

# Is there any association between calcium values and otosclerosis?

## Kalsiyum değerleri ve otoskleroz arasında bir ilişki var mı?

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### Abstract

**Aim:** Otosclerosis; is an idiopathic disease caused by the occupation of the otic capsule and the stapes base with the spongioform bone. It is the most common type of conductive hearing loss after otitis media in otorhinolaryngology. There are no studies in the literature showing the relationship between blood calcium levels and hearing loss. The aim of this study is to investigate the blood calcium levels and hearing loss of patients with otosclerosis diagnosed retrospectively.

**Methods:** The study was performed case-control study. Patients were divided into two groups: patient and control. The patient group consisted of 40 patients who were operated for otosclerosis in the otolaryngology clinic between 2013 and 2017. Calcium values in the blood biochemistry of these patients and preoperative hearing tests were recorded retrospectively. The control group admitted for any reason, the otolaryngology clinic and consisted of 40 patients with non-ear disease. Calcium values in blood biochemistry and hearing tests performed in outpatient clinic were recorded retrospectively. The hearing of the patients in both groups was recorded by taking the average of the right and left ear. **Results:** The mean age of the control group was 28 (2.4) (18-60) years. The mean age for the patient group was 32 (2.6) (19-68). No significant difference was observed between the two groups in terms of age ( $P=0.061$ ). The control group was 10.8 (1.2) dB on the right and the left ear. The mean calcium blood levels in the control group were 9.8 (0.4) mg/dL. The mean right and left ear audiometry of the patient group was 38 (0.6) dB. The mean blood calcium level of the patient group was 11.7 (0.9) dB. There was a significant difference between the control group and the patient group in the audiometry test ( $P=0.024$ ). There was no significant difference between the patient group and the control group in terms of blood calcium ( $P=0.078$ ).

**Conclusion:** There was a significant deterioration in hearing in patients with otosclerosis. However, there was no significant increase in blood calcium levels. Therefore, there was no significant relationship between blood calcium level and hearing in otosclerosis.

**Keywords:** Otosclerosis, Conductive hearing loss, Calcium, Stapedectomy

### Öz

**Amaç:** Otoskleroz; otik kapsülün ve stapes tabanının spongioform kemik ile işgalinden kaynaklanan idiyopatik bir hastalıktır. Kulak burun boğazın pratiğinde otitis media sonrası en sık görülen iletim tipi işitme kaybı nedenidir. Literatürde kan kalsiyum düzeyleri ile işitme kaybı arasındaki ilişkiyi gösteren çalışma yoktur. Bu çalışmanın amacı, otosklerozlu hastaların kan kalsiyum seviyelerini ve işitme kaybını retrospektif olarak inceleyip arasındaki ilişkiyi saptamaktır.

**Yöntemler:** Çalışma vaka kontrol çalışması olarak yapıldı. Hastalar hasta ve kontrol grubu olmak üzere iki gruba ayrıldı. Hasta grubu, kulak burun boğaz kliniğinde 2013 ve 2017 yılları arasında otoskleroz ameliyatı geçirmiş 40 hastadan oluşuyordu. Bu hastaların kan biyokimyasındaki kalsiyum değerleri ve preoperatif işitme testleri retrospektif olarak kaydedildi. Kontrol grubu, herhangi bir nedenle, kulak burun boğaz kliniğinde için başvuran ve kulak hastalığı olmayan 40 hastadan oluşmaktadır. Kan biyokimyasında kalsiyum değerleri ve poliklinikte yapılan işitme testleri geriye dönük olarak kaydedildi. Her iki gruptaki hastaların işitmesi sağ ve sol kulağın ortalaması alınarak kaydedildi.

**Bulgular:** Kontrol grubunun yaş ortalaması 28 (2,4) (18-60) idi. Hasta grubunun yaş ortalaması 32 (2,6) (19-68) idi. Yaş açısından her iki grup arasında anlamlı fark izlenmedi. ( $P=0,061$ ). Kontrol grubu sağ ve sol kulakta 10,8 (1,2) dB idi. Kontrol grubundaki ortalama kalsiyum kan seviyeleri 9,8 (0,4) mg/dL idi. Hasta grubunun sağ ve sol kulak odyometrisi ortalama 38 (0,6) dB idi. Hasta grubunun ortalama kan kalsiyum seviyesi 11,7 (0,9) dB idi. Odyometri testinde kontrol grubu ile hasta grubu arasında anlamlı fark vardı ( $P=0,024$ ). Hasta grubu ile kontrol grubu arasında kan kalsiyum açısından anlamlı fark yoktu ( $P=0,078$ ).

**Sonuç:** Otosklerozlu olan hastalarda işitme duyusunda önemli bir bozulma vardı. Ancak, kan kalsiyum seviyelerinde önemli bir artış yoktu. Bu nedenle otoskleroz hastalığında kan kalsiyum seviyesi ile işitme arasında belirgin bir ilişki saptanmadı.

**Anahtar kelimeler:** Otoskleroz, İletim tipi işitme kaybı, Kalsiyum, Stapedektomi

## Introduction

Otosclerosis; is an idiopathic disease caused by the occupation of the otic capsule and the stapes base with the spongioform bone. For the first time, Politzer described stapes fixation in 1894. The disease is common in the white race and in women. The most common age is around 30-40. The etiology has not been fully elucidated. The most common causes of genetic, viral diseases and autoimmunity are discussed. Genetic transition is approximately 60% and autosomal dominant [1,2].

In otosclerosis, osteoblastic activity increases around the otic capsule. The most common place in the ear is the oval window, the second most often seen in the anterior of the round window. After the anterior of the capsule, the base is wrapped with sclerotic bone areas. After occupying the base of the Stapes, it holds the cochlea. Conductive hearing loss starts with stapes involvement and sensorineural loss is added with cochlea involvement. It is the most common type of conductive hearing loss after otitis media in otorhinolaryngology [3].

In 10% of the population there is only histological otosclerosis and in 10% clinical otosclerosis occurs. Histologically, spongiosis and sclerosis are two stages. It is primarily composed of avascular and soft bone. Then it becomes hardened and becomes vascular. Clinical otosclerosis is quite rare except for white race. Women are 3 times more common than men. It progresses mostly with pregnancy. Generally, involvement is bilateral. Firstly, the insidious progression begins as the type of hearing loss. Initially low frequencies keep all frequencies affected over time. Over time, resonance and dizziness are added depending on the effect of the cochlea. Otoscopic examination is common in most patients. Some patients may have a red reflex behind the eardrum (Schwartz Sign). Hypodense foci can be seen in the radiological involvement [4-6].

Medical or surgical treatment is used in the treatment of the disease, but its definitive treatment is surgery. Sodium fluoride (NaF) is the first choice for medical treatment and steroids can also be used. A significant number of patients benefit from the hearing aid. Stapedectomy or stapedetotomy is used for surgical treatment. Stapes are removed from the base and the piston is replaced. In stapedectomy, the stapes are completely removed [7-9].

There are no studies in the literature showing the relationship between blood calcium levels and hearing loss. An increase in blood calcium levels can be expected in this disease, which is characterized by abnormal bone formation. In our study, the relationship between the increase in hearing loss, which is an indicator of the progression of the disease, and the blood calcium levels, will be explained with the literature.

## Materials and methods

The study was performed case-control study. Patients were divided into two groups: patient and control. The patient group consisted of 40 patients who were operated for otosclerosis in the otolaryngology clinic between 2013 and 2017. Calcium values in the blood biochemistry of these patients and preoperative hearing tests were recorded retrospectively. The control group admitted for any reason, the otolaryngology clinic

and consisted of 40 patients with non-ear disease. Calcium values in blood biochemistry and hearing tests performed in outpatient clinic were recorded retrospectively. The hearing of the patients in both groups was recorded by taking the average of the right and left ear. Patients with one ear disease in the patient group, those with chronic disease that would impair calcium metabolism and those with sensorineural hearing loss due to age were excluded. In the control group, those with chronic disease that would impair calcium metabolism and those with sensorineural hearing loss due to age were excluded. Ethics committee approval was obtained (Afyon Kocatepe University Faculty of Medicine 2018-2).

### Statistical analysis

SPSS 21.0 software (IBM, SPSS, Chicago, USA) was used for analysis. Continuous data were given as mean (standard deviation) and categorical data as number (n) and percentage (%). Student t test in was used to compare independent data groups. Chi-square test was used for comparison between groups.  $P < 0.05$  was considered statistically significant.

## Results

The mean age for the control group was 28 (2.4) (18-60). The mean age for the patient group was 32 (2.6) (19-68). No significant difference was observed between the two groups in terms of age ( $P=0.061$ ). In the control group, male/female was 22/18, and patient group was 16/24. No significant difference was observed between the two groups in terms of gender ( $P=0.094$ ). The mean right and left ear audiometry of the control group was 10.8 (1.2) dB. The mean calcium blood levels in the control group were 9.8 (0.4) mg/dl. The mean right and left ear audiometry of the patient group was 38 (0.6) dB. The mean blood calcium level of the patient group was 11.7 (0.9) mg/dl. There was no significant difference in blood calcium between the patient group and the control group ( $P=0.078$ ). A significant difference was observed in the audiometry test between the control group and the patient group ( $P=0.024$ ) (Table 1).

Table 1: Age, gender, calcium, audiometry test characteristics of working groups

	Control group	Patient group	P-value
Age	28 (2.4) (18-60)	32 (2.6) (19-68)	0.061
Gender (M/F)	22/18	16/24	0.094
Blood calcium level (mg/dl)	9.8 (0.4)	11.7 (0.9)	0.078
Left-right mean hearing level (dB)	10.8 (1.2)	38 (0.6)	0.024

## Discussion

Otosclerosis is an inflammatory idiopathic disease that causes abnormal bone formation in the otic capsule. Genetic aspects are dominant and women are 3 times more than the average. The common characteristics of these patients are white race and female gender. Although it is seen as histological otosclerosis, it is not seen clinically. As a result, the staple and then holding the cochlea causes transmission and sensorinoral hearing loss. In a study related to otosclerosis imaging, it was found that the hypodense spongiotic foci in the CT were the main responsible area for hearing loss [10,11].

There are many studies related to inflammatory and biochemical analysis of otosclerosis. In otosclerosis, otic capsule contains abnormal bone. Therefore, osteoblastic activity increased. Thus, serum alkaline phosphatase activity also increases. It is possible that increased enzyme activity may

trigger calcium increase [12]. The effect of calcium and vitamin D deficiency on otosclerosis has been investigated and their hearing loss has been improved [13]. In another study conducted with otosclerosis, oxidative stress indicators increased in otosclerosis [14].

Otosclerosis is an idiopathic disease. But many reasons have been put forward. In the studies, it was observed that the inflammatory process, hormonal activity, measles virus and oxidative stress increased osteoblastic activity [15]. Aurbach et al. [16] observed an increase in enzyme activity by an increase in blood PTH (Parathormone) level. After an increase in osteoblastic activity, there is also an increase in calcium in the tissues. However, there are no studies for blood levels in the literature.

Hearing loss is the indicator of progression in otosclerosis. Initially, the stapes are kept and, depending on the fixation, conductive hearing loss occurs. Later, the stapes base and cochlea involvement begin. As a result, the sensorineural part of the hearing loss occurs. At the same time, the other indicator of progression is the increase in alkaline phosphatase with osteoblastic activity. Thus, calcium increase is expected in the blood [17,18]. Our claim in this study is to expect an increase in blood calcium levels with the increase of hearing loss. However, as the hearing loss increased, there was no significant increase in calcium levels. The increase in enzyme activity in the otic capsule did not lead to a regular increase of calcium in the blood.

In this study, we examined the relationship between blood calcium levels and degree of hearing in patients with otosclerosis. There was no significant difference between blood calcium levels and hearing degrees were different. However, the number of patients in these study groups was limited. If it is investigated in a larger population and larger patient series and can give more accurate results.

#### Conclusion

Otosclerosis is a progressive disease in which abnormal bone formation and enzyme activity is increased significantly. As the hearing loss increases, bone formation in the disease increases, but this increase is not reflected in the blood calcium levels.

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