram in Cases of Fluid in The Middle Ear

Table 6: Sensitivity and Specificity of Tympanometry to diagnose Type B tympanogram in cases of fluid in the middle ear

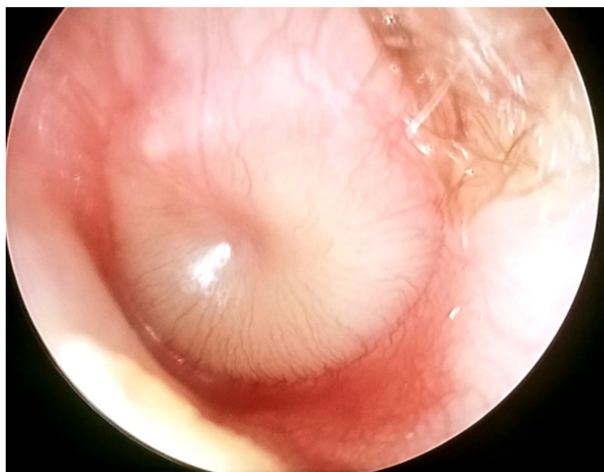
	Otoendoscopic Findings Suggestive of ASOM/SOM Changes	Otoendoscopic Findings Not Suggestive of ASOM/SOM Changes
Type B Tympanogram	23	27
Other Types of Tympanograms	50	91

Table 7: Sensitivity and Specificity of Otoendoscopy to diagnose cases of fluid in the middle ear

	Type B Tympanogram	Other Types of Tympanograms
Otoendoscopic Findings Suggestive of ASOM/SOM Changes	23	50
Otoendoscopic Findings Not Suggestive of ASOM/SOM Changes	27	91

Case No.: 177

Jiya Taslim Pathan 05Y/F



LEFT EAR OTOENDOSCOPIC FINDING SUGGESTIVE OF CARTWHEEL APPEARANCE

Figure 6: Left ear otoendoscopic finding suggestive of cartwheel appearance

Case No.: 168

Avdesh Prasad 40Y/M

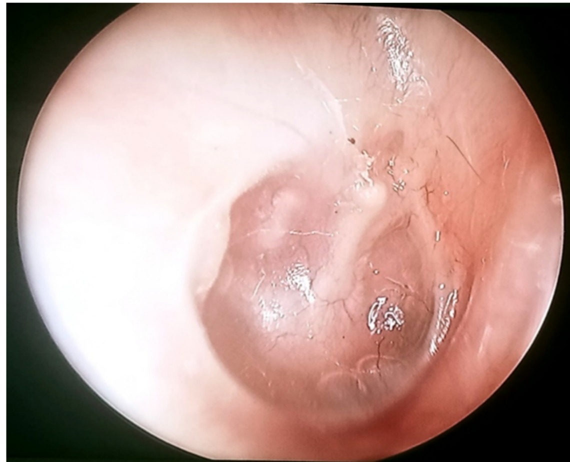


Figure 7: Right ear otoendoscopic image-suggestive of bubble appearance-SOM

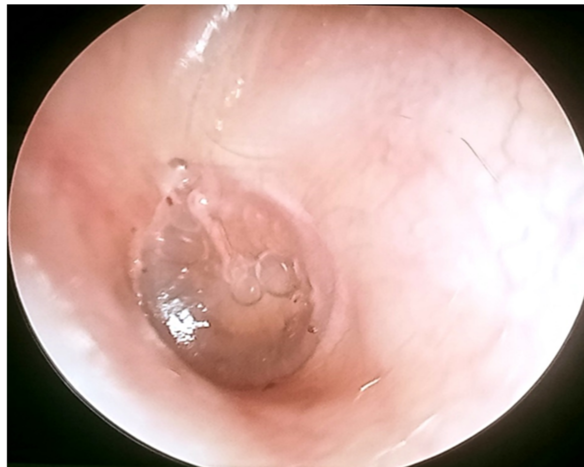


Figure 8: Left ear otoendoscopic image-suggestive of bubble appearance-SOM

Case No.: 13

Pinkiben Shyamu Saroj 40Y/F

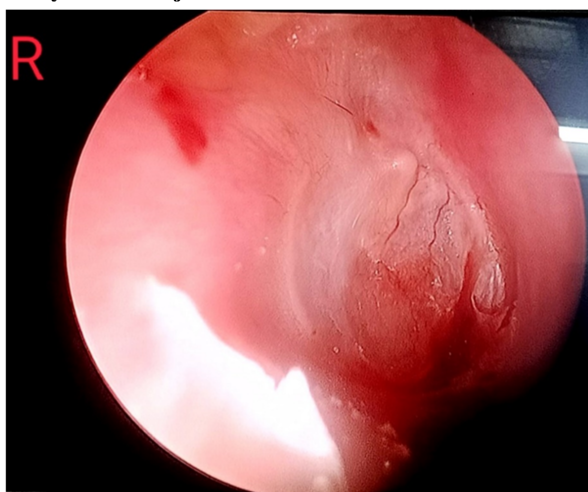


Figure 9: Right ear otoendoscopic finding-suggestive of severe congested cocongested TM-ASOM

Discussion

We used both tympanometry as well as video-otoendoscopy to the assess the tympanic membrane and the condition of the middle ear and for diagnosing AOM or OME as standard. Reduced hearing was the most common presenting complaint followed by earache and tinnitus (57.06%). The most common sign in ASOM among the patients was TM intact followed by bulging of the TM.

In our study using an otoendoscope to diagnose OME/ASOM which showed a sensitivity of 46%, specificity of 65% and PPV of 31.50%. In our study using tympanometry to diagnose OME/ASOM which showed a sensitivity of 31.50 % and specificity of 77.11 % and PPV of 46 %. We found that Tympanogram was type B in 26.17% of patients. and type A in 41% in left ear and 37% in right ear patients in first visit.

We found tympanometry to have a sensitivity of 22.44% in left ear and 35.29% in right ear and PPV 32.35% in left ear and 8.45% in right ear on the 1st visit.

We found that tympanometry had a higher overall Sensitivity and specificity than video-otoendoscopy. Thus, tympanometry is good for catching actual cases of OME but it also comes with a fairly high rate of false positives. Whereas, Otoendoscopy is superior at early diagnosis of AOM/OME but cannot rule out persisting OME. This shows that while tympanometry is a good tool for detecting residual or persisting OME but it cannot differentiate between AOM and OME.

Conclusions

Our study found that there is good correlation between tympanometry and video-otoendoscopy. Tympanometry remains superior to Otoendoscopy in detecting AOM with respect of sensitivity and specificity. On the other hand, tympanometry is more precise in detecting the presence or absence of OME. It also shows that tympanometry plus otoendoscopy together greatly increase the chances of detecting AOM and OME. Using both these modalities together:

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