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A Comparative Study on Hearing Evaluation between Rheumatoid Arthritis Patients and Controls among Iraqis

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Abstract: Background: Rheumatoid arthritis (RA) was a prevalent chronic inflammatory illness that can cause partial hearing loss. Due to that, our study was conducted a comparative study that assess hearing impairment for patients and control groups. **Patients and methods:** Clinical outcomes were performed into patients who having hearing impairments, where it included 80 participants, which divided into two groups. Group A represented the patients' group, where participants with rheumatoid arthritis (40), and Group B, shown control group, who participants without rheumatoid arthritis (40). We were measuring hearing thresholds with ultra-high-frequency audiometry in both groups, the patients' group and the control group. Also, tympanometry, pure speech audiometry, along with otoacoustic emission measurements were all accomplished. **Results:** Clinical outcomes of hearing loss evaluation, we found atients with ages (61 - 70) years were higher with 32 cases, males were lower with 45% than females with 55%, obesity with 32 cases, rate of smokers 35%, family history of hearing loss was 30%, medications that are ototoxic was 25%, previous surgery was 60%, hypertension included 64 cases, diabetes included 32 cases, diabetes included 32 cases, chronic Kidney disease included 24 cases, symptoms found tinnitus have 11 cases, conductive hearing loss have 6 cases, and sensorineural hearing loss have 5 cases in the patient's group, and seven while tinnitus have 7 cases, conductive hearing loss have 8 cases, and sensorineural hearing loss have 9 cases in the control group. According to the hearing threshold with ultra-high-frequency audiometry, we noticed hearing started at 29.08 HZ at an intensity (8000) dB in the patients' group, while the frequency was 11.86 HZ at the intensity of 8000 and end up at a frequency of 40.49 HZ at 17938.95 intensity in the control group. **Conclusion**: Our recent investigation found that patients with rheumatoid arthritis had greater hearing impairment than the control group.

Keywords: Rheumatoid Arthritis; Hearing loss, Sensorineural hearing loss; and Tympanometry.

INTRODUCTION

Rheumatoid arthritis (RA) is a clinical entity characterized by disseminated erosive arthropathy and different systemic inflammatory manifestations [Smolen, J. S. *et al*., 2016]. Currently, autoimmune diseases are considered to have a high incidence, which is found to affect 3.5% of the world's population. CREA also points out that scientific studies worldwide show that up to 5 out of every 100 people may suffer from at least one autoimmune disease. It can be considered that today the increase in people with some kind of autoimmune disease depends on multiple factors (genetic, environmental, social, economic, etc.). [Angelotti, F. *et al*., 20017 – Gazeau, P. *et al*., 2014]

On the other hand, RA systemic lupus erythematosus (SLE) are diseases that fall into the category of inflammatory rheumatic connective tissue, mixed connective tissue, undifferentiated connective diseases, and overlapping syndromes. [Özkırış, M. *et al*., 2014]

These diseases are also included in the autoimmune inner ear disorders (AIED), which, according to Boulassel, are a heterogeneous group of diseases associated with immunoreactivity to the components of the inner ear [Colletti, V. *et al*., 1997]. Recently, these studies demonstrated that antibodies to myelin P0 and β-actin, present in the form of proteins in the serum of patients suffering from AIED, are found in abnormal markers for these proteins and can lead to a dysfunction of signals in cellular transduction and, consequently, produce complications in the vestibular auditory system [Elwany, S. *et al*., 1986 – Kakani, R. S. *et al*., 1990]. Boulassel also stated that, after this, hearing damage located in the cochlea was found, which mostly affects the high frequencies of hearing; this causes a significant correlation with sensorineural hearing loss. [Salvinelli, F. *et al*., 2006; Heyworth, T. *et al*., 1972]

The interest in sensorineural hearing loss (SNH) in autoimmune or immune-mediated diseases began with McCabe in 1979, who described the autoimmune disease of the inner ear, which has been the object of study in the last 30 years and on which several pathogenic etiopathogenic hypotheses have been developed and immunological tests related to the disease itself have been sought. [García Callejo, F. J. *et al*., 2007; Treviño-González, J. L. *et al*., 2015]

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RA, SLE, and SS are immune-mediated diseases that present with hearing loss in a variable percentage, mostly of a sensorineural type, although transmission (HT) and mixed (HM) hearing loss have been described. The pharmacology used to treat these diseases corresponds to ototoxic agents. However, the use of these medications generates transient or permanent HNS, which also have associated symptoms such as tinnitus and vertigo. The degree of severity varies depending on each individual. [Mijovic, T. *et al*., 2019]

PATIENTS AND METHODS

Study Design:

The study comprised 40 RA patients along with 40 controls who visited the Orthopedics as well as Traumatology outpatient clinic from March 2022 to December 2023. The control group comprised of healthy people without rheumatoid arthritis. Patients with a history of surgery, systemic diseases, drug use, family history, and smoking habits were questioned in both groups.

Clinical Parameters:

Demographic information such as age, height, weight, prior surgery, concomitant systemic disease, medicines taken, family history, smoking, and alcohol use habits were collected from both groups. Patients enrolled in the research underwent tympanometry (Interacustic AZ-26 Denmark 2000), pure speech audiometry (Interacustic AC-33 Denmark 2000), as well as (OAE patients) (Interacustic ILO 25 Denmark 2002).

All patients had pure tone averages ranging from 250 to 6000 Hz. Patients with conductive hearing impairment, a combination of hearing loss, and SNHL were identified. Acoustic stapes reflexes (ASR) as well as tympanograms of patients were assessed, and ASRs at 500, 1000, and 2000 Hz were classified as missing or present. Tympanogram curves were classified into types A, B, C, and As. All patients had transitory OAE testing. Patients who reacted along with didn't respond to the examination at least three times were classified as "passed" and "failed".

Statistical Analysis:

All data were analyzed with the SPSS, version 21 program. Frequency numbers, percentages, arithmetic averages, and standard deviations were computed for all data. The test known as Kolmogorov-Smirnov was performed to evaluate if the data fit a normal distribution. Chi-square tests were employed to figure out the differences among groups. The variation among the data was judged significant if the p-value was less than 0.05.

RESULTS

Table 1: Demographic and clinical features of rheumatoid arthritis (RA) patients

Features	Number of patients (n = 70)	Percentage [%]
Age		
40 – 50	20	25%
51 – 60	28	35%
61 – 70	32	40%
Sex		
Male	36	45%
Female	44	55%
BMI, kg/m3		
Underweight	8	10%
Normal weight	12	15%
Overweight	28	35%
Obesity	32	40%
Smoking status		
Yes	28	35%
No	52	65%
Family history of hearing loss		
Yes	24	30%
No	56	70%
Medications that are ototoxic		
Yes	20	25%
No	60	75%

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Previous surgery		
Yes	48	60%
Mo	32	40%
Ear infections		
Yes	80	100%
No	0	0%
Exposure to loud noise		
Yes	44	55%
No	36	45%
Morbidities		
Obesity	52	65%
Hypertension	64	80%
Diabetes	32	40%
Chronic Kidney disease	24	30%
Cerebrovascular disease	12	15%
Heart diseases	36	45%
Pulmonary disease	8	10%
Asthma	28	35%
Education status		
Not in the school	20	25%
Primary	12	15%
Secondary	16	20%
College/university	32	40%
Monthly income, $		
< 700	32	40%
700 – 1000	36	45%
> 1000	12	15%

Table 2: Distribution of hearing impairment data into patients

Groups	Number of patients [80]	Percentage [%]
Group A [patients]	40	50%
Group B [Control]	40	50%

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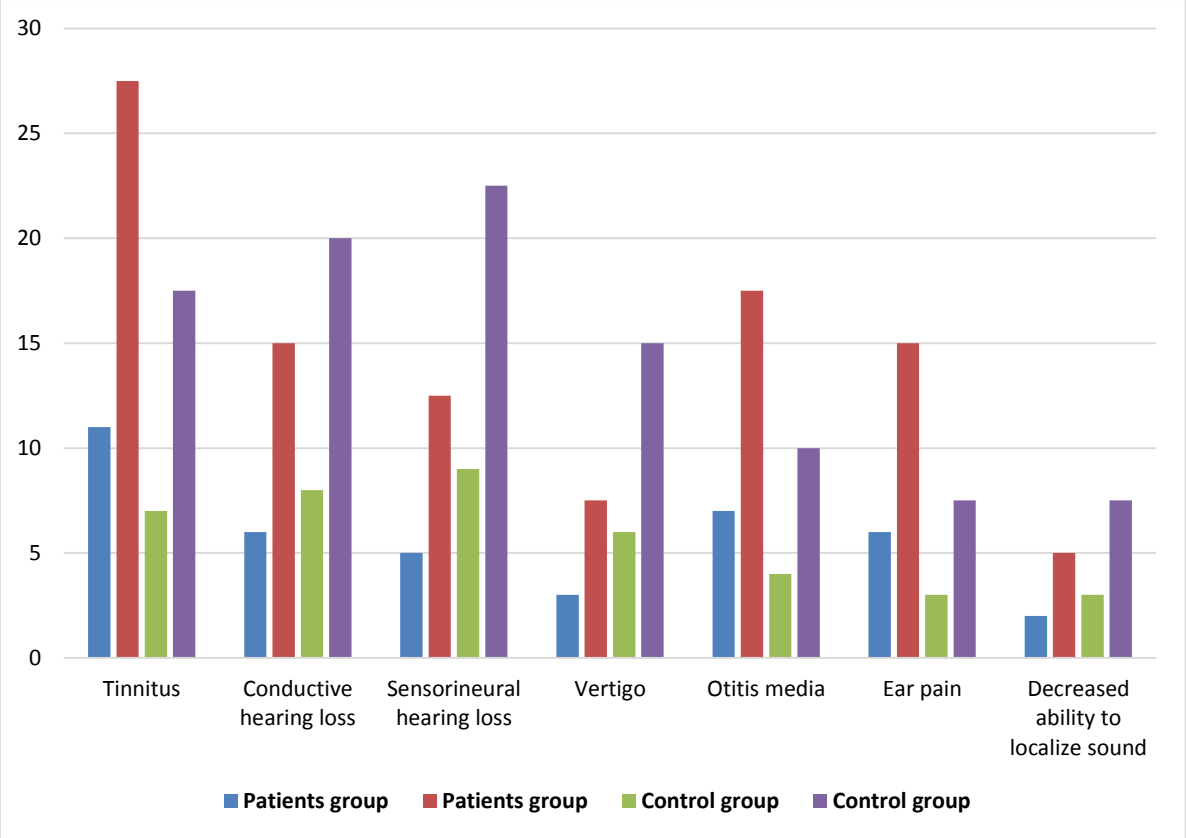

Figure 1: Identifying symptoms related to hearing impairment of rheumatoid arthritis patients.

Table 3: Distribution of level of ear pain on into patients and control groups

Scores	Patients Group [40]	Control Group [40]
Normal	0 [0%]	14 [35%]
Mild	3 [7.5%]	10 [25%]
Moderate	15 [37.5%]	9 [22.5%]
Severe	22 [55%]	7 [17.5%]

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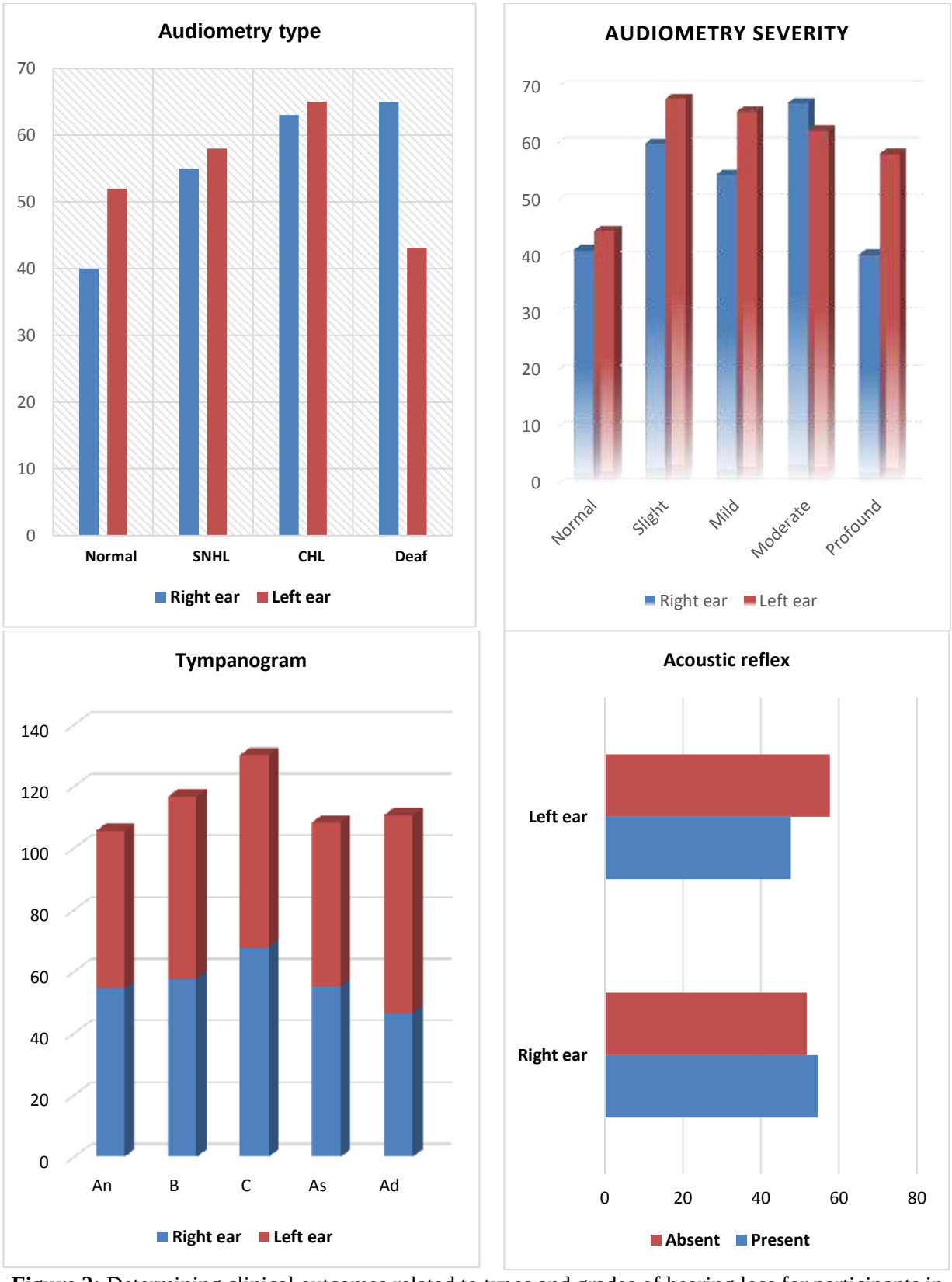

Figure 2: Determining clinical outcomes related to types and grades of hearing loss for participants in this study.

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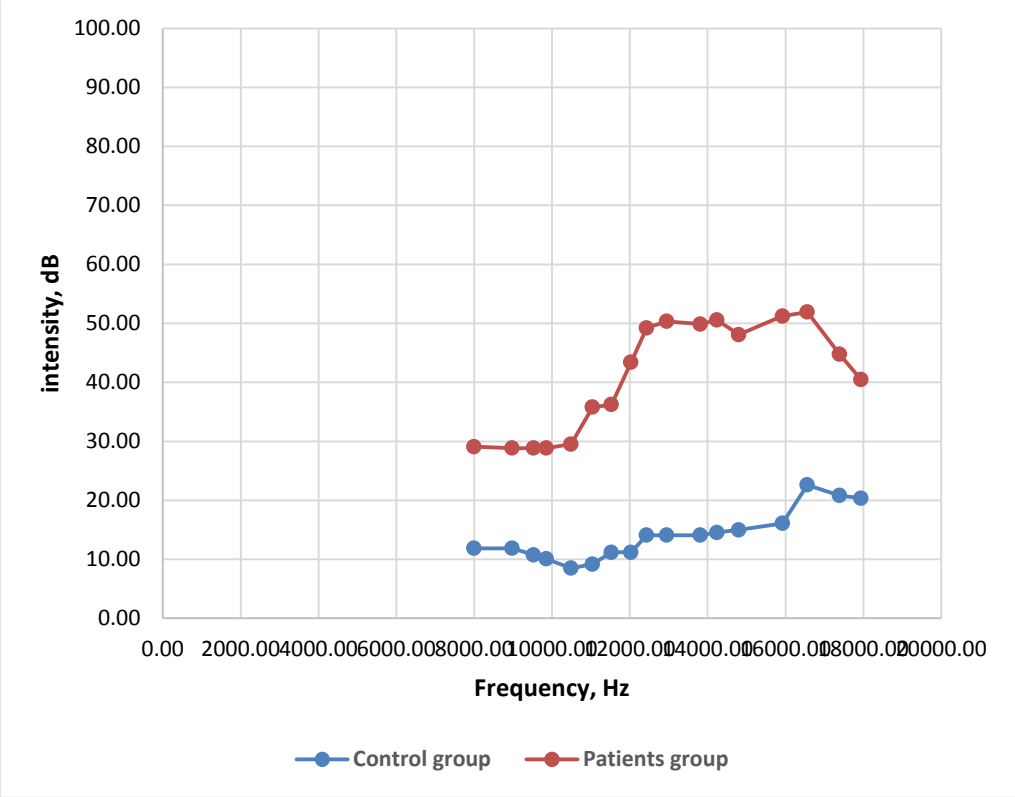

Figure 3: Measuring hearing threshold with ultra-high-frequency audiometry in both groups, patients' group and control group.

Table 4: Conducting hearing tests between patients and control in terms of tympanometry test, acoustic reflex, air conduction, bone conduction, and air-bone gap

	Right ear			Left ear		
Items	**Patients group**	**Control group**	**P - value**	**Patients group**	**Control group**	**P-value**
Air conduction	32.4 ± 6.8	14.3 ± 4.6	< 0.001	28.9 ± 5.2	16.7 ± 4.1	< 0.001
Bone conduction	25.6 ± 8.8	13.4 ± 4.8	0.128	18.2 ± 9.5	12.6 ± 3.6	0.258
Air-bone gap	8.5 ± 5.7	6.4 ± 4.8	0.274	12.2 ± 6.4	7.5 ± 5.6	0.348
Tympanometry (%)						
Type A	65.8	72.4	0.131	61.20	68	0.37
Type As	4.8	5.2	<0.01	0	0	0.15
Type Ad	34.89	28	0.282	40.41	38	0.39
Type B	3.7	0	0.441	3.2	0	0.24
Type C	0	0	0.05	0	0	0.05
Type D	0	0	0.05	0	0	0.05

DISCUSSION

Our study was found patients with ages (61 - 70) years were higher with 32 cases, followed by patients with (51 - 60) years were 28 cases, along with patients with ages 40 - 50 years were 20 cases, males were lower with 45% than females with 55%, BMI classified into four sections which included underweight with 8 cases, normal weight with 12 cases, overweight with 28 cases, and obesity with 32 cases, rate of smokers 35%, family history of hearing loss was 30%, medications that are ototoxic was 25%, previous surgery was 60%, and all patients have ear infections, exposure to loud noise was 55%, morbidities related to patients contains obesity included 52 cases, hypertension included 64 cases, diabetes included 32 cases, chronic Kidney disease included 24 cases, cerebrovascular disease included 12 cases, heart diseases included 36 cases, pulmonary disease included 8 cases, asthma included 28 cases, most common symptoms found tinnitus have 11 cases and otitis media have 7 cases, conductive hearing loss have 6 cases, and sensorineural hearing loss have 5 cases in the patients group and 7 while

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tinnitus have 7 cases and otitis media have 4 cases, conductive hearing loss have 8 cases, and sensorineural hearing loss have 9 cases in the control group. In addition, the level of ear pain was distributed into mild with 3 cases, moderate with 15 cases, and severe with 22 cases in the patients' group, but the control group shown normal with14 cases, mild with 10 cases, moderate with 9 cases, and severe with 7 cases.

According to the hearing threshold with ultra-high-frequency audiometry, we noticed hearing started at 29.08 HZ at an intensity (8000) dB in the patients' group, while the frequency was 11.86 HZ at the intensity of 8000 and end up at a frequency of 40.49 HZ at 17938.95 intensity in the control group. According to the patients' group, tympanometry scores in the right ear shown Type A was 65.8, Type As was 4.8, Type Ad was 34.89, Type B was 3.7, while tympanometry scores in the left ear shown Type A was 61.20, Type As was 0, Type Ad was 40.41, Type B was 3.2. According to the control group, tympanometry scores in the right ear shown Type A was 72.4, Type As was 5.2, Type Ad was 28, and Type B was 0, while tympanometry scores in the left ear shown Type A was 68, Type As was 0, Type Ad was 38, Type B was 0.

In an American investigation, rheumatoid arthritis (RA) was identified as an inflammatory illness that causes persistent inflammation of the joints, which inflammation may cause damage to bones and cartilage in joints. However, it may additionally impact other regions of the body, such as the ears. [Munjal, S. *et al*., 2017]

Recent studies have indicated a relationship among rheumatoid arthritis along with hearing loss, where the inflammation induced by RA can harm the delicate components of the ear, especially the small hair cells within the inner ear which hear sound, which this inflammation can compromise the normal function in these cells, resulting in hearing loss. [Raut, V. V. *et al*., 2001 – Maciaszczyk, K. *et al*., 2011]

CONCLUSION

Our current study recorded that hearing impairment in the group of patients with rheumatoid arthritis was higher compared to the control group. Also, the study found that people having rheumatoid arthritis are significantly more likely to experience sensorineural hearing loss, that affects the inner ear as well as the auditory nerve.

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