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The Impact of Otosclerosis Surgery on Tinnitus

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Abstract

Background: Tinnitus is the perception of sound within the ear without external sound. It's common in patients with otosclerosis and can compromise surgical results. Stapedectomy or stapedotomy can relieve tinnitus, with the latter being preferred due to fewer complications. In a retrospective study, we aim to gather tinnitus data using a validated instrument over time.

Aim: This study aimed to gather data on tinnitus by using a validated tinnitus severity instrument over a while after Stapedectomy or stapedotomy.

Methods: We conducted a retrospective study on patients with otosclerosis who underwent stapedectomy or stapedotomy and suffered from tinnitus. The diagnosis was done through physical examination and pure tone audiometry. The surgical procedure involved a partial stapedectomy, stapedotomy, and Teflon piston prosthesis insertion under general anesthesia. We used the tinnitus handicap inventory to evaluate tinnitus severity before and after surgery. We analyzed the data using SPSS version 22 and found statistically significant improvements in tinnitus severity post-surgery.

Results: In this study, 30 patients were included, with a mean age of 35 ±10.62. Each question showed a significant difference pre-and post-operatively. A paired t-test was conducted to assess the effect of stapedotomy on each subcategory of THI, which found a significant difference in tinnitus severity for each subscale. The total THI score was also significantly different (p-value=0.000).

Conclusion: Stapedectomy or stapedotomy in otosclerotic patients who suffer from tinnitus significantly decreases tinnitus severity.

Conflicts of Interest: The Authors declare no conflicts of interest.
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Introduction

Tinnitus is the perception of sound within the human ear when no external sound is present. It is a common symptom caused by various factors such as noise-induced hearing loss, age-related hearing loss, and ear diseases (1). Tinnitus is a significant complaint in patients with otosclerosis. The incidence of tinnitus in patients with otosclerosis varies from 40% to 55% and can compromise operative results (2, 3). Stapedectomy is a surgical procedure used to improve hearing. In stapedectomy, the surgeon removes the stapes suprastructures and footplate and replaces them with a prosthesis. This procedure was first performed by Dr. John J. Shea (4,5). This procedure is an opening into the footplate of the stapes, or stapedectomy, which is the total removal of the stapes and is successful in treating otosclerosis. However,

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most otologists prefer stapedotomy since it has fewer complications than stapedectomy. Several reports have revealed that the tinnitus was relieved by stapedectomy or stapedotomy. Previous studies have suggested that tinnitus may decrease following stapedectomy, as hearing improvement is often observed. In this retrospective study, we aimed to gather data on tinnitus by using a validated tinnitus severity instrument over a period of time.

Methods

Tinnitus is the perception of sound within the human ear when no external sound is present. It is a common symptom caused by various factors such as noise-induced hearing loss, age-related hearing loss, and ear diseases (1). Tinnitus is a significant complaint in patients with otosclerosis. The incidence of tinnitus in patients with otosclerosis varies from 40% to 55% and can compromise operative results (2, 3). Stapedectomy is a surgical procedure used to improve hearing. In stapedectomy, the surgeon removes the stapes superstructures and footplate and replaces them with a prosthesis. This procedure was first performed by Dr. John J. Shea (4,5). This procedure is an opening into the footplate of the stapes, or stapedectomy, which is the total removal of the stapes and is successful in treating otosclerosis. However, most otologists prefer stapedotomy since it has fewer complications than stapedectomy. Several reports have revealed that the tinnitus was relieved by stapedectomy or stapedotomy. Previous studies have suggested that tinnitus may decrease following stapedectomy, as hearing improvement is often observed. In this retrospective study, we aimed to gather data on tinnitus by using a validated tinnitus severity instrument over a period of time.

Results

Thirty consecutive patients were included in this study. Seventeen cases (56.7%) and 13 (43.3%) were female and male, respectively. The mean age of patients was 35 ±10.62. After conducting a paired t-test, there was a significant difference in each question pre-and post-operatively. To assess the effect of stapedotomy on each subcategory of THI, a paired t-test was conducted. The results are shown in Table 1.

Table 1. The average score of THI in each subscale and the resulting P-value of the conducted paired t-test

THI subcategory	Mean	Standard deviation	P-value
Functional before surgery	29	3.5	0.000
Functional after surgery	8.6	7.3	
Emotional before surgery	27.6	2.76	0.000
Emotional after surgery	6.8	7.31	
Catastrophic before surgery	14.8	3.29	0.000
Catastrophic after surgery	4.2	3.23	

After conducting paired t-test, it was revealed that the total THI score significantly differed (p-value=0.000, Figure 1). As demonstrated in Table 1, the difference in tinnitus severity before and after surgery in each subscale is statistically significant.

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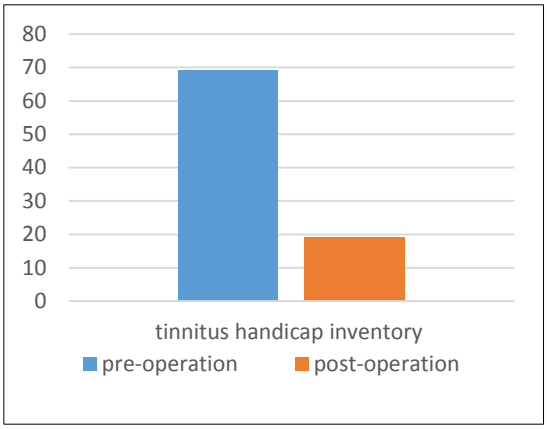

Figure 1. The mean of THI score for all included individuals pre- and post-stapedotomy.

Discussion

Clinical outcomes of stapedectomy or stapedotomy have mainly focused on hearing improvements, such as the air-bone gap closure (ABG). Overall, the various surgical techniques and prostheses used in stapedectomy or stapedotomy have resulted in favourable hearing outcomes. Although fewer studies have examined the effect of stapedectomy or stapedotomy on tinnitus, all available studies indicate reduced symptoms following the surgery.

In this retrospective study, we evaluated the tinnitus of 30 patients who underwent stapedotomy. THI assessed the severity of tinnitus. As mentioned, each question and the total score after surgery decreased significantly. Thus, patients' quality of life increased.

Ayache et al. prospectively conducted a study on 65 ears and found that three-quarters experienced tinnitus pre-operation. Of these patients, 24.6% reported severe tinnitus that had a debilitating effect on their daily lives. After the surgery, at six months follow-up, more than half of the patients reported no tinnitus and a third reported decreased tinnitus. Only a minority of patients reported no change or increase in tinnitus (6). Accordingly, the Sobrinho et al. study showed tinnitus improvement after surgery (7).

Sakai et al. assessed 22 patients who suffered from tinnitus with tinnitus questions before and after surgery. Nearly 70% of them reported improvement (8). Gerdorff et al. used descriptive evaluations for tinnitus. In agreement, they also revealed that tinnitus was resolved in more than half of the included patients and improvement in 16 %(2).

In one of the most extensive retrospective studies, Szymanski et al. assessed 149 patients with tinnitus 1 to 19 years after stapedectomy. Approximately three-quarters of cases reported that their tinnitus ceased, and 17 % said degrees of improvement (9). In another large prospective study, 168 otosclerotic patients with chronic tinnitus were analyzed with TFI before surgery, 3- and 6-months post-operation. Accordingly, it was revealed that the tinnitus severity decreased after stapedectomy (10).

Two other studies evaluated patients' tinnitus with validated quantitative questionnaires. Sparano et al. assessed 40 patients with the Kirchhoff-lindblom tinnitus classification system; they showed that 85% had improved (11). Besides, Chang et al. used a tinnitus functional test in a prospective repeated measures study. The result of this study was following Sparano's, which showed that the most prominent effect of stapedectomy on tinnitus is within the first month after surgery (12).

Bast et al. evaluated 37 ears pre- and post-operatively. They showed that stapedotomy improves hearing loss and reduces tinnitus (60% of cases). Furthermore, in their study, emotional, cognitive, and mental burden,

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intrusiveness, hearing problems, somatic ailments, and sleep disturbances also improved post-surgery (13). Furthermore, Rajati et al. assessed the level of discomfort in their cases, they revealed that after stapedectomy, the discomfort caused by tinnitus significantly declined (14).

This study has several limitations. A larger multi-centric analysis should be performed to obtain more precise results.

Conclusion

stapedectomy or stapedotomy in otosclerotic patients who suffer from tinnitus significantly decreases tinnitus severity.

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Conflicts of Interest

The authors declare no conflicts of interest.

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Ethics

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