

A comparative analysis of preoperative tympanometry and intraoperative findings in patients otitis media with effusion

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Abstract

Otitis media with effusion is one of the most commonly encountered diseases by otolaryngologists. Hearing loss is the most common symptom, particularly affecting academic performance in school-age children. Therefore, establishing an accurate diagnosis is crucial. The primary diagnostic method is an otoscopic ear examination. Tympanometry is the most frequently used technique for diagnosis. In this study, we aimed to compare the results of tympanometric examinations with intraoperative findings. Our study included a total of 126 patients with a diagnosis of chronic otitis media with effusion and a decision for surgery, comprising 224 ears that were followed by our clinic. All patients underwent at least one myringotomy. Ventilation tubes were inserted in cases of glue ear. Preoperative physical examination and tympanometry results were compared with intraoperative findings. Of the 126 patients, 81 were male. The mean age was 5.3 years (range: 2-15). Preoperatively, 135 ears exhibited Type B tympanogram, and 89 ears exhibited Type C tympanogram. The rate of tube insertion was statistically significant in cases with type B tympanogram. Additionally, the tube insertion rate was determined to be 32.5% in cases with Type C tympanograms. In conclusion, diagnosing effusive otitis media is a crucial matter. While physical examination is the most important diagnostic tool, it may sometimes be insufficient. Tympanometry is a highly useful method for improving the diagnostic rate of this condition.

Keywords: otology, otitis media with effusion, tympanometry, ventilation tube

1. Introduction

Otitis media with effusion (EOM) is an inflammation of the middle ear mucosa characterized by fluid accumulation in the middle ear cavity without signs and symptoms of acute infection(1). EOM often occurs following acute otitis media (AOM). In approximately 50% of cases, the effusion in the middle ear resolves within 4 weeks during the recovery phase of AOM, while in 80% of cases, it resolves within 8 weeks. If the middle ear effusion persists beyond three months after AOM (seen in approximately 10% of patients), it is considered chronic EOM and requires treatment(2). Symptoms typically include hearing loss or a sensation of fullness in the ear, while pain or fever is typically absent. The resulting hearing impairment can significantly affect speech, language, and cognitive development in children(3). Children with risk factors such as Eustachian tube dysfunction, adenoid hypertrophy, nasal allergies, cleft palate, Down syndrome, and other craniofacial anomalies are at a higher risk of developing EOM(4). The most important examination method for diagnosis is otoscopy (Fig. 1). Pneumatic otoscopy and microscopic examination enhance the diagnostic sensitivity. Tuning fork tests can be used to identify conductive hearing loss in cooperative children. Pure-tone audiometry typically

reveals conductive hearing loss ranging from 25-45 dB.

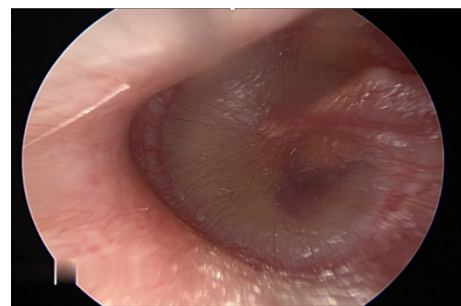


Fig. 1. Otoscopic examination of EOM

Tympanometry is the most commonly used audiological diagnostic method for diagnosing EOM. Measurement with impedance audiometry typically shows Type B, non-peak curves(5). When appropriate medical treatment fails to resolve the effusion in the middle ear, the application of ventilation tubes is one of the most reliable methods to eliminate the effusion (Fig. 2). Surgical treatment is indicated in cases of EOM where improvement is not expected soon and when hearing loss becomes a hindrance. It is also considered an urgent intervention when signs of complications arise(6).

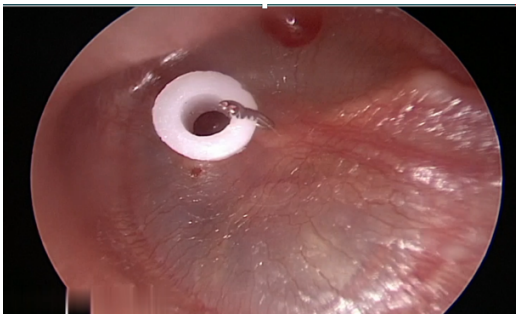


Fig. 2. Ventilation tube insertion

Our study aimed to compare the preoperative tympanometry findings with intraoperative findings and the rate of tympanostomy tube placement in patients with chronic EOM who underwent surgical intervention.

2. Materials and Methods

Patients who were being followed up in our clinic for effusive otitis media and did not show improvement with medical treatment or follow-up (after a minimum of 3 months of follow-up) were included in this study. A total of 126 patients who underwent surgery between January 2018 and August 2018 were included in this study. Prior to the operation and during follow-up visits, all patients underwent tympanometric examination using the Interacoustic AT235 tympanometer. Tympanograms were classified according to Jerger's classification as follows: 1-Type A (curves with a peak between -100 and +100 daPa), 2-Type B (flat curves without a peak), and 3-Type C (curves with a peak at values more negative than -100 daPa). Tympanometry results and the presence of effusive otitis media based on preoperative physical examination were considered for the 224 ears, in which at least a myringotomy procedure was performed during the operation. Ventilation tubes were inserted into the ears

from which glue-ear was aspirated from the middle ear after myringotomy. The preoperative tympanometry results of the analyzed 242 ears were compared with the need for tympanostomy tube placement during the operation. Ethics committee approval was obtained from * University Faculty of Medicine Non-Interventional Clinical Research Ethics Committee before the study (Decision no:2021/60). All patients signed a written informed consent form before the study.

2.1. Statistical Analysis

Statistical analyses were performed using SPSS version 23.0 for Windows (SPSS, Inc., Chicago, IL). Variables were analyzed using the Shapiro-Wilk test to determine whether they were normally distributed. Descriptive statistics are presented as mean ± SD for normally distributed variables and as minimum, maximum and median for non-normally distributed variables. Independent t-test or Mann-Whitney U test will be used to compare variables between groups. The chi-square test was used for categorical variables. The level of statistical significance was set at $p < 0.05$.

3. Results

A total of 126 patients were included in the study, consisting of 81 males (64.3%) and 45 females (35.7%). The age of the patients ranged from 2 to 15 years, with a mean age of 5.3 ± 2.2 years. Among the 224 ears in the study, 135 had a type B tympanogram, and 89 had a type C tympanogram as the preoperative tympanometric result. For the right ear, out of the 69 patients with a type B tympanogram, significant tube placement ($p < 0.05$) was performed in 61 patients (88.4%). For the left ear, out of the 66 patients with a type B tympanogram, significant tube placement ($p < 0.05$) was performed in 55 patients (83.3%) (Table 1).

Table1. Tympanogram and procedure performed on the ear

			Procedure Performed on the Ear		Total
			Myringotomy	Tube	
Right Ear Tympanogram	Type B	Count (% within)	8 (11,6%)	61(88,4%)	69(100,0%)
	Type C	Count (% within)	31(67,4%)	15(32,6%)	46(100,0%)
Total		Count (% within)	39(33,9%)	76(66,1%)	115(100,0%)
Left Ear Tympanogram	Type B	Count (% within)	11(16,7%)	55(83,3%)	66(100,0%)
	Type C	Count (% within)	29(67,4%)	14(32,6%)	43(100,0%)
Total		Count (% within)	40(36,7%)	69(63,3%)	109(100,0%)

Table 2. Predicted and observed procedure comprasion

		Observed	Predicted		Percentage (%)
			Myringotomy (n)	Tube (n)	
Right Ear		Myringotomy	31	8	79,5
		Tube	15	61	80,3
		Overall Percentage (%)			80
Left Ear		Myringotomy	29	11	72,5
		Tube	14	55	79,7
		Overall Percentage(%)			77,1

Our model showed high effectiveness in predicting significant tube placement based on type B tympanogram for

the right ear (80%) and the left ear (77.1%). Among all patients, out of the 89 cases with a type C tympanogram, 29

patients (32.5%) required the placement of a tympanostomy tube (Table 2).

4. Discussion

Otitis media with effusion is a common but treatable cause of hearing loss in children. Depending on the age of the child, it can lead to delayed speech acquisition, behavioral problems, and poor performance in school. Therefore, it is important to diagnose the condition before such complications arise. Along with history and clinical examination, tympanometry is the most commonly used method for diagnosis.

Numerous studies have been conducted on the prevalence of EOM, and the data obtained vary widely. In a screening conducted on primary school-aged children in our country, the prevalence was found to be between 10.4% and 6.5%. The same study found that the highest prevalence was observed in boarding schools(7).

Several risk factors have been identified that contribute to the development of EOM. These include gastroesophageal reflux, allergies, genetic predisposition, exposure to second-hand smoke in the child's environment, and crowded daycare settings(8). In various studies, it has been reported that there are associations between the levels of certain immunological molecules and EOM(9).

Tympanometry has been used for many years in the diagnosis of EOM and is considered a reliable diagnostic tool. In a study conducted by Watters et al., the operative findings of 501 patients were compared with preoperative tympanometry results. They found that Type B tympanograms had a specificity of 79% in detecting middle ear effusion(10). Our study also found that Type B tympanogram was statistically significant in predicting the need for tube placement in the right ear with 80% accuracy and in the left ear with 77.1% accuracy.

In our study, we found that out of the 89 patients with Type C tympanogram, 29 (32.5%) required the placement of tympanostomy tubes. Although Type B tympanogram is specific for the diagnosis of otitis media with effusion, we recommend performing myringotomy and considering tympanostomy tube placement in patients with Type C tympanogram, even with follow-ups.

Main Point

In the treatment of serous otitis, physical examination is supplemented by tympanometry to aid in diagnosis and treatment selection.

There is a high probability that a ventilation tube will need to be inserted if the tympanogram is type B.

Glue ear can be detected in some patients with a type C tympanogram.

Conflict of interest

None.

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All included patients were provided with detailed information about the aims and methods of the study and signed informed consent forms.

Authors' contributions

Concept: M.B., O.G., M.Ç., Design: M.B., O.G., M.Ç., Data Collection or Processing: M.B., O.G., A.U.K., Analysis or Interpretation: M.B., O.G., M.Ç., Ö.Ç.E., Literature Search: M.B., T.Y., M.Ç., Ö.Ç.E., Writing: M.B., T.Y., M.Ç., Ö.Ç.E.

Ethical Statement

The study was conducted in accordance with the ethical standards stated in the 'Declaration of Helsinki', and was approved by the local ethics committee (protocol number No: 2021/60).

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