



Brazilian Journal of
OTORHINOLARYNGOLOGY

www.bjorl.org



ORIGINAL ARTICLE

Does stapes surgery improve tinnitus in patients with otosclerosis?☆

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Received 23 May 2016; accepted 11 July 2016

KEYWORDS

Otosclerosis;
Tinnitus;
Stapedotomy;
Low pitch;
High pitch

Abstract

Introduction: Otosclerosis (OS) is the primary disease of the human temporal bone characterized by conductive hearing loss and tinnitus. The exact pathogenesis of tinnitus in otosclerosis patients is not known and factors affecting the tinnitus outcome in otosclerosis patients are still controversial.

Objectives: To find the effect of stapedotomy on tinnitus for otosclerosis patients.

Methods: Fifty-six otosclerosis patients with preoperative tinnitus were enrolled to the study. Pure tone average Air-Bone Gap values, preoperative tinnitus pitch, Air-Bone Gap closure at tinnitus frequencies were evaluated for their effect on the postoperative outcome.

Results: Low pitch tinnitus had more favorable outcome compared to high pitch tinnitus ($p = 0.002$). Postoperative average pure tone thresholds Air-Bone Gap values were not related to the postoperative tinnitus ($p = 0.213$). There was no statistically significant difference between postoperative Air-Bone Gap closure at tinnitus frequency and improvement of high pitch tinnitus ($p = 0.427$). There was a statistically significant difference between Air-Bone Gap improvement in tinnitus frequency and low pitch tinnitus recovery ($p = 0.026$).

Conclusion: Low pitch tinnitus is more likely to be resolved after stapedotomy for patients with otosclerosis. High pitch tinnitus may not resolve even after closure of the Air-Bone Gap at tinnitus frequencies.

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☆ Please cite this article as: Ismi O, Erdogan O, Yesilova M, Ozcan C, Ovla D, Gorur K. Does stapes surgery improve tinnitus in patients with otosclerosis? Braz J Otorhinolaryngol. 2016. <http://dx.doi.org/10.1016/j.bjorl.2016.07.001>

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<http://dx.doi.org/10.1016/j.bjorl.2016.07.001>

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PALAVRAS CHAVE

Otosclerose;
Zumbido;
Estapedotomia;
Grave;
Agudo

A estapedotomia melhora o zumbido em pacientes com otosclerose?**Resumo**

Introdução: Otosclerose (OS) é a principal doença do osso temporal humano caracterizada por perda auditiva condutiva e zumbido. A patogenia exata do zumbido em pacientes com otosclerose não é conhecida e fatores que afetam o desfecho de zumbido em pacientes com otosclerose ainda são controversos.

Objetivos: Encontrar o efeito da estapedotomia sobre o zumbido em pacientes com otosclerose.

Método: Cinquenta e seis pacientes com otosclerose com zumbido pré-operatório foram incluídos no estudo. Os valores médios tonais do gap Aero-Ósseo, o tom de zumbido no pré-operatório, o fechamento do gap nas frequências dos zumbidos foram avaliados quanto ao seu efeito sobre o desfecho pós-operatório.

Resultados: O zumbido em tom grave teve desfecho mais favorável em comparação com o zumbido agudo ($p=0,002$). Os valores médios dos gaps pós-operatórios não foram relacionados com o zumbido pós-operatório ($p=0,213$). Não houve diferença estatisticamente significativa entre o fechamento pós-operatório do gap na frequência do zumbido e melhora do zumbido de tom agudo ($p=0,427$). Houve diferença estatisticamente significativa entre a melhora no gap nas frequências do zumbido e recuperação do zumbido de tom mais grave ($p=0,026$).

Conclusão: O zumbido de tom mais grave parece ser melhor resolvido depois de estapedotomia em pacientes com otosclerose. O zumbido de tom agudo pode não desaparecer, mesmo após o fechamento do gap nas frequências do zumbido.

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Introduction

Otosclerosis (OS) is the primary disease of the human temporal bone. It is an autosomal-dominant hereditary disease with variable penetrance. Clinically, progressive conductive hearing loss and tinnitus are the main symptoms. The most common area for stapedial fixation is the anterior crura. Sensorineural hearing loss can develop if the plaques involve the cochlea.¹

Otosclerosis was described about two centuries ago; however, the exact pathogenesis is not fully understood. Although hearing AIDS and medical therapy have been recommended in certain conditions, small fenestra stapedotomy still remains the main choice in patients with conductive type hearing loss.¹ The success of stapes surgery in patients with OS is evaluated with the results of postoperative hearing and the rate of Air-Bone Gap closure.

Tinnitus is also a common and underestimated symptom beside conductive hearing loss in OS.² Satisfaction rates after stapes surgery is directly related to the postoperative tinnitus cessation. OS patients with unresolved tinnitus in the postoperative period reported significantly lower satisfaction scores from surgery.³ The estimated incidence of subjective tinnitus in OS patients is 56–84.5%.^{2,4}

The exact pathogenesis of tinnitus in OS is not known. Several authors have reported different possible mechanisms as follows: reduction of inner ear fluid vibration, unmasked muscular or vascular noises with conductive hearing loss, intravascular agglutination of red blood cells in the vessels of the cochlea, toxic metabolites produced by the otosclerotic foci, pathological vascularization of the

otosclerotic bone and irritation of the nerve fibers by otosclerotic bone.^{4,5}

Although there have been several published studies, the effect of stapes surgery on tinnitus is still a subject of debate. Some authors reported that preoperative low pitch tinnitus is more likely to be resolved by stapes surgery,^{5,6} whereas Gersdorff et al.⁷ and Ayache et al.⁸ found no statistical significance between low and high pitch tinnitus recovery. Apart from tinnitus frequency, preoperative non-compensated tinnitus⁹ and postoperative high frequency hearing loss³ were claimed to have an unfavorable outcome. Furthermore, the effect of Air-Bone Gap (ABG) closure at tinnitus frequencies on the postoperative tinnitus outcome has not been discussed in any of the studies.

Different from other studies, in this manuscript, we evaluated the effect of Air-Bone Gap closure at tinnitus frequencies on the low, middle and high pitch tinnitus status.

Methods

Local ethical committee approval was acquired for our study with the number of 2016190. Sixty-nine patients with conductive hearing loss were enrolled to present study. After a detailed otorhinolaryngologic examination, hearing loss type and hearing thresholds were evaluated regarding tuning fork tests and audiometric findings. The patients with hearing loss (ABG ≥ 20 dB and Rinne [–] with 512, 1024 tuning forks) with speech discrimination scores of $\geq 90\%$ were operated. Preoperative temporal bone computerized tomography was performed to all patients. The diagnosis of

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