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Hearing profile in patients with Rheumatoid Arthritis and Systemic Lupus Erythematosus

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ABSTRACT

Introduction and aim: Rheumatoid arthritis (RA) and Systemic Lupus Erythematous (SLE) are chronic, inflammatory diseases with intra and extra articular manifestations. They affect 1% of the population. The auditory system can be affected in the course of these diseases. However, the pathogenesis of hearing impairment in these diseases is not clearly understood. The current work aimed to determine frequency and type of hearing impairment (HI) in patients with RA and SLE and possible correlation with different disease parameters.

Methodology: Fifty RA and Fifty SLE patients, and 50 healthy, age and sex matched controls, were included. Their age ranged from 35 to 50 years. They were selected from the outpatient clinic of Al-Azhar university hospital (Damietta). HI was evaluated by pure tone audiometry and tympanometry including acoustic reflex threshold test and auditory brain stem response (ABR). Complete medical history and general & local examination were done along with full laboratory and immunological investigation.

Results: Hearing loss was found in 41(82%) in RA patients and in 19 (38%) in control group. Hearing loss in SLE patients was found in 27(54%) and 15(30%) in control group. In AR patients, the level of hearing loss varied from mild to moderate in 28(56%) and 13(26%) respectively, and in control group was 17(34%) and 2(4%) respectively. In SLE group, level of hearing loss varied from mild to moderate in 19(38%) and 8(16%) respectively, and in control group was 13(26%) and 2(4%).

Conclusion: There was a high frequency of sensorineural hearing loss in both RA (82%) and SLE (54%) patients compared to normal controls. Careful surveillance of hearing profile in early stages of both diseases is important and follow up testing of hearing status should be part of patient care.

Keywords: **Hearing Impairment; Pure Tone Audiometry; Rheumatoid Arthritis; Systemic Lupus Erythematosus; Auditory Brainstem Response.**

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INTRODUCTION

Rheumatoid arthritis (RA) is considered a chronic inflammatory disease that involve 1% of the population. In spite of its cardinal articular and periarticular features RA can include other organs counting heart lung skin and eye [1].

In the same way the auditory system can be affected by a variety of pathologies in the course of the disease [2].

There is a wide variety in the reported prevalence of various types of hearing loss in RA patients. Sensorineural hearing loss (SNHL) has been reported as the most common hearing impairment in RA with a prevalence of approximately 12-80% followed by conductive hearing loss (CHL) and mixed hearing loss (MHL) [3].

The pathogenesis of hearing impairment in RA is not clearly understood, there are many mechanisms have been proposed and will be clarified later [4].

SNHL being the most common type, detected by pure tone audiometry, particularly high frequency, though involvement of middle and low frequencies has also been reported. Extended high frequency audiometry, which evaluates very high frequencies (>8000 Hz), can detect hearing impairment at earlier stages [5].

This may be due to vasculitis/neuritis of the cochlea and cochlear nerve leading to SNHL. Ahmadzadeh *et al*. [6] has recorded higher bone conduction threshold in RA patients in low frequencies and in the average of 500 - 2000 Hz frequencies. Aging, gender, current smoking and level of education may affect prevalence of hearing impairment in RA. For this we tried to characterize type and prevalence of hearing loss in RA patients compared to normal population.

Systemic lupus erythematosus is a prototype chronic autoimmune disease mostly affecting women with periods of remission and exacerbation and variable course and prognosis. The SLE pathogenesis is complex with interplay of genetic, hormonal, environmental factors with excessive production of autoantibodies and may be associated with antiphospholipid syndrome [7].

In recent years, pathological, immunological reactions have been proven to affect also the inner ear. There is a growing number of reports about sensorineural hearing loss (SNHL) in autoimmune diseases of connective tissue, such as systemic sclerosis, rheumatoid arthritis, Cogan syndrome, Sjogren syndrome, Wegener's granuloma, ankylosing spondylitis and systemic lupus erythematosus. This is why the aim of our study is to evaluate hearing disorders in RA and SLE patients with particular reference to their prevalence and relationship to SLE duration and severity.

THE AIM OF THE WORK

Our aim to determine frequency and type of hearing impairment in patients with rheumatoid arthritis and systemic erythematosus with correlation with different disease parameters.

PATIENTS AND METHODS

This study was conducted on 50 patients with RA and 50 patients with SLE and 100 healthy participants as a control group.

The patients were selected from the Rheumatology Clinics of Al-Azhar University Hospitals. An informed consent was obtained from participants in the study.

The study was approved by the Local Ethics and Research Committee, Faculty of Medicine (Al-Azhar University). The patient's ages ranged from 35 to 50 years, with mean age of 41.3±5.1 years.

The control group ages ranged from 35 to 50 years, with mean age of 40.9 ± 4.2 years. HI was evaluated by pure tone audiometry and tympanometry including acoustic reflex threshold test.

Complete medical history and general and local examination were taken along with full investigation (including ESR, CRP, CBC, RF, Anti-CCP, complement level (C3, C4), ANA, anti-dsDNA, anti-cardiolipin and lupus anticoagulant). We excluded from study patients having suffered, in the 60 days prior to the study, any acute or subacute process that could be resolved by appropriate therapeutic procedures, previously known diagnosis of a chronic condition or surgery of the middle ear:

Adhesive process, otosclerosis, perforation of the ear drum or cholesteatomata's otitis. The control group consisted of 100 volunteers with a similar age and sex distribution, who presented without pathology in the hearing examination, as normal during tympanometry and with no remarkable history of familial hearing disorder or exposure to ototoxic mediations.

Audiological evaluation

1. Pure-tone audiometry with air conduction testing varying frequencies from 250Hz to 8000 Hz and may be extended high frequency audiometry testing frequencies from 8000-12000Hz for early detection of hearing loss. delivered through head-phone TDH39 and bone conduction testing from 500 through 4000Hz, bone conduction stimulus will be delivered via bone conduction vibrator model B71 on mastoid using ascending descending techniques
2. Speech audiometry speech reception threshold (SRT) using Arabic spondee word and word discrimination score (SD %) using Arabic phonetically balanced word.
3. Immittancemetry including Tympanometry will be done at varying pressure ranging from +200 to -400 mm H2O (single-component, single frequency) with a probe tone of 226 Hz and Acoustic reflex threshold, for elicited reflexes using pure tones at frequencies 500, 1000, 2000, and 4000 Hz.

4.Auditory Brain Stem Response (ABR).

Statistical analysis

Data were statistically described in terms of mean ± standard deviation (SD), or frequencies (number of cases) and percentages when appropriate. Comparison of numerical variables between the study groups was done using the student (*t*) test for independent samples when variables were normally distributed. p value < 0.05 was considered statistically significant. All statistical calculations were done using computer programs SPSS (Statistical Package for the Social Science; SPSS Inc., Chicago, IL, USA) version 23 for Microsoft Windows.

RESULTS

A total of 50 patients with RA and 50 patients with SLE, with mean age of 41.3±5.1 years, 78% were females in RA patients and 100% in SLE group, and 100 healthy controls, with mean age of 40.92±4.2 years.

The two groups show that there was no statistically significant difference between both groups.

Hearing loss:

Frequency: In RA group 82% of patients were diagnosed with hearing loss and in normal control group only 38% of persons had some sort of hearing loss. In the SLE group 54% of patients were diagnosed with hearing loss and in the control group only 30% had some sort of hearing loss.

Levels: In the RA group, 18% were normal, 56% were mild loss and 26% were moderate; in control group 62% were normal, 34 were mild and only 4% were moderate. In SLE group 46% were normal, 38% showed mild loss and 16% showed moderate loss while in control group 70% were normal, 26% were mild and only 4% were moderate (Table 1).

Pure Tone Audiometry

In the RA group in (right ear) there was significance difference between RA and control group in the range from 250 to 12000 HZ; except in 500 HZ, it was insignificant (p=0.190). In (left ear) there was significance difference between RA and control in audiometry in range from 250 to 12000 HZ; except in 500 Hz, it was insignificant (p=0.182) (Table 2).

In the SLE group in the (right ear), there was significance difference between patients and control group regarding audiometry in range from 4000 to 12000 Hz; and insignificant from 250 to 2000Hz. However, in the (left ear), there was a significance difference between both groups in the range from 4000 to 12000 HZ and insignificant from 250 to 2000 Hz (Table 2).

Bone Conduction

In RA group in (right ear) there was significance difference between RA and control group in bone conduction in frequency range from 1000 to 4000 HZ; except in 500 HZ, it was insignificant (p=0.241). In the Left ear, there was a significance difference between RA and control group in range from 1000 to 4000 HZ; except in 500 HZ, it was insignificant (p=0.245).

In the SLE group in the (right ear) there was insignificance difference between patients and control in bone conduction in range from 500 to 2000 HZ; except in 4000 HZ, it was significant (p=0.018).

In the (Left ear), there was insignificance difference between patients and control group in range from 500 to 2000 HZ; except in 4000 HZ, it was significant (p=0.245) (Table 3).

Auditory Brain stem response (Low)

In RA group in (right ear) ABR low repetition rate was statistically different between both groups except in III-V wave (p=0.645). In the (Left ear), ABR low repetition rate was statistically different between both groups except in III-V wave (p=0.512) (Table 4).

In the SLE group in the (right ear), the ABR low repetition rate was statistically insignificant different between patients and control groups. In the (Left ear), the ABR low repetition rate was statistically insignificant different between patients and control groups (Table 4).

Auditory Brain stem response (High)

In the RA group, (right ear) the ABR high repetition rate was statistically different from control group. In the (Left ear), the ABR high repetition rate was statistically different from control group. Except in III-V wave (p=0.697).

In the SLE group, in the (right ear), the ABR high repetition rate was statistically insignificant different between patients and control groups. In (left ear) the ABR high repetition rate was statistically insignificant different between patients and control groups, except in wave III and V (p=0.008 and 0.034) respectively (Table 5).

Table (1): Frequency and level of hearing loss in the studied groups

		RA patients				P value	SLE Patients				P Value
		Case		Control			Case		Control		
		N	%	N	%		N	%	N	%	
Frequency of Hearing loss	Hearing lost	41	82%	19	38%		27	54%	15	30%	
	Preserved	9	18%	31	62%	0.81	27	54%	15	30%	0.59
Level of Hearing Loss	Mild	9	18%	31	62%		23	46%	35	70%	
	Moderate	28	56%	17	34%		19	38%	13	26%	0.72
	Sever	13	26%	2	4%	0.54	8	16%	2	4%	

Table (2): Comparison of Pure Tone audiometry between the studied groups

	Frequency (HZ)	RA patients		test	P value	SLE Patients		test	P value
		Cases	Control			Cases	Control		
Right ear	250	23.2±7	20.7±2.9	2.343	0.021*	22.7± 6.5	21.4±4.7	1.144	0.255
	500	23.5±7.3	22.0±3.4	1.320	0.190	21.6 ±7	21±5.4	0.477	0.634
	1000	25.7±9.1	21.1±4.9	3.153	0.002*	22±8	19.8±6.4	1.518	0.132
	2000	27.3±9.1	21.6±4.2	4.017	<0.001*	23.3±8.9	20.8±6.4	1.604	0.112
	4000	30±9.2	24.3±4.3	3.970	<0.001*	26.8±8.9	22.9±6.4	2.526	0.013*
	8000	33.5±11.1	30.1±7.4	5.329	<0.001*	28.6±9.4	24.1±6.6	2.766	0.007*
	12000	40.8±11.1	30.1±7.4	5.681	<0.001*	33.7±10.9	28.7±7.7	2.641	0.010*
Left ear	250	23.3±7	21.1±2.9	2.060	0.042*	22.9±6.6	21.5±4.7	1.231	0.221
	500	22.6±7.2	22.1±3.2	1.343	0.182	21.8±7.1	21.1±5.3	.555	0.580
	1000	25.2±8.3	21.2±4.6	2.976	0.004*	21.9±7.8	19.9±5.9	1.449	0.151
	2000	27.2±9.2	21.7±4.1	3.854	<0.001*	23.2±8.9	21.1±6.3	1.353	0.179
	4000	30.1±9.1	24.3±4.3	4.091	<0.001*	26.8±8.9	23.2±6.2	2.345	0.021*
	8000	33.2±10.8	24.4±4.8	5.274	<0.001*	28.7±9.5	24.2±6.6	2.761	0.007*
	12000	40.5±11.2	30.1±7.4	5.492	<0.001*	33.8±10.9	28.7±7.7	2.688	0.008*

Table (3): Comparison of Bone Conduction between the studied groups

		RA patients		t	P value	SLE Patients		t	P value
		Case	Control			Case	Control		
Right ear	**500**	23.3±7	22±3.4	1.179	0.241	21.6±7	21±5.4	0.477	0.634
	1000	24.9±8.6	21.1±4.9	2.718	0.008*	21.7±7.7	19.8±6.4	1.346	0.181
	2000	27.1±9.0	21.6±4.2	3.919	<0.001*	22.9±8.3	20.8±6.4	1.412	0.161
	4000	29.9±9.2	24.3±4.3	3.891	<0.001*	26.5±8.5	22.9±6.4	2.399	**0.018***
Left ear	**500**	23.4±7.2	22.1±3.2	1.170	0.245	21.8±7.1	21±5.4	0.631	0.530
	1000	24.6±7.6	21.2±4.6	2.705	0.008*	21.5±7.4	19.9±5.9	1.196	0.235
	2000	27.1±9	21.7±4.1	3.864	<0.001*	22.8±8.3	21.1±6.3	1.148	0.254
	4000	29.9±9.2	24.3±4.3	3.910	<0.001*	26.6±8.4	23.1±6.2	2.354	**0.021***

Table (4): Comparison of Low ABR between the studied groups

		RA patients		t	P value	SLE Patients		t	P value
		Case	Control			Case	Control		
Right ear	**I**	1.7±0.1	1.5±0.1	8.006	<0.001*	1.6±0.13	1.5±0.11	1.281	0.203
	III	3.7±0.1	3.6±0.1	6.074	<0.001*	3.6±0.10	3.7±0.15	1.692	0.094
	V	5.6±0.1	5.0±0.1	5.605	<0.001*	5.7±0.15	5.6±0.12	0.914	0.363
	I-III	2.6±0.1	2.0±04	-5.885	<0.001*	2.1±0.05	2±0.11	-0.020	0.984
	III-V	2.1±0.1	2.0±0.1	0.463	0.645	1.91±0.13	1.94±0.12	-0.787	0.433
	I-V	3.8±0.1	4.3±0.3	6.042	<0.001*	4.2±0.12	4.1±0.13	-0.665	0.508
Left ear	**I**	1.9±0.1	1.3±0.1	7.571	<0.001*	1.6±0.14	1.5±0.14	1.480	0.142
	III	3.9±0.1	3.2±0.1	6.870	<0.001*	3.5±0.43	3.6±0.31	-0.262	0.794
	V	5.8±0.1	5.2±0.1	6.248	<0.001*	5.6±0.12	5.7±0.13	0.548	0.585
	I-III	2.3±0.1	2.0±0.01	4.481	<0.001*	1.9±0.43	1.9±0.32	-0.545	0.587
	III-V	2.1±0.3	2.0±0.4	-0.658	0.512	2.1±0.42	2.0±0.33	0.358	0.721
	I-V	4.5±0.1	4.0±0.03	4.884	<0.001*	4±0.041	4±0.14	1.475	0.143

Table (5): Comparison of high ABR between the studied groups

		RA patients		t	P value	SLE Patients		t	P value
		Case	Control			Case	Control		
The right ear	**I**	1.9±0.1	1.2±0.02	8.416	<0.001*	1.6±0.1	1.6±0.1	1.195	0.235
	III	3.7±0.1	3.1±0.01	9.332	<0.001*	3.6±0.5	3.6±0.1	1.215	0.227
	V	5.7±0.1	5.1±0.1	5.874	<0.001*	5.6±0.3	5.6±0.1	0.826	0.411
	I-III	2.8±0.1	2.0±0.03	3.711	<0.001*	2±0.04	2±0.1	0.435	0.664
	III-V	2.9±0.18	2.1±0.04	3.704	<0.001*	1.9±0.3	1.9±0.1	1.116	0.267
	I-V	4.9±0.17	4.1±0.02	6.095	<0.001*	3.9±0.3	4±0.1	1.190	0.237
The left ear	**I**	1.9±0.18	1.3±0.01	8.118	<0.001*	1.6±0.1	1.6±0.1	1.354	0.179
	III	3.7±0.19	3.0±0.01	6.013	<0.001*	3.9±0.04	3.4±0.04	2.720	0.008*
	V	5.7±0.13	5.1±0.04	7.278	<0.001*	5.9±0.14	5.1±0.19	2.156	0.034*
	I-III	2.6±0.1	2.0±0.02	5.388	<0.001*	2.0±0.03	2.3±0.19	1.168	0.246
	III-V	2.0±0.1	2.2±0.03	0.390	0.697	1.93±0.03	1.90±0.04	0.375	0.708
	I-V	4.9±0.1	4.0±0.02	4.635	<0.001*	4.2±0.04	4.0±0.06	0.609	0.544

DISCUSSION

Rheumatoid arthritis (RA) is a chronic inflammatory disease that affects 1% of the population. In spite of its cardinal articular and periarticular features, RA can involve other organs including heart, lung, skin, and eye [1].

In the same way, the auditory system can be affected by a set of pathologies in the course of the disease [2].

The SLE pathogenesis is complex with interplay of genetic, hormonal, environmental factors with excessive production of autoantibodies and may be associated with antiphospholipid syndrome [7].

The inner ear is a susceptible target of an autoimmune response and that sensorineural hearing loss can occur in complications of various autoimmune diseases including RA, ankylosing spondylitis, systemic lupus erythematous, Bechet's disease, and psoriatic arthritis [8]. Pure tone audiometry (PTA) is the key hearing test used to identify hearing threshold levels and provide a basis for diagnosis and management; it relies on patient responses to pure tone stimuli [9].

In our study included RA patients and control group. The mean age of RA group was 41.3 ± 5.1 year and in control group was 40.9 ± 4.2 years, frequency of hearing loss was 41(82%) in RA group and 19 (38%) in the control group. The level of hearing loss was varying from mild 28 (56%) to moderate13 (26%), in the RA group.

In the control group 17 (34%) had mild and 2 (4%) had moderate hearing loss. The pure tone audiometry of air conduction varies from 250 to 12000 Hz in the right and left ears. We had found that there was a significant fall in the threshold of conduction between RA and control group in all frequencies except at 500 Hz; while the normal group has a lower mean value. In the pure tone audiometry, bone conduction varies from 500 to 4000 Hz in the right and the left ears. We found that there was a significant fall in threshold of conduction between RA and control group in all frequencies except at 500 Hz; while normal group has a lower mean value. In the study of Guo *et al.* [1] on 194 RA patients and 107 healthy controls, hearing loss was detected in 42.7% of the RA group and 15.9% of the control group. The pure tone audiometry of air conduction ranged from 250 to 8000 Hz in the right and left ears, and showed significantly higher values of all tones in RA group. The study by Fragoso *et al.* [2] included 29 RA patients, it showed no significant differences in the hearing impairment compared to healthy age and gender matched control group. They had found 59% of cases with a raised threshold in at

least one frequency, versus 47% in the control group. Regarding the affected ears, these differences increased to 52% and 38% respectively.

In the study of De La Vega *et al*. [5], 43% of RA patients had hearing loss (46 ears). The type of hearing loss was sensorineural, with high-frequency loss predominant. High frequencies were affected in 56.6%, medium frequencies in 17%, and low frequencies in 13.2%.

There was a significant difference in hearing thresholds (arithmetic mean) at 6000 Hz (p = 0.001) and 8000 Hz frequencies between patients and control group (p = 0.001). Their results showed that RA patients had greater high frequency loss than the control population, there was a significant difference in the 4000 (p = 0.038), 6000 (p = 0.004), and 8000 Hz (p = 0.009) frequencies.

Our results differed from Rahne *et al*. [10] who claimed a greater hearing loss in intermediate frequencies of 500 Hz, 1000 Hz, and 2000 Hz, and from De La Vega *et al*. [5] reported that patients mainly had hearing loss in low and medium frequencies (from 250 to 4000 Hz). Furthermore, the poorer bone conduction hearing thresholds observed in RA patients in comparison to controls shows the presence of inner ear impairment.

In our study there was a significant difference between both groups as regard to SDS and SRT in the right and left. And there was no significant difference between mean value of compliance in both ears. The study of Bayoumi *et al*. [11] on 16 patients with psoriatic arthritis and 16 normal participants and there was no significant impairment except in high frequencies 8000Hz in air conduction (p=0.017 and 0.046) respectively; and no significant in bone conduction. Although they found that there was no significant impairment in the SRT and SDS between both groups. This disagreement between our findings may be results of different disease group (RA and PsA) and indicate association between RA and SDS and SRT impairment.

In our study low repetition rate ABR in the right ear showed significant impairment in RA group in all waves except III-V wave and in Lt ear although there was significant impairment in all waves except III-V wave. In high repetition rate ARB in the right ear was significantly impaired in RA group than normal control in all waves, while in Lt ear there was significant impairment in all waves except III-V wave (p=0.697).

Alhefny *et al*. [12] studied 28 RA patients and there was no significant difference in mean compliance between RA patients and controls. There was an increase in the Wave I latency of ABRs in Group 1 (1.639/ 0.08 ms) compared to Group 2 (1.609/ 0.08 ms). The reduced compliance of the TOS is probably due to a chronic arthritic process involving the middle ear ossicular chain.

In our study, SLE patients and control group showed that mean age of SLE group was 41.3±5.1 years and in control group was 40.9 ± 4.2 years, all participants were females, and frequency of hearing loss was 27 (54%) of SLE group and 15 (30%) of normal control group. In SLE group, hearing loss was varying from mild to moderate, 19 (38%) and 8 (16%) respectively. And in control group, 13 (26%) were mild and 2 (4%) were moderate hearing loss.

The pure tone audiometry of air conduction was varying from 250 to 12000 Hz in the right and the left ears. We had found that there was significant fall in threshold of conduction in SLE group than control group in high frequencies, 4000, 8000 and 12000 Hz; the control group has lower mean value.

Pure tone audiometry (PTA) of bone conduction was varying from 500 to 4000 Hz in RT and LT ears.

We found that there was significant fall in threshold of conduction of SLE group than control group at frequency of 500 Hz while control group has lower mean value.

In the study of Mokbel *et al*. [13] on 20 female patients with SLE and 20 matched healthy volunteers. They found that 13 (65%) patients had hearing loss. The PTA results showed a highly significant statistical difference from the control. Moreover, there was a significantly lower hearing level (right ear) at 12,000 Hz in juvenile-onset (N = 6) (20.83 ± 3.76 dB) compared to adult-onset cases (32.5 ± 15.66 dB) (p = 0.02).

The mean values of the air-conduction hearing thresholds in SLE patients were poorer than in control group for frequencies 250, 8000 and 12,000 Hz. The results showed highly significant statistical difference between SLE patients and control as regards PTA. About 15.3% had low tone loss and 11 (84.6%) patients had high tone loss.

Hearing loss in systemic lupus erythematosus may be potentially due to autoimmunity, vasculitis, premature presbycusis and drug ototoxicity [14].

In the study of Abbasi *et al*. [15] on 45 patients with SLE and 45 control volunteers, 5 (11.1%) patients were complaining from hearing loss. They found that 26.7% of case group had sensori-neural loss and 8.9% of normal group

PTA of the left ear showed significant falling in SLE patients' thresholds of air conduction in all frequencies from 250 up to 8000 except frequency of 1000Hz and in the right ear except 1000 and 2000 respectively. The bone conduction of the right ear PTA showed significant fall in all frequencies except 1000 and 2000 respectively, and in the left ear significant fall in lower frequencies (250 and 500). In addition, there was no significant difference between both groups as regard to SDS, SRT, and compliance in both ears.

In our study low repetition rate ABR in the right ear showed no significant impairment in SLE group in all waves, and in the left ear although there was no significant impairment in all waves. The high repetition rate ARB in the right ear was not significantly impaired in SLE group than normal control in all waves, while in the left ear there was significant impairment in III and V waves respectively. The hearing thresholds in dB HL (air conduction) for the left and the right ear in both SLE and control groups did not differ significantly. The mean values of the air-conduction hearing thresholds in SLE patients were significantly poorer than in control group for all frequencies, except for 500; 2000 and 4000 Hz [16].

All SLE patients had 100% speech discrimination scores and type-A tympanogram, except for one patient with type C tympano-gram. Acoustic reflex showed thresholds consistent with the level of hearing loss. The speech discrimination scores reached 100% and middle-ear function was normal in all controls. In ABR examination, symmetric responses were found in all SLE patients. The average latencies were increased in the SLE patients compared with the control group. Significant differences concerned the latency of waves III and V and interval I–V [16]. Also, in other studies, no abnormalities in conventional ABR or in middle and long latency auditory potentials were demonstrated [17].

Study Limitations:

Our small sample size may reduce its generalizability and a multi-centered case control studies are needed in the future.

Conclusion:

Our study suggests the necessity of monitoring SLE patients regarding sensorineural hearing loss to take measures against its development during early stage, which may be another disability in patients with RA, which is a potential cause of severe disability. Collaboration with audiologist for monitoring and management of subclinical auditory impairment is of paramount importance in both diseases.

Financial and Non-Financial Relationships and Activities of Interest

None

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