Original Article* / *Çalışma - Araştırma

Relationship between serum magnesium level and subjective tinnitus

Serum magnezyum düzeyi ve subjektif tinnitus arasındaki ilişki

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ABSTRACT

Objectives: This study aims to assess the relationship between serum magnesium level and bilateral subjective tinnitus.

Patients and Methods: The study included a total of 76 patients (36 males, 40 females; mean age 48.5±6.5 years; range 43 to 65 years) suffering from severe bilateral subjective tinnitus (accepted as severe and catastrophic according to tinnitus severity index) as the study group and 86 healthy participants (42 males, 44 females; mean age 43.8±7.3 years; range 40 to 61 years) as the control group. Serum magnesium levels of both groups were measured and compared statistically.

Results: The serum magnesium concentration was significantly lower in the study group compared to the control group (1.8±0.2 vs. 2.3±0.4 mg/dL, p=0.03).

Conclusion: The significant association between serum magnesium level and tinnitus shows the importance of magnesium in the pathophysiology of subjective tinnitus.

Keywords: Magnesium; pathophysiology; subjective tinnitus.

ÖZ

Amaç: Bu çalışmada, serum magnezyum düzeyi ve iki taraflı subjektif tinnitus arasındaki ilişki araştırıldı.

Hastalar ve Yöntemler: İki taraflı şiddetli tinnitus yakınması (tinnitus şiddet indeksine göre şiddetli ve dayanılmaz olarak kabul edilen) olan toplam 76 hasta (36 erkek, 40 kadın; ort. yaş 48.5±6.5 yıl; dağılım 43-65 yıl) çalışma grubu ve 86 sağlıklı katılımcı (42 erkek, 44 kadın; ort. yaş 43.8±7.3 yıl; dağılım 40-61 yıl) kontrol grubu olarak çalışmaya dahil edildi. Her iki grubun serum magnezyum düzeyleri ölçüldü ve istatistiksel olarak karşılaştırıldı.

Bulgular: Serum magnezyum konsantrasyonu, kontrol grubu ile karşılaştırıldığında çalışma grubunda anlamlı olarak düşük bulundu (2.3±0.4 m/dL'ye karşın 1.8±0.2, p=0.03).

Sonuç: Serum magnezyum düzeyi ile tinnitus arasındaki anlamlı ilişki subjektif tinnitus patofizyolojisinde magnezyumun önemini göstermektedir.

Anahtar Sözcükler: Magnezyum; patofizyoloji; subjektif tinnitus.

Tinnitus is the perception of sound within the human ear or head when no external sound is present. It affects about 15% of the world population and 33% of individuals older than 60 years.[1] Many otological conditions could be associated with tinnitus. However, in 8~10% of patients, no definitive reason is found. Many aspects of the pathophysiology of tinnitus are

Available online at
www.kbbihtisas.org
doi: 10.5606/kbbihtisas.2016.87094
QR (Quick Response) Code

Received / *Geliş tarihi:* December 11, 2015 Accepted / *Kabul tarihi:* May 04, 2016

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still unclear. Damage to, or irregularities of, the cochlear hair cells and neural and central auditory pathways are postulated to be responsible for the development of subjective tinnitus.[2]

Magnesium is necessary for the activity of many enzymes within brain cells and serves as a key regulator of calcium channels involved in neurotransmission.[3] Therefore, magnesium plays a major role in neural and central auditory pathways. It has been shown that magnesium supplementation facilitates nerve regeneration after hearing loss due to noise exposure or sudden idiopathic sensorineural hearing loss.[4]

Definitive researches on tinnitus are difficult because there are many factors related to this situation. Nonetheless, specific relations between tinnitus and clinical conditions such as magnesium level can be a crucial precursor for future clinical trials of magnesium related auditory dysfunction. In this study, we assessed the correlation between the serum magnesium level and subjective tinnitus by comparing healthy individuals and patients with bilateral subjective tinnitus.

PATIENTS AND METHODS

This study was performed in accordance with the Helsinki Declaration of the World Medical Association and informed consent was obtained from all participants. The study was approved by the Research Ethics Committee of Van Training and Research Hospital (no. 2015/11).

In this study 335 patients admitted to Van Training and Research Hospital between May 2014 and April 2015 suffering from tinnitus were identified retrospectively. All patients were evaluated with the same systematic protocol. Their clinical features were evaluated by accessing medical records, pure tone audiograms and obtaining patient histories with phone calls. Patients with a history of unilateral or intermittent tinnitus, any hearing loss, otitis media, middle ear effusion, acoustic trauma or barotrauma in the last four weeks, ear surgery, ototoxic drug use, temporomandibular joint dysfunction, other neurological and systemic diseases (multiple sclerosis, migraine, thyroid diseases, diabetes, hyperlipidemia, hypertension and chronic obstructive pulmonary disease) were excluded. The next step was a full clinical otorhinolaryngological examination followed by pure tone audiometry and tinnitus severity index (TSI) assessment. The TSI is an assessment questionnaire consisting of 12 questions and a rating system of scores 0-5. Patients were assessed on the basis of 60 points. Patients who received 1-12 points were classified as very mild, 13-24 points as mild, 25-36 points as moderate, 37-48 points as severe, 49-60 points as catastrophic.[5] As a result, 76 patients (36 males, 40 females; mean age 48.5±6.5 years; range 43 to 65 years) with bilateral subjective, persistent and severe tinnitus affecting night sleep were recruited as the study group and 86 healthy individuals (42 males, 44 females; mean age 43.8±7.3 years; range 40 to 61 years) comprised the control group. Blood samples were taken from the antecubital vein using a sterile needle and syringe at 8 a.m. after an overnight fast. The serum magnesium level was measured using a colorimetric method (Agilent 7500a; 54 Agilent Technologies, Stockport, UK). The lower and upper limits of the magnesium level were 1.7 and 2.5 mg/dL, respectively.

The data were analyzed using the IBM SPSS software package for Windows version 20.0 (IBM Corporation, Armonk, NY, USA). Continuous variables were presented as means ± standard deviation. The chi-square test was used to compare qualitative and two-tailed t tests for quantitative data of the demographic characteristics. The magnesium levels among the control and study groups were compared using two-tailed t tests. A p-value <0.05 was taken to indicate statistical significance.

RESULTS

There were no significant differences in demographic characteristics between the patients suffering from subjective tinnitus and healthy controls. A statistically significant difference was observed between the magnesium levels of the study (1.8±0.2 mg/dL; range 1.41-2.32 mg/dL) and the control groups (2.3±0.6 mg/dL; range 1.88-2.83 mg/dL) ($p=0.03$, $p<0.05$). In the study group hypomagnesemia was detected in 19 patients and they were referred to the internal medicine clinic.

DISCUSSION

In the literature, very few studies have investigated the relationship between tinnitus and magnesium. In most of these studies, the effect of magnesium

therapy was investigated as a treatment choice for tinnitus and for noise-induced hearing loss, which often causes tinnitus. Cevette et al.[6] examined the potential benefit of magnesium by diminishing the severity of tinnitus and claimed that magnesium supplementation is useful in reducing the perception of tinnitus. Xiong et al.[7] examined the relation between the cochlear magnesium content and noise-induced hearing loss and suggested that the cochlear magnesium content affects the severity of cochlear damage after acoustic trauma. Gordin et al.[8] determined that magnesium treatment improves nerve regeneration, hearing recovery and prognosis in idiopathic sudden hearing loss. Joachims et al.[9] and Attias et al.[10] investigated the effect of magnesium on noise-induced hearing loss. Both studies found that magnesium was significantly protective against noise-induced cochlear damage.

The exact mechanism of magnesium supplementation in tinnitus remains unclear. Magnesium deficiency is related to the reduction of microcirculation and is responsible for the formation of free radicals in the inner ear. It is proposed that magnesium supplementation improves the microcirculation, reduces inflammatory cytokines and oxidative stress in the cochlea by maintaining normal membrane characteristics.[4,11-13]

The strength of our study depends on the evaluation of the patients suffering only from bilateral subjective tinnitus without any predisposing factors such as noise exposure, sensorineural or idiopathic sudden hearing loss. The most important finding is the significant association between the serum magnesium level and subjective tinnitus. However, the small sample size limits interpretation and generalizability. The main limitation is the lack of clinical follow-up data of magnesium treatment in the study group. This type of information could determine the effect of magnesium supplementation in reducing the perception and severity of tinnitus.

In conclusion, on the basis of the results of the present study; magnesium deficiency could have an important role in the pathophysiology of subjective tinnitus and therefore, magnesium supplementation can be a treatment choice. Further evaluations are necessary to establish this association.

Declaration of conflicting interests

The authors declared no conflicts of interest with respect to the authorship and/or publication of this article.

Funding

The authors received no financial support for the research and/or authorship of this article.

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