

Research Article

Impaired Hearing at High Frequency in Patients with Ankylosing Spondylitis: A Report from Japan

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Abstract

We analyzed cases of hearing impairment in Japanese patients with ankylosing spondylitis (AS), as only two similar studies from Asia are found in the literature. Patients were diagnosed using the revised diagnostic criteria for AS as well as positive MRI findings of the sacro-iliac joints. Patients older than sixty years were excluded because of potential age-related hearing impairment. Four patients met the study criteria and were included in the analysis. Three patients were found to have high-frequency hearing impairment, presumably with cochlear dysfunction. In addition, the patients with AS are reported to have HLA B27 antigen positivity with high frequency in the European countries. Therefore, HLA B27 positivity is also studied. HLA B27 was only one patient positive. Hearing impairment in Japanese patients with AS is also frequently observed but not associated with HLA B27 positivity.

Keywords

Ankylosing Spondylitis, Impaired Hearing, Cochlear Dysfunction, HLA B27

1. Introduction

We report cases of hearing impairment in patients with ankylosing spondylitis (AS) from Japan. To date, most published reports in the literature have been from European countries, North American countries and Turkey [1-6]. And, only two reports have been published from Asia [7, 8]. One is from India and the other is from Japan. The data from these two countries suggest that the environmental and genetic factors influence hearing impairment in AS patients to some extent. Therefore, in this study we describe our findings, including the relationship of HLA B27 antigenicity with this condition.

2. Materials and Methods

Patients were diagnosed with AS according to the diagnostic criteria of the revised AS diagnosis guideline as well as positive MRI findings of the sacroiliac joints [9, 10]. HLA B27 positivity was determined by a genetic sequence-based DNA analysis [11]. Based upon the clinical determinations, patients agreed to have the HLA B 27 study as well as auditory tests. The auditory tests included standard pure tone audiometry, tympanometry, bone conductive audiometry, and cochlear function test. Patients who were more than 60 years old were excluded from the study. Because, age-related hearing

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impairment with otosclerosis of the cochlea is a common condition even in our country. In addition, patients with spondyloarthritis pustulosis palmaris et plantaris, psoriatic spondyloarthritis, juvenile spondyloarthritis, and spondyloarthritis associated with ulcerative colitis or Crohn’s disease were excluded. We obtained the permission of publication in the medical journal from each patient.

3. Results

Only four patients, who met the diagnostic criteria for AS, underwent the hearing tests and HLA B27 assessment (Table 1). None of the four patients had tympanometry abnormalities. Pure tone audiometry revealed decreased function at 2000,

4000 and 8000 Hz in three patients but not No.3 (Figures 1 and 2), and No.3 patient did show no hearing impairment (simple data shown in Table 2). In contrast, hearing function at 125, 250, 500 and 1000 Hz was approximately normal for three patients but not for patient No.1. Patient No.1 demonstrated a decreased level of bone conduction in the right ear, but that in the left ear was almost within the normal range. The results for patient No.3 did not show a decreased level of bone conduction hearing, too (Table 2). Patient No.1 also had a decreased distortion product of otoacoustic emission (DPOAE) in the right ear, whereas that in the left ear was within the normal range (Figure 3). The auditory brainstem response of No. 1 patient did not disclose a V wave at 20 dB in the right ear (Figure 4). In terms of HLA B27 positivity, patient No.1 was positive but all three other patients were negative for antigen.

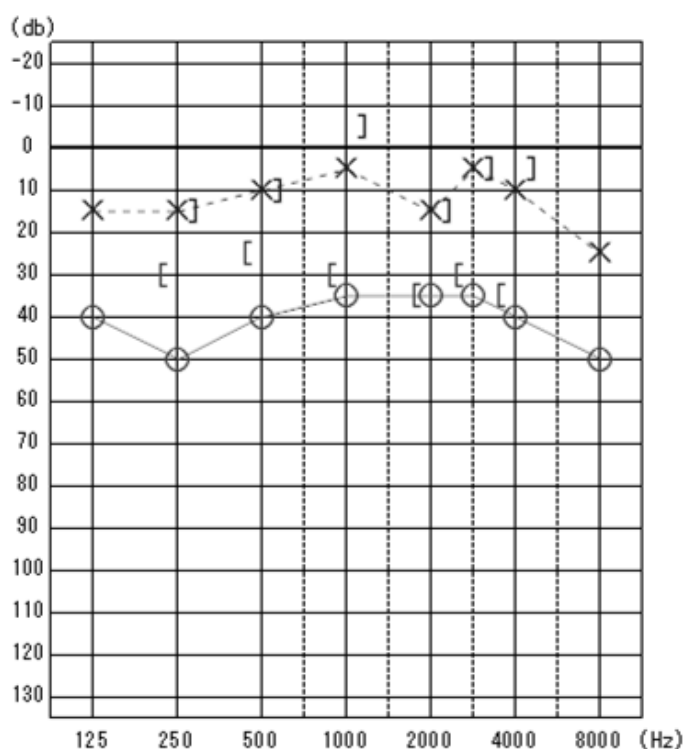


Figure 1. Pure tone audiometry results for patient No.1 who was 18 years old.

Air conduction: ○: right ear ×: left ear

Bone conduction: [: right ear]: left ear

The right ear showed decreased hearing at high frequencies (1000 to 4000Hz) in the both air and bone conduction tests. However, no abnormalities of the left ear was observed in either test.

Table 1. Clinical features. HLA B27 antigenecity. XP MRI findings of sacro-iliac joints, and treatment of each patient

Case	Onset	Initial symptoms	HLA 27	XP of sacro-iliac joints	MRI	Treatment
18 y/o male	16 y/o	lumbago	(+)	2nd degree(erosions)	A2 C0	AZF, PSL

Case	Onset	Initial symptoms	HLA 27	XP of sacro-iliac joints	MRI	Treatment
49 y/o female	20 y/o	lumbago	(-)	3rd degree(erosions, joint space widening)	A2 C2	AZF or MTX, PSL
53 y/o female	46 y/o	lumbago, PIP arthralgia	(-)	2nd degree(erosions)	A1C0	AZF
57y/o female	34y/o	lumbago, PIP arthralgia	(-)	2nd degree(erosions)	A2 C2	AZF or MTX

XP findings: depend on the modification of the New York criteria

MRI findings: depend on the EULAR recommendations for the use of imaging in the diagnosis and management of spondyloarthritis in the clinical practice

AZF: Salazosulfapyridine

MTX: Methotraxate

PSL: predonisolone

Table 2. Air and bone conduction hearing of each patient at 4000Hz.

Case	Hearing at 4000Hz		air conduction		bone conduction	
No.1	18 y/o	male	rt 40dB	lt 5db	rt 35dB	lt 5dB
No.2	49 y/o	female	rt 55dB	lt 40dB	(-)	(-)
No.3	53 y/o	female	rt 10db	lt 10dB	rt 0dB	lt 0dB
No.4	57 y/o	female	rt 20dB	lt 30dB	rt 5dB	lt 15dB

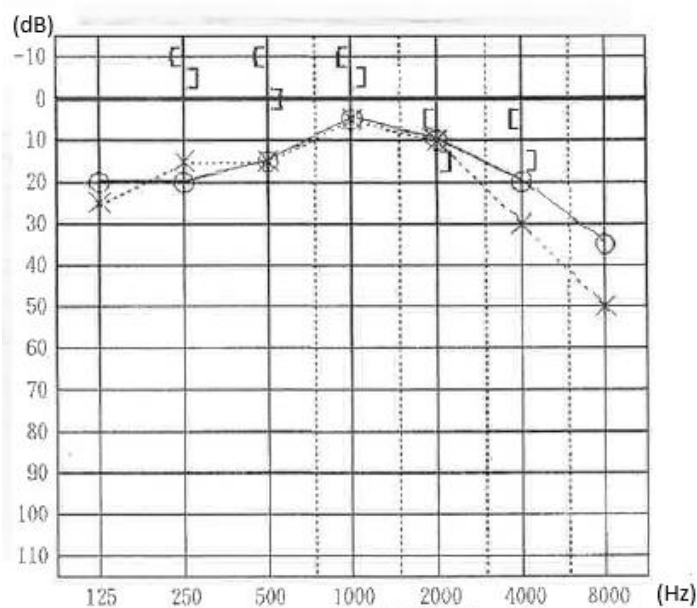


Figure 2. Pure tone audiometry results for patient No.4 who was 46 years old.

Air conduction: ○: right ear ×: left ear

Bone conduction: [: right ear]: left ear

The left ear showed decrement hearing from 4000 to 8000 Hz in the air conduction test and slightly impaired hearing at high frequency (4000 Hz) in the bone conduction test. However, the right ear showed age-appropriate hearing in the both tests.

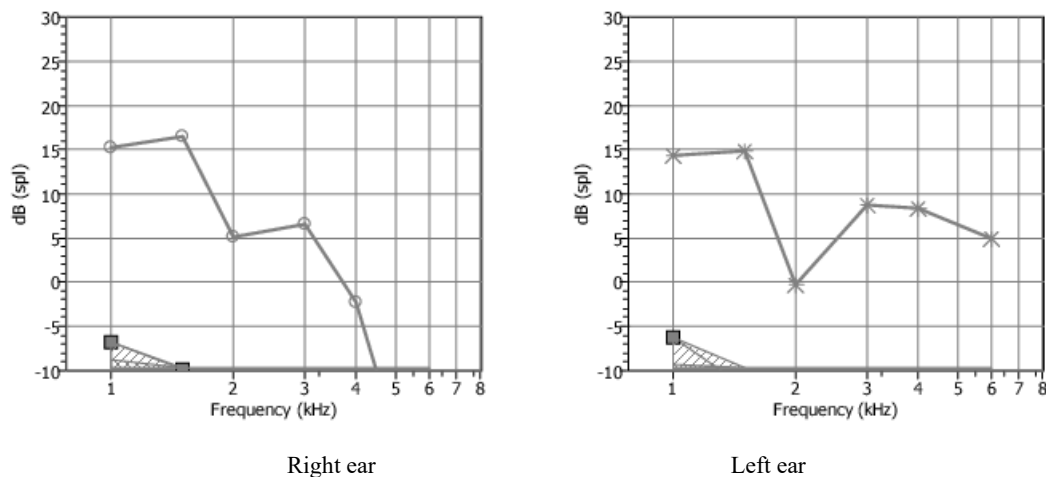


Figure 3. Distortion product of otoacoustic emission (DPOAE) test. Patient No.1 who was 18 years old.

The right ear showed a decreased in the DPOAE test at high frequencies (more than 4 kHz), whereas the DPOAE of the left ear remained within normal levels even at high frequencies.

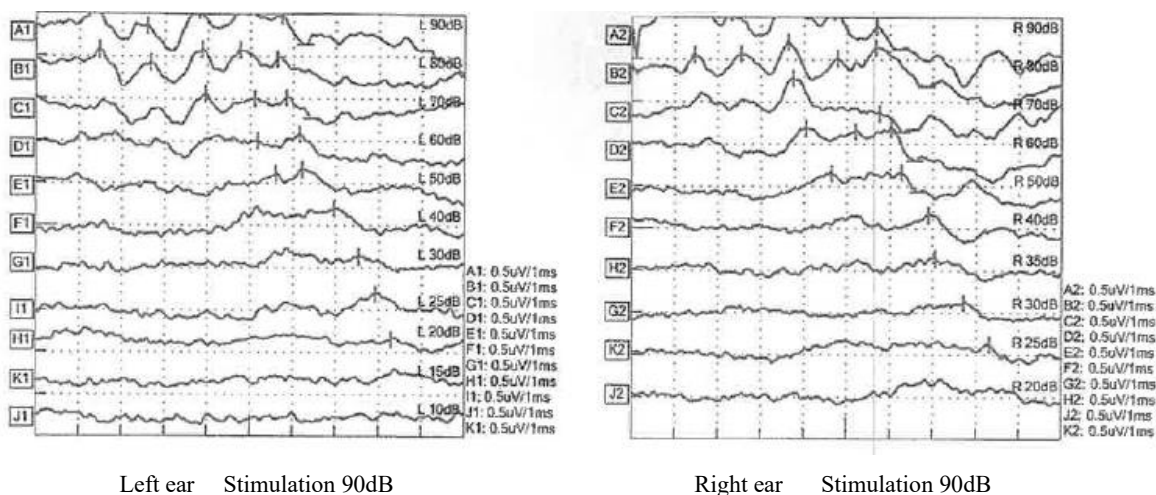


Figure 4. Auditory brain stem response for patient of No.1 who was 18 years old.

There is no evidence of a V wave at 20dB in the right ear whereas the left ear shows an apparent V wave at this intensity.

4. Discussion

Several studies investigated hearing impairment in the patients with AS [3-6]. Some studies report such a condition in otolaryngology patients, while others describe it in rheumatology patients. In the past, few articles suggested the association of arthritis of middle ear (among the joints of the malleus, incus, and stapes) with hearing impairment in AS [12, 13]. However, now-a-days this conclusion is denied with other articles. In contrast, the impaired hearing in this disease is considered to be associated with inner ear dysfunction and has been observed at high frequencies sound with cochlear dysfunction [4, 5]. Two articles suggested that hearing impairment with AS is

due to cochlear dysfunction. Amor-Dorado et al. reported that AS patients exhibit a predominance of high- frequency sensorineural hearing loss as well as head-shaking nystagmus, and concluding vestibular dysfunction [4]. Karatas D et al. reported that in bone conduction tests, the hearing level at 4000 Hz is low , and otoacoustic tests reveal approximately 20% of the patients with hearing impairment [5]. Our data suggest that impaired hearing is frequent in patients with AS, even in our country, and is observed at high audio frequencies. These results are supported with the other auditory report of Japanese general adult population from 20 to 60 years old and is described not less than 40dB [14]. Accordingly, the impairment of the patients seems to be associated with inner ear dysfunction, as shown by the results of the otoacoustic emission test and auditory brainstem response. The patients with AS are reported to HLA B27 antigen positivity about 80% in the Europe

countries [15]. Therefore, we studied HLA B27 positivity in our patients. HLA-B27 positivity was confirmed in patient No.1, but the other three patients were negative. Therefore, hearing impairment does not seem to be associated with B27 positivity in patients with AS.

Data from India study of 100 patients with AS revealed that approximately 50% of the cases had hearing impairment, among which sixty percent of cases were due to conductive hearing loss and only six cases had sensorineural hearing impairment [8]. These data differ greatly from the data of European countries and Tukey, and suggest differences in environmental and genetic factors. The report from Japan that described a young AS patient who presented with sensory neural hearing impairment and nystagmus. Otoacoustic test revealed decreased hearing ability at 4000Hz. Oral and intratympanic steroid treatment gave good response [7].

5. Conclusion

AS-related hearing impairment seems to be frequently observed in our country. In addition, it is presumed to be associated with inner ear dysfunction. Further studies are needed to clarify the pathophysiology of hearing impairment in patients with AS.

Abbreviations

AS	Ankylosing Spondylitis
DPOAE	Distortion Product of Otoacoustic Emission
Hz	Hertz
dB	Decibel

Author Contributions

Kimimasa Nakabayashi: Conceptualization, Data curation, Writing – original draft

Yasuhiro Hamanoue: Investigation

Mamiko Miyaji: Investigation

Koichiro Saito: Validation

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Raza K, Karokis D, Wilson F, et al. Sensorineural hearing loss, iritis and ankylosing spondylitis. *Brit J Rheumatol* 1998; 37: 1363.
- [2] Savasatno M, Morioni G, Bernini G, et al. Tinnitus and bilateral sensorineural hearing loss: Ankylosing spondylitis or a side-effect of sulphasalazine treatment? *Acta Oto-Laryngologica* 2005; 125: 671-673.
- [3] Adam M, Nabi Erkan A, Arslan D, et al. High-frequency sensorineural hearing loss in patients with ankylosing spondylitis: is it an extraarticular feature of the disease? *Rheumatol Int* 2008; 28: 413-417.
- [4] Amor-Dorado JC, Barreria-Fernandez MP, Vazquez-Rodriguez TR, et al. Audiovestibular manifestations in patients with ankylosing spondylitis. *Medicine* 2011; 90: 99-108.
- [5] Karatas D, Dogan J, Ekinci A, et al. Evaluation of auditory and cochlear function in ankylosing spondylitis patients according to the site of involvement. *Eur Arch Otorhinolaryngol* 2017; 274: 3875-3881.
- [6] Yan F, Reddy PD, Nguyen SA, et al. Hearing loss in patients with ankylosing spondylitis: A systematic review and meta-analysis. *J Rheumatol* 2021; 48: 40-47.
- [7] Sugawara K Hashimoto M, Hirose Y, et al. Autoimmune inner ear disease associated with ankylosing spondylitis. *Egyptian J Otolaryng* 2014; 30: 176-179.
- [8] Ajmani S, Keshri A, Srivastava R, et al. Hearing loss in ankylosing spondylitis. *Int J Rheum Dis* 2019; 22: 1202-1208.
- [9] Van der Linden S, Valkenberg HA, Cats A. Evaluation of diagnostic criteria of ankylosing spondylitis. A proposal for modification of New York criteria. *Arthritis Rheum* 1984; 27: 361-366.
- [10] Mandl P, Navarro-Compan V, Terslev L, et al. EURAR recommendation for the use of imaging in the diagnosis and management of spondyloarthritis in clinical practice. *Ann Rheum Dis* 2015; 74: 1327-1339.
- [11] Itoh Y, Mizuki N, Shimada T, et al. High-throughput DNA typing of HLA-A,-B,-C, and -DRB1 loci by a PCR-SSOP-Luminex method in the Japanese population. *Immunogenetics* 2005; 57: 717-729.
- [12] Magaro M, Ceresia G, Frustaci A. Arthritis of the middle ear in ankylosing spondylitis. *Ann Rheum Dis* 1984; 43: 658-659.
- [13] DE Miguel E, Tomas M, Benito S, et al. Ankylosing spondylitis and middle ear impairment. *Ann Rheum Dis* 1987; 46: 174.
- [14] Wasano K, Kaga K, Ogawa K. Patterns of hearing changes in women and men from denarians to nonagenarians. *The Lancet Reginal Health-Western Pacific* 2021; 9: 100131.
- [15] Rudwaleit M, van der Heijde D, Khan MA, et al. How to diagnose axial spondylitis early. *Ann Rheum Dis* 2004; 63: 535-543.