

Assessment of Hearing Level after Resolution of Acute Otitis Media

Ali Maeed Al-shehri*

Background: Acute otitis media is a very common global bacterial infection in children, which could occasionally lead to major complications and deafness.

Objective: The aim is to evaluate the middle ear function and hearing level during and after an acute attack of otitis media in children.

Setting: Out Patient Clinics, ENT Department, Aseer region, KSA.

Design: Prospective study.

Method: Twenty-six children, 44 ears with acute otitis media (AOM) were evaluated clinically and audiotically at outpatient clinics. The tests included, pure tone audiometry, tympanometry and Eustachian tube function tests, which were repeated after 10th and 30th days of the treatment.

Result: Audiological examinations during the acute episode of otitis media showed that 35 (79.5%) had moderate and moderately severe conductive hearing loss (CHL), only 7 (16%) had mild CHL. Eustachian tube function was poor in 35 (79.5%) ears. Assessment after 10 days of treatment showed normal hearing in 3 (6.8%) ears and improved Eustachian tube (ET) function in 19 (43.2%) ears. Thirty days after post-therapy revealed that 5 (11.4%) had normal hearing level with better Eustachian tube function in 32 (72.7%) ears.

Conclusion: Although children may show clinical improvement after receiving treatment for acute otitis media (AOM), they can still suffer from some residual morbidity. Hence, children with AOM should be followed until there is complete resolution of the condition and its complications.

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About 85% of children are known to have experienced at least one episode of otitis media per year¹. Diagnostic accuracy is essential to identify children who will potentially benefit from treatment with antibiotics and to eliminate unnecessary medication².

Although severe pyogenic complications of untreated otitis media are now rarely seen, many cases do not resolve completely with antibiotic therapy. Middle ear effusion often persists after

*Associate Professor and Consultant of ENT

Department of Surgery

College of Medicine

King Khalid University

Abha, Saudi Arabia

E-mail: alimaecedalshetri@yahoo.com; namas3@hotmail.com

an initial episode and this could lead to recurrent or chronic otitis media with effusion. One of the major complications of otitis media with effusion is conductive hearing loss^{3,4}.

Several studies have shown that children with hearing loss might have middle ear effusion⁵. Other studies have indicated variable degrees of delayed language development in children with middle ear effusion⁶. This was particularly observed in the first few years of life, especially if the condition is recurrent.

The aim of this study is evaluate the middle ear function and hearing level during and after the acute attack of otitis media in children.

METHOD

The study included 26 children (44 ears) of both sexes; all were suffering from acute suppurative otitis media, the age ranged 6-12 years.

The equipments used were pure tone audiometer and acoustic impedance audiometer. All patients were subjected to full history, general examination otological examination. After the clinical diagnosis, the following audiological investigations were performed:

- Pure tone audiometry for both air conduction (250-8000 Hz) and bone conduction (250-4000 Hz).
- Acoustic test, including tympanometry at varying pressure ranging from +200 to -400 mm H₂O and acoustic stapedial reflex threshold measurements.
- Examination of Eustachian tube function using the Valsalva's maneuver and Toynbee tests. Measuring the middle ear pressure before and after the tests was done.

RESULT

In our study, fourteen (54%) of the children were males and 12 (46%) were females. The distribution of symptoms in Table 1 show that fever and earache were the most common symptoms. Audiological evaluation revealed elevated pure tone thresholds at all frequencies indicating hearing loss, see Table 2. The average degrees of hearing loss according to ANSI were: mild in 7 (16%) ears, moderate in 22 (50%), moderate to severe in 13 (29.5%) and severe in 2 (4.5%), see Table 3.

The average pure tone thresholds of air through the speech frequency (500-2000) Hz were 34.1 dB. Audiometric configuration was relatively flat. The mean air-bone gap was found to be 14 dB.

Table 1: Symptoms before Treatment (n=26)

Patients' Symptoms	No. of Cases	Percentage
Fever	24	92
Deterioration of general condition	15	58
Sore throat	18	69
Snoring	12	46
Running nose	18	69
Cough and expectoration	17	65
Earache	26	100
Diminution of hearing	21	81

Table 2: Mean SD, Range and Standard Mean Error (SME) of Pure Tone Thresholds of Air Conduction before Treatment

Condition	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Mean	38.38 dB	33.53 dB	35.88 dB	32.79 dB	33.68 dB	34.71 dB
SD±	7.15	6.59	6.59	7.30	8.16	80.04
Range	25-50	25-50	25-50	20-50	20-60	20-60
SME	1.23	1.13	1.13	1.25	1.40	1.88

Table 3: Degree of Hearing Loss before Treatment According to ANSI⁷

Degree of Hearing Loss	No. of Cases	Percentage
Mild	7	16
Moderate	22	50
Moderately severe	13	29.5
Severe	2	4.5

Acoustic immittance test results in AOM before treatment were shown in Table 4. The results indicated that type B, flat tympanogram was the commonest. This was consistent with the presence of middle ear effusion. However, 34.1% showed type C, indicating Eustachian tube dysfunction type.

Table 4: Acoustic Immittance Test Results before Treatment

Tympanogram	No. of Ears	Percentage
Type A	3	6.8
Type B	22	50
Type C	15	34.1
Type As	4	9.1
Total	44	100

The mean compliance during acute otitis media is about 0.13 ml equivalent volume. Ipsilateral acoustic reflex was absent in 45.5% of ears and impaired in 50.2% during the acute attack. No normal reflexes were detected during this stage.

Eustachian tube function tests showed that 35 (79.5%) ears had negative Valsalva's maneuver and 84.1% ears had negative Toynbee test, see Table 5.

Table 5: Toynbee and Valsalva's Maneuver before Treatment

	Good Response		Negative Response	
	Number	Percentage	Number	Percentage
Valsalva's Maneuver	9	20.5	35	79.5
Toynbee Test	7	16	37	84

Table 6 shows modification of the main presenting symptom after medical treatment, deterioration of hearing in 15 (57.7%) and earache in 1 (4%). Follow up of one month showed deterioration of hearing in 11 (42.3%) and no complaint of earache.

Table 6: Symptoms among Patients 10 Days and 30 Days Post Treatment

Patients' Symptoms	10 days		30 days	
	No. of Cases	Percentage	No. of Cases	Percentage
Fever	2	7.7	1	4
Deterioration of general condition	1	4	-	-
Sore throat	4	15.4	3	11.5
Snoring	5	19.2	5	19.2
Running nose	5	19.2	1	4
Cough & expectoration	6	23.1	2	7.7
Earache	1	4	-	-
Diminution of hearing	15	57.7	11	42.3

Audiological evaluation ten days after treatment indicated improved pure tone thresholds with a statistically significant difference compared to the mean thresholds before treatment ($p \leq 0.01$), see Table 7. Follow up after one month revealed marked improvement of pure tone thresholds and highly significant difference compared to before treatment ($p \leq 0.001$), see Table 7. Nevertheless, there was no significant difference between the mean thresholds when patients were evaluated ten days and one month later ($p \geq 0.5$).

Three (6.8%) ears had normal hearing in the following ten days, see Table 8. Follow up after one month showed that 5 (11.4%) ears had normal hearing, see Table 8.

Table 7: Mean, SD Range and SME of Pure-tone Thresholds of Air Conduction 10 and 30 Days after Treatment

Condition	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
Mean	34.41	29.41	30.88	28.08	28.23	30
SD±	6.39	6.03	6.69	7.17	7.84	7.76
Range	25-45	20-40	20-45	15-40	15-40	15-40
SME	1.10	1.04	1.48	1.23	1.35	1.33
And after 30 Days from Treatment						
Mean	33.09	29.26	30.29	27.94	26.91	27.79
SD±	5.15	5.58	5.93	6.08	6.30	5.96
Range	20-40	20-40	20-40	15-40	15-35	15-35
SME	0.88	0.96	1.02	1.04	1.08	1.02

Table 8: Degree of Hearing Loss 10 Days and 30 Days after Treatment

Degree of Hearing	10 days		30 days	
	No. of Cases	Percentage	No. of Cases	Percentage
Normal	3	6.8	5	11.4
Mild	15	34.1	18	40.9
Moderate	23	52.3	18	40.9
Moderately severe	3	6.8	3	6.8
Severe	-	-	-	-

Acoustic test of treated cases of AOM showed restoration of type (A) tympanogram shown in Table 9. There was an increase of the mean compliance from 0.13 ml equivalent volume before treatment to 0.32 ml equivalent volume after 10 days and 0.37 ml equivalent volume after one month.

Evaluation of Eustachian tube function ten days and one month after the acute episode showed improved function, see Table 10. The improvement was marked after one month on both Valsalva and Toynbee tests, which resulted in restoration of normal Eustachian tube functions and resolution of OME.

Table 9: Acoustic Immittance Test Results 10 Days and 30 Days after Treatment

Acoustic Test	10 days		30 days	
	No. of Ears	Percentage	No. of Ears	Percentage
Type A	7	16	14	31.8
Type B	20	45.5	10	22.7
Type C	10	22.7	16	36.7
Type As	7	16	3	6.8

Table 10: Toynbee and Valsalva's Tests 10 Days after Treatment

	Good Response		Negative Response	
	Number	Percentage	Number	Percentage
Valsalva's Maneuver	19	43.2	25	56.8
Toynbee Test	17	38.6	27	61
The Eustachian tube patency and function 30 days after treatment				
Valsalva's Maneuver	32	72.7	12	27.3
Toynbee Test	26	59	18	41

DISCUSSION

In this study, the hearing loss due AOM was usually conductive; this is similar to Liden and Renvall who defined the accepted border line for middle ear pathology to be a hearing threshold more than 20 dB at 500 Hz and/or 4000 Hz⁸.

The average degree of hearing loss in this study is somewhat worse than the findings of Bluestone and Klein who found that 55% of ears had loss of hearing up to 15 dB, which was restored in one to six months⁹. Twelve percent of ears had loss of hearing six months after the acute episode of OM⁹.

The result of this study shows that type B, flat tympanogram was the commonest. Wheeler found that 64% of ears were type B, 23.6% of ears were of type C, 7.4% type A, and, 6.4% were of type As¹⁰.

The hearing deterioration and earaches in this study are comparable to a study by Gates et al, who reported that children with effusion suffered from hearing loss and earache¹¹.

In this study, the hearing was restored in 6.8% of ears after 10 days and 11.4% after one month. Fria et al reported better results where 30% of his patients had normal hearing¹². However, he did not specify the exact period of time at which he evaluated his patients, whether it was after one month or more.

Acoustic test of treated cases of AOM showed restoration of type (A) tympanogram. Gates et al showed that 50% resolution of effusion after one week and 81% one month after acute episode of OM¹¹.

CONCLUSION

This study revealed that resolution of AOM and its complications need long time. This period may extend beyond one month. Hence, it is recommended to continue treatment and Follow up till the acute otitis media and its complications resolve completely.

It is recommended for the prevention of acute otitis media to use the existing and future viral and bacterial vaccines, which is the most promising approach to affect disease burden and consequences, both in developed and developing countries.

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