

Evaluation of Hearing in Patients With Rheumatoid Arthritis Compared With Controls

Assist. Prof. Zafer Volkan Gökçe, MD¹ - Sidar Öztürk, MD¹ - Ceki Paltura, MD²

1 Department of Orthopaedics and Traumatology, Derindere Hospital, Istanbul, Turkey

ORCID NO: 0000-0002-4712-3732

1 Department of Orthopaedics and Traumatology, Derindere Hospital, Istanbul, Turkey

ORCID NO: 0000-0002-3536-204X

2 Department of Otorhinolaryngology, Gaziosmanpasa Taksim Training and Research Hospital, İstanbul, Turkey

ORCID NO: 0000-0002-0971-3643

Abstract

Objective: To demonstrate the effects of rheumatoid arthritis (RA) on hearing with audiometric and tympanometric measurements, and to reveal its relationship with the disease in comparison with healthy volunteers.

Methods: The study included 30 RA patients and 30 healthy controls. Demographic findings such as age, height, weight, onset of complaint (year), time elapsed since diagnosis, previous surgery, accompanying systemic disease, drugs used, family history, habits of smoking and alcohol use were questioned for both groups. Tympanometry, pure voice audiometry and otoacoustic Emission tests were performed.

Results: The hearing thresholds in the airway conduction in RA group were significantly higher in all frequencies (0.25-6 kHz) than in the control group. When bone con-

duction hearing thresholds were compared, RA group was more affected at only 4 kHz and left ear ($p=0.006$). When air-bone conduction differences (AB-gap) were examined, the differences in the RA group at 0.5, 1 and 4 kHz were statistically significant. When tympanometry and acoustic reflex measurement results were evaluated, there was no statistically significant difference between groups. In the transient OAE test, 3 (10%) patients were in the RA and 2 (6.6%) patients in the control group ($p=0.064$).

Conclusion: Conductive hearing loss was significantly more frequent in patients with RA than in healthy individuals, whereas bone conduction was affected partially at high frequencies; whereas stapes reflex, compliance and pressure values were not significantly affected.

Keywords: Hearing, sensorineural hearing loss, rheumatoid arthritis.

Introduction

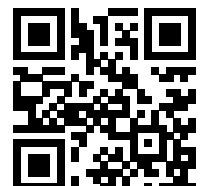
Rheumatoid arthritis (RA) is one of the most common autoimmune diseases affecting about 1% of the world population.^[1] Although the etiology is not known, genetic, hormonal, immunological disorders, sex, infectious agents,

trauma and the etiological roles of stress have been investigated. The most common extra-articular involvement sites in RA are; lung, heart, skin and eyes. In the head-neck region; temporomandibular joint, larynx, cervical spine and audiovestibular system may be affected.^[2] The disease

Correspondence: Assist.Prof. Zafer Volkan Gökçe, MD
Department of Orthopaedics and Traumatology, Derindere Hospital, Istanbul, Turkey
e-mail: zafervolkangokce@gmail.com

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affects the synovial joints symmetrically causing cartilage and bone damage.

Hearing loss in patients with RA is a debatable issue. Its physiopathology has not been fully explained and it has been reported that both conduction type and sensorineural hearing loss (SNHL) is present in patients. RA mostly prefers the synovial diarthrodial joints. Diarthrodial type incudostapedial and inkudomalleolar joints in the middle ear can be affected by RA.^[3] While the ankylosis in the joints leads to a decrease in ossicular movements, more importantly its piston effect does not change. It has been reported that SNHL is more common in RA patients (24–60%) and it is caused by RA influencing the inner ear.^[4] RA may cause auditory neuropathy with mononeuritis multiplex type vasculitis. Autoimmunity may cause destruction of cochlear hair cells or the accumulation of immune deposits in the inner ear. Drugs used in the treatment of RA may affect the inner ear. Some of these drugs are salicylates, other nonsteroidal anti-inflammatory drugs, anti-malarial drugs and cyclosporine.^[5] There are also studies suggesting lack of any relationship between hearing loss and RA.^[6]

In the present study, we aimed to demonstrate the effects of RA on hearing with audiometric and tympanometric measurements, and to reveal its relationship with the disease in comparison with healthy volunteers.

Methods

Study Design: The approval of the Maltepe University Institutional Review Board was obtained prior to the study. The study included 30 RA patients and 30 healthy controls applied to Orthopedics and Traumatology outpatient clinic between June 2018 and December 2018, and diagnosed according to the 1987 ACR criteria. The control group consisted of healthy individuals without any illness.

Patients with previous and other chronic diseases during the study, hearing loss due to drug use (ototoxic drugs such as aminoglycoside and salicylate), chronic otitis media, retracted tympanic membrane-serous otitis media and those who had middle ear surgery were excluded from both groups.

Outcome Parameters: Demographic findings such as age, height, weight, onset of complaint (year), time elapsed since diagnosis, previous surgery, accompanying systemic disease, drugs used, family history, habits of smoking and alcohol use were questioned for both groups. Tympanometry (Interacoustic AZ-26 Denmark 2000), pure voice audiometry (Interacoustic AC-33 Denmark 2000) and

otic Emission (OAE) (Interacoustic ILO 25 Denmark 2002) tests were performed in patients included in the study. Pure tone averages were determined between 250–6.000 Hz frequencies in all patients. The patients with conductive hearing loss, mixed type hearing loss, and SNHL were detected. Acoustic stapes reflexes (ASR) and tympanograms of the patients were evaluated and ASRs at 500, 1000, 2000 Hz were evaluated as absent or present. Tympanogram curves were evaluated as type A, B, C, and As. All patients underwent transient OAE testing. Patients who responded and did not respond to the test at least 3 frequencies were evaluated as “passed” and “failed”, respectively.

Statistical Analysis: Statistical analysis of all data was done using the SPSS (Statistical Package for Social Sciences) 21 program. Frequency values, percentages, arithmetic averages and standard deviations of all data were calculated. The Kolmogorov-Smirnov test was used to determine whether the data conformed to normal distribution. Chi-square tests were used to determine the difference between groups. The difference between the data was considered significant if *p* value was below 0.05.

Results

The RA Group included 30 patients (22 females, 8 males) with a mean age of 47.8±6.9 years. The Control Group included 30 patients (21 females, 9 males) with a mean age of 45.9±8.1 years. Both groups did not differ from each other by means of age and gender (*p*=0.644, and *p*=0.422, respectively).

When the pure tone audiometry results of the patient and control groups were compared, the hearing thresholds in the airway conduction in RA group were significantly higher in all frequencies (0.25–6 kHz) than in the control group. When bone conduction hearing thresholds were compared, it was found that RA group was more affected at only 4 kHz and left ear (*p*=0.006). When air-bone conduction differences (AB-gap) were examined, the differences in the RA group at 0.5, 1 and 4 kHz were statistically significant. The audiometric measurement results of the patient and control groups and the comparison data between the groups are shown in **Table 1**.

When tympanometry and acoustic reflex measurement results were evaluated, there was no statistically significant difference between groups (*p*=0.72 for right ear in tympanometric measurement and *p*=0.64 for left ear). A comparison of the tympanometry test and acoustic reflex positivity results of the groups is shown in **Table 2**.

Table 1. Analysis of audiogram (dB) by frequency of RA patients and controls (mean±SD).

			RA Group (n=30)	Control Group (n=30)	p Value
Air conduction (dB)	0.25	Right	25.4 ± 5.9	17.9 ± 8.1	< 0.001
		Left	26.4 ± 5.8	18.1 ± 8.2	< 0.001
	0.5	Right	22.2 ± 6.4	19.2 ± 5.4	< 0.001
		Left	23.4 ± 6.9	19.1 ± 7.8	< 0.001
	1	Right	20.2 ± 7.4	16.4 ± 4.6	0.012
		Left	20.8 ± 5.9	17.2 ± 4.2	0.004
	2	Right	20.4 ± 8.4	16.8 ± 4.1	0.024
		Left	20.9 ± 7.2	15.6 ± 3.9	0.006
	4	Right	26.2 ± 9.3	16.9 ± 4	< 0.001
		Left	29.2 ± 11.4	18.8 ± 4.8	< 0.001
	6	Right	31.8 ± 11.1	23.0 ± 7.6	< 0.001
		Left	33.8 ± 12.4	24.2 ± 8	< 0.001
Bone conduction (dB)	0.5	Right	14.8 ± 5.7	14.2 ± 4.1	0.468
		Left	14.9 ± 6.8	13.6 ± 4.8	0.384
	1	Right	14.1 ± 5.8	13.8 ± 4.2	0.592
		Left	13.6 ± 8.1	13.1 ± 3.8	0.284
	2	Right	13.8 ± 7.2	12.6 ± 4.6	0.146
		Left	14.8 ± 7.8	13.1 ± 3.9	0.124
	4	Right	16.9 ± 8.4	15.9 ± 4.2	0.094
		Left	18.6 ± 9.6	13.2 ± 3.8	0.006
Air-bone gap (dB)	0.5	Right	8.6 ± 5.2	4.4 ± 3.8	< 0.001
		Left	8.4 ± 5.1	5.2 ± 3.9	< 0.001
	1	Right	7.4 ± 4.8	5.1 ± 4.0	0.042
		Left	7.4 ± 4.4	5.2 ± 4.1	0.032
	2	Right	7.6 ± 5.4	4.1 ± 3.8	0.224
		Left	7.2 ± 4.8	6.5 ± 4.1	0.246
	4	Right	8.8 ± 5.9	5.2 ± 4.4	< 0.001
		Left	11.8 ± 6.4	6.2 ± 4.2	< 0.001

Table 2. Comparison of tympanometry test and acoustic reflex positivity results.

		RA Group (n=30)		Control Group (n=30)	
		Right*	Left**	Right*	Left**
Tympanometry (%)	Type A	64.5	59.9	70	65
	Type As	3.5	0	4	0
	Type Ad	32	38.1	26	35
	Type B	0	2.0	0	0
	Type C	0	0	0	0
	Type D	0	0	0	0
Acoustic reflex positivity (%)		100	100	100	100

*: for the right ear p=0,72, **: for the left ear p=0,64

In the transient OAE test, 3 (10%) patients were in the RA and 2 (6.6%) patients in the control group (p=0.064).

Discussion

Rheumatoid arthritis has been shown to cause both SNHL and conductive hearing loss in patients. In this study, it was shown that conductive hearing loss was significantly more common in patients with RA, whereas bone conduction was affected especially at high frequencies and partially, whereas stapes reflex, compliance and pressure values were not significantly affected.

The prevalence of conductive hearing loss is reported to be between 0.0-17.4%.^[7,8] Conductive hearing loss in RA may be due to impaired movement of the middle ear or deterioration of the ossicles. Colletti et al reported that conductive hearing loss was caused by movement disorder in the ossicular system.^[7] Reiter et al reported loss of conductive hearing loss of 0.25 to 0.5 kHz in patients with RA (30-35 dB).^[9] The idea that RA may affect the joints of the ossicles was found logical and pathological evidence has been demonstrated by Gussen.^[10] It has been suggested that incudostapedial and incudomalleolar joints are replaced by cellular collagenous tissue. Copeman et al reported that conductive hearing loss was associated with disease activity and used the term osteoarthritis.^[11]

Elwany et al observed movement disorder in the ossicular system in 56% of the ears of 68 patients with RA.^[8] In this study, conductive hearing loss was detected in 1 (1.5%) patient. The prevalence of sensorineural hearing loss in RA is reported to be between 0% and 60%. It has been report

ed that sensorineural hearing loss is due to cochlear changes.^[7,9] The finding of the retrocochlear effect of RA was not detected by the majority of the authors, but Magaro found this effect.^[12] Kakani et al found mixed type 4 hearing loss in RA patients.^[13] Salvinelli et al reported that conductive type and sensorineural hearing loss would be seen in patients with RA.^[14] Heyworth et al found a sensorineural hearing loss in 36.4 % of patients with RA; They did not find any evidence that RA affected the ossicular chain.^[15] RA was hypothetically thought to cause sensorineural or labyrinthine dysfunction by arthritis or neuropathy. Callejo et al detected a hearing loss in 42.7% of the patients with RA.^[16] Sensorineural hearing loss was detected in 38.6% of these patients. Ozturk et al detected sensorineural hearing loss, especially at high frequencies, in RA patients.^[17] Baradaranfar et al. stated that hearing loss at 8000 Hz was sensorineural and loss of acoustic reflex was due to the involvement of the middle ear.^[18] Similar to the literature, our study also showed that conductive type hearing loss was significantly higher in our RA patients and that bone conduction was affected particularly at high frequencies and partially, and as a result both conductive and SNHL were observed. Similar to the literature, in our study; airway hearing thresholds in RA patients were significantly higher in all frequencies than in the control group. Bone pathway hearing thresholds were generally higher than the control group but were not statistically significant.

In their study, in patients with RA without conductive hearing loss, Moffat et al analyzed oto-admittance using tympanograms, and a marked notch at 660 Hz in 38% of

the ears of RA patients, and only in 8% of the ears in the control group.^[19] They associated the notched curve detected in the tympanogram with an increase in ossicular system mobility. In contrast, other authors have found a decrease in the mobility of ossicular system.^[8,9] Rosenberg et al reported that patients with RA had a similar abnormality in 42% of the ears of RA patients, and 7% of the ears in the control group.^[20] The resulting result was attributed to the inadequacy of the middle ear conduction system.^[14] In their study with multiple frequency tympanometry, Coletti et al, detected an increase in the hardness of the ossicular system in 40% of the patients with RA.^[7] This result may be due to a reduction in the mobility of one or both of the joints or the ankylosis in the ossicle chain. In their study Kakani et al^[13] found abnormal tympanograms in 10 % of the patients. All of these tympanograms have been reported to be of As type.^[8] This condition was interpreted as decreased compliance and increased stiffness of the tympanoossicular system. In our study; the results of tympanometry of RA patients did not show a significant difference in terms of compliance and pressure values from the control group. In our study, any significant intergroup difference was not detected as for measurements of acoustic reflexes.

Murdin et al found that the majority of RA patients had not undergone Transiently Evoked Otoacoustic Emission (TEOAE) examinations.^[21] They thought this might be an indicator of early asymptomatic hearing loss. Ashok et al

investigated rheumatoid factor and hearing loss, and found that 27% of the patients with rheumatoid factor positivity, had not undergone Distortion Product Otoacoustic Emission tests.^[22] Dikici et al found a significant decrease in TEOAE at 1.0 / 1.5 / 2.0 and 3.0 kHz amplitude values, and a significant increase in the ipsilateral stapes reflex at 1.0 kHz thresholds.^[23] In the present study, we could not find any significant difference between the two groups in our OAE measurements. The relatively low number of our patients, a single-centered cross-sectional design of our study, lack of long-term follow-up data, and the fact that frequencies above 6 kHz were not evaluated can be considered as limitations of this study.

Conclusions

In conclusion, this study showed that conductive hearing loss was significantly more frequent in patients with RA than in healthy individuals, whereas bone conduction was affected partially at high frequencies; whereas stapes reflex, compliance and pressure values were not significantly affected. We think it would be beneficial for clinicians following RA patients to consider possible hearing loss.

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