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Does fibromyalgia have an effect on hearing loss in women?

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Background/aim: Fibromyalgia (FM) patients may have several neuroendocrine dysfunctions, resulting in a hypervigilant sensory output that may be responsible for sensorineural complaints. In this study, we evaluated the audiological findings of a cohort of female fibromyalgia patients.

Materials and methods: Between 1 September 2012 and 1 June 2013, 35 female FM patients, followed by the Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Bozok University, were recruited for the study. The patients were referred to the Department of Otolaryngology for routine otolaryngological and audiological evaluations. Age range was between 30 and 65 years, with a mean age of 48.10 years. The control group consisted of 25 healthy female volunteers ranging from 32 to 65 years (mean age: 45.52). All subjects were audiologically tested, including tympanometric evaluation. Low- and high-frequency audiometry was carried out by a single experienced investigator under standard audiometric testing conditions.

Results: At low frequencies, the mean air conduction threshold values between the two groups were not statistically significant. At high frequencies, the mean air conduction threshold values and tympanometric values between the FM and control groups were statistically significant ($P < 0.05$ for both).

Conclusion: Our results point to a pathophysiologic link between FM and the development of audiological abnormalities in these patients.

Key words: Fibromyalgia, hearing loss, frequency

1. Introduction

Fibromyalgia (FM) is a disease of unknown etiology characterized by systemic symptoms such as fatigue, chronic pain, sleep dysfunction numbness, and muscle stiffness. Diagnosis is based on complaints of extensive pain persisting for at least 3 months and reports of pain from 4 kgF pressure in at least 11 of 18 tender points on the body (1). Specific diagnostic criteria for FM were first published by Smythe and Moldofsky in 1971 and were later revised by the American College of Rheumatology (2).

Additionally, FM patients show symptoms of poor mental health and cold intolerance. FM may also impact quality of life by causing functional disability (3). This syndrome is mostly seen in females, with a female-to-male ratio of 6–9/1 (4,5).

Recent studies have shown that several neuroendocrine dysfunctions may accompany FM, including serotonin deficiency, increased cerebrospinal fluid substance P, disturbance of non-REM sleep, and involvement of the caudate nuclei (6). It has been proposed that these pathologic conditions may be derived from the dysfunction of the mechanisms responsible for their regulation as a result of the reduction of blood supply to the targeted areas. As reported previously, FM may distort blood supply to the inner ear structures (7).

In this study, we aim to evaluate hearing levels in a group of FM patients using audiometric measurements.

2. Materials and methods

The study was approved by the Local Research Ethics Committee. All patients provided written informed consent to participate in the study according to the Declaration of Helsinki. This was a case-control study, enrolling 35 patients with FM (mean age: 48.10, range: 30–65 years) and 25 healthy volunteers without chronic disease as the control group (mean age: 45.52, range: 32–65 years) between September 2012 and June 2013 at Bozok University. All the study and control subjects were female, in relative accordance with the frequency of the condition. All patients and control subjects agreed to participate in

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the study. FM was diagnosed according to the criteria of the American College of Rheumatology (2). These criteria include diffuse pain and stiffness in the muscles, as well as tendon insertions on digital palpation with an approximate force of 4 kg (the amount of pressure required to blanch a thumbnail), lasting for at least 3 months. To meet the diagnostic criteria, pain must occur in 11 or more of the 18 specified tender point sites. Routine ENT examination was performed in both groups.

Subjects were excluded if they had a history of systemic or chronic disease, chronic use of medications, previous history of otologic disease, family history of early onset hearing loss, hearing loss due to other causes, or a history of high-risk noise exposure or ototoxic drug therapy.

2.1. Audiological evaluation

Otoscopic examination revealed normal external ear canal and tympanic membrane findings in all 60 subjects. Each subject was tested with low- (250–2000 Hz) and high-frequency (4000–8000 Hz) audiometry, performed by a single experienced investigator in a sound-treated room. The standard battery of hearing tests consisted of pure tone, speech, and impedance audiometry and was performed in the same audiology laboratory. For each set of tests, the mean values of air and bone conduction at each frequency value were calculated for both groups.

Tympanometric results were classified as type A, B, or C tympanograms. Acoustic reflexes were simultaneously recorded and evaluated.

2.2. Statistical analysis

Analysis of variance was used to analyze differences in baseline data between the two groups. Student's t-test and the chi-square test were used to compare air conduction, bone conduction, and tympanogram results in the three groups. $P < 0.05$ was considered to indicate statistical significance. Data were analyzed with SPSS 15.0 (SPSS Inc., Chicago, IL, USA). Results are expressed as mean ± SD.

3. Results

The mean age of patients with FM was 48.10 ± 9.4 years (30–65 years) and mean age was 45.52 ± 10.8 years (32–65 years) for the control group. There was no statistically significant difference between the groups with regard to mean age ($P > 0.05$). The hearing levels at low and high frequencies are shown in Table 1. At low (250–2000 Hz) frequencies, the mean air and bone conduction threshold values between the two groups were not statistically significant ($P > 0.05$). In contrast, at high frequencies (4000–8000 Hz), air-bone conduction threshold values in the FM group were lower than in the control group, which proved to be statistically significant ($P < 0.05$). The speech discrimination score (SDS) of these patients was also diminished; however, these values did not reach statistical significance compared to control group's values ($P > 0.05$) (Table 1).

Table 1. Comparison of the mean air conduction thresholds for the two groups at different frequencies.

Frequencies		Fibromyalgia (n = 35)	Control (n = 25)	P
250 Hz	Right	10.35 ± 5.31	10.02 ± 5.2	>0.05
	Left	10.25 ± 5.35	10.10 ± 5.61	>0.05
500 Hz	Right	11.35 ± 5.11	10.90 ± 5.2	>0.05
	Left	11.39 ± 6.22	11.01 ± 5.55	>0.05
1000 Hz	Right	13.34 ± 6.12	13.15 ± 7.1	>0.05
	Left	13.37 ± 6.99	13.32 ± 7.04	>0.05
2000 Hz	Right	15.01 ± 6.45	15.01 ± 6.98	>0.05
	Left	15.60 ± 7.50	15.36 ± 7.19	>0.05
4000 Hz	Right	19.80 ± 7.70	15.13 ± 7.20	<0.05
	Left	21.42 ± 7.72	15.06 ± 7.31	<0.05
6000 Hz	Right	25.76 ± 8.33	15.11 ± 7.22	<0.05
	Left	25.83 ± 8.67	15.62 ± 7.21	<0.05
8000 Hz	Right	30.22 ± 8.60	17.17 ± 8.41	<0.05
	Left	31.14 ± 9.15	17.12 ± 8.81	<0.05

Table 2. Tympanometric values of the two groups.

Tympanometric values		Fibromyalgia (n = 35)	Control (n = 25)
Pressure	Right	29.2 ± 11.1	22.3 ± 13.4
	Left	31.2 ± 12.4	22.1 ± 11.4
Compliance	Right	1.52 ± 0.21	0.99 ± 0.31
	Left	1.41 ± 0.23	1.12 ± 0.18

With regard to tympanometric values, we could not find any statistically significant difference among the groups ($P > 0.05$, Table 2).

4. Discussion

Although the diagnosis of FM is based on a particular clinical presentation, the pathogenesis of FM appears to be complex. Several abnormalities have been observed in FM patients, some of which are notable:

1) Release of P substance (neurohormone) at high levels in the cerebrospinal fluid;

2) Deficit of serotonin in the platelets;

3) Low levels of adenosine triphosphate;

4) Abnormal metabolism of carbohydrates in the red blood cells;

5) Abnormal regulation of cortisol production;

6) Reduction of blood flow in certain brain structures (8).

Heller et al. analyzed the incidence of phospholipid, serotonin, and ganglioside antibodies and found that these values were remarkably higher in patients with inner ear disorders compared to the controls. They concluded that increased antibody levels may indicate a possible role in the development of the inner ear type of hearing loss. Furthermore, these three antibodies were frequently found in patients with FM syndrome, which may indicate a similar mechanism in the etiopathogenesis of otologic manifestations (9).

Normal inner ear function depends on maintenance of homeostasis of the inner ear fluids and biochemical integrity of auditory receptor cells. The sex and age differences in human hearing function are well documented, and women are known to exhibit shorter auditory brainstem response latencies (10). FM syndrome is mostly seen in females.

Sensorineural deafness and auditory brainstem response abnormalities were reported in 15% and 30% of 168 fibromyalgia patients, respectively, suggesting that fibromyalgia may be associated with inner ear or central auditory impairment (11). Wolfe et al. (2) reported that the prevalence of hearing difficulties among patients with FM was 36.2%, which was significantly higher than in patients with rheumatoid arthritis or osteoarthritis.

Auditory brainstem response (ABR) studies in FM patients detected a pathway from the cochlea to the brainstem in response to auditory stimuli. A study by Bayazit et al. demonstrated several ABR abnormalities in FM patients (3). They detected Eustachian tube dysfunction due to obstructed or patulous Eustachian tube in 19 of 32 ears with ear fullness, suggesting that ear fullness in these 19 cases was not due to sensorineural deafness but rather to Eustachian tube dysfunction (3). In our study, there was a statistically significant difference between the two groups in terms of tympanometric values ($P < 0.05$). Tensor veli palatini muscle and levator veli palatini muscle myopathy in FM patients may have caused Eustachian tube dysfunction. The tensor veli palatini muscle and levator veli palatini muscle are responsible for the opening and closing of the Eustachian tube.

Contrary to studies supporting a causal relationship for the development of hearing loss in FM, several reports demonstrated no significant difference in the incidence of deafness between healthy subjects and FM patients, with no particularly higher incidence noted with patients (14–16).

With regard to the result that mean air conduction threshold values at high frequencies in the FM group were lower than in the control groups, which was not observed at low frequency thresholds, the difference may be attributed to the fact that high frequencies are more sensitive to the effects of phospholipid antibodies, serotonin, and ganglioside antibodies (9).

Our findings suggest that FM patients should be referred to ENT clinics for routine audiological evaluations. The absence of evaluation of the phospholipid serotonin and ganglioside antibodies in our study is a limitation of our study design. We plan to investigate these parameters combined with audiological evaluation in future studies.

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