Assessment of Audiovestibular function in Fibromyalgia Patients

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Original Article

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ABSTRACT

Introduction: Fibromyalgia(FM)is a chronic pain syndrome characterized by generalized muscle pain.Despite of disease severity, several neurological symptoms including tinnitus, ear fullness, vertigo, and dizziness could be related.
Purpose: Evaluation of the audio- vestibular function in patients diagnosed with fibromyalgia.
Methods: The Study group involved sixty patients with fibromyalgia and the control group composed of sixty healthy individuals with age and gender matching to the study group. Pure tone audiometry, auditory brainstem-evoked potential test, cervical and ocular vestibular evoked myogenic potential (cVEMP and oVEMP), videonystagmography test (VNG)were done. Fall risk assessment of fibromyalgia patients was done by arabic version of Short Falls Efficacy Scale-International (FES-I).
Results: Mean hearing thresholds were significantly higher in cases at 250Hz, 4000Hz, and 8000Hz than in controls. The latencies of I, III, V, I-III, I-V and III-V waves were statistically significant prolonged in FM patients than the control.Also, patients with FM had statistically significant longer P13 and N23 latencies than the control group and significantly lower IP amplitude as regard cVEMP results. FES-I revealed that 16 (26.7%) of FM patients had low concern, 40 (66.7%) had moderate concern, and 4 (6.7%) had high concern.
Conclusion: FM was found to be associated with a high incidence of sensorineural hearing loss. Impairment of ABR, c VEMP and o VEMP indicate both auditory and vestibular system involvements. The hearing and balance functions work in combination and should be tested concurrently in systemic disorders such as fibromyalgia.

Key Words: Auditory brain stem, fibromyalgia, neurologic effect of fibromyalgia, risk of fall, vestibular disease.

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INTRODUCTION

Fibromyalgia (FM) is a chronic non-inflammatory condition that causes generalized musculoskeletal pain[1]. The cause is still undetermined, and FMS is frequently misdiagnosed[1]. Females between the ages of 25 and 65 are affected by fibromyalgia. Females are more likely to be affected than males[2]. The diagnosis depends on complaints of severe pain that has lasted at least three months in at least 11 of 18 areas of tenderness[3].

FM patients frequently experience vague symptoms and are more likely to develop a variety of comorbidities and illnesses[4]. A mechanism underpinning FM etiopathology was recently hypothesized, leading to findings suggesting that patients with FM may also be at risk of hearing loss (HL)[5]. Damage to any portion of the peripheral or central auditory systems can cause hearing loss[6]. Peripheral HL might be conductive, sensorineural, or mixed. Hearing loss in fibromyalgia patients is thought to be caused by neuronal disintegrate caused by systemic disturbances or neural mediators linked with the disease[7].

Vertigo may also be associated in certain fibromyalgia patients to the use of medicines such as analgesics and antidepressants, which can cause drowsiness and dizziness as side effects[8]. Vertigo can also be caused by hypotension and autonomic nervous system (ANS) dysfunction, or by fibromyalgia's direct effect on the vestibular system[9].

Patients with FM have a generalized postural balance impairment and a higher risk of falling[10]. Balance disorders are ranked as one of the ten most disabling symptoms of FM, with a reported incidence of 45%[11]. Patients have a defective balance system due to inadequate integration of visual and vestibular afferents with a sensorimotor preference when balancing[12].

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AIM OF THE WORK

Evaluation of the audio - vestibular function in patients diagnosed with fibromyalgia.

METHODS

This is a case control study.The Study Group involved sixty patients with fibromyalgia and the control group composed of 60 healthy individuals with age and gender matching to the study group. Patients were collected from adults who attended to the Rheumatology Outpatient clinic, Beni-Suef University Hospital. The audiological assessment was performed at the unit of Audio-Vestibular Medicine in Beni-Suef University Hospital. The study started from January 2021 to January 2023. The study was approved by the ethical committee of the Faculty of Medicine, Beni-Suef University. Informed written consent was obtained from all participants.

Each participant was subjected to the following procedures:1) Compete history taking that includes medical history of fibromyalgia for cases, 2) Clinical examination: Fibromyalgia diagnosis based on the proposed 2016 criteria[13], Generalized pain, characterized as pain in at least four of five locations; symptoms are consistent with being present at a similar degree for at least three months; and a Widespread pain index (WPI) ≥7 and symptom severity scale (SSS) score ≥5 OR WPI 4–6 and SSS score ≥9.

Basic audiological evaluation including

Pure tone audiometry including air and bone conduction. Speech audiometry including Speech Reception Threshold (S.R.T), using arabic spondic words[14] and word discrimination score (WDS %), using arabic phonetically balanced (PD)[15]. Immittancemetry that includes tympanometry and acoustic reflex threshold .

Auditory brainstem evoked potential

At an intensity of 80 dBHL, click was provided at a rate of 21.1 stimuli per second in rarefaction polarity. The average potential for 1200 clicks was obtained. Two recordings were collected to ensure that the waveforms could be replicated. The latencies of waves I, III, and V were studied.

Evaluation of vestibular system by

a- Bedside vestibular tests

- Gait observation
- Vestibulo-ospinal reflex (VSR)examination including Romberg test and Fukuda Stepping Test.
- Vestibulo-ocular reflex (VOR) examination including spontaneous Nystagmus and gaze evoked nystagmus
- The search for Head shaking nystagmus.
- Head Impulse Test .
- Positioning and Positional Testing.

b- Videonystagmography test

- Occulography test: smooth pursuit testing, saccade, optokinetic tests.
- Water caloric test. Each ear was irrigated with water at temperatures of 30 and 44◦C for 40 seconds to perform bithermal caloric testing. The responses were recorded for three minutes. Jongkees' formula[16] was used to calculate canal paresis and directional preponderance. More than 20% canal paresis and 25% directional predominance were regarded abnormal.
- Positional tests.
- Positioning tests.

c- Vestibular evoked myogenic potential including Cervical vestibular evoked myogenic potential (c VEMP) and Ocular vestibular evoked myogenic potential (oVEMP)

Peak latencies of waves P1 and N1, N1and P1 as well as peak to peak amplitudes (P1-N1) and (N1-P1), were measured in each ear. This equation was used to determine the Asymmetric Ratio (AR):

AR = greater P1-N1 amplitude - smaller P1-N1amplitude /Sum of P1-N1 amplitudes in both ears) x 100 as regards (c VEMP)

AR = greater N1-P1 amplitude - smaller N1-P1 amplitude /Sum of N1-P1amplitudes in both ears) x 100 as regards (o VEMP)

Fall risk assessment

Using Arabic version of Short Falls Efficacy Scale-International (FES-I)[17].

The questionnaire is intended to assess the level of concern about falling while participating in seven different physical activities. The participant used the questionnaire to rate their level of concern about falling during the seven different activities. Concern levels were labelled as follows: not at all concerned, moderately concerned, fairly concerned, and very concerned. The final scores are mild concern (7-8), moderate concern (9-13), and high concern (14-28) .

Statistical analysis

The data was analyzed using a social science statistical software (SPSS 25).The quantitative variables were evaluated using mean standard deviation, median, and interquartile range (IQR). The qualitative factors were

stated using frequencies and percentages. The independent T test was used to compare normally distributed means, while the Mann Whitney U test was used to compare non-normally distributed variables. The chi squared test, exact, and fisher exact tests were used to compare categorical data based on the predicted counts in the cells. To connect qualitative variables with normal distribution, Pearson correlation was utilized. Correlation was used to determine the relationship between scale variables. The *P value* was determined, which is either non-significant if it is greater than or equal to 0.05, or significant if it is less than 0.05.

RESULTS

The study group composed of 60 fibromyalgia patients, aged 18 to 50 years with a mean of 33.83 years ± a SD of 7.202 years and the control group composed of 60 healthy individuals, whose age ranged from 18 to 50 years and with a mean of 35.22 ± SD of 9.365 years. There was no statistically significant difference between the two groups regarding age (p>0.05). As regard gender, the study group involved 51 (85%) females and 9 (15 %) males, and the control group involved 50 (83.3%) females and 10 (16.7%) males, with no statistically significant difference between the two groups (p>0.05).

(Table 1) showed that the most common complaint was dizziness followed by headache then tinnitus and hearing loss.It also shows number of cases complaining of imbalance, falls, blurring of vision, sense of knuckle head and sleep disorders.

Table 1: Symptoms distribution in FM group.

Items	Cases (no=60)
Dizziness	50(83.3%)
Imbalance	29(48.3%)
Falls	7(11.7%)
blurring of vision	9(15.0%)
Sense of knuckle head	12(20.0%)
Headache	46(76.7%)
Tinnitus	45(75.0%)
Sleep disorders	17(28.3%)
Hearing loss	34(56.7%)

(Table 2) showed that there were significant higher mean hearing thresholds in cases at 250Hz, 4000Hz, 8000Hz than the control (*P-value*<0.05). There were 33 patients with sensorineural hearing loss.

Table 2: Comparison of the mean hearing thresholds in cases and control regarding PTA(in dBHL)

PTA	Control (no=120) [mean± SD]	Cases (no=120) [mean± SD]	t-value	*P-value*
250Hz	19.41±4.811	20.92±4.250		0.007*
500Hz	22.16±4.055	21.83±3.237		0.597
1000Hz	21.06±3.803	20.83±3.326		0.928
2000Hz	20.89±3.902	21.58±2.898		0.091
4000Hz	20.72±4.589	29.17±7.706		<0.001*
8000Hz	20.81±4.028	28.83±8.345		<0.001*

t:independent t-test .**P-value* < 0.05 is significant **P value* ≥ 0.05 (non significant)

(Table 3) showed that there were statistically significant prolonged waves I, III, V, I-III, I-V and III-V latencies in FM patients than the control. Also, V/I amplitude ratio was statistically significant lower in FM patients than the control. (*P-value*<0.05).The number of ears in cases where the latencies of wave I were prolonged was 52, wave III was 30 ears, wave V was 70 ears, and I-V IPL was 66 ears.

Table 3: Auditory Brainstem Response (ABR) results in cases and control

Items	Control (no=120 ears)	Cases (no=120 ears)	t- value	*P-value*
I latency	1.68±0.194	1.90±0.134	-10.119	<0.001*
III latency	3.71±0.166	3.86± 0.165	1.244	<0.001*
V latency	5.68±0.168	6.08±0.324	-7.539	<0.001*
I-V IPL	3.97±0.228	4.19±0.342	2.470	<0.001*
I-III IPL	2.02±0.144	2.09± 0.291	-12.357	0.029*
III-V IPL	1.97±0.155	2.11±0.309	4.730	<0.001*
			MW value	*P-value*
V/I amplitude ratio	7.75±9.433	4.63±7.386	2.853	0.005*

t: independent t-test MW: Mann Whitney U test for non-parametric data **P-value* < 0.05 is significant **P value* ≥ 0.05 (nonsignificant)

Table 4 showed that patients with FM had statistically significant longer P1 and N1 latencies than the control group and statistically significantly lower interpeak (IP) amplitude and Asymmetry ratio in FM patients than the control as regard c VEMP (*P-value*<0.05). No statistically significant difference between FM patients and the control group regarding oVEMP N1 and P1 latencies. But there was statistically significant lower IP amplitude in FM

patients than the control (*P-value*<0.05).The number of ears in cases where cVEMP P1 latencies were prolonged was 102, and cVEMP N1 latencies were 108, whereas oVEMP N1 and P1 latencies revealed no abnormalities when compared to the control.

Table 4: Cervical and ocular vestibular evoked myogenic potential (cVEMP and oVEMP) results in cases and controls

c VEMP	Control (no=120)	Cases (no=120)	Type of test	
			t-value	*p-value*
P1 latency	15.4±0.672	15.69 ±0.603	-3.568	<0.001*
N1 Latency	24.73 ±1.051	25.91±0.651	-10.450	<0.001*
IP amplitude	38.04 ±8.399	30.30±5.170	8.588	<0.001*
Asymmetry ratio (no=60)	13.5% (11%,17%)	7.5% (2.25%,16%)	MW value	*p-value*
			3.996	<0.001*
o VEMP			t-value	*p-value*
N1 latency	11.09±0.449	11.11 ±0.39	-0.307	0.759
P1 latency	16.55±0.796	16.62±0.79	-0.675	0.500
IP amplitude	5.35±1.204	4.79±0.999	3.925	<0.001*
Asymmetry ratio (no=60)	10.7% (9.4%,15.1%)	11.9% (9.3%,21.5%)	MW	*P-value*
			-1.022	0.309

t: independent t-test MW: Mann Whitney U test for non-parametric data . *P-value < 0.05 is significant *P value ≥ 0.05 (nonsignificant)

(Table 5) showed that there was a significant higher proportion of positive head impulse test, Fukuda stepping test and Romberg test in cases than controls (*P-value*<0.05). Head position was central , ocular alignment was normal and there was no skew deviation in all subjects in both groups. Also ,there was no spontaneous nystagmus or gaze evoked nystagmus in all subjects in both groups.

Table 5: Comparison between cases and control regarding bed side tests

Items		Control (no=60)	Cases (no=60)	Type of test	
				FET	*p-value*
Head impulse test	Positive	0(0.0%)	6(10.0%)		0.006*
	Negative	60(100%)	54(90%)		
Head shaking test	Positive	0(0.0%)	4(6.7%)		0.119
	Negative	60(100%)	56(93.3%)		
Positional test	Positive	0(0.0%)	7(11.67%)		0.006*
	Negative	60(100%)	53(88.33%)		
Fukuda stepping test	Positive	0(0.0%)	11(18.3%)		0.001*
	Negative	60(100%)	49(81.7%)		
Romberg test	Positive	0(0.0%)	11(18.3%)		0.001*
	Negative	60(100%)	49(81.7%)		

FET: Fisher Exact Tests.*P-value < 0.05 is significant *P value ≥ 0.05 (non significant)

(Table 6) This table showed that there was a significant lower smooth pursuit test gain ,saccades velocity, and saccades accuracy %in cases than controls (*P-value*<0.05). There was no spontaneous nystagmus in all subjects in both groups. Smooth pursuit test was symmetrical and optokinetic test was equal in both sides in all subjects in both groups.

Table 6: Comparison between cases and control regarding VNG tests

Items		Control (no=60)	Cases (no=60)	Type of test	
				FET	*p-value*
Positional test	Normal	60(100%)	53(88.3%)		0.006*
	Abnormal	0(0.0%)	7(11.7%)		
Dix Hallpike test	Normal	60(100%)	53(88.3%)		0.006*
	Abnormal	0(0.0%)	7(11.7%)		
				t-value	*P-value*
Smooth pursuit test gain		0.922±0.028	0.869±0.071		<0.001*
Saccades	Latency	228.20±10.894	235.55±27.443		0.052
	Velocity	359.68±20.920	346.95±37.643		0.024*
	accuracy %	89.158±2.247	87.237±5.476		0.013*
				χ2value	*p-value*
VNG caloric test	No canal paresis	60(100.0%)	42(70.0%)	21	<0.001*
	Unilateral weakness	0(0%)	18 (30.0%)		

t:independent t-test (X2):Chi-square Test FET: Fisher Exact Tests. *P-value < 0.05 is significant *P value ≥ 0.05 (non significant)

(Figure 1) This figure showed short FES-I scoring in FM group.

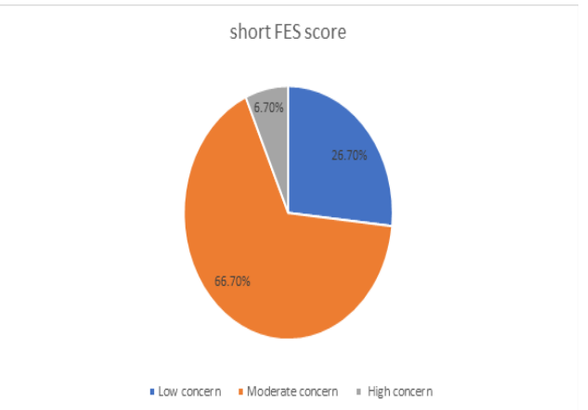

Fig. 1: Short FES-I results in FM group

(Table 7) showed that there was a significant linear positive correlation between disease duration and PTA at 500Hz, 4000 Hz, and 8000 Hz .Also, there was a significant linear positive correlation between disease duration and ABR wave V , ABR I-V IPL and ABR III-V IPL latencies among FM group.

Table 7: Correlation between pure tone average(PTA) ,auditory brainstem response (ABR) and disease duration on both sides among cases (no=120).

PTA	Disease duration	
	(r) coef.	*P-value*
250 Hz	0.167	0.068
500 Hz	0.193	0.035*
1000 Hz	-0.005	0.954
2000 Hz	0.100	0.278
4000 Hz	0.258	0.004*
8000 Hz	0.372	<0.001*
ABR		
I latency	0.046	0.617
III latency	-0.045	0.625
V latency	0.444**	0.001*
I-III IPL latency	0.226	0.485
I -V IPL latency	0.415**	0.013*
III-V IPL latency	0.246**	0.007*
V/ I amplitude ratio	-0.155	0.236

(Table 8) showed that there was significant negative linear correlation between disease duration and cVEMP asymmetry ratio only among FM group.While , there was no significant correlation between disease duration and oVEMP findings among FM group.

Table 8: Correlation between disease duration and cervical and ocular vestibular evoked potential (cVEMP and oVEMP) parameters among cases (no=60).

cVEMP	Disease duration	
	(r) coef.	*P-value*
P1 latency	0.175	0.055
N1 latency	-0.150	0.101
IP amplitude	0.057	0.537
Asymmetry ratio	-0.398	<0.001*
oVEMP		
N1 latency	-0.011	0.907
P 1 latency	0.018	0.842
IP amplitude	0.175	0.055
Asymmetry ratio	0.081	0.538

(r) using Pearson coefficient *p *value* $\geq$ 0.05 (non significant) * p *value* < 0.05 (significant).

(Table 9) showed that there was a statistically significant linear negative correlation between short FES-I and cVEMP findings. A statistically significant linear negative correlation was also found between short FES and oVEMP N1 and P1 latency and asymmetry ratio .

Table 9: Correlation between cervical and ocular vestibular evoked potential (cVEMP and oVEMP)parameters and short fall efficacy scale International(FES-I) among cases (no=60).

cVEMP	Disease duration	
	(r) coef.	*P-value*
P1 latency	-0.186*	0.042*
N1 latency	-0.224*	0.014*
IP amplitude	-0.381**	<0.001*
Asymmetry ratio (n=60)	-0.447*v	<0.001*
oVEMP		
N1 latency	-0.318	0.001*
P1 latency	-0.183*	0.045*
IP amplitude	0.017	0.853
Asymmetry ratio (n=60)	0.263*	0.042*

(r) using Pearson coefficient .*p *value* $\geq$ 0.05 (non significant) * p *value* < 0.05 (significant).

DISCUSSION

Fibromyalgia (FM) is a medical disorder characterized by chronic widespread pain, exhaustion, waking up feeling tired, cognitive problems, lower abdomen pain or cramping, and depression[13]. The pain appears to be caused by central nervous system processes, and the disease is known as "central sensitization syndrome"[18].

In the present study, there was a wide range of otoneurological and clinical symptoms among patients with fibromyalgia. The most prevalent complaint in cases was dizziness, which was reported by 83.3% of study group. It was followed by tinnitus (75.0%) and headache (76.7%).It also demonstrated the number of cases with hearing loss, imbalance, sleep difficulties, knuckle head, blurring of vision, and falls (Table 1).

This was in agreement with Mohamed *et al*[19] and Koca *et al*[20] who stated that the vertigo prevalence was found high with 60% and 84 % frequency respectively in patients with fibromyalgia. According to Mohamed *et al*[19] the overall dizziness handicap inventory scores were significantly higher in the FM group. They found 78% of FM patients complained of disequilibrium for a long time with complaints of vertigo (mean of 30 months) that could be associated to musculoskeletal problems.

Similarly, Chung *et al*[21] demonstrated that 46.8% and 87.2% of the 47 FM patients had tinnitus and headache, respectively, suggesting a high incidence of these symptoms in FMS. They proposed that tinnitus is an important aspect of centrally related symptoms in FM, implying that the degree of tinnitus corresponds directly to the severity of

FM and should be investigated in all FM patients. This could be due to abnormal neurological processing referred to as central sensitization.

Studying audiometric threshold in FM we found statistically significant differences in thresholds at 250 Hz, 4000 Hz, and 8000 Hz frequencies that were considerably higher than the mean PTA thresholds in the control group in the same frequencies (Table 2). A more or less similar findings were described by Gencer *et al*[22] and Tuncer *et al*[23] who reported in their case control studies a statistically significant difference between control and study groups at high frequencies (4000-8000 Hz) and they explained their findings by stating that high frequencies are more vulnerable to the effects of phospholipid antibodies, serotonin, and ganglioside antibodies.

In contrast to our findings, Likuni *et al*[24] discovered that for all patients with FM, regardless of report of ear fullness, mean threshold was found to be within the normal range, suggesting that the causes of ear fullness and hearing loss associated with fibromyalgia vary from the diseases of hearing loss indicated by pure tone audiometry.

Regarding ABR findings, we found a considerable delay in the absolute peak latency of waves I, III, and V, as well as the interpeak latency of the I-III, III-V, and I-V in cases. ITD and V/I amplitude ratio were also significantly reduced in cases (Table 3). In accordance with Gencer *et al*[22] who conducted a study on 168 female patients with fibromyalgia. Their findings revealed that the absolute latencies of the I, III, and V waves were statistically significantly delayed, and the interpeak latencies of the I-III, III-V, and I-V waves were statistically significantly prolonged compared to the control group.

According to Le *et al*[25] sensorineural HL occurs frequently in FM patients at both high and low frequencies. Because of inner ear or central auditory impairment, patients with FM may have sensorineural HL and auditory brainstem response abnormalities.

cVEMP test results showed significant delay of P1 and N1 latencies and decrease in both IP amplitude and AR in study group in spite of being in normal value as reported in literature (Table 4), while oVEMP showed only significant reduction in IP amplitude and non-statistically significant difference in N1 and P1 latencies or AR between controls and study group (Table 4).

These findings may be explained by muscle fatigue that may affect sternocleidomastoid and inferior oblique muscles or brain stem dysfunction that is demonstrated in some patients with fibromyalgia[22]. The differences between cVEMP and oVEMP can be attributed to the fact that oVEMP is a contralateral recording so even in norms it would show prolonged timed pathway.

Bayazit *et al*[26] detected no significant difference in P1 latencies between fibromyalgia patients and controls. But when fibromyalgia patients were compared to controls, their N1 and interpeak latencies were much longer. Although the presence of a normal P1 wave, the prolongation of the N1 wave and the interpeak latency imply that the vestibular evoked myogenic potential needs tonic contraction of the sternocleidomastoid muscle so fibromyalgia pathogenetic pathways may have impacted the sacculocollic reflex arc[27].

Tuncer *et al*[23] found that both VEMPs were recorded in the controls, while in FMS patients, 57/66 ears recorded cVEMPs and 49/66 ears recorded oVEMPs. They referred their findings to the possibility of vestibular reflex system impairment in fibromyalgia patients.

Bed side testing revealed as shown in (Table 5) that the head impulse test was positive in 10.0% (6 subjects), fukuda stepping test was positive in 18.3% (11 subjects), Romberg test was positive in 18.3% (11 subjects) and head shaking test was positive in 6.7% (4 subjects) indicating peripheral type of vestibular affection which involves both vestibulo-ocular reflex (VOR) and mainly vestibulo-spinal reflex (VSR)(Romber, …etc).

This could be explained by the use of medications that include analgesics and antidepressants, which may trigger dizziness and drowsiness as adverse effects (reported in 8% of all patients using these drugs), especially when used for a prolonged period of time (the mean duration of consumption in the current study was 1.5 years). Additionally, dizziness may develop if an SSRI is abruptly discontinued Mohamed *et al*[19]. However, in their study, Mohamed *et al*[19] they reported that fibromyalgia is unlikely to be a cause of peripheral vestibular dysfunction. Thus, no vestibular testing is needed for such patients.

Mohamed *et al*[19] their study examined subjects with FM with bedside examinations, they found no spontaneous nystagmus, no gaze-evoked nystagmus, and no post head-shaking nystagmus. However ,there was deviation in the stepping test in 3 (20%) patients of fibromyalgia .They explained their results by decompensation or imbalance of vestibular system.

There was no spontaneous nystagmus in either group of participants, according to VNG results. In study group , the smooth pursuit test was symmetrical with significant low gain. In study group , the saccade test revealed a minor increase in latency and a significant reduction in velocity and accuracy, although the optokinetic test revealed equal results on both sides in all patients in both groups. In 11.7% of study group (7 individuals), the positional test and the Dix-Hallpike test were significantly abnormal. In 30% of study group (18 individuals), the caloric test revealed unilateral weakness (Table 6).

In accordance with our results Mohamed *et al*[19] indicated that VNG testing produced the same findings in terms of spontaneous and gaze-evoked nystagmus, and that tracking tests produced normal results in both groups.

Furthermore, optokinetic test findings showed diminished gain in three FM group patients (20%), and saccade test results showed aberrant accuracy and latency in three FM group patients. (20%). They explained their results by fibromyalgia does not appear to contribute to the cause of peripheral vestibular disorder, although it may be a source of vertigo complaints due to musculoskeletal defects.

Mohamed *et al*[19] demonstrated that Positional testing revealed inappropriate results in two fibromyalgia patients (13.3%), both of whom had significant nystagmus. Because the positional test has a moderate sensitivity and specificity, their abnormal results are unlikely to be explained by an uncompensated peripheral vestibular lesion[28].

An interesting study done by , Pérez-de-Heredia-Torres[29] performed the sensory organisation test of balance (Posturography) in women with fibromyalgia and found that women with FM had significantly lower values in all SOT conditions (vestibular, visual, and somatosensory) , with scores of conditions 4-6 significantly decrease than those of conditions 1-3. The current study differs from that study in that the caloric test assesses vestibulo-ocular function, whereas sensory organisation tests assess vestibulo-spinal function, and many patients with fibromyalgia had musculoskeletal abnormalities, which may have resulted in lower posturography balance scores.

According to Pérez-de-Heredia-Torres[29] the distribution of peripheral vestibular examination (caloric, stepping, Romberg, and positional tests) in the fibromyalgia group revealed that 18 patients had unilateral caloric weakness, 11 had abnormal stepping and Romberg tests, and 7 had abnormal positional tests, and those 7 patients are likely to have peripheral vestibular dysfunction as each assessment solely has limited specificity and sensitivity while using a combination of several clinical tests got the most reliable vestibular assessment.

The fear of falling was questioned verbally in the current study and it was calculated according to the short FES-I . It revealed 26.7% of study group with low concern (they have better fall-related efficacy and low concern about falling), 66.7% with moderate concern and 6.7% with high concern (severe concern about falling)(Figure 1).

Leon-Llamas *et al*[30] conducted a cross sectional study on women with fibromyalgia. Participants completed questionnaires (FES- I) to assess fear of falling, kinesiophobia and the impact of fibromyalgia .They found that the FM group reported higher scores of fear of falling than apparently healthy group measured through the FES-I and reported a higher number of falls in the last year than apparently healthy group. Fibromyalgia is linked to impaired balance and an increased risk of falling .There is no one mechanism that might explain the impaired postural instability in FM patients, but vestibular, somatosensory, or postural reflex abnormalities could[31].

There was a significant linear positive correlation between disease duration and PTA thresholds at 500Hz, 4000 Hz, and 8000 Hz (Table 7). There was a significant linear positive correlation between disease duration and ABR V latency , ABR I-V IPL ABR III-V IPL (Table 7). We could refer these correlation to ear symptoms of patients may also develop due to muscular involvement in addition to sensorineural pathway pathologies which is definitely deteriorating overtime.

Exploring the effect of duration of the disease, there was a significant negative linear correlation between disease duration and cVEMP asymmetry ratio only reflecting duration effect of the response amplitude. A non-significant correlation between disease duration and oVEMP findings was found in the study group indicated no effect for the disease on muscle response in the beginning of the problem and also later on in the later course of the disease (Table 8). To the best of our knowledge, no previous studies investigated these associations in fibromyalgia patients. These results may be explained by postural instability and musculoskeletal fatigue.

A significant linear negative correlation was found between short FES-I and c VEMP P13 latency, N23 latency, IP amplitude, and AR in cases , as well as there was a significant linear negative correlation between short FES-I and oVEMP N10 latency and asymmetry ratio .There was no significant correlation between short FES-I and disease duration (Table 9).

Sarhan *et al*[32] discovered no significant correlation between balance loss and disease duration. But, Meireles *et al*[33] indicated that as the disease progresses in FMS patients, the postural control processes become compromised due to inactivity caused by pain, fatigue, and chronic sleep problems, so the duration of the disease could be linked to postural instability and a higher probability of falls.

Accordingly, our findings in auditory brainstem response revealed that fibromyalgia may be related with inner ear and central auditory pathway problems.In terms of cVEMP results, latencies were delayed and amplitudes were lower in fibromyalgia patients, raising the potential of vestibular reflex pathway impairment.Unilateral canal weakness was discovered in 18% of the cases, indicating the presence of a peripheral vestibular disease in FM.We might conclude that fibromyalgia may have an impact on both the peripheral and central audiovestibular systems.

CONCLUSION

1. Fibromyalgia was found to be associated with a high incidence of sensorineural hearing loss(33 cases out of a total of 60).

2. 2-Fibromyalgia duration was correlate positively with PTA thresholds at 500 ,4000 and 8000 kHz and ABR V latency , ABR I-V IPL ABR III-V IPL but as disease duration increased , the cVEMP asymmetry ratio significantly decreased.

3. Fibromyalgia is linked to impaired balance and an increased risk of falling which was assessed by FES -I.

4. The hearing and balance functions work in combination and should be tested concurrently in systemic disorders such as fibromyalgia.

5. Impairment of ABR, c VEMP, and o VEMP, as well as unilateral canal paresis, indicating involvement of both the peripheral and central audiovestibular systems.

CONFLICT OF INTERESTS

There are no conflicts of interest.

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