

## The tympanogram types in infants suffering from bronchiolitis

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**Abstract: Introduction:** Otitis media is common in children's who are suffering bronchiolitis. Among viruses RSV is the most etiology of otitis media. On the other hand, RSV is responsible for 50% of bronchiolitis. Involvement of middle ear and eustachian tube is likely in bronchiolitis because of preceding upper respiratory tract infections symptoms. There is no study, including accompaniment of C and B tympanogram, which are signs of eustachian tube dysfunction and middle ear effusion, with bronchiolitis. We decided to measure the existence of pathological tympanograms (B and C) in patients with bronchiolitis in a prospective study. **Materials and Methods:** In our prospective study. Tympanometry was done in 6 – 24 month old infants, who were admitted to pediatric department with clinical diagnosis of bronchiolitis. **Results:** Among 177 studied infants, B tympanogram was seen in 96 infants (54.2%), C tympanogram was seen in 54 infants (30.5%), and BC tympanogram (One ear is B and the other C) In 18 infants (20.2%). There were only 9 infants (5.1%) with tympanogram A. **Conclusion:** Based on our findings, 94.4% of patients suffering from bronchiolitis (168 of 177 patients) had pathologic tympanogram. This shows accompaniment of MEE and eustachian tube dysfunction in bronchiolitis. It seems rational to consider prolonged MEE in follow up of bronchiolitis cases because complications of prolonged MEE can be irreversible, In addition , MEE and eustachian tube dysfunction predisposing this patients to AOM(Acute otitis media) and OME(Otitis media with effusion).

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### 1. Introduction

The bronchiolitis is an acute respiratory disease of infants that can result from viral and rarely bacterial infections and is determined by wheezing (5). There are several causes of wheezing in infants, but the most common cause is bronchiolitis. RSV (respiratory syncytial virus) is responsible for 50% of the cases (7). Other factors include parainfluenza, adenovirus (2) influenza and the rhinovirus and rarely mycoplasma pneumonia (5).

It is more common in male infants, also not breast-fed infants and who they live in the crowded conditions. Mostly is seen in winter and early spring when the prevalence of viral infection is the highest. 50% of children up to two years of age are encountered(5).

The Clinical findings include loss of appetite, mild fever (T:38.5 -39), although it can be without fever. Wheezing cough, shortness of breath and restlessness followed by Respiratory distress (2).

The diagnosis is based on clinical findings and understanding the epidemiology of viral diseases and its prevalence in the Community (5). Basic chest X ray (PA and Lt.) is done that shows air filling and patchy atelectasia. WBC and its differentiation usually are normal while in bacterial

pneumonia CXR and WBC are changed. Testing for the specific viral cause including PCR and rapid IF can be done, but has little effect on management and this is not routinely recommended (2).

During the process of creating the bronchiolitis, patient have a course of upper respiratory infection and then clinical symptoms of bronchiolitis appear after a few days. All patients with infection do not evolve bronchiolitis (2). Viral infections may be limited at the level of the upper airway.

Complications include apnea, respiratory failure, atelectasia, otitis media (caused by RSV with or without bacterial infections), pneumothorax(5).

AOM is common in children who had suffered from bronchiolitis. But the aspiration of the middle ear often contains bacterial pathogens and this is suggested that RSV rarely is the only cause of AOM (5-6).

On the other hand, the spectrum of the middle ear disease, which is referred to as otitis media, is divided into two main components; 1-acute infection, acute otitis media (AOM) or suppurative otitis media. 2-non-infectious inflammation, serous otitis media or non-suppurative otitis media or otitis media with effusion (OME). Two types of otitis media are related to each other. Acute infection usually leads to

non-infectious inflammation and remaining of effusion, which itself results in susceptibility to the recurrent infections (2). There is evidence that the majority of cases of OME occur as the result of AOM sequelae or at least the etiologic factors are the same (1).

Respiratory viruses or RNA derived from viruses may be present in the middle ear exudate in children with AOM alone or along with bacterial pathogens. Among these viruses, RSV and rhinovirus are found more than others.

These viruses cause secretion of cytokines and other inflammatory mediators that some of them may disturb Eustachian tube function (2).

The middle ear ventilation disturbance is caused in all the cases of OME and most cases of AOM. Although otitis media may evolve in the absence of respiratory infection; however, if not all, but most cases start with viral or bacterial upper respiratory tract infections.

Before the creation of the symptoms of the bronchiolitis, in the patients suffering from upper airway infections, Eustachian dysfunction is very likely. This disturbance of the air ventilation is the predisposing factor for evolving the Otitis media in form of AOM or OME.

The progression of disease in otitis media and bronchiolitis is the same at least in the beginning. On the other hand, the etiologic pathogens are very same in both diseases.

In order to show the eustachian dysfunction, there is an objective method called tympanometry. There are three types of tympanogram:

Type A: a normal tympanogram which is Notch-shaped that represents a high compliance. B and C type tympanograms may reveal fluid in the middle ear, perforation of the tympanic membrane, scarring of the tympanic membrane (2-3).

There is no study, including accompaniment of C and B tympanogram, which are signs of eustachian tube dysfunction and middle ear effusion, with bronchiolitis.

We decided to measure the existence of pathological tympanograms (B and C) in patients with bronchiolitis in a prospective study. We hereby specify what percentage of patients suffering from bronchiolitis has Eustachian tube dysfunction during acute phase. And, to answer the question whether patients with bronchiolitis need to follow up for MEE as in AOM and OME?

## 2. Materials and Methods

In our prospective study, infants 6-24 months old of whom the definitive clinical diagnosis

was bronchiolitis enrolled for tympanometry. Infants under six months were excluded from our study because tympanometry under this age is not diagnostic and it can cause bias (1). Physical examination and otoscopic examination was done. Signs suggesting AOM and acute inflammation were not found.

For all patients CXR was done. No evidence of bacterial pneumonia was found. ESR, WBC and differentiation were done. The inflammatory signs in lab test out of definition for bronchiolitis were not found. Patients who had clinical and paraclinical symptoms and signs out of definition for bronchiolitis were excluded.

A total number of patients were 177 including 90 male and 87 female. All of these patients underwent tympanometry by an experienced and non-informed of study audiologist. The infants were divided into three age groups 6 – 12, 12 – 18, 18 -24 months of age. The patients in whom both ears had A tympanogram were named as group A. Patients that at least one of their ears or both had B tympanogram were named group B. Patients that at least one of their ears or both had C tympanogram were named group C. Patients that one of their ear had B tympanogram and the other ear had C tympanogram were named group BC.

Each Patient's data was registered in a chart that was prepared beforehand. After collecting data from all charts, they were analysed based on descriptive statistics analysis.

## 3. Results

A total number of 177 patients were studied. 90 patients were male (50.84%) and 87 patients were female (49.16%).

Among 90 male infants, 61 patients were in the age range of 6-12 months, 16 patients were 12-18 months and 13 patients were in the age range of 18-24 months (table 3 and fig. 4).

Among 87 female infants, 45 patients were in the age range of 6-12 months, 18 patients were 12-18 months and 24 patients were in the age range of 18-24 months (table 3 and fig. 4).

Among 177 infants who were enrolled for study with clinical diagnosis of bronchiolitis, 96 patients 54.2% were in group B, 54 patients 34.5% were in group C and 18 patients 10.2% were in group BC tympanograms. Only nine of 177 patients 5.1% were in group A tympanogram (table 1 and fig. 2).

The results of tympanogram groups according to sex have come in table 2 and figure 3.

Partial incidence	incidence	Tympanogram
5.1	9	A
54.2	96	B
30.5	54	C
10.2	18	BC
	177	Total

Table (1)

Total	BC	C	B	A	Tympanogram
					Gender
90	15	33	36	6	Male
87	3	21	60	3	Female

Table (2)

Female	Male	Gender
		Age
45	41	6 - 12
13	16	12 - 18
24	13	18 - 24
87	90	Total

Table (3)

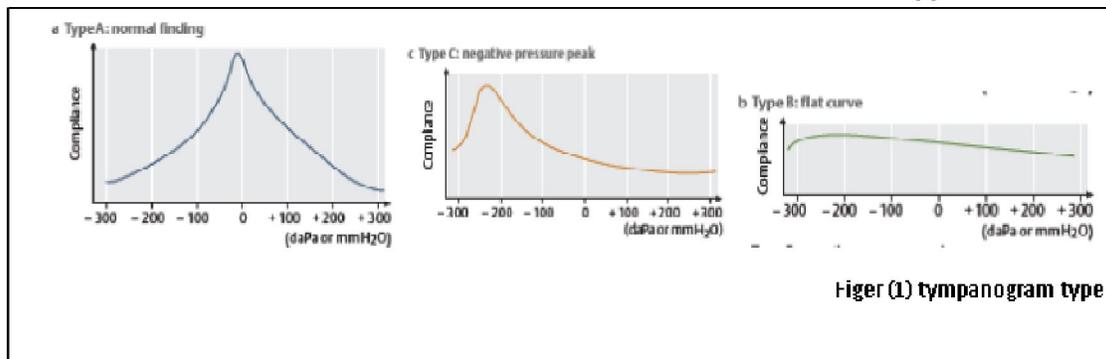


Figure (1) tympanogram type

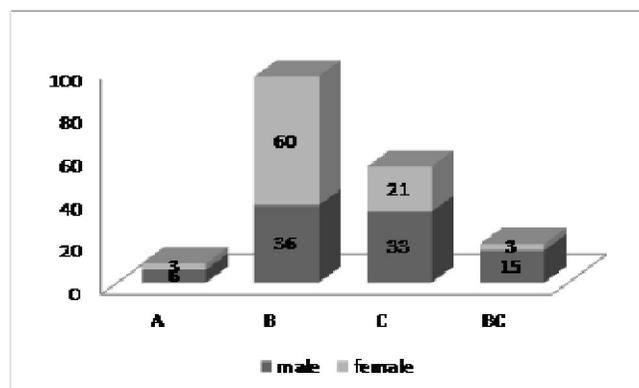
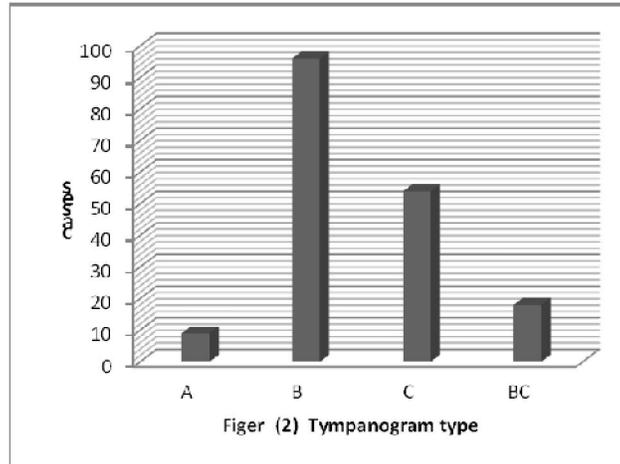
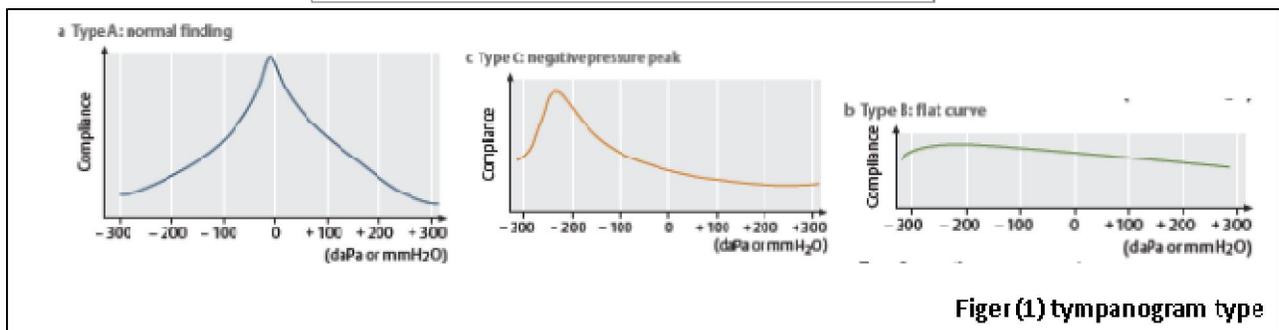


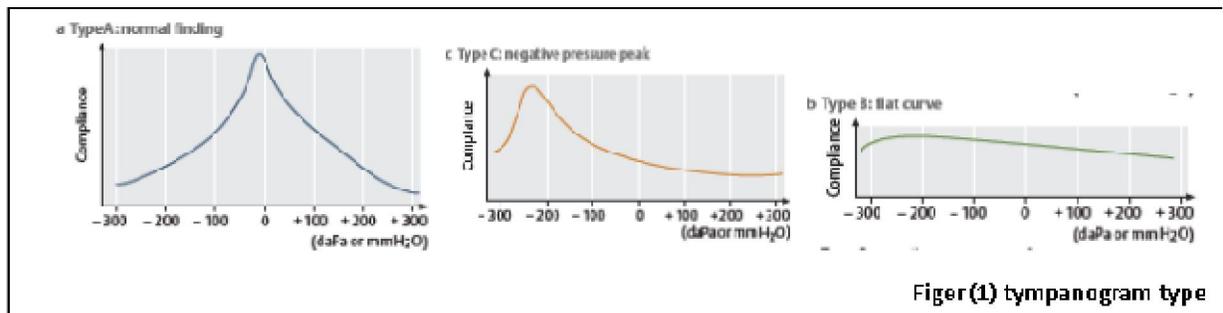
Figure (3)



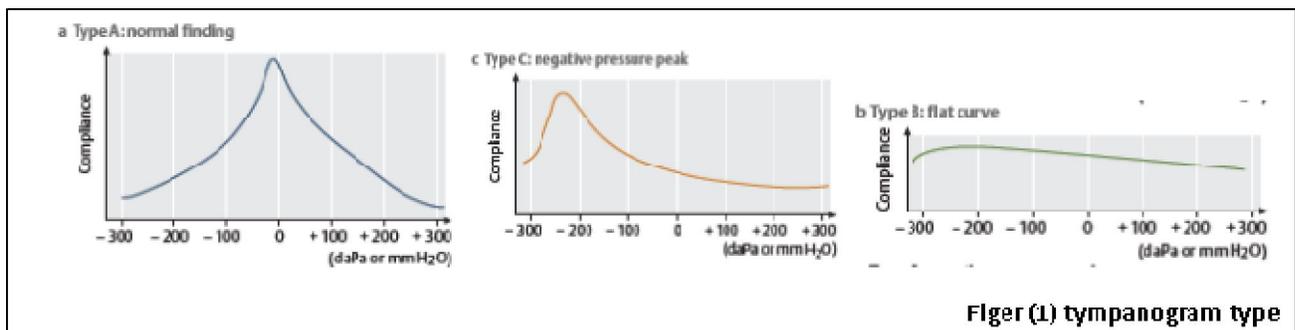
Figur (2) Tympanogram type



Figur (1) tympanogram type



Figur (1) tympanogram type



Figur (1) tympanogram type

**4. Discussion**

Bronchiolitis is the most frequent cause of hospitalization in the infant population (8). According to the results of our study, the prevalence of B and C tympanograms is very high (94.9%) in patients

suffering from bronchiolitis. This indicates that middle ear pathology and Eustachian tube dysfunction are commonly seen in the course of bronchiolitis.

As we discussed in the introduction with regard to the same course of Otitis media and Bronchiolitis at least in the beginning as well as the similarity of etiologic factors, middle ear pathology and Eustachian tube dysfunction was suspected in bronchiolitis and our study proved this issue. These results clearly show simultaneous involvement of the middle ear in bronchiolitis. Involvement of the middle ear is defined as the existence of the fluid in the middle ear (B tympanogram) and Eustachian tube dysfunction (C tympanogram).

In addition, the existence of MEE and the eustachian tube dysfunction can prone infants to AOM (2). Long lasting MEE have several side-effects including tympanic membrane atelectasia, adhesive otitis media, cholesterol granuloma, Permanent hearing loss. Permanent hearing loss has negative effect on children's development, especially delay in their speech development (2).

Follow up of the infants suffering from the long lasting MEE which can result in OME, is rational. OME is a silent disease that mostly is presented with its complications that the majority of them (especially developmental effects) are irreversible (1).

## 5. Conclusion

The results of this study prove the coexistence of pathologic tympanograms with bronchiolitis. In this study, infants with bronchiolitis underwent tympanometry only during the acute phase of disease. We suggest future studies should be done in

order to clarify what proportion of infants and at what time limit after the acute phase of the disease continue to have abnormal tympanometry.

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