Audiovestibular findings in autoimmune diseases

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Received 26 February 2018
Accepted 17 April 2018

The Egyptian Journal of Otolaryngology
2019, 35:71–78

Background
Audiovestibular manifestations are reported in autoimmune diseases including hearing loss and vestibular symptoms.
Objectives
This study is designed to evaluate the audiovestibular manifestations in patients with different autoimmune diseases especially asymptomatic cases.
Subjects and Methods
This work included two groups: study group (29 cases with different autoimmune diseases) and control group (20 healthy subjects). All participantswere subjected to basic audiologic evaluation, Sinusoidal harmonic acceleration (SHA) test of the rotatory chair at different frequencies (.01-.64Hz).
Results
patients with ADs showed elevated hearing thresholds (>25dBHL) at all tested frequencies. As regard SHA test, only 5 cases from the study grop showed normal results, while the rest of cases showed vestibular hypofunction (bilateral in 22 cases and unilateral in 3 cases).
Conclusion
Audiovestibular symptoms are common in different autoimmune diseases even asymptomatic cases. SHA test showed that vestibular affection is much more frequent than expected. So, regular screening of hearing and vestibular functions in patients with autoimmune should be done, for better and early management.

Keywords:
Autoimmune diseases, hearing loss, sinusoidal harmonic acceleration (SHA)

Egypt J Otolaryngol 35:71–78
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1012-5574

Introduction

Autoimmune diseases (ADs) are diseases in which immune responses to specific self-antigens cause tissue damage. ADs may be either tissue specific, where unique tissue-specific antigens are targeted, or may be more systemic, in which multiple tissues are affected [1]. The audiovestibular manifestations are reported in many cases with ADs; however, they may be asymptomatic or underdiagnosed owing to a variety of multisystem affections that occur in these diseases [2]. The most accepted mechanisms of audiovestibular affection are vasculitis, immune complex-mediated damage, and sometimes anti-phospholipid antibodies [3,4]. The most common audiovestibular manifestations are the sensorineural hearing loss (SNHL), vertigo, or unsteadiness [3]. In rheumatoid arthritis (RA), which is one of the most common ADs, conductive hearing loss can occur as a result of inflammatory arthritis of the synovial incudostapedial and incudomalleolar joints. Additionally, SNHL can occur owing to vasculitis (leading to auditory neuropathy), inflammatory destruction of the cochlear hair cells, immune complex deposition, or drugs used to treat the disease [5,6]. Patients with systemic lupus erythematosus (SLE) can be presented with both unilateral and bilateral SNHL predominantly affecting the middle and high frequencies in addition to subclinical hearing loss in more than 22% of patients [7]. Acute audiovestibular failure has also been reported in primary antiphospholipid syndrome [7,8]. SNHL of the middle and high frequencies and patulous Eustachian tube have been described in patients with systemic sclerosis and less frequently mixed hearing loss [9]. Other diseases such as ankylosing spondylitis and Sjögren's syndrome also showed audiovestibular manifestations [3]. Cochlear or vestibular dysfunction and cardiac manifestations often coexist in patients with relapsing polychondritis and Cogan syndrome [2]. Churg–Strauss syndrome and Behçet's disease have been rarely associated with such deficits [10,11].

Rotational chair testing is ideal for the assessment of these patients, because unlike caloric testing, higher frequencies are also tested, and both labyrinths are stimulated simultaneously. This allows for accurate determination of remaining vestibular function. Sinusoidal harmonic acceleration (SHA) test is one

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of commonly rotatory chair tests used in the vestibular evaluation. It aims to assess the patient's vestibulo-ocular reflex (VOR) by rotating the patient in a pendular pattern at various frequencies ranging from 0.01 up to 1.28 Hz with vision denied. The chair is moved in either direction (right and left) to stimulate both labyrinths equally. It has a good clinical utility in diagnosing patients with bilateral vestibular weakness. Additionally, it can be used as an adjuvant tool for diagnosing unilateral vestibular loss and monitoring vestibular compensation over time [12]. Three parameters are used to evaluate SHA test. These include the following: first, the gain, which is the ratio of the amplitude of eye movement to the amplitude of head movement; second, the phase, which is the time relationship between head movement and reflexive eye response; and third, symmetry, which is a comparison of the slow component of the nystagmus when rotated to the right compared with rotation to the left [13].

Rotational chair testing is suitable for the assessment of patients experiencing autoimmune inner ear diseases and adds a diagnostic value as it evaluates the horizontal semicircular canal (SCCs) along a wide range of frequencies and both labyrinths are stimulated simultaneously in contrary to caloric test, which is used to evaluate the SCCs at extremely low frequency (0.002–0.004 Hz). This allows for accurate determination of remaining vestibular function [14]. In fact, Arriaga *et al.* [15] determined that rotational chair testing has a sensitivity of 71% for diagnosing peripheral vestibulopathies, as opposed to only 31% sensitivity for caloric testing of videonystagmography.

Aim

Several audiovestibular findings have been reported in many ADs as mentioned before; however, there is a lack of data regarding patients with no audiovestibular complaints. So this study is designed to assess the audiovestibular manifestations in patients with different ADs which may help in early detection and management of an important neglected comorbidity of ADs. In this work, we will try to find the correlations between the disease duration and activity and audiovestibular test results.

Patients and methods

The study protocol was approved by Research Ethics Committee. Signed informed consent was obtained from each patient and control following a thorough explanation of the purposes and the methodology to be used in the present study. A total of 49 cases participated in this study: 29 patients with ADs recruited from Rheumatology Unit, Internal Medicine Department at Tanta University Hospitals constituted the study group and 20 healthy volunteers constituted the control group. All the audiovestibular assessments were done at the Audiovestibular Unit, ENT Department, University Hospitals.

Inclusion criteria of the study group

Patients with ADs with or without auditory or vestibular complaints, age range 20–50 years with no history of middle ear diseases were included. Various types of ADs with different levels of disease activity were included in this study to find different patterns of audiovestibular manifestations among different ADs in correlation to disease activity. Assessment of disease activity was done using standardized techniques like disease activity score 28 in RA and SLE disease activity index of SLE in SLE. Moreover, routine laboratory investigations such as blood glucose level, renal and hepatic function tests, complete blood picture, erythrocytes sedimentation rate, and C-reactive protein were all done for both groups.

Exclusion criteria

Cases with a history of otorrhea, middle ear diseases, noise trauma, head injury, chronic neurological disease, Meniere's syndrome, or previous use of ototoxic agents were excluded. All patients had normal tympanic membranes on otoscopic examination.

All cases were subjected to the followings: thorough history taking, otological examination, basic audiological evaluation including pure tone audiometry (along the frequency range of 250–8000 Hz for air conduction and 500–4000 Hz for bone conduction), speech audiometry performed in a sound-treated room with Interacoustics AC-40 audiometer (Interacoustic, Interacoustic, Middelfart, Denmark), and immittancemetry including both tympanometry and acoustic reflex tests using AZ226 impedance audiometer (Interacoustic).

Rotational SHA subtest was done using System 2000 Comprehensive rotational chair (Micromedical Technologies, Chatham, IL, USA). Patients were positioned and secured to the rotational chair with their head restrained and adjusted so that both lateral SCCs were close to the plane of stimulus (30° forward tilt), and during rotation, they were instructed to keep their eyes open. SHA subtests were done at frequencies of 0.01, 0.02, 0.04, 0.08, 0.16, 0.32, and 0.64 Hz. The chair was rotated with a maximum velocity of 80°/s that decreased gradually with increase in the frequency of the rotation. At each

frequency, the system calculate the following: gain (the ratio of the amplitude of eye movement to the amplitude of head movement), phase (describes the timing relationship between head movement and reflexive eye response), and symmetry (comparison of the slow component of the nystagmus when rotated to the right vs. left). Patients with two consecutive frequencies out of range are considered abnormal [13].

For quantitative data analysis, the Shapiro–Wilk test for normality was performed. For data that were not normally distributed, median, interquartile range (expressed as 25th–75th percentiles), and mean ranks were calculated using Mann–Whitney *U* test. For normally distributed data, values were expressed as the mean±SD and Independent samples, *t* test was performed for comparison between two groups. For qualitative data, Pearson's χ^2 and Fisher's exact tests were used to examine the association between two variables. Significance was adopted at *P* value less than 0.05 for interpretation of the results of these tests.

Table 1 Data of autoimmune diseases in patients included in this study regarding type, disease activity and duration, and audiovestibular symptoms

	n (%)
Autoimmune disease type	
Scleroderma	1 (3.44)
RA	13 (48.3)
SLE	11 (37.9)
Overlap SLE-RA	1 (3.44)
Sarcoidosis	1 (3.44)
Neuro-Behçet disease	2 (6.89)
Disease activity	
Mild active	1 (3.44)
Mod active	14 (48.2)
Not active	7 (24.1)
Severe active	7 (24.1)
Audiovestibular symptoms	
Subjective symptomatic HL	10 (34.5)
Tinnitus	19 (65.5)
Aural fullness	2 (6.66)
Vestibular complaints	12 (41.4)
Disease duration	
Minimum–maximum	1.00–20.00
Median	5.00
IQR	2.00–8.00

IQR, interquartile range; HL, hearing loss; RA, rheumatoid arthritis; SLE, systemic lupus erythematosus.

Results

A total of 49 cases were enrolled in this study: 29 patients diagnosed with different ADs (study group) and 20 normal healthy participants with normal auditory and vestibular function (control group). Types of AD, diseases activity, and duration of the diseases are shown in Table 1. Patients of the study group had a mean age of 39.93±10.45 years and included 28 (96.6%) females and one (3.33%) male. The mean age of control group was 39±11.4 years and included 14 (70%) females and six (30.0%) males. Both groups showed no significant statistical difference regarding age; however, the study group showed significant predominant female affection (Table 2).

Table 2 Demographic data of control and study groups

	Study	Control	Test statistic	*P* value
Age				
Mean	39.93±10.45	39±11.40	t=0.292	0.771
Sex [n (%)]				
Female	29 (96.6)	14 (70.0)	χ^2=4.59	0.032*
Male	1 (3.33)	6 (30)		

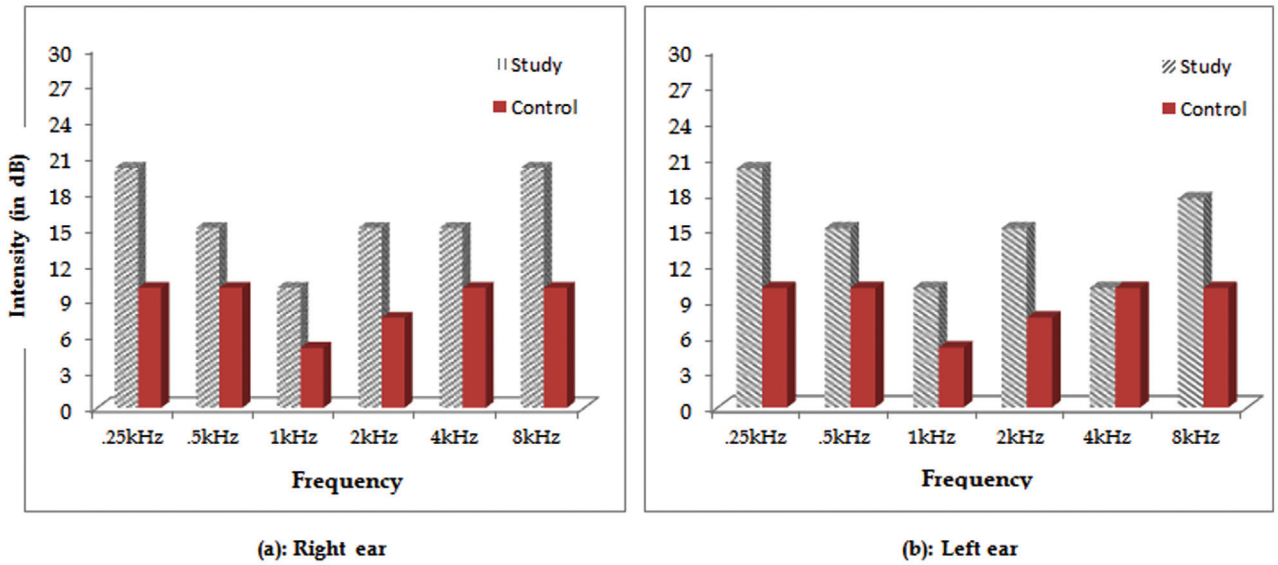
*Significant *P* value.

Table 3 Results of pure tone audiometry and comparison between the study and control groups

	Study			Control			Mann–Whitney test	*P* value
	Median	IQR	Mean rank	Median	IQR	Mean rank		
Right								
0.25 kHz	20.0	10.0–27.50	30.27	10.0	5.0–12.50	16.42	z_{mw}=–3.46	0.001*
0.5 kHz	15.0	10.0–22.50	29.0	10.0	5.0–12.50	18.2	z=–2.70	0.007*
1 kHz	10.0	10.0–20.0	32.20	5.0	0.0–10.0	13.72	z=–4.67	<0.001*
2 kHz	15.0	10.0–20.0	30.48	7.5	5.0–10.0	16.12	z=–3.59	<0.001*
4 kHz	15.0	10.0–25.0	29.43	10.0	5.0–12.50	17.60	z=–2.94	0.003*
8 kHz	20.0	7.5–22.5	29.66	10.0	2.5–10.0	17.28	z=–3.07	0.002*
Left								
0.25 kHz	20.0	10.0–22.5	29.05	10.0	5.0–12.5	18.12	z=–2.73	0.006*
0.5 kHz	15.0	10.0–22.5	29.21	10.0	5.0–12.5	17.90	z=–2.82	0.005*
1 kHz	10.0	7.5–20.0	30.91	5.0	0.0–10.0	15.52	z=–3.87	<0.001*
2 kHz	15.0	10.0–20.0	30.46	7.5	5.0–10.0	16.15	z=–3.57	<0.001*
4 kHz	10.0	10.0–20.0	28.39	10.0	5.0–12.5	19.05	z=–2.34	0.019*
8 kHz	17.5	10.0–27.5	31.12	10.0	2.5–10.0	15.22	z=–3.94	<0.001*

IQR, interquartile range; MW, Mann–Whitney. *Significant *P* value.

Figure 1



Thresholds of PTA at different frequencies in the study group and the control groups. PTA, pure tone audiometry.

All patients of the study group had audiovestibular complaints; 10 patients gave history of hearing loss (eight cases had bilateral hearing loss and two cases had right hearing loss), 19 patients had tinnitus (bilateral in 16 cases and unilateral in three cases), two patients had aural fullness and 12 patients had vestibular complaints that ranged from sense of unsteadiness to true vertiginous attacks with variable duration (few seconds up to several hours) associated with vomiting in three cases (Table 1).

Regarding the results of pure tone audiometry, median, mean rank, and interquartile range were calculated for right and left ears for both groups at the frequency range of 250–8000 Hz. The control group showed normal results in both ears (<25 dBHL). Patients of the study groups showed significantly elevated thresholds (>25 dBHL) at all tested frequencies in both right and left ears when compared with control (Table 3 and Fig. 1). Four (38.46%) of thirteen of the RA cases had SNHL (two cases with bilateral SNHL and two cases with unilateral SNHL). The configuration of SNHL was low frequency in two (25%) ears, flat in two (25%) ears, and high frequency in four (50%) ears. In patients with SLE, three (27.27%) of the 11 (66.6%) patients had bilateral SNHL with flat configuration in four ears and sloping high frequency in two (33.33%). However, normal hearing threshold was found in 21 (72.41%) patients of the 29 patients. The relations between hearing thresholds and age, disease duration, presence of rheumatoid factor, type of medication used, and laboratory investigations were not significant (P>0.05) (Table 3).

Table 4 Results of sinusoidal harmonic acceleration gain at different frequencies and their comparison between the study and the control group

Frequencies	Study	Control	Test statistic	*P* value
0.01 Hz				
Median	0.39	0.52	Zmw=3.42	0.001*
IQR	0.31–0.50	0.45–0.55		
Mean rank	18.68	32.65		
0.02 Hz				
Median	0.43	0.57	z_{mw}=3.34	0.001*
IQR	0.36–0.54	0.50–0.60		
Mean rank	18.80	32.48		
0.04 Hz				
Median	0.45	0.67	z_{mw}=4.54	<0.001*
IQR	0.39–0.56	0.60–0.79		
Mean rank	16.75	35.35		
0.08 Hz (mean ±SD)	0.53 ±0.19	0.68 ±0.11	*t*=–3.35	0.002*
0.16 Hz (mean ±SD)	0.48 ±0.19	0.66 ±0.06	*t*=–4.75	<0.001*
0.32 Hz				
Median	0.53	0.68	z_{mw}=2.86	0.004*
IQR	0.43–0.70	0.66–0.76		
Mean rank	19.62	31.32		
0.64 Hz				
Median	0.65	0.67	z_{mw}=0.481	0.630
IQR	0.54–0.84	0.58–0.77		
Mean rank	23.68	25.65		

IQR, interquartile range; z_{mw}, *z* value of Mann–Whitney test.
*Significant *P* value.

Regarding speech audiometry, the results were proportional to the results of pure tone audiometry, and the range of discrimination scores was 88–100%. All the participants had normal middle ear function, and acoustic reflex thresholds were consistent with hearing thresholds.

Table 5 Results of sinusoidal harmonic acceleration asymmetry at different frequencies and their comparison between the study and the control groups

Frequencies	Study	Control	Test statistic	*P* value
0.01 Hz				
Median	5	5	z_{mw}=0.056	0.956
IQR	3–11	4–7		
Mean rank	23.60	23.38		
0.02 Hz				
Median	7.00	4.40	z_{mw}=2.18	0.029*
IQR	2.00–10.00	2.75–4.75		
Mean rank	27.76	18.92		
0.04 Hz				
Median	7.00	5.00	z_{mw}=1.75	0.080
IQR	3.00–13.00	3.44–6.00		
Mean rank	27.0	19.95		
0.08 Hz				
Median	9.00	4.22	z_{mw}=2.86	0.004*
IQR	5.00–14.00	4.00–5.55		
Mean rank	28.91	17.38		
0.16 Hz				
Median	10.50	5.83	z_{mw}=2.076	0.038*
IQR	5.00–20.50	4.37–6.50		
Mean rank	28.04	19.55		
0.32 Hz				
Median	14.00	7.00	z_{mw}=1.95	0.052
IQR	6.00–30.50	5.32–10.00		
Mean rank	27.82	19.85		
0.64 Hz				
Median	11.50	4.70	z_{mw}=2.78	0.005*
IQR	4.00–29.50	4.00–5.50		
Mean rank	29.23	17.88		

IQR, interquartile range; z_{mw}, *z* value of Mann–Whitney test.
*Significant *P* value.

Table 6 Results of sinusoidal harmonic acceleration phase at different frequencies and their comparison between the study and the control groups

	Study	Control	Test statistic	*P* value
0.01 Hz (mean±SD)	43.92 ±14.94	38.07 ±3.63	z_{mw}=1.93	0.064
0.02 Hz				
Median	26.00	22.15	z_{mw}=–1.4	0.161
IQR	20.0–32.0	20.0–25.0		
Mean rank	26.41	20.75		
0.04 Hz				
Median	13.0	11.55	z_{mw}=–0.625	0.532
IQR	8.0–21.0	10.0–14.0		
Mean rank	25.07	22.55		
0.08 Hz				
Median	13.00	7.85	z_{mw}=–1.67	0.094
IQR	4.00–23.00	5.76–10.00		
Mean rank	26.87	20.12		
0.16 Hz				
Median	5.50	5.45	z_{mw}=–0.566	0.571
IQR	3.50–12.50	4.65–6.60		
Mean rank	25.46	23.15		
0.32 Hz				
Median	9.50	1.00	z_{mw}=–4.158	<0.001*
IQR	2.0–21.50	0.95–1.95		
Mean rank	31.57	14.60		
0.64 Hz				
Median	11.0	4.0	z_{mw}=–4.74	<0.001*
IQR	9–19	3–6		
Mean rank	32.59	13.18		

IQR, interquartile range; z_{mw}, *z* value of Mann–Whitney test.
*Significant *P* value.

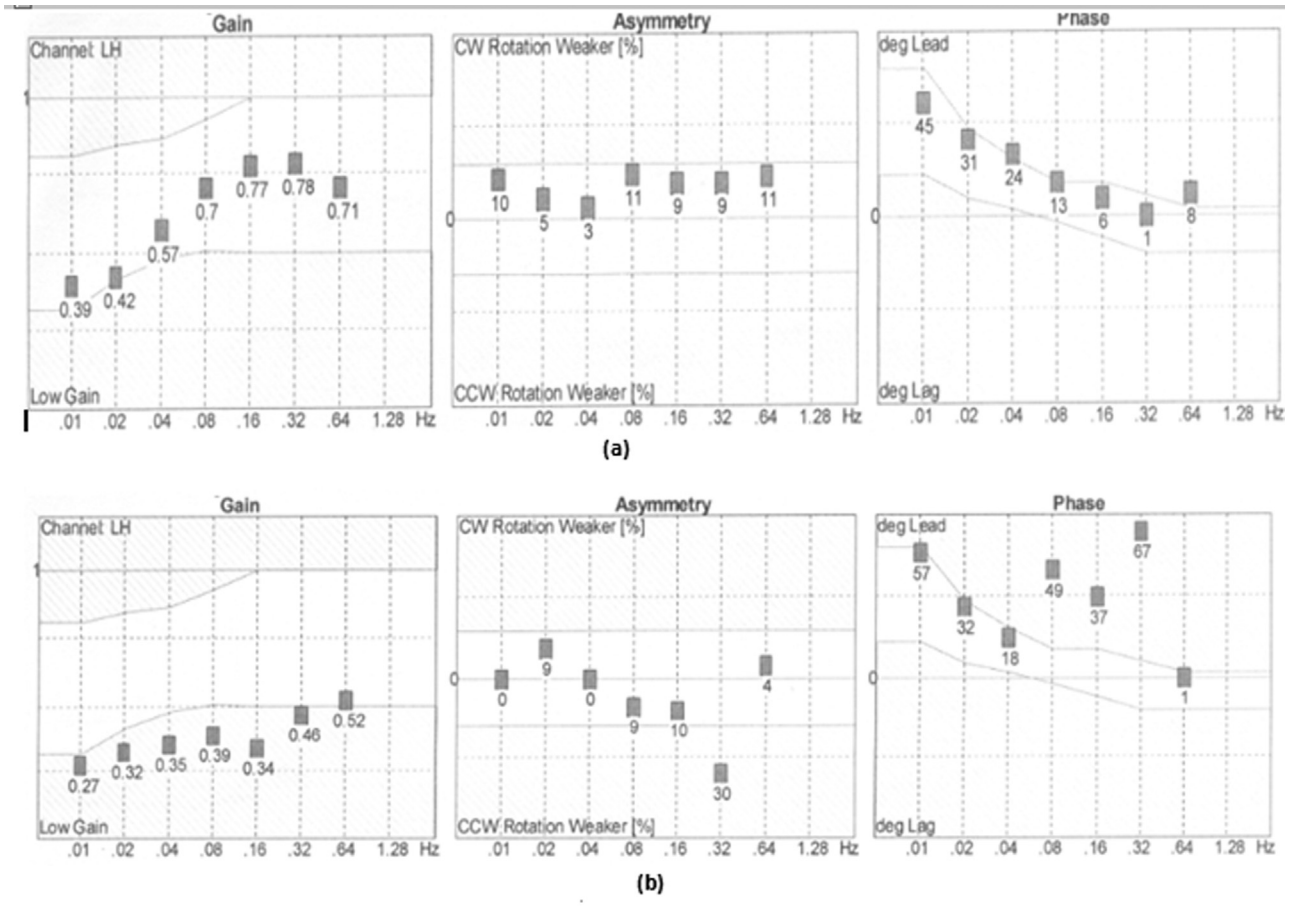
Sinusoidal harmonic acceleration test results

Rotatory chair was done to all participants. SHA gain, phase, and symmetry were measured at all tested frequencies (0.01, 0.02, 0.4, 0.8, 0.16, 0.32, and 0.64 Hz). Quantitatively, five (17.2%) patients of the 29 patients gave normal results for SHA test parameters (gain, phase, and symmetry), whereas two (6.89%) cases with neuro-Behçet showed abnormal high gain at all frequencies and the other 22 (75.86%) cases showed abnormal low gain at different frequencies. Patients with two consecutive frequencies out of range are considered abnormal which constitute two cases. There was a statistically significant reduction in gain in the study group at all frequencies except at 0.64 Hz (Table 4). Regarding symmetry, there was a significantly higher level of asymmetry in the study group mainly at the high frequencies (0.02–0.32) except at 0.04 and 0.32 Hz, where asymmetry did not reach significant levels (Table 5). On the contrary, SHA phase showed no significant difference between both groups except at high frequencies (0.32 and 0.64 Hz) where the study group showed phase lag when compared with control (Table 6).

Several abnormal SHA test results may present in different ways, and our interpretation of the results was based on Hamid [16], Wall [17], and Jacobson and Shepard [12]. Reduced VOR gain over a range of test frequencies may indicate that there is a bilaterally weak peripheral vestibular system, provided that technical issues have been accounted for. The presence of phase lead is more often related to central pathology. Cases with increased asymmetry are supposed to have unilateral vestibular hypofunction, whereas cases with lower degree of asymmetry are most probably of central pathology. An asymmetric SHA response indicates that there is a difference between maximum left-beating and maximum right-beating eye velocity during sinusoidal rotation and provides evidence of a potential unilateral vestibular pathology with the identification of the affected ear.

According to these criteria, this work included 22 (75.8%) patients with abnormal SHA test results: 19 cases had bilateral vestibular hypofunction (eight cases had SLE, nine cases had RA, one case had overlap SLE-RA, and one case had scleroderma) and two cases

Figure 2



Traces of normal (a) and abnormal (b) SHA test in the control group and the study group. SHA, sinusoidal harmonic acceleration.

with unilateral vestibular hypofunction (one case had SLE with right vestibular hypofunction and two cases had RA with left vestibular hypofunction). Among the affected patients, only one patient with SLE had bilateral severe vestibular hypofunction with severe gain affection and out-of-range results of phase and symmetry. Examples of normal and abnormal SHA test are shown in Fig. 2. Studying the effect of the disease activity on the results of SHA tests showed no significant effect ($P>0.05$).

Discussion

A total of 29 patients with different ADs were enrolled in this work. Their vestibular complaints ranged from the sense of unsteadiness or imbalance to the true vertiginous attack, and this is may be related to chronicity of the diseases with tendency of central compensation. The true rotational vertigo may indicate endolymphatic hydrops that may be developed in such cases or due to toxic neuritis [10].

The results of demographic data showed female predominance among the study group. The reasons for such sex predominance are unclear; however, estrogen hormone role in modulating the process of immune response in ADs is recommended [2]. Elevated monosomy X in SD is another hypothesis in the pathophysiology of these disorders [3].

Regarding hearing thresholds, the comparison between the control and the study groups showed statistically significant elevated hearing thresholds in the study group. Generally, 21 (72.41%) patients had normal hearing sensitivity with pure tone average threshold better than 25 dBHL, three patients had bilateral mild SNHL (two cases with RA and SLE), three cases had mild low-frequency SNHL (two cases with RA and one case with SLE) and one case with SLE had bilateral moderately severe SNHL. The prevalence of SNHL in ADs has been reported with great variability ranging from 0 [18], 22 [19], 48 [8] and up to 65% [20]. The mechanism of SNHL is still unknown; however, immune complex-dependent vasculitis, antibody formation against the inner ear causing a destruction of the cochlear hair cells, neuritis, or ototoxic effect of the drugs (e.g. NSAID and methotroxiate) used in the treatment are

suggested. Moreover, the inner ear itself could be the site of immune complex deposition [9,21]. Low-frequency SNHL was found in three cases with RA and might be related to endolymphatic hydrops (which is known to be associated with RA) with later progression to higher frequencies. In SLE, both unilateral and bilateral SNHL (mainly affecting the middle and high frequencies) had been reported [10].

The relation between hearing loss and the AD duration or activity is not well established. For example, Andonopoulus *et al.* [22], Maciaszczyk *et al.* [23], and Mokbel *et al.* [20] reported no such relationship. This work also showed no correlation between hearing loss, duration of the disease, presence of rheumatoid factor, erythrocytes sedimentation rate or type of medical treatment. However, Magaro *et al.* [24] reported that the hearing loss in RA appeared to correlate significantly with the disease activity and the presence of rheumatoid factor.

Regarding SHA test results, five patients of the 29 patients had normal results indicating normal VOR at all tested frequencies with normal horizontal SCC function. Two patients with neuro-Behçet had abnormal high gain with normal phase and symmetry. This might indicate central vestibular affection in neuro-Behçet's disease with loss of normal velocity storage that can occur in 5–50% of patients [5]. There are two types of neuro-Behçet's disease, the parenchymal type with central vestibular system affection as a result of either brainstem affection, cranial neuropathy, and cerebellar or pyramidal dysfunction [6] and nonparenchymal type with vascular pathology including the vestibular one [7].

In our study, 19 (65.5%) patients of 29 patients had bilateral vestibular hypofunction: eight of patients had SLE, nine patients had AR, one patient had overlap SLE-RA, and one case had scleroderma. Only 12 (63.16%) of those 19 patients with vestibular hypofunction were complaining of vertigo. This might be related to the slow course of the disease that allows for central compensation. Unsteadiness and the sense of imbalance were the main complaints. Although the bilateral affection was the predominant, unilateral vestibular hypofunction was detected in three patients. Our findings are in accordance with Batuecas-Caletrío *et al.* [25], who reported that SNHL and vertigo are frequent in SLE, suggesting a common audiovestibular dysfunction. The immune system can attack not just the ear but also some other body parts like the eye, or attack the entire body (including the ear). An autoimmune reaction from distant locations creates debris which is then transported and deposited by the circulation in other body parts including the ear and the vestibular system [25]. This may explain the vestibular affection in those patients with different vestibular symptomatology. Several factors determine the type of vestibular symptoms that might be experienced, including the speed with which the vestibular loss occurred, the degree of loss, whether one side or both sides are affected, and whether the damage has triggered a problem with fluctuating function (e.g. if endolymphatic hydrops developed from the autoimmune reaction). The symptoms of autoimmune problems can be similar, even indistinguishable, from other vestibular disorders. One of our patients had SLE with bilateral severe vestibular hypofunction, severe gain reduction and out-of-range phase and symmetry. This case aged 30 years had bilateral mild low-frequency SNHL with non-active SLE of 5-year duration. Other cases with SLE had bilateral vestibular hypofunction and normal peripheral hearing and active disease. This indicated that neither the activity nor the duration had an effect on the vestibular function.

Conclusion

Audiovestibular symptoms are common in different ADs. Among these symptoms are tinnitus, vestibular complaints, SNHL, and aural fullness. Hearing loss was observed in 34.5%, whereas vestibular complaints were present in 41.4% of the cases. SHA test showed that vestibular affection is much more frequent than expected, and some patients with no vestibular complaints showed abnormal SHA test results (75.8%). Most importantly that audiovestibular symptoms had no correlation with disease duration or activity. So, regular screening of hearing and vestibular functions in patients with autoimmune should be done, for better and early management. It also emphasizes the importance of enrolling audiovestibular evaluation as a routine in their initial investigations.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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