

Original Research Article

Prevalence of hearing loss due to ossicular chain involvement in rheumatoid arthritis

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ABSTRACT

Background: Rheumatoid Arthritis (RA) is a chronic multisystem disease commonly affecting the synovial joints. Involvement of middle ear ossicular chain in RA may lead to hearing loss. The effects of hearing loss are profound, with consequences in the social, functional, and psychological well-being of the persons affected. Both conductive and sensorineural types of hearing impairments have been found in these patients in various studies. This study aimed at evaluating the prevalence of hearing impairment in our patients.

Methods: Pure tone and impedance audiograms were taken for 100 RA patients who came to the outpatient department. They were divided into three groups based on their disease activity (DAS28). The hearing thresholds were compared among these groups. Tympanographic features and acoustic reflexes were recorded. Disease duration was also taken into account for assessing the severity of hearing impairment.

Results: Out of 100 patients, 52 patients had significant hearing impairment audiometrically, of which 44 had sensorineural, 1 conductive and 7 mixed impairments. No significant difference was found between the hearing thresholds and the disease activity but those with high disease activity had higher incidence of abnormal tympanograms (72.2%) and absence of acoustic reflex (55.5%). Prevalence of hearing impairment was found to be increased with increasing disease duration, with steep rise between 5 and 10 years of disease duration.

Conclusions: Hearing impairment affects the quality of life adversely. Severity of hearing impairment is significantly associated with having a hearing-related handicap and with self-reported communication difficulties. Thus, hearing assessment if done routinely can improve the outcome in these patients.

Keywords: Disease activity, Hearing loss, Ossicular chain, Rheumatoid arthritis

INTRODUCTION

Rheumatoid arthritis (RA) is a chronic inflammatory disease that affects 1% of the worldwide population.¹ RA leads to the destruction of the cartilage and bone due to chronic synovitis and may consequently impair joint function.

In addition, patients with RA may have involvement of other organ systems such as skin, eyes, heart, lung, and auditory system alterations.²

With respect to the auditory system, previous studies have shown conflicting findings, in both hearing loss (HL) and the RA disease activity and severity. There is a wide variation in the reported prevalence of HL in patients with RA. Sensorineural, conductive and mixed impairments were reported.

Ferrara et al, described a transmissive hypoacusia in the first stages of the disease, while sensorineural or mixed-type hypoacusia were observed later. Research studies have been undertaken to discover the existence of typical

inflammatory alterations in the middle ear joints and their relationships with functional audiological alterations. The incudo-malleolar and incudo-stapedial joints are diarthroses, the former between the malleus' head and incus is a 'saddle' joint and the latter between the long process of the incus and the head of the stapes is an anarthrosis.³

Raut et al, showed a significant hearing impairment at 500Hz, 1.0kHz, and 2.0kHz in patients with RA.⁴ Sensorineural hearing loss of the cochlear variety is a common finding in patients with RA, whereas conductive loss, although seen, is much less common. Increased laxity of the middle ear transducer mechanism is the likely cause of the conductive element.

Ozcan et al, documented 35.1% sensorineural (SNHL), 24.3% conductive loss and 10.8% mixed type of hearing loss in RA.⁵ The SN hearing loss is probably cochlear in origin, and the conductive hearing loss is due to discontinuity of the ossicles rather than stiffness.

Cumulative disease activity measured as DAS28 score was found to be a predictor of hearing impairment in RA by Pascual-Ramos et al.⁶ Reiter et al, found 59% prevalence of abnormal tympanographic patterns as characterised by notched shapes at 660-Hz and convergence at negative pressure in 226-Hz and 660-Hz tympanograms.⁷ Pure tone audiometry and acoustic reflex were used to rule out middle ear disorders not dependent on RA. This study was done to analyse the prevalence of hearing loss among rheumatoid arthritis patients.

METHODS

We performed a cross sectional study of 100 patients who came to the outpatient facility of Department of Rheumatology, Government Kilpauk Medical College from June 2018 to August 2018. The patients were diagnosed using 2010 ACR/EULAR classification criteria for RA. The sample consisted of 81 women and 19men with a mean age of 47 years (range 25-59 years). Inclusion criteria were patients aged between 20 and 59 years and having disease duration of 6 months to 20 years with intact tympanic membranes without any history of pre-existing ear disease, barotrauma, ear trauma, brain trauma, acoustic trauma, and chronic exposure to intense noise.

Disease activity was measured as Disease Activity Score 28 ($DAS28 = 0.56 \times \text{square root (tender joints)} + 0.28 \times \text{square root (swollen joints)} + 0.78 \times \log_e (ESR) + 0.014 \text{ (global activity score)}$) for all the patients and they were grouped as low (≤ 3.2), moderate ($>3.2 \text{ but } \leq 5.1$) and high (>5.1) depending on the scores.

All patients were subjected to audiological evaluation with pure tone audiometry, which was carried out in noise-proof cabins, with AC 40 model clinical audiometer and TDH 39 Mx-41/AR standard earphones

by the same audiologist. Air conduction (AC) hearing thresholds were measured at 250Hz to 8kHz frequencies, and bone conduction (BC) hearing thresholds at 500 to 4000Hz frequencies. Air bone gap (ABG) values, which are the difference in thresholds of AC and BC thresholds at 500 to 4000Hz frequencies, were obtained. Impedance audiometry was performed for each tested ear at 226Hz frequency using Az-26 clinical impedance device and classified according to Jerger's types (A, As, Ad, B, C). The auditory threshold of both air conduction and bone conduction were compared among groups with differing disease activities and also with disease duration.

The collected data was entered in MS-Excel and statistical analysis was performed using SPSS20 package.

RESULTS

On the basis of disease activity score, our patients were divided into 3 groups: Group A containing 35 patients with low disease activity, Group B containing 47 patients with moderate disease activity and Group C containing 18 patients with high disease activity.

While analysing the audiometric results, we observed that 44 (44%) patients developed sensorineural hearing loss, 7 (7%) patients with mixed hearing loss and one (1%) patient with conductive hearing loss. Group A had mean air conduction thresholds between 26.47dB and 33.82dB with poorest threshold at 4000Hz, and mean bone conduction threshold between 19.14dB and 22.57dB with poorest threshold at 2000Hz. Group B had mean air conduction thresholds between 27.39dB and 35.32dB with poorest at 4000Hz, and mean bone conduction thresholds between 19.14dB and 21.7dB with poorest at 4000Hz. Group C had mean air conduction thresholds between 27.35dB and 33.82dB with poorest at 2000Hz, and mean bone conduction thresholds between 21.11dB and 23.61dB with poorest at 2000Hz (Figure 1 and Figure 2).

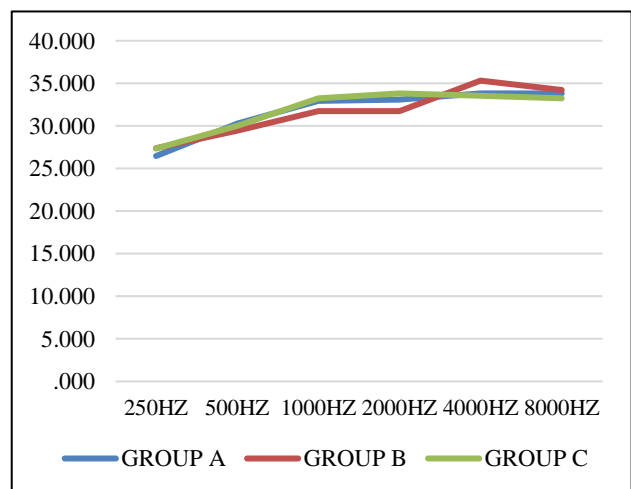


Figure 1: Air conduction thresholds of patients measured by pure tone audiometry.

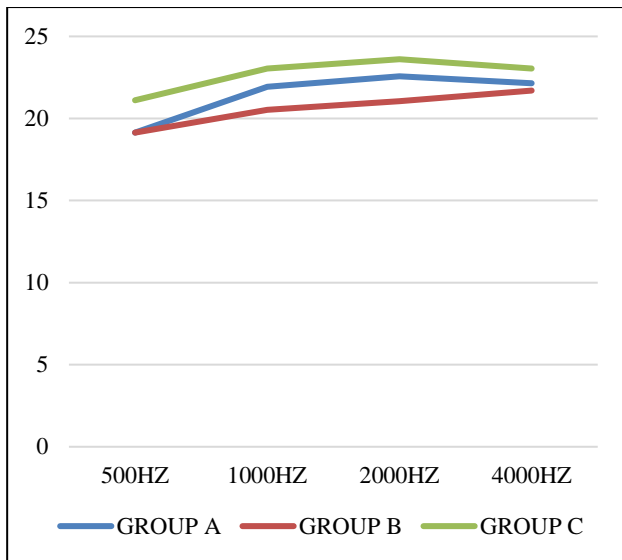


Figure 2: Bone conduction thresholds of patients measured by pure tone audiometry.

There was statistically no significant difference among the groups with different disease activities in terms of both air conduction and bone conduction thresholds. Tympanometry revealed abnormal audiograms in 101 (50.5%) out of 200 ears tested. Group A had 31 (44.28%), Group B had 44 (46.8%) and Group C had 26 (72.22%) abnormal tympanograms. Thus, patients with high disease activity were found to have increased incidence of abnormal tympanograms. Acoustic reflex was absent in 83 (41.5%) among 200 ears tested, of which Group A, B, C had 20 (28.57%), 43 (45.74%), 20 (55.55%) respectively (Table 1).

Disease duration has been found positively correlated with the prevalence of hearing loss from Table 2. The risk seems increase greatly between 5 years and 10 years of disease duration (from 32.2% in less than 5 years duration to 77.4% between 5- and 10-years duration). The incidence of abnormal tympanograms and absence of acoustic reflex also increases with increasing duration of the disease.

Table 1: Relationship between DAS28 and hearing impairment.

Group (based on DAS28)	Mean age	Sex M+F	Conductive hearing loss	Sensori neural hearing loss	Mixed	Tympanometry (no. of ears)	Absent acoustic reflex (no. of ears)
A(n=35)	47.7	9+26	Nil	17(48.5%)	3(8.6%)	31(44.2%)	20(28.5%)
B(n=47)	45.4	6+41	1(2.1%)	18(38.2%)	3(6.3%)	44(46.8%)	43(45.7%)
C(n=18)	47.2	4+14	Nil	9(50%)	1(5.5%)	26(72.2%)	20(55.5%)

Table 2: Relationship between disease duration and hearing impairment.

Disease duration	Conductive hearing loss	Sensorineural hearing loss	Mixed hearing loss	Abnormal tympanograms (no. of ears)	Absent acoustic reflex (no. of ears)
6months to 59 months (n=59)	1 (1.69%)	18 (30.5%)	Nil	48 (40.67%)	35 (29.66%)
60 months to 119 months (n=31)	nil	20 (64.5%)	4 (12.9%)	36 (58.06%)	30 (48.38%)
120 months to 240 months (n=10)	nil	6 (60%)	3 (30%)	17 (85%)	18 (90%)
Total	1	44	7	101	83

DISCUSSION

Out of 100 patients taken in our study, 81 were women and 19 were men with female to male ratio of 4.26:1, which coincides with the female to male ratio of RA among the general population.⁸ But the prevalence of hearing loss seems to be almost equal among both men and women in our study. Hearing thresholds of both the sexes were found to have significant differences.

In this study, it was found that DAS28 score does not have significant association with hearing impairment though there was higher incidence of abnormal

tympanograms and absence of acoustic reflex in those with high scores. Thus, cumulative disease activity over the duration of disease, showing the amount of insult to the middle ear joints may predict the hearing impairment.

Ossicular chain (malleus, incus, stapes and its articulations) is the seat of inflammation in RA, characterised by infiltration of mononuclear cells and are associated with increased stiffness and laxity of the middle ear system.⁹ Vasculitis may lead to necrosis of long process of incus and thus ossicular discontinuity.¹⁰ This study also found this as the reason for the abnormal tympanographic features associated with increasing

activity of the disease as measured by DAS28. Thus, the disease activity if kept in low levels with proper medications can improve the overall outcome in these patients.

This study revealed an increased number of patients with absence of acoustic reflex in the group with high disease activity. The increased rate of SNHL observed in patients with RA is because these changes affect the protective mechanism of the middle ear such as acoustic reflex. The anomalous compressive effect exercised on labyrinthine fluids by the stiffened ossicular chain, combined with the chemical damage because of the inflammatory mediators produced by inflamed stapedio-ovalar articulation.¹¹

Takatsu et al, showed that IL-6 and matrix metalloproteinase-3 may harm inner ear cells by an oxidative process, whereas MMP-3, RF and anti-ccp antibody are not significant in pathogenesis of SNHL.¹² Our study has found no difference in incidence of hearing impairment with regarding to RF and anti-ccp status of the patients with RA.

Ozturk et al, attributed hearing loss in RA to neuritis, vasculitis, ototoxicity of medication used for the rheumatoid arthritis and the duration of the disease.¹³ This study has a limitation that we didn't take into account the medications taken by the patient. Authors also didn't take into account the co morbidities like hypertension, diabetes, and chronic kidney disease, which are also associated with hearing impairment.

In this study, there was a definite increase in number of patients with hearing impairment after 5 years of duration of disease. Thus, it may be the ideal time for screening to reduce the impact of hearing impairment in patients with RA.

CONCLUSION

Most patients do not complain hearing impairment until it is profound when it affects their occupation or quality of life. Early detection and prompt treatment of Rheumatoid arthritis can prevent hearing loss in most patients as the incidence of hearing impairment is low in earlier phase of the disease. Adequate control over the disease activity by giving effective drugs in adequate dosage is essential for reducing damage to middle ear ossicles. Audiometric investigations can detect hearing loss in subclinical stages and thus have the potential to be used as screening tests.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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