

CLINICAL AND TYMPANOMETRIC ASSESSMENT OF MIDDLE EAR EFFUSION VERSUS MYRINGOTOMY FINDING

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Summary

Background: The present study was planned to show the accuracy of clinical examination and tympanometry in diagnosis of middle ear effusion.

Patients and Methods: The study involved 80 patients (160 ears)suspected to have otitis media with effusion (OME) from different age groups ; 56 were males and 24 were females .

Clinical assessment for all patients included otoscopy , pneumatic otoscopy and audiological assessment by using pure tone audiometry and tympanometry then comparing the results to findings at myringotomy as the gold standard for presence or absence of fluid in the middle ear .

Results : Fluid whether serous or glue was found in 100 ears (62.5 %) where as sixty ears were dry, sensitivity , specificity and accuracy of tympanometry were 90 % , 70 % and 85 % respectively , and for clinical assessment were 82 % , 52% and 71 % respectively . A combined clinical and tympanometry sensitivity and specificity were calculated and found to be 96 % and 92 % respectively.

Conclusion : clinical examination as a method for diagnosis of middle ear effusion depend on experience of the examiner . tympanometry proved to be a reliable diagnostic tool for the diagnosis of OME , it appeared significantly better at determining non effusion state.

Keywords: tympanometry , otitis media with effusion , myringotomy

Abbreviations: COME : chronic otitis media with effusion , MEE : middle ear effusion

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Introduction :

The middle ear is an almost completely enclosed area located immediately behind the tympanic membrane (eardrum). The only opening is the eustachian tube leading to the nasopharynx⁽¹⁾.

Otitis media is used as a generic term for any inflammatory process in the middle ear cleft beginning behind an intact tympanic membrane .The two major classes of otitis media are acute otitis media and chronic otitis media with effusion (COME) . COME indicates a middle ear effusion without pain, redness ,or bulging of the tympanic membrane . Middle ear effusion denotes a liquid in the middle ear cleft regardless of etiology⁽²⁾.

The hallmark of the otitis media is replacement of the air within the middle ear with fluid , the type of which is pathognomonic for the type of otitis media present⁽³⁾.

Confirmation of the diagnosis of middle ear effusion using routine otoscopy , however, is limited due to the subjective nature of the clinical judgement involved in these procedures⁽⁴⁾.

Pneumatic otoscopy and tympanometry are the major diagnostic techniques used to identify otitis media with effusion⁽⁵⁾.

The ‘ gold standard ‘ for diagnosis of middle ear effusion is myringotomy and aspiration of fluid⁽⁶⁾.

Patients and methods

This is prospective and comparative randomized study that had been done from the 1st of September 2000 to the 1st of November 2001, at otolaryngology department in surgical specializations hospital , medical city – Baghdad .

The study involved 80 patients (160 ears) ranged in age from 4 to 59 years ; 56 were males and 24 were females , the mean age for both females and males was 16.5 years .

All patients suspected to have OME were subjected for proper ENT examination using otoscopy , pneumatic otoscopy , audiological assessment by using pure tone audiometry and tympanometry and the data were registered on special formula prepared for that reason contained a detailed criteria for the findings during examination like tympanic membrane color , translucency ,

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position , state of blood vessels , cone of light , presence of air bubbles or fluid level , state of middle ear ossicles were assessed also by observing handle of malleus , lateral process of malleus , long process of incus , incudostapedial joint .

Mobility of tympanic membrane was assessed with Siegle's pneumatic otoscope , three classifications were allowed :

- a- Normal mobility .
- b- Impaired mobility (hypomobility) .
- c- Immobile .

Audiological assessment included :

- 1- Tunings fork test by using 512 Hz tuning fork by applying Rinne and Weber tests.
- 2- Pure Tone Audiometry (PTA) using frequency range from (250 Hz to 8000 Hz) and intensity level from (- 10 dB to 120 dB) both air conduction study and bone conduction study were done , using masking when it was necessary . The degree of hearing loss were determined and air – bone gap average were estimated .
- 3- Tympanometry : This was done by using an impedance audiometer one had a test of 226 Hz and a peak pressure range of + 200 dapa to - 300 dapa ,

The compliance , peak pressure , pressure range , stapedia reflex were estimated .

A Fiellau – Nikolajson classification for tympanometry results was used ⁽⁷⁾.

Type A : maximum compliance the same or more than 0.2 ml with a middle ear pressure of (-99 to +200 dapa).

Type C1: maximum compliance the same or more than 0.2 ml with a middle ear pressure of (-100 to -199 dapa).

Type C2: maximum compliance the same or more than 0.2 ml with a middle ear pressure of (- 200 to - 400 dapa).

Type B: maximum compliance less than 0.2 ml or middle ear pressure less than (- 400 dapa).

Type A and C1 curves were classified as normal.

Type B and C2 curves were classified as abnormal.

All patients then underwent myringotomy under general anesthesia , in addition to other surgical procedures according to the case , the result were categorized into :

- a- dry ear
- b- serous (thin) fluid
- c- glue (thick) fluid

The possible cause for OME was not took in consideration.

Results

The age distribution was shown in table (1) with highest incidence of OME in age group between 0 to 9 years .

Gender distribution for 80 patients were 56 males (70 %) and 24 females (30%) .

The presenting symptoms of patients shown in table (2) which reveals that hearing loss is the main presenting symptom.

Table (3) shows the findings during tympanic membrane examination by using otoscopy and pneumatic otoscopy and the findings at myringotomy for presence or absence of fluid in the middle ear of any type (serous or glue) .

The mobility of tympanic membrane which was detected by Siegle's pneumatic otoscopy , we found 15% of ears with normal mobility , of those only 0.6 % had middle ear effusion , while 61 % had impaired mobility of which 42 % had fluid in the middle ear and the rest 19% were dry . At the same time immobile tympanic membrane detected in 24 % of ears , 20% had effusion while other 4 % were dry .

Table(4) displays the relation between tympanometric curves and results of myringotomy and tympanocentesis. In type A curve agreement to findings at myringotomy occurred in 19 ears (73 %) . Seventy-six ears (48%) , demonstrated type B curve which suggest presence of effusion. Sixty-eight ears (89.5%) of these cases were in agreement with myringotomy findings . There were 58 ears (36%) with type C1 and C2 curves. Twenty-five ears (43%) revealed effusion .

Sensitivity represents the ability of the measurement to find the positive (effusion filled ear) .

Specificity represents the ability of the measurement to find the negative (effusion free ear)

Thus using a 2 X 2 matrix ,sensitivity and specificity calculated as shown in table (5).

Sensitivity and specificity for type A and B curves were 90% and 70% respectively.

If we add the transition type C tympanogram into analysis and consider them negative , then sensitivity of 68% and specificity of 86.6% will appear.

If we consider C2 positive in addition to type B tympanogram then the results will be : Sensitivity = 84 % , Specificity = 60 %

Accuracy of tympanometry was calculated and found to be 85%

By using clinical assessment alone as shown in table (6) we get sensitivity =82% , specificity =52% and accuracy =71%.

By using combined clinical and tympanometry values we found this combination resulted in an increase in sensitivity to 96% , specificity to 92% while accuracy highly increased to 96%.

Table (1) age distribution of patients

Age (years)	Number	Percentage %
0 – 9	48	60
10 – 19	12	15
20 – 29	6	7.5
30 – 39	4	5
40 – 49	4	5
50 – 59	6	7.5
Total	80	100

Table (2) presenting symptoms

Symptoms	Number	Percentage%
Hearing loss	66	82.5
Otalgia	20	25
Nasal symptoms	37	46
Snoring	44	55
Click in the ear	26	32.5
Speech impairment	13	16
Vertigo	3	4

Table (3) Results of tympanic membrane examination and myringotomy findings

Tympanic Membrane examination		No.	%	Myringotomy			
				dry	%	fluid	%
position	normal	8	5	7	87.5	1	12.5
	retracted	136	85	43	32	93	68
	bulging	2	1.3	-	-	2	100
	pocket	5	3	4	80	1	20
	atelactasis	9	5.7	6	67	3	33
color	pale grey	108	67.5	50	46	58	54
	amber	46	28.5	10	22	36	78
	blue	6	4	-	-	6	100
	dull	111	69	29	26	82	74
	translucent	49	31	31	63	18	37
cone	normal	0	0	-	-	-	-
	broken	128	80	40	31	88	69
	absent	32	20	20	62	12	38
vessel	normal	64	40	24	38	40	63
	dilated	96	60	36	38	60	63
Air bubbles		6	4	-	-	6	100
Fluid level		7	4	1	14	6	86
Incudostapedial joint / long process of incus		16	10	-	-	-	-
mobility	normal	24	15	23	96	1	4
	impaired	98	61	31	32	67	68
	immobile	38	24	6	16	32	84

Table (4) comparison of all tympanogram types with myringotomy

Curve	No fluid	%	Fluid	%	total
B	8	11	68	89.5	76
C1	21	70	9	30	30
C2	12	43	16	57	28
A	19	73	7	27	26
TOTAL	60	-	100	-	160

Table (5) tympanometry sensitivity and specificity A and B types only

Tympanogram	Myringotomy Yes (OME present)	Myringotomy No (OME absent)
B	True positive 68	False positive 8
A	False negative 7	True negative 19

Table (6) otoscopy sensitivity and specificity

	Myringotomy Yes (OME present)	Myringotomy No (OME absent)
Otoscopy (OME present)	82	29
Otoscopy (OME absent)	18	31

Discussion

In this study we found the majority of patients were children and adolescent (75 %) and there was a male predominance.

The main presenting symptoms was hearing loss (82.5 %), other symptoms are less common.

Daly-ka et. al. ⁽⁷⁾ has shown that 70 % of children who have COME suffer mild to moderate hearing loss.

Otoscopic and pneumatic otoscopic examinations of tympanic membrane are recommended for assessment of the middle ear because it combines visualization of the tympanic membrane with a test of membrane mobility .

Tympanic membrane found to be retracted in 136 ears (85 %) of those 93 ears (68 %) discovered to contain middle ear effusion, so it carry higher possibility of effusion than other positions such as atelectasis or pocket

The color of tympanic membrane found to be pale grey in 108 ears (67.5 %) , amber in 46 ears (28.5 %) , and blue in 6 ears (100 %) so a blue color tympanum carry high possibility of effusion although it's incidence was low . Other colors had no significant correlation with middle ear contents. The color of ear drum is of lesser importance than the position and mobility ⁽⁸⁾.

De- Melker ⁽⁵⁾ showed serious retraction of the ear drum and absence of mobility under positive pressure were the most predictive feature but the color of the tympanum did not show any relation to effusion.

The translucency of tympanic membrane was determined and it had been found to be in 111 ears (69 %) dull looking (opaque) , in 82 ears (74 %) contained fluid while in the rest was negative at myringotomy.

Loss of translucency is a feature suggestive of MEE, where cloudiness and mobility of the tympanum show the highest sensitivity and specificity ⁽⁵⁾.

In regard to cone of light which was found to be broken in 128 ears (80 %) from which (69 %) contained fluid , while absent cone of light noticed in 32 ears (20 %) of which (37.5 %) contained fluid , so degree of light reflex derangement was not significant factor in prediction of MEE .

Air bubbles and fluid level when present carry important sign for detection of MEE.

The otoscopic observation of liquid meniscus , even in the presence of a type A tympanogram , always yielded a diagnosis of otitis media with effusion ⁽⁹⁾ .

Otoscopy has limited value for the diagnosis of MEE ⁽¹⁰⁾. There are limitation to observer reliability with otoscopy , which has good sensitivity but poor specificity in contrast to Immittance audiometry ⁽¹¹⁾ .

We found Sensitivity of 82%, specificity of 52% and accuracy of 71% for clinical assessment alone. Finitzo et. al. ⁽¹²⁾ showed results of 93 % and 58 % respectively .

Vaughan et.al. ⁽¹³⁾ showed results of 90% and 75% respectively in highly skilled person. Regarding tympanometry we get 76 ears (47.5%) with B curve from which 68 ears (89.5%) were positive.

Twenty- six ears (16%) had type A curve from which 7 ears (27%) yielded an effusion. Twenty eight ears (18.5%) had type C2 curve from which 16 ears (57%) yielded an effusion. we get sensitivity =90%, specificity =70% and accuracy =85% for type B tympanogram.

Vaughan et. al., ⁽¹³⁾ revealed similar results (sensitivity= 88% and specificity= 71%) for standard tympanometry.

Watters et. al., ⁽¹⁴⁾ found type B tympanogram has a sensitivity of 91% and specificity of between 79 and 90% .

Lastly when we combined clinical and tympanometric results we get sensitivity increased to reach 96%, specificity 92% and accuracy approaching 96%.

Finitzo et. al., ⁽¹²⁾ results were 98.3% for sensitivity and 92.8% for specificity when used both clinical and tympanometric assessment.

In conclusion we advice to use clinical diagnosis and tympanometry as a complimentary to each other whenever it is possible to reduce unnecessary surgical procedures.

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