Accuracy of otoscopy, tympanic membrane mobility and tympanometry in the diagnosis of otitis media with effusion

S. KC, R. P. S. Guragain, B. K. Sinha

Department of Otorhinolaryngology and Head & Neck Surgery, Tribhuvan University, Institute of Medicine, Maharajgunj, Kathmandu, Nepal.

Correspondence to: Dr Sarita KC, Department of Otorhinolaryngology and Head & Neck Surgery, Tribhuvan University, Institute of Medicine, Maharajgunj, Kathmandu, Nepal.

e-mail address: transientoae@yahoo.com

Background: To determine the accuracy of otoscopy, pneumatic otoscopy and tympanometry in the diagnosis of otitis media with effusion.

Materials and Methods: A total of 71 patients (121 ears) suffering from Otitis Media with Effusion (OME) diagnosed clinically were subjected to myringotomy and ventilation tube insertion (VTI). The finding of presence of fluid in middle ear after myringotomy was correlated with Tympanic Membrane (TM) color, fluid level, air bubble, TM mobility and tympanometric curve recorded preoperatively.

Results: Otoscopic findings revealed pink TM in 78.5%, prominent landmarks in 98.3%, generalized retraction 73.6%, fluid level in 14% and air bubble in 2.5% of cases. On pneumatic otoscopy, decreased or absent mobility was found in 85.1%. Tympanometry with 'B' curve was the most sensitive finding (98.9%), whereas pneumatic otoscopy was found to be the most specific amongst all the three tools. Combination of tympanometry with either otoscopy or pneumatic otoscopy or combination of all three modalities was found to be highly significant .

Conclusion: Tympanometry is the most sensitive tool for the diagnosis of OME and combination of tympanometry with either otoscopy or pneumatic otoscopy is highly significant.

Key words: otitis media with effusion (OME), pneumatic otoscopy, tympanometry

Introduction

Otitis media with effusion is one of the most common causes of acquired hearing loss amongst children worldwide[1].OME is defined as an inflammatory process behind an intact tympanic membrane (TM) leading to accumulation of non-purulent fluid in middle ear[1]. It is also defined as "fluid in the middle ear without signs or symptoms of ear infection" as proposed by the 1994 AHCPR (Agency for Health Care Policy and Research) OME guideline[2,3]. The incidence of OME decreases as the age goes up. It is 40% and 1% at the age of two and eleven years respectively [4]. In Nepal, incidence of OME was found to be 1.65%[12]. It is a fairly common condition encountered in our department as well. About 500 to 600 new cases of OME has been found to attend our OPD every year[13].

Correct diagnosis of OME on time could prevent hearing loss and it's effect on speech and language. Therefore, the main objective of this prospective study is to investigate the most appropriate and easily accessible diagnostic modality for accurate diagnosis of OME in developing counties like Nepal.

Materials and Methods

This was a prospective cross sectional study conducted amongst 71 patients (121 ears) suffering from unilateral or bilateral clinically diagnosed cases of OME diagnosed clinically in the Department of ENT -HNS, TUTH OPD between April 2004 to August 2005 (16 months) Patients with history of VTI, Acute Otitis Media (AOM) during the past three months, trauma to ear producing hemotypanum, fracture temporal bone with cerebrospinal fluid in the middle

ear, barotrauma and history of taking oral antibiotics for ear problem within the past six weeks were excluded from the study. A detail history regarding the presenting complaints e.g. hearing loss, aural fullness, earache, itching of ear, dizziness, ear discharge, delayed speech, tinnitus were elicited. Welch Allyn, number 25020-3.5v otoscope with halogen light was used for examination of TM. Normal TM was defined as having pearly white color with normal position and landmarks, without fluid level or air bubble. The following signs were taken as features of OME by otoscopy - pink TM, retraction of TM, prominent landmarks, fluid level or air bubble.

Tympanic membrane mobility was checked using siegle's pneumatic speculum. Normal TM mobility was defined as brisk inward and outward mobility of all the quardants of pars tensa with application of negative and positive pressure in external auditory canal (EAC). The findings were grouped into three categories- normal mobility, decreased mobility and absent mobility.

Portable impedence audiometer CE 0123 equipment was used for tympanometry. Tympanometric curves results were classified according to modified Jerger's classification as types A ,B, or C1 and C2. This study included both B as well as C2 curves as indicators of OME. After completion of examinations and tests, diagnosis of OME was clinically made. History of hearing loss or consequences of hearing loss, pink TM with either decreased or absent mobility and type B or C2 tympanometric curves were taken as indicators of OME.

Myringotomy was performed giving a radial incision at the antero inferior quadrant and fluid was aspirated if present (confirmed OME) and when absent, it was labelled as "dry tap".

The confirmed OME cases were correlated with the TM color, TM mobility and tympanometric curve.The results were analysed using SPSS 11.5 and Epi info 2000 software. Pearson's Chi Square test and Fishers' exact test were applied as appropriate and it was labelled significant at 'p' value less than 0.05 ('P' <0.05) and within 95 percent confidence interval.

Results

A total of 71 patients were studied with 121 ears included. The age range was from 10 months to 75 years. Overall 62.1% were children below 12 years of age.

Hearing loss was the commonest complaint either alone or in combination. It was present in 100 ears (82.6%).

Correlation of TM colors with OME

The pink TM was taken into consideration to diagnose OME clinically. But, the accuracy was found not to be

significant.($P = 0.193$)

Correlation of Pneumatic Otoscopy (PO) and OME

Out of 103 clinically diagnosed ears of OME by PO, only 85 ears had fluid during myringotomy (Fig: I) which was statistically significant. ($P = 0.005$)

Fig. 1: Showing correlation of TM mobility with myringotomy fluid (n=121)

Correlation of tympanometry and OME

We came across a total of 116 ears with B curve and out of that 93 were with middle ear fluid during myringotomy. Remaining six ears had A type curve.No C2 curve was seen in our study.

Correlation of combination of Otoscopy and Tympanometry with OME

Combination of Otoscopic and Tympanometric findings were correlated with OME to find out whether this combination of diagnostic tools were better in diagnosing fluid in middle ear. A total of 94 ears with pinkish TM having B Curve were found and out of which 73 were confirmed to have OME. This combination of tympanometry and otoscopy was found to be highly significant ($P=0.00001$).

Correlation of combination of Pneumatic otoscopy and Tympanometry with OME

When B curve with either decreased or absent TM mobility was combined, 98 such ears were found and out of which 84 had OME during myringotomy. This reflects good combination in diagnosing OME.($P=0.009$)

Combination of diagnostic tools were found to be better in diagnosing OME. But combination of otoscopy and pneumatic otoscopy was found to be insignificant. Combined diagnostic accuracy of any tools with tympanometry appeared significant. Combination of all three tools was highly significant ($P=0.00004$)

Diagnostic accuracy of each tool in diagnosing OME

Tympanometry had the highest sensitivity but overall pneumatic otoscopy seems better with high sensitivity as

well as reasonable specificity. So, PO appears to be a practical tool in the diagnosis of OME. Otoscopy does not seem to be so accurate in the diagnosis of OME. (Table I)

Table 1: Accuracy of Individual Tools in Diagnosing OME

Particulars	Otoscopy	Pneumatic Otoscopy	Tympanometry
	%	%	%
Sensitivity	78.70	90.40	98.90
Specificity	22.20	33.30	14.80
Positive predictive value	77.90	82.50	80.20
Negative predictive value	23.10	50.00	80.00
False positive rate	22.10	17.50	19.80
False negative rate	76.90	50.00	20.00
Accuracy rate	66.10	77.70	80.20
Prevalence rate	77.70	77.70	77.70

Discussion

This study was conducted to find out the accuracy of otoscopy, tympanic membrane mobility and tympanometry in diagnosing otitis media with effusion.In common practice only uniformly pink TM is being considered as a diagnostic criteria to diagnose OME. Long standing cases with amber TM had contributed to low accuracy rate of only 66% in the dignosis of OME by otoscopy.

In fact, otoscopy is a good, cost effective,easily available diagnostic modality and a fairly large number of cases can be diagnosed with it. In difficult cases it can be combined with other modalities to confirm the diagnosis. Several studies have found TM color to be a good indicator[6,7]. But, subjective interpretation of the appearance of TM is difficult to quantify and graded.

In our study, TM mobility was either decreased or absent in 85.1% cases and normal in 14.3% of cases on pneumatic otoscopy. Of these, 90.4% and 9.6% respectively had fluid with 90.4% sensitivity and 33.3% specificity. In various studies sensitivity of pneumatic otoscopy is found to have ranged from 87% to 99% with a mean of 93% and specificity of 78%[5,9]. Present study had comparable sensitivity but low specificity, It may have been due to uncooperative children in our study having narrow ear canal where it was difficult to perform PO.Moreover Nepalese children are comparatively short statured having narrow ear canals compared to the western children of corresponding age. So the result of mobility was not satisfactorily comparable to the western studies.

The present study has shown the highest sensitivity (98.9%) with tympanometry in the diagnosis of OME ('P'=0.009). None of the published studies have so far reported such a high sensitivity. In one of the studies, 'B' curve sensitivity and specificity was found to be about 91% and 79% respectively[10,11].

In our study, portable tympanometer seems to be the most sensitive though not specific as compared to other studies. One study reported 13% dry tap with 'B' curve even when tympanometry was performed just prior to general anaesthesia[9].

None of the tools alone appeared to be both sensitive and specific.

Differentiation of OME from AOM is also challenging since there is no clear line of demarcation between them.Hence, more than one tool has to be used in diagnosing OME confidently. In our study when otoscopic findings and tympanometry were combined, sensitivity was highly significant (P=0.00001). Similarly the sensitivity was ('P'=0.009) for combined PO and tympanometry. When all the three tools were combined it was highly significant ('P'=0.00004). But interestingly combinations of otoscopy and PO was not significant.

Conclusion

Among the tools for diagnosing OME, tympanometry with 'B' curve showed the highest sensitivity (98.9%) but unfortunately low specificity (14.8%). Pneumatic otoscopy showed slightly low sensitivity (90.4%) but fairly good specificity (33.3%). Otoscopy alone had poor sensitivity and specificity for diagnosing OME. None of the diagnostic tools had both high sensitivity as well as specificity so combined modalities appears better with significant 'P' value. So, a combination of otoscopy, pneumatic otoscopy and tympanometry is recommended to confirm the diagnosis of OME.

References

1. Cumming's Otolaryngology. Gates GA. Acute Otitis Media and Otitis Media with Effusion. In: Cummings CW, Fredrickson JM, Krause CJ, Richardson MA, Schuller DE, ed. Otorhinolaryngology and Head and Neck Surgery. 3rd Ed. St. Louis: Mosby Inc;1999:461-477.

2. Stool SE, Berg AO, Berman S, et al. Otitis Media Guideline Panel. Otitis Media with Effusion in Young Children. Clinical practice guideline, Number 12. AHCPR Publication No. 94-0622. Rockville. MD; Agency for Health Care Policy and Research, Clinical Practice Guideline, Public Health Service, US Department of Health and Human Services;1994 July.

3. Shekelle P, Takata G, Chan LS et al. Diagnosis, Natural

History and Late Effects of OME. Evidence Report/ Technology Assessment no. 55. AHRQ Publication No. 03-E023. Rockville, MD; Agency for HealthCare Research and Quality; 2003.

4. R Richard Maw. Otitis Media with Effusion. In: Scott-Brown's Otolarygology. 6th Ed. Oxford: Butterworth-Heinemann. 1997;3/6/1-3/6/18.

5. Takata GS, Chan LS, Morphew T, Managione-Smith R, Morton SC, Shekelle P. Evidence assessment of the accuracy of methods of diagnosing middle ear effusion in children with otitis media with effusion. Zhonghua Yi Xue Zo Zhi (Taipei). 2002;**65(8):** 372-7.

6. Froom J, Culpepper L, Grob P, Bartelds A, Bowers P, Bridges- Webbs C et al. Diagnosis and antibiotic treatment of Acute Otitis Media: report from International primary care network. Br Med. J 1990;**2300:**582-586.

7. Finitzo T, Friel- Patti S, Chinn K and Brown O. Tympanometry and otoscopy prior to myringotomy: Issues in diagnosis of otitis media. Int J Pediatr Otorhinolaryngol 1992;**24:**100-110.

8. Ovesen T, Paaske PB, Elbrond O. Accuracy of an automatic impedance apparatus in a population with secretory otitis media: principles in the evaluation of tympanometrical findings. Am J Otolaryngol. 1993;**14(2):**100-103.

9. Steinbach WJ, Sectish TC. Pediatric resident in the diagnosis and treatment of acute otitis media. Pediatrics. 2002;**109:**404-08.

10. Watters GW, Joanes JE, Freeland AP. The predictive value of Tympanometry in the diagnosis of middle ear effusion. Clin Otolaryngol Allied Sci. 1997;**22(4):** 343-5.

11. Spremo S, Markic Z, Kurbalija. Clinical importance of tympanometry in the diagnosis of chronic secretory Otitis. Srp Arch Celok Lek. 1998;**126:**242-7.

12. Little P, Bridges A, Guragain RPS, Prasad R, Weir N, Friedman D. Hearing impairment and pathology in Nepal. J. Laryngolotol. 1993;**107:**395-400.

13. ECHOES. Chief Editor: Guragain RPS. Department of ENT-HNS TUTH, Kathmandu; 2005(Jan-Apr);12(1).