



## PREVALENCE AND PATTERN OF HEARING LOSS AMONG PATIENTS WITH ANKYLOSING SPONDYLITIS: A CROSS-SECTIONAL STUDY

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### ABSTRACT

**Background:** Ankylosing spondylitis (AS) is a chronic inflammatory disease of the axial skeleton that can also involve extra-articular structures. Chronic inflammation, ossicular fixation, and immune-mediated inner ear injury have all been proposed as mechanisms by which AS may affect hearing, yet audiological involvement often remains subclinical and under-recognised.

**Objective:** To determine the prevalence, type, and severity of hearing loss among patients with ankylosing spondylitis and to study its distribution with respect to age, sex, and disease duration.

**Methods:** This cross-sectional study was conducted over one year (June 2021 to May 2022) in the Departments of Rheumatology and Otorhinolaryngology and Head-Neck Surgery of a tertiary care institute. A hundred clinically or radiologically confirmed cases of AS, aged 20 to 60 years, were enrolled after excluding patients with congenital hearing loss, anatomical head-and-neck abnormality, middle-ear disease or surgery, ototoxic drug or radiation exposure, and diabetes mellitus. All patients underwent detailed history taking, otoscopic examination, pure tone audiometry, and tympanometry.

**Results:** Hearing loss was detected in 43 of 100 patients (43%), comprising 36 of 89 males (40.4%) and 7 of 11 females (63.6%). Sensorineural hearing loss (SNHL) was the predominant type, affecting the majority of involved ears, followed by conductive hearing loss (CHL) and a small proportion of mixed loss. Bilateral involvement (24 patients) was more common than unilateral involvement (19 patients). Hearing loss was mild in the majority of affected patients (34/43), moderate in 7, and severe in 2. Both the prevalence and severity of hearing loss increased with advancing age and with longer duration of AS. Only 29 of the 43 patients with audiometrically confirmed hearing loss reported subjective hearing symptoms.

**Conclusion:** Nearly half of the patients with ankylosing spondylitis in this cohort had audiometrically detectable hearing loss, predominantly sensorineural, mild in degree, and frequently asymptomatic. These findings support routine audiological screening in patients with AS, particularly those with longer disease duration, to enable early detection and management.

**KEYWORDS:** Ankylosing Spondylitis, Hearing Loss, Sensorineural Hearing Loss, Audiometry, Extra-articular Manifestation.

## Introduction

Ankylosing spondylitis (AS) is a chronic inflammatory disease of the axial skeleton characterised by inflammatory back pain, progressive spinal stiffness, and involvement of the sacroiliac joints[1]. Beyond the musculoskeletal system, AS is associated with a range of extra-articular manifestations, including inflammatory bowel disease, acute anterior uveitis, psoriasis, and cardiovascular and pulmonary involvement[1,2]. The disease predominantly affects men, with most patients developing symptoms before the fourth decade of life[3].

The pathogenesis of AS centres on enthesitis, driven by chronic inflammation involving CD4<sup>+</sup> and CD8<sup>+</sup> T lymphocytes and macrophages, with cytokines such as tumour necrosis factor- $\alpha$  and transforming growth factor- $\beta$  mediating inflammation, fibrosis, and subsequent ossification at sites of tendon and ligament insertion[4]. Because these fibro-inflammatory processes are not confined to the axial skeleton, interest has grown in whether AS can similarly affect the auditory apparatus. Conductive hearing loss (CHL) has been postulated to result from ossicular fixation secondary to enthesitis or joint involvement of middle-ear structures, while sensorineural hearing loss (SNHL) has been attributed to immune-mediated inner ear injury or, alternatively, to ototoxicity of medications used in AS management[5,6].

Several case-control and cross-sectional studies over the past two decades have examined the audiovestibular profile of patients with AS, with many reporting a higher prevalence of SNHL compared with healthy controls[6-11]. However, the reported prevalence and pattern of hearing involvement vary considerably across these studies, and at least one large series has instead found conductive hearing loss to predominate [13]. Hearing loss in AS also frequently remains subclinical, detected only through audiometric screening in the absence of overt otological complaints[13]. Given this potential for silent progression and its implications for quality of life, systematic audiological evaluation of patients with AS may allow earlier identification and timely intervention.

The present study was undertaken to determine the prevalence, type, and severity of hearing loss among patients with ankylosing spondylitis attending a tertiary care institute, and to characterise its distribution with respect to age, sex, and duration of disease.

## Materials and Methods

This cross-sectional study was conducted jointly in the Departments of Rheumatology and Otorhinolaryngology

and Head-Neck Surgery of a tertiary care postgraduate institute over a period of one year, from June 2021 to May 2022, after approval from the institutional ethics committee. Written informed consent was obtained from all participants, and the study conformed to the principles of the Declaration of Helsinki.

A total of 100 clinically or radiologically confirmed cases of ankylosing spondylitis, of either sex and any ethnicity, aged between 20 and 60 years, attending the outpatient departments of Rheumatology and Otorhinolaryngology, were enrolled. Patients with congenital hearing loss, anatomical abnormality of the head and neck, known middle-ear disease or prior otologic surgery, exposure to radiation or ototoxic drugs, or diabetes mellitus were excluded.

Following enrolment, a detailed history was taken covering age, onset and duration of AS, and associated audiological or vestibular symptoms. All patients underwent otoscopic examination followed by pure tone audiometry (PTA) and tympanometry. Hearing loss was defined as a pure-tone threshold greater than 20 dB at two or more frequencies (0.25, 0.5, 1, 2, 4, and 8 kHz). Severity was graded as mild (25-40 dB), moderate (40-55 dB), moderately severe (55-70 dB), severe (70-90 dB), and profound (>90 dB), in line with standard audiometric convention[14,15]. Relevant autoimmune and inflammatory markers (complete blood count, erythrocyte sedimentation rate, anti-double-stranded DNA) were reviewed to exclude coexisting autoimmune disease.

Data were tabulated and summarised using descriptive statistics, and results were expressed as frequencies and percentages, with comparison against previously published literature.

## Results

Of the 100 patients with ankylosing spondylitis enrolled, 89 were male and 11 were female. The mean age of the study population was 46.64 years, and the mean duration since diagnosis of AS was 6.38 years.

Patients were distributed across four age groups: 20-29 years (7 patients), 30-39 years (18 patients), 40-49 years (22 patients), and 50-59 years (53 patients). Hearing loss was present in 43 patients overall, and its frequency rose with advancing age: 1 of 7 patients in the 20-29 year group, 6 of 18 in the 30-39 year group, 14 of 22 in the 40-49 year group, and 22 of 53 in the 50-59 year group (Table 1).

Among the 89 male patients, 36 (40.4%) had hearing loss, while among the 11 female patients, 7 (63.6%) had hearing loss. Of the 43 patients with hearing loss overall, 36 (84%) were male and 7 (16%) were female (Table 2).

**Table 1: Age distribution of the study population and of patients with hearing loss**

| Age group (years) | Total patients | Patients with hearing loss |
|-------------------|----------------|----------------------------|
| 20-29             | 7              | 1                          |
| 30-39             | 18             | 6                          |
| 40-49             | 22             | 14                         |
| 50-59             | 53             | 22                         |
| Total             | 100            | 43                         |

**Table 2: Sex distribution of patients with and without hearing loss**

| Sex    | Total patients | Patients with hearing loss |
|--------|----------------|----------------------------|
| Male   | 89             | 36                         |
| Female | 11             | 7                          |
| Total  | 100            | 43                         |

**Table 3: Distribution of hearing loss by duration of ankylosing spondylitis**

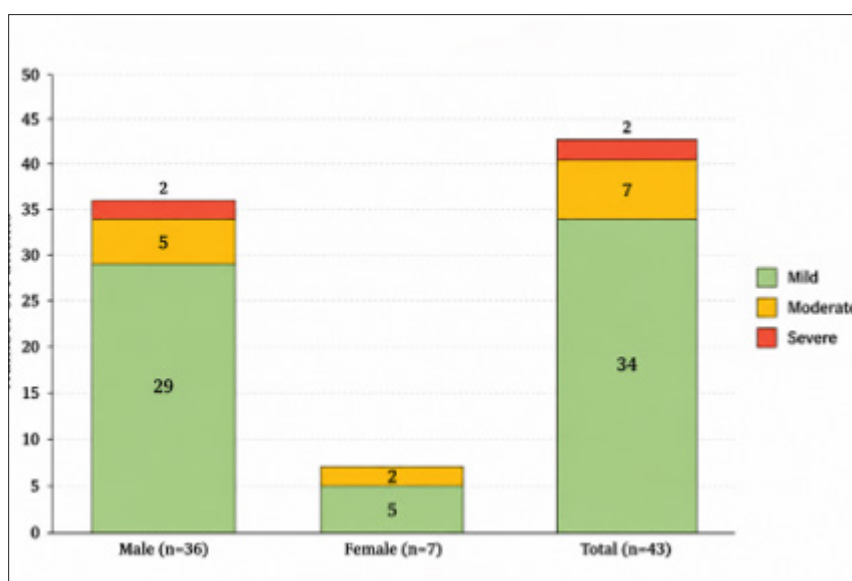
| Duration of AS (years) | Total patients | Patients with hearing loss | Mild | Moderate | Severe |
|------------------------|----------------|----------------------------|------|----------|--------|
| 1-5                    | 53             | 19                         | 15   | 0        | 0      |
| 6-10                   | 29             | 14                         | 13   | 1        | 0      |
| 10-15                  | 11             | 5                          | 4    | 3        | 0      |
| 15-20                  | 6              | 4                          | 2    | 2        | 1      |
| >20                    | 1              | 1                          | 0    | 0        | 1      |

**Table 4: Type of hearing loss by ear**

| Ear   | Conductive (CHL) | Sensorineural (SNHL) | Mixed |
|-------|------------------|----------------------|-------|
| Right | 6                | 28                   | 1     |
| Left  | 7                | 24                   | 1     |

Patients were grouped by duration since diagnosis of AS: 1-5 years (53 patients), 6-10 years (29 patients), 10-15 years (11 patients), 15-20 years (6 patients), and more than 20 years (1 patient). The proportion of patients with hearing loss increased with disease duration, and, among the subset

with hearing loss, severity also tended to increase with longer duration of illness, with mild loss predominating in the shorter-duration groups and moderate-to-severe loss appearing more frequently among patients with disease duration beyond 10 years (Table 3).

**Figure 1. Severity of hearing loss among affected patients**

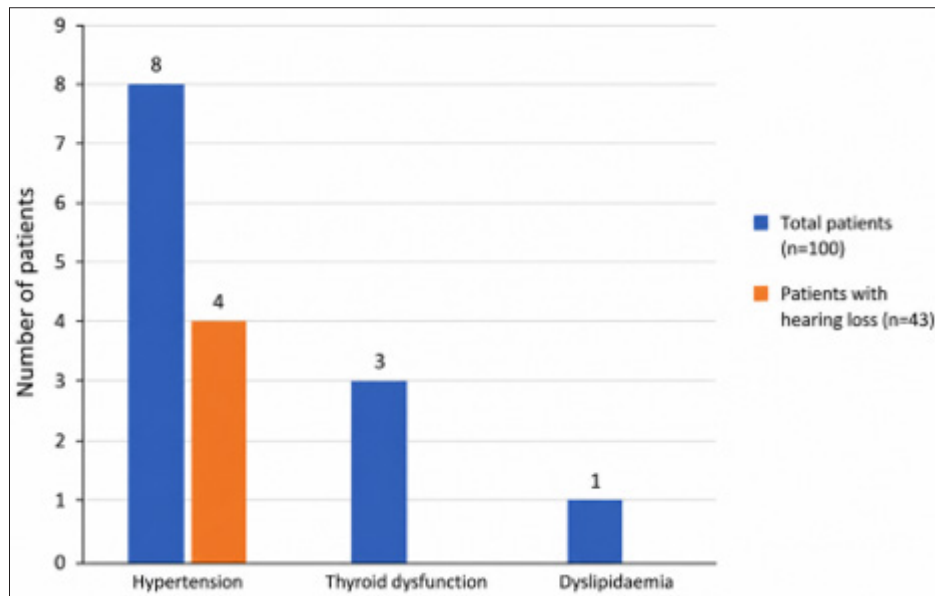


**Figure 2. Severity of hearing loss patients with comorbidities**

Among the 43 patients with hearing loss, 24 had bilateral involvement and 19 had unilateral involvement (11 right ear, 8 left ear). Analysed by ear (86 ears from 43 patients), sensorineural hearing loss (SNHL) was the predominant type, found in 28 right ears and 24 left ears, followed by conductive hearing loss (CHL) in 6 right ears and 7 left ears, with mixed hearing loss noted in 1 right and 1 left ear (Table 4).

Of the 43 patients with hearing loss, mild loss was seen in 34 patients (79%), moderate loss in 7 patients (16%), and severe loss in 2 patients (5%); no patient had profound loss. By sex, 29 of 36 affected males had mild loss, 5 moderate, and 2 severe, while among the 7 affected females, 5 had mild loss and 2 had moderate loss (Figure 1).

Tympanometry showed a normal Type A curve in 96 patients and a Type As curve, suggestive of ossicular stiffening, in 4 patients.

Comorbidities were present in 12 patients overall (hypertension in 8, thyroid dysfunction in 3, dyslipidaemia in 1); among the 43 patients with hearing loss, 4 had hypertension and the remainder had no recorded comorbidity (Figure 2).

Only 29 of the 100 patients reported subjective hearing symptoms, while 71 were asymptomatic. Notably, of the 43 patients with audiometrically confirmed hearing loss, only 29 reported symptoms, indicating that 14 patients (33% of those affected) had hearing loss that would otherwise have gone undetected without audiometric screening. Most patients (86%) were on regular medication for AS at the time of evaluation.

## Discussion

In this cross-sectional study of 100 patients with ankylosing spondylitis, audiometrically confirmed hearing loss was present in 43% of patients, predominantly sensorineural

in type and mild in severity, with a substantial proportion remaining subjectively asymptomatic. These findings are broadly consistent with, though somewhat higher in prevalence than, several previously published series.

The mean age of the study population (46.64 years) and the observation that hearing loss increased with advancing age are in keeping with earlier reports. Casellini et al. found that patients with AS had a median age of 45.5 years and noted a higher frequency of SNHL among patients aged 45 to 59 years compared with healthy controls[7]. Similarly, Amor-Dorado et al. studied a cohort with a mean age of 52.5 years at the time of assessment[11]. In contrast, Ajmani et al., studying a comparable sample size of 100 AS patients, reported a considerably younger mean age of 32 years, illustrating that the demographic profile of AS populations, and consequently the observed prevalence of hearing loss, can vary across cohorts and geographic settings[13].

The marked male predominance in this cohort (89%) is consistent with the well-recognised higher prevalence of AS in men, and mirrors the sex distribution reported by Ajmani et al., in whom 96% of patients were male[13]. Hearing loss was proportionally more frequent among the female patients in this cohort (63.6%) than among males (40.4%), although the small number of female patients limits the reliability of this comparison.

Sensorineural hearing loss was the predominant pattern observed in this study, consistent with multiple prior reports. Casellini et al. reported a significantly higher frequency of SNHL in middle-aged AS patients compared with controls[7]. Alatas et al. found SNHL in 28.6% of AS patients compared with 4.35% of age-matched controls[6]. Eryilmaz et al., in a case-control study of 59 AS patients, reported SNHL in 35.5% of patients, predominantly bilateral[10]. Dagli et al. similarly reported SNHL in 35% of AS patients in a case-control design[9]. Kahveci et

al. also demonstrated impaired cochlear function, using otoacoustic emission testing alongside pure tone audiometry, among AS patients compared with controls[16]. Amor-Dorado et al. found abnormal audiometric findings in 58% of AS patients compared with only 18% of controls, with a predominant high-frequency SNHL pattern, and additionally demonstrated a higher frequency of abnormal vestibular tests in AS patients, supporting a broader pattern of inner-ear compromise in this disease[11].

The proportion of mild hearing loss in this cohort (79% of affected patients) parallels the findings of Ajmani et al., who reported that hearing loss was mild in 38 of 48 affected patients and moderate-to-severe in the remaining 10, with higher age associated with the presence of hearing loss[13]. Notably, however, Ajmani et al. found pure conductive hearing loss in 29 of their 48 affected patients, mixed loss in 16, and pure SNHL in only 3, in contrast to the SNHL-predominant pattern observed in the present study and in most of the literature cited above; the authors themselves noted this as a departure from prior reports and attributed it, in part, to the comparatively younger age of their cohort[13]. This divergence highlights that the relative proportion of conductive versus sensorineural involvement in AS-associated hearing loss may not be uniform across populations and warrants further comparative study. The present study additionally found that both the prevalence and severity of hearing loss increased with longer duration of AS, a trend also reported by Bozkurt et al. in their evaluation of hearing loss in patients with ankylosing spondylitis[12].

A particularly notable observation in this study was the discrepancy between subjective symptoms and audiometrically detected hearing loss: only 29 of 43 affected patients (67%) reported hearing-related symptoms, leaving a third of cases that would have remained undetected without formal audiometric evaluation. This finding underscores the largely occult nature of hearing involvement in AS and reinforces the rationale for incorporating audiological screening into the routine evaluation of these patients, rather than relying on symptom-triggered referral.

The mechanisms underlying auditory involvement in AS remain incompletely understood. Proposed explanations for SNHL include immune-mediated inner ear disease, chronic microvascular inflammation affecting cochlear blood supply, and, less commonly, ototoxicity related to disease-modifying medications, while CHL has been attributed to ossicular fixation from enthesitis or joint involvement of middle-ear structures, as reviewed by Mancini et al. in the broader context of hearing loss across autoimmune rheumatic disease[4,5,17]. In the present study, most patients showed a normal Type A tympanometric curve, with only 4 patients showing a Type As pattern suggestive of ossicular stiffening, suggesting that sensorineural rather than conductive mechanisms predominate in this population, consistent with the ear-wise distribution of hearing loss

types observed.

## Limitations

This study has certain limitations. The sample size, while comparable to similar published series, remains modest for firm epidemiological conclusions. The study was conducted at a single tertiary care centre which may introduce hospital-referral bias. Consecutive rather than randomised sampling was used, raising the possibility of selection bias. Data collection also coincided in part with the COVID-19 pandemic, which may have affected patient recruitment and follow-up.

## Conclusion

Nearly half of the patients with ankylosing spondylitis in this study had audiometrically detectable hearing loss, predominantly sensorineural, mild in degree, more frequent with advancing age and longer disease duration, and often subclinical. These findings suggest that hearing impairment represents an under-recognised extra-articular manifestation of AS and support the incorporation of routine audiological screening, including pure tone audiometry, into the clinical evaluation of patients with this disease to enable earlier detection and management.

## Conflict of Interest

Authors declares that they have no conflict of interest.

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