THE BENEFIT OF TYMPANOMETRY FOR CERTAIN EAR DISEASES

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Abstract

Tympanometry is an objective test measure the mobility (compliance) of the tympanic membrane as a function of applied air pressure in external canal, It is particularly useful in assessing the secretory otitis media during childhood. This is a prospective study performed at ENT department of the Basrah Teaching Hospital for the period from November / 2013 to February / 2014. The study is to assess the advantage of tympanometry as a diagnostic tool and to audit the uses of tympanometry in the ear diseases in ENT department of Basrah Teaching Hospital. The statistical calculations were carried out using chi-square test. The p value >0.05 was considered statistically insignificant. Fifty patients aged (4—84years) who were referred by otolaryngologist to our audiological unit for audiological assessment were included in the study. Out of these 50 patients (55 ears had otitis media with effusion, 12 ears had Eustachian tube dysfunction, 4 ears had barotraumas, 7 ears had acute otitis media, 4 ears had chronic suppurative otitis media, 2 ears had otosclerosis and 15 ears were normal on clinical examination). The clinical diagnoses was compared with tympanometric findings and the coincidence between two, was as follow; 80% in otitis media with effusion, 75% in barotraumas , 100% in acute otitis media.
In conclusion; tympanometry is an important tool in the diagnosis of some of the ear diseases. It is not necessary to performed in every case as the clinical examination could clarify the diagnosis in most cases .

Keywords: benefit , tympanometry.

Introduction

The term acoustic admittance describes the mobility of vibrating structure. It is the ratio of velocity of the middle ear displacement to the applied sound pressure, it measures at low frequency 220Hz. Ahighly mobile ear will present at high admittance to an incoming sound wave.

Admittance: quantity of the energy accepted by the middle ear.

Impedance: quantity of energy rejected by the middle ear.

The relevant unit of admittance c.g.s. millimho (mmho)..

Tympanometry: it is part of impedance audiometry, which consists of 3 tests: Tympanometry, acoustic reflex, and static compliance [1] provide a simple, less invasive and objective measurement of middle ear condition and is commonly used for the clinical diagnosis and follow up of glue ear.

(Middle ear pressure, acoustic admittance, and tympanometric gradient are the main test parameters). The range of normal middle ear pressure is between (-100…+50mmH2O) and represent normal Eustachian tube function. The maximum compliance range is from 0.39 ---1.30ml [2].

Tympanometry particularly useful in watching children with otitis media with effusion (OME) diagnostic ability 85%, type B tympanogram gives 93% sensitivity and 76% specificity [3].

There are 5 types of tympanogram:

1. Type A normal tympanogram
2. Type B flat tympanogram seen in OME

Sensitivity of tympanometry (type B) among Infant less than 7 month of age was 70% specificity 98% with positive predictive value of 93% and negative predictive value of 94% [4]. Ninty Percent of patient whose Eustachian tube dysfunction is characterized by type B simultaneously show mild or medium hearing loss and 70% have mild conductive hearing loss between 20 –40dB, and 20% to have medium hearing of 40—60 dB. One study (College of applied medical science, king Saudi University) was found point prevalence of type B tympanogram was 8.2%the prevalence of OME was 7.5% [5].

3. Type C seen in negative ear pressure or when there is Eustachian tube dysfunction, this subdivided into C1 middle ear pressure between –100 to-199 mmH2o , C2 ,middle ear pressure between –200----to –400 it indicates retracted tympanic membrane. Negative tympanometric peak (less than –100dapa) was found to expect the evolving of otitis media when observed during respiratory infection with no concomitant ear disease but for prediction of resolution of acute otitis media , the finding still inconclusive [5]. Middle ear fluid was encountered in 15% of ears with negative tympanometric peak pressure negative middle ear bacterial culture for the main pathogen (71% of bacterial cultures ,remained negative for main pathogen) [6]. Eustachian tube with mild dysfunction demonstrated as type C tympanogram, the conductive hearing loss does not exceed 25 dB.

4. Type As shallow type tympanogram this seen in otosclerosis, scarred tympanic membrane and acute otitis media

5. Type Ad deep type or hyper complaint in flaccid tympanic membrane or disarticulation or partial or total ossicular chain loss.

Patients and methods

Fifty patients were seen at ENT department of Basrah Teaching Hospital for the period from November / 2013 to February 2014.

There were 28 Female and 22 Male patients, the age range (4 - 84 years) Table (1). The patients were referred by otolaryngologists and examined by the same examiner.(history, full ENT examination).

Instrument and Technique: The instrument which was used DANPLEX. Chancel middle ear analyze TYMP87.

Results

The clinical provisional diagnosis was as follow ;
1. Fifty-Five ears had otitis media with effusion (OME), 44 ears showed type B tympanogram (75 %), 10 ears showed type As tympanogram (18%) 2 ears showed type C1 tympanogram (3 - 6%) and one ear showed type A tympanogram (1 – 8 %).
2. Fifteen ears were normal, 7 ears had showed type A tympanogram (47%), 6 ears showed type As (40 %), 2 ears showed type A tympanogram (13%).
3. Twelve ears had Eustachian tube dysfunction.
4. Four ears had barotraumas.
5. Seven ears had acute otitis media.
6. Four ears had CSOM.
7. Two ears had otosclerosis.
8. One ear had acoustic trauma, with normal tympanogram. Table (1), (2) & (3)

Table (1) Distribution of various types of tympanogram in relation with clinical provisional diagnoses

	Type A	Type Ad	Type c1	Type C2	Type B	Type As	Total number
Normal	7	----	--------	-------	2	6	15
Eustachian tube dysfunction	5	2	2	---------	---------	3	12
OME	1	------	2	---------	42	10	55
Barotraumas	1	------	2	---------	1	--------	4
OM	------	------	----------	---------	1	6	7
CSOM	-------	-----	-----------	---------	4	--------	4
Of sclerosis	-------	------	2	---------	----------	-------	2
Acoustic trauma	1	------	----------	---------	----------	--------	1
Total number	15	2	8		50	25	100

Table (2) Diagnosis and frequency of each case

Diagnosis	Number	%
OME	31	62%
Normal	7	14%
CSOM	2	4%
Eustachian		
Tube dysfunction	3	6%
Barotraumas	2	4%
OTOSCLEROSIS	1	2%
Acoustic trauma	1	2%
Acute otitis media	3	6%

Table (3) types, number of tympanogram, and percentage of number of tympanogram that goes with clinical provisional diagnosis for each case.

Type and number of tympanogram									
Provisional diagnosis	Type A	Type Ad	Type AS	Type C1	Type C2	Type B	% of +ve Results	% of -ve Results	Total Number
Normal	7	-	6	-	-	2	87%	13%	15
Eustachian tube dysfunction	5	2	3	2	-	-	16%	84%	12
OME	1	-	10	2	-	42	80%	20 %	55
Barotraumas	1	-	-	2	-	1	75%	25%	4
OM	-	-	6	-	-	1	100%		7
CSOM						4			4
Otosclerosis				2					2
Acoustic trauma	1								1
Total	15	2	25	8		50			100

% of +ve Results: means how the tympanometric finding coincides with provisional clinical diagnosis.
% of –ve Results: that tympanometric finding did not coincide with provisional clinical diagnosis.

Discussion:

Most ear diseases can be diagnosed clinically from history, physical examination and tuning fork test nevertheless, some need other investigations and tympanometry is one of these.

1. In our study 76.4% of those ears with otitis media with effusion (OME) showed type B tympanogram and 3.6% showed type C tympanogram. So the tympanometry coincide with clinical diagnoses in 80 % of cases this result does not goes with Helsinki , Finland study which showed that tympanometry was technically successful in 94% of ears [3].

In a small Turkish research using myringotomy as a main step in confirmation of middle ear effusion, tympanometry had a positive predictive value and specificity of 96 and 92 percent, respectively [4].

This is because probably they had better tympanometric machine in their audiological unit and also their study took other parameter into consideration. But when we add type As tympanogram the percentage will be 98% - Table (3).

2. Another study was done in king Saud university, Riyadh showed that prevalence rate of type B tympanometry was 8.2% and prevalence of OME was 7.5 % [7], while our study showed percentage of type B tympanometry was 50 % and percentage of OME was 55 %, because not all cases gives type B tympanogram

3. In National Public Health Institute Helsinki Finland a study concluded that, type C1 tympanometry was a poor indicator for the presence of middle ear fluid in our study we found that type C1 tympanometry was present in about 3.6 % of ears with provisional diagnosis of OME and this goes with result of Helsinki , study [8].

4. In Boston university American academy of family physician centre interpretation of tympanometry was 35.8 % type A , 30% type B, 15.5 % type C1 12 % type C2 6.8% un interpretable, so 37.8 % was normal (A + C1), 55. 6 % was abnormal ((C2 + B)) [9]. In our study interpretation of all tympanometry was 42% type A, type C1 8% C2 0% type B 50%. So normal tympanogram was 58 % and abnormal tympanogram was 42 % this may be explained by the time of doing of our study, which was done at winter time, with high incidence of URTI and there is high incidence of OM and OME as late sequel [10].

5. In our study it is found that type B tympanogram can predict the presence of the effusion in 76.4% of ears with OME, while the study of Aartus University, flat tympanogram predicts middle ears effusion in about 90 % of cases [11].

6. Those ears with barotraumas, 75 % of ears had showed significant tympanometric changes (type C and B), that confirmed the clinical diagnoses diagnosis of barotraumas.

7. Holmberg et al (1986) found that tympanogram changes associated with acute otitis media (stage of acute myringitis) was decreased tympanic membrane mobility [5].

In our study those ears with provisional diagnosis of acute otitis media (myringitis) had type As tympanogram in 85% and 15 % had show type B tympanogram this goes with the result of Holmberg et al.

8. The cases of chronic suppurative otitis media (CSOM), and acoustic trauma, for which tympanometry was ordered; tympanometry did not add to the clinical diagnoses (Tympanometry is a clinical support tool in examination especially for the children).

Conclusion

We conclude that although, tympanometry is an important tool in the diagnosis of ear diseases such as otitis with effusion ,stage of myringitis in acute otitis media and barotraumas but , it is not necessary to be performed in every case as the clinical examination could clarify the diagnosis in most cases.

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