RESEARCH ARTICLE

The effect of active rheumatoid arthritis on hearing impairment

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Abstract

Objective: To assess hearing loss in rheumatoid arthritis (RA) patients, and to explore its association with disease attributes and activity.

Method: The cross-sectional case-control study was conducted from June to December 2022 at Al-Imamein Al-Kadhimein Hospital, Medical City, Baghdad, Iraq, and comprised rheumatoid arthritis patients and healthy controls of either gender aged 18-45 years. Data was collected using electronic instruments and a physical examination, including pure tone audiometry and tympanogram. Data was analysed using SPSS 24.

Results: Of the 90 subjects, 60(66.7%) were patients; 45(75%) female and 15(25%) males with mean age 32.9 1±7.21 years and mean body mass index 27.14±8.58kg/m^2. There were 30(33.3%) controls; 18(60%) female and 12(40%) males with mean age 30.25±5.51 years and mean body mass index 26.92±6.66kg/m^2. The control group had thresholds below 25dB for all frequencies in both ears, which were notably lower than those of the RA patients (p=0.005). The left ear showed significant variation at 2000Hz and 4000Hz, while the right ear showed substantial differences at all frequencies except 1000Hz.

Conclusion: The risk of hearing loss was found to be increased in rheumatoid arthritis patients, and it seemed to be related to illness duration.

Key Words: Audiometry, Arthritis, Rheumatoid, Electronics,

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Introduction

Rheumatoid arthritis (RA) is an autoimmune disease that affects the synovial membranes of the middle ear's diarthrodial, incudomalleolar and incudostapedial joints. When these joints are weakened, the ossicular system becomes rigid, resulting in hearing loss (HL)[1]. Small joints of the hands and feet are commonly affected first, resulting in joint pain and physical weakness[2]. Since RA is a chronic condition, it can cause various extra-articular symptoms, including HL, which leads to partial or permanent disability in most patients. RA, the most prevalent inflammatory rheumatic condition, can cause extreme joint destruction and disability. Although the role of cartilage and bone in RA is undeniable, pathogenesis is still being debated[3]. Chronic synovitis caused by RA can damage cartilage and bone, impairing joint functions. There is also evidence to support an osteitis-focussed approach, known as the inside-out model, in which inflammation and joint trauma are caused by bone tissue. Extra- or intra-articular fat tissue is another tissue implicated in cartilage and bone damage in RA[4]. The cause and occurrence of HL in RA are still being discussed, and the chronic rheumatic condition seems to leave each ear's anatomical system (external, external, and middle) potentially compromised[5].

Pure tone audiometry (PTA) is used to evaluate the hearing tone to diagnose HL. To identify HL degree in each ear, air conduction levels of 500Hz, 1000Hz and 2000Hz were employed in a study[6]. These thresholds are traditionally used to classify HL degree. Adults' hearing thresholds are about 25 decibels (dB) on average[7]. Mild hearing impairment is described as 26-40dB, moderate 41-55dB, mildly intense 56-70dB, serious 71-90dB, and profound >90dB. HL can be unilateral or bilateral, and HL patterns between the two ears can be the same or distinct. It is possible to assess whether the hearing damage is conductive or sensorineural, using methods, such as otoscopy and tympanometry, as well as masking and air conduction audiometry[8].

The current study was planned to determine if there is a probable correlation between RA and HL, and to explore HL's association with RA attributes and activity.

Patients and Methods

The cross-sectional case-control study was conducted from June to December 2022 at Al-Imamein Al-Kadhimein Hospital, Medical City, Baghdad, Iraq. After approval from the ethics review committee of the College of Medicine, Mustansiriyah University, Baghdad, the sample was raised using purposive sampling technique. Those included

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were consecutive RA patients and controls of either gender aged 18-45 years. The controls were patients diagnosed with hearing impairment but had no chronic or autoimmune disease. RA patients were diagnosed according to the American College of Rheumatology's (ACR) criteria[9].

Those excluded were patients with Meniere's condition, history of ear surgery or trauma, middle ear effusion, a hole in the tympanic membrane , other chronic illnesses, and patients aged >45 years.

Informed written consent was obtained from all the participants PTA was done using a clinical audiometer (AD-28 Interacoustic, Assens, Denmark). Calculations were done using the ascension process (Hughson-Westlake, up 5, down 10 methods)[9], and clinical evaluations were done.

Data was analysed using SPSS 24. Paired or independent sample test was used to assess the validity of differences between two contingent means. Qualitative data was subjected to chi-square test. P<0.05 was considered significant.

Results

Out of the 90 subjects, 60(66.7%) were patients; 45(75%) female and 15(25%) males with mean age 32.9 1±7.21 years and mean body mass index (BMI) 27.14±8.58kg/m^2. There were 30(33.3%) controls; 18(60%) female and 12(40%) males with mean age 30.25±5.51 years and mean BMI 26.92±6.66kg/m^2. Age and BMI were significantly different between the groups (p<0.05), while overall there were more females than males (p<0.05). Erythrocyte sedimentation rate (ESR) and anti-cyclic citrullinated peptides (anti-CCP) values were significantly higher among the patients than the controls (Table 1).

All the frequencies of the controls had a threshold <25dB

Table-1: Clinical analysis of rheumatoid arthritis (RA) patients and healthy controls.

Clinical tests	RA patients	Controls	p-value
ESR	34.08 ± 19.21	10.05 ± 4.43	< 0.00001*
Anti-CCP	25.5 ± 0.09	16.3 ± 0.08	0.0023*
RF	Negative 11 (18 %) Positive 50 (82 %)	NA	NA
CRP	Negative 49 (80 %) Positive 12 (20 %)		
Drugs			
Adalimumab	5 (8 %)	NA	NA
Etanercept	34 (55.8 %)	NA	NA
Methotrexate	12 (19.71 %)	NA	NA
No treatment	10 (16.49 %)	NA	NA

*Significant difference at a level less than 0.05
NA: non-available,
CCP: Cyclic citrullinated peptides, RF: Rheumatoid factor, CRP: C-reactive protein.

Table-1: Pure tone audiometry (PTA) comparison between rheumatoid arthritis (RA) patients and healthy controls.

Left ear Frequency (Hz)	RA patients	Controls	p-value
250	18.19 ± 8.31	13 ± 5.93	0.0220*
500	21.31 ± 6.13	14.75 ± 6.56	0.0004*
1000	17.29 ± 9.20	12 ± 6.56	0.0142*
2000	24.75 ± 8.38	15.75 ± 5.91	< 0.00001*
4000	23.60 ± 11.11	14.75 ± 4.72	0.0006*
8000	23.52 ± 14.50	13.25 ± 5.19	0.0023*
Right ear Frequency (Hz)	**RA patients**	**Controls**	**p-value**
250	20.66 ± 9.22	14.75 ± 6.58	0.0071*
500	22.54 ± 8.72	14.5 ± 6.46	0.0001*
1000	19.40 ± 9.47	15.5 ± 5.59	0.0628
2000	26.35 ± 8.84	18.25 ± 6.74	0.0003*
4000	24.40 ± 11.14	16.25 ± 6.25	0.0018*
8000	27.29 ± 16.62	14 ± 4.75	0.0018*

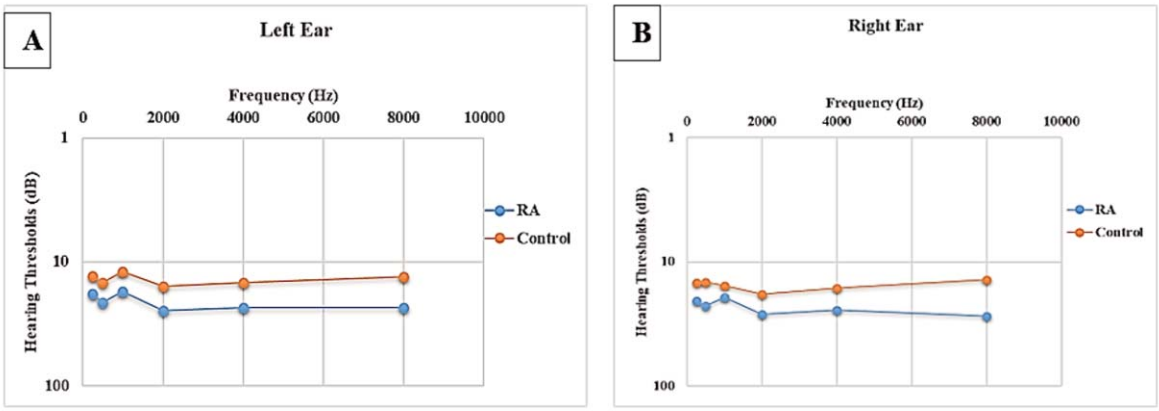

Figure: Pure tone audiometry (PTA) mean threshold values in rheumatoid arthritis (RA) patients and healthy controls.

for both ears which were significantly lower than the corresponding values for the RA patients (Table 2).

There was a significant difference between the groups for the left ear at 2000Hz and 4000Hz, while for the right ear, there was a highly significant difference between the groups at all frequencies except 1000Hz (Figure 1).

Discussion

The current study showed significantly higher ESR and anti-CCP values than the controls. This is obvious because RA disease causes an increase in ESR and anti-CCP levels due to an inflammatory response that increases white blood cells (WBCs). Mohammed et al.[10] discovered an essential association between increased ESR and increased hearing threshold in the RA group.

Dikici O et al.[11] and Takatsu M et al.[12] discovered a correlation between a rise in ESR and disease length and a correlation between platelet count and hearing threshold. Elevated ESR levels and rheumatoid nodules in many participants indicated disease activity.[13].

Most of the RA patients in the current study had a sensorineural HL (SNHL). This finding agreed with Arslan et al. who reported that 72% of their patients diagnosed had a mild degree of SNHL in the RA group[13].

HL pathophysiology in RA patients remains unknown. While retro-cochlear involvement has been confirmed, the majority of the literature indicates that the cause is cochlear pathology, and the inner ear's function is altered by vasculitis, neuritis, and ototoxic medications used in care.[14].

Numerous researchers have hypothesised that SNHL was associated with rheumatoid nodules, active illness, disease level, rheumatoid factor (RF), and anti-CCP. [12,15,16]. The pharmacological impact of RA therapy with a corticosteroid against a common disease-modifying antirheumatic medication, such as methotrexate, hydroxychloroquine, sulfasalazine, azathioprine, or cyclosporine, and a biological disease-modifying antirheumatic medication reported introducing particular HL-related consequences. Furthermore, the prevalence of amyloid accumulation in patients with long-term RA is a less severe complication[17]. Other measurements of auditory function in older people, such as hearing for high frequencies and success on dichotic listening tasks, have also been shown to be gender-dependent. Men are confirmed to have a higher prevalence of high-frequency peripheral HL than women, even after adjusting for sensitivity to occupational noise.[1819]. Men's hearing levels drop more than twice as quickly as women's at most frequencies[20]. Similarly, older men do not perform as well as older women on dichotic hearing tasks, which may reflect differences in degenerative changes to the central auditory pathways.

The PTA thresholds showed a significantly worse value than the controls for both ears in the current study. This is due to the prevalence of middle ear subclinical lesions [15,21]. The low threshold was noticed at 1000Hz for both ears, especially on the right. Other investigators also reported low frequency in air conduction threshold at lower frequencies to suggest subclinical middle ear involvement[21–23]. A study by Baradaranfar et al. 2010[24] found a considerable variation in hearing levels at 8000Hz between RA patients and controls, and it asserted that the trigger was cochlear injury. They claimed that the most probable reason for conductive hearing loss is laxity of middle ear transducer mechanism, which is caused by synovial joints between middle ear ossicles element. A multi-type hearing loss was also indicative of multifocal involvement of the auditory system in RA. Findings from Baradaranfar et al. 2010 research on the correlation between RA and hearing loss indicate that RA patients have considerably lower hearing thresholds, particularly at high frequencies (8000 Hz), and that RA also affects the middle ear (absent reflex).

Limitation: The current study has limitations as the sample size was not calculated which could have affected the power of the study.

Conclusion

RA females were more influenced by HL than males. RA caused deformation in the hearing frequency of the ear canal. The duration of RA increased HL degree. Early diagnosis of hearing damage and an effective recovery strategy are essential to improve a patient's quality of life.

Disclaimer: None.

Conflict of Interest: None.

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