RESEARCH ARTICLE

Reliability of the otoscopic tympanic membrane findings in the diagnosis of middle ear effusion

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Abstract

Objective: To estimate the reliability of otoscopic findings to predict the presence of middle ear effusion.

Method: The cross-sectional study was conducted at Al-Yarmouk Teaching Hospital, Baghdad, Iraq, from April 1, 2019, to January 1, 2020, and comprised patients of either gender aged 3-70 years complaining of ear problems. The patients were randomly assigned to two specialist otolaryngologists who checked the presence of retraction of the tympanic membrane and other features suggesting middle ear effusion. All the patients underwent tympanometric impedance measurement to compare the results with the otoscopic findings. Data was analysed using SPSS 25.

Results: The study comprised 369 ears of 203 patients. There were 98(48.3%) male and 105(51.7%) female patients. The overall mean age was 19±17.45 years. In 141(38%) ears, middle ear effusion was confirmed by tympanometric finding type B flat impedance curve, while 187(51%) ears had impedance curve type C and 41(11%) ears had impedance curve type A. The positive predictive value of otoscopic appearance in the diagnosis of middle ear effusion was 38%. History of recent hearing loss or upper respiratory tract infection had no significant association with the condition ($p>0.05$).

Conclusion: Otoscopic tympanic membrane findings were found poor predictors of the existance of middle ear effusion.

Keywords: Otitis media with effusion, Tympanometry, Simple otoscopy. (JPMA 71: S-110 [Suppl. 8]; 2021)

Introduction

Otitis media with effusion (OME) is characterised by an inflammatory process of the middle ear cavity with accumulation of serous or mucoid fluid in the middle ear cleft,[1] resulting in metaplasia of the middle ear mucosa, with the proliferation of mucous glands and goblet cells. Vascular proliferation usually leads to the process of a lymphocyte and plasma cell infiltrate.[2] OME is a disease that affects patients in childhood when the middle ear is filled with a thick fluid which blocks sound conduction inside the middle ear. Various other terms have been used for this condition, such as secretory/serous otitis media, non-purulent chronic otitis media, and glue ear.[3] Otoscopicaly, the tympanic membrane is intact, but is abnormal in position or colour. The negative pressure of the middle ear and the surface tension of the middle ear fluid tend to retract the tympanic membrane towards the middle ear cavity. The middle ear fluid itself causes a loss of translucency of the pars tensa which becomes dull and opaque.[3] Tympanometry is the best diagnostic method for the presence or absence of middle ear effusion (MEE).[4] Type-A or type-C tympanogram should be considered strong evidence that there is no MEE.[4]

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The current study was planned to find the reliability of otoscopy in MEE diagnosis, and to highlight the importance of doing other confirmatory tests, like tympanometry.

Patients and Methods

The cross-sectional study was conducted at the Era-Nose-Throat (ENT) outpatient department (OPD) of Al-Yarmouk Teaching Hospital, Baghdad, Iraq, from April 1, 2019, to January 1, 2020. After approval from the institutional ethics review committee, the sample size was calculated using EpiInfo equation 5. Simple random sampling was used to collect the sample. The sample comprised patients of either gender aged 3-70 years presenting to the OPD with complaints of ear problems. They were randomly assigned to one of the two specialist otolaryngologists. Both ears were examined for features indicating MEE by simple otoscopy exam. Then the patients were referred to the other specialist otolaryngologist in the same department for the same examination. The ear that was confirmed by the examination of the 2 specialists as ear with simple otoscopic features of MEE was included. The diagnosis was confirmed on the basis of the presence of 3 or more features suggesting MEE, including retraction of pars tensa, retraction of pars flaccida air-fluid level, air bubbles behind the tympanic membrane, the hrizontal appearance of the handle of malleus, dull tympanic

membrane (pale colour with loss of shine), and shattering of the cone of light.

Accordingly for some patients one ear was included, while for other patients both ears were included.

Patients with history and examination suggesting any possibility of acute otitis media were excluded.

For all the ears included, a history of the presence of recent development of hearing loss (HL) in that specified ear was noted, and so was the history of recent upper respiratory tract infection (URTI) for all patients.

All the ears were investigated by tympanometry, and the impedance curve type was recorded. All the ears were tested by the same tympanometric device which had been calibrated within the preceding year by the manufacturer (Otowave 102-1; Amplivox, United Kingdom).

The positive predictive value (PPV) was calculated using the formula:

PPV = True positive (TP) x 100 / TP + false positive (FP).

Data was analysed using SPSS 25. Chi-square test was used as appropriate. P<0.05 was considered significant.

Results

The study comprised 369 ears of 203 patients. There were 98(48.3%) male patients and 105(51.7%) female patients. The overall mean age was 19±17.45 years. In 141(38%) ears, MEE was confirmed by tympanometric finding type-B flat impedance curve, while 187(51%) ears had impedance curve type-C and 41(11%) ears had impedance curve type-A. PPV of otoscopic appearance in the diagnosis of MEE was 38%.

Table-1: Incidence of recent upper respiratory tract infections (URTIs) in the study sample.

	URTI	No URTI	
MEE	41	62	
No MEE	28	72	
Total	69	134	203 patients

MEE: Middle ear effusion.

Table-2: History of recent hearing loss (HL) in the ears included in the study.

	HL	No HL	
MEE	83	58	
No MEE	112	116	
Total	195	174	369 ears

MEE: Middle ear effusion.

History of recent HL (Table-1) or URTI (Table-2) had no significant association with MEE (p>0.05).

Discussion

There are many clinical and audiological laboratory tests to prove the presence of MEE and the diagnosis of OME. The use of all or some of these methods is dependent on the availability, age of the patient, and development of the medical centre concerned. According to the American Academy of Otolaryngology, clinicians shoud look for MEE presence with pneumatic otoscopy during OME diagnosis and should obtain tympanometry when OME is suspected[6]. One study[7] showed that the combination of otomicroscopy, transient otoacoustic emissions, and 226Hz and 1kHz tympanometry together allowed OME diagnosis in young infants more accurately than each test alone. The current study was conducted to compare the finding of simple otoscopy with the result of tympanometry. Tympanometry was used because of its high sensitivity (85.85%), specificity (72.22%), PPV (94.44%) and overall accuracy (83.76%).[8]

In the current study, although each ear included was examined by two specialist otolaryngologists and both of them confirmed the presence of retraction and other MEE features, only 38% of the ears had impedance curve that proved the presence of effusion. The findings were in contrast to earlier findings[9] showing simple otoscopy as comparable to tympanometry in OME diagnosis. Limited sample size of the other study (n=82) might be reason for the different findings. A study[7] recommended the use of at least tympanometry to confirm the diagnosis, which supports the current findnigs. One study[10] reported that pneumatic otoscopy can be superior to tympanometry in detecting MEE, but in another study[11] tympanometry was superior to pneumatic otoscopy in childhood ear disease. Ammar Hadi et. al.[12] also reported that the use of both tympanometry and pneumatic otoscopy can increase the accuracy of the diagnosis of OME. Puhakka T. et. al.[13] concluded that the high specificities and negative predictive values (NPVs) of tympanometry make it the best method to excluse MEE in children with respiratory infections.

Another laboratory testing suggested by many studies to confirm the presence of MEE as part of a disease process of OME, like spectral gradient acoustic reflectometry[13] and distortion product otoacoustic emissions,[14] while others suggested the use of vestibular evoked myogenic potentials (VEMPs) in OME and the response after surgical aspiration (tympanocentesis).[15] More recently, remote optical sensing was used to detect MEE by applying a laser beam directed on an infra-sonic stimulated

tympanic membrane with a high-quality camera detecting the backscattered secondary speckle patterns. A camera enables inspection of the frequency and amplitude of the changes in tympanic membrane characteristics obtained by analysis of the spatial-temporal statistics of the speckle patterns.[16]

Despite the fact that conductive HL is one of the cardinal components of OME,[17] and even though OME may occur during URTI spontaneously because dysfunctioning eustachian tube,[18] adding a history of HL or URTI with a physical examination by simple otoscopy did not add any diagnostic value as the PPV of simple otoscopy for detecting MEE in the current was only 38%, and the statistical analysis of adding HL or URTI history showed no significance. Further diagnostic methods may be necessary to confirm or exclude the state of HL, especially in children, like auditory brainstem and steady-state responses.[19]

The current study has its limitations as gender age groups were not compared. Further studies are needed to identify whether the otoscopic tympanic membrane findings of ears with MEE vary with age or gender of the patients.

Conclusion

Simple otoscopy of the ear was not found to be enough for the confirmation of MEE. The use of tympanometry was highly beneficial.

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Conflicts of Interest: None.

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