

Hearing Results Following Type 1 Tympanoplasty in Elderly Patients

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Abstract. *Background/Aim: The outcomes of type 1 tympanoplasty in elderly patients remain controversial. Therefore, more studies are needed to clarify the prognosis of elderly patients after tympanoplasty. The purpose of this study was to evaluate the clinical outcomes of type 1 tympanoplasty in elderly patients. Patients and Methods: We retrospectively analyzed data from 116 patients who underwent type 1 tympanoplasty due to chronic otitis media. Seventy-one of the 116 patients were elderly individuals aged 65 years or older (study group). Forty-five patients were younger than 65 years (control group). Due to cochlear intolerance by aging in the study group, we used dexamethasone soaked gelfoam packing in the middle ear and intraoperative dexamethasone injection. To compare the outcomes between groups, we determined the mean hearing levels by averaging the hearing thresholds. The differences in the air-bone gaps before and after tympanoplasty were compared between groups. Results: In the study group, 54 patients had an underlying disease (76%). Hypertension was the most common underlying disease. The postoperative air conduction (AC) and bone conduction (BC) improved in both the study group and the control group. In the control group, postoperative air-bone gap (ABG) was significantly higher than preoperative ABG. Although the postoperative ABG improved in the study group, the improvement was insignificant. Conclusion: Although significant improvement of ABG was not achieved, postoperative AC and BC were improved. Intraoperative dexamethasone injection and dexamethasone soaked gelfoam packing in the middle ear was effective to prevent deterioration of BC after operation.*

Nowadays the elderly population in Asia is increasing compared to that in other regions (1). Elderly patients are more vulnerable to stress associated with surgery. As with other surgeries in elderly patients, healing is expected to be less than satisfactory following tympanoplasty, with a greater tendency for fibrosis and intolerance of cochlear function, even when only minor operative trauma is generated (2). In fact, most elderly patients experience an age-related change in hearing, called presbycusis, particularly at high frequencies. Several previous reports have shown poor outcomes in elderly patients after type 1 tympanoplasty in comparison to younger patients (3-5). Recently, several authors have reported that age is not factor influencing type 1 tympanoplasty (6-8). The outcomes of type 1 tympanoplasty in elderly patients remain controversial. Therefore, more studies are needed to clarify the prognosis of elderly patients after tympanoplasty.

Middle ear packing materials such as gelfoam are commonly used to provide support to grafts in tympanoplasty and are considered to be one of the factors affecting the success rate of tympanoplasty. Gelfoam is commonly used as a middle ear packing agent, especially when an underlay graft technique is used. One limitation of gelfoam is that it can induce middle ear fibrosis or adhesions (9), especially in cases of eustachian tube dysfunction. One experimental study has reported that gelfoam mixed with a corticosteroid diminished adverse effects, such as fibrosis, in the middle ear (10). Experimentally and clinically, dexamethasone injection during surgery has been shown to be protective for the inner ear (11, 12). Because of cochlear intolerance in elderly patients, we use middle ear packing with dexamethasone-coated gelfoam routinely in the tympanoplasty. When required, intraoperative dexamethasone injection is also performed.

The purpose of this study was to evaluate the clinical outcomes of type 1 tympanoplasty in elderly patients.

Patients and Methods

We retrospectively analyzed data from 116 patients who underwent type 1 tympanoplasty due to chronic otitis media. This study was approved by institutional review of board (CNUH-2016-279). Seventy-one of the 116 patients were elderly

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individuals aged 65 years or older (study group). Forty-five patients were younger than 65 years (control group). All patients received a routine preoperative examination that included temporal bone CT and pure tone audiometry. Despite the use of local anesthesia during the procedure, chest x-ray, electrocardiogram, and complete blood count analysis were performed. Physicians were consulted for patients with underlying diseases such as hypertension or diabetes mellitus, or upon abnormal findings during routine examination. All patients underwent type 1 tympanoplasty. A single senior surgeon performed all operations using local anesthesia. The temporalis muscle fascia was used for repair tympanic membrane (TM) perforation using an underlay graft with postauricular approach. Before trimming the perforation margin at the handle of the malleus, intraoperative dexamethasone (5 mg/ampoule) was injected intravenously in all patients except 12 in the study group who had diabetes mellitus. The fascia graft was placed using an underlay technique with middle ear packing. Ciprofloxacin- and dexamethasone-impregnated gelfoam was used to reduce the incidence of gelfoam-induced fibrosis in the middle ear. Cochlear protection was aided by the sustained release of dexamethasone into the round or oval window. To compare the outcomes between groups, we determined the mean hearing levels by averaging the hearing thresholds at 500, 1,000, 2,000, and 4,000 Hz. The differences in the air-bone gaps before and after tympanoplasty were compared between groups. Preoperative and postoperative air conduction (AC), bone conduction (BC), and air-bone gap (ABG) between groups were examined using paired *t*-tests. Significance was achieved when the *p*-value was less than 0.05.

Results

The mean age of the elderly patients in the chronic otitis media group was 68.8 years (range=65-81 years). The mean age in the control group was 45.0 years (range=15-64 years). The gender ratio and side of operation did not differ significantly between groups. In the study group, 54 patients had an underlying disease (76%; Table I). Hypertension was the most common underlying disease (Figure 1). In the study group, the mean preoperative AC and BC thresholds were 52.7 dB and 37.2 dB, respectively. The mean postoperative AC and BC thresholds were 43.8 dB and 29.8 dB, respectively. In the control group, the mean preoperative AC and BC thresholds were 35.7 dB and 16.6 dB, respectively. The mean postoperative AC and BC thresholds were 25.2 dB and 12.2 dB, respectively. The study group had higher mean preoperative and postoperative AC and BC thresholds than the control group. The postoperative AC and BC improved in both the study group and the control group (Figure 2).

In the control group, postoperative ABG was significantly higher than preoperative ABG. Although the postoperative ABG improved in the study group, the improvement was insignificant (Figure 3). The difference in the overall success rate between the two groups indicates that surgery in the study group (success rate: 84%) was less effective than in the control group (success rate: 93%).

Table I. Underlying disease in the study group (N=54).

Disease	Number of patients
Hypertension	35 (65%)
Diabetes	12 (22.2%)
Arrhythmia	3 (5.6%)
Old CVA	2 (3.7%)
Chronic liver disease	2 (3.7%)

CVA: Cerebrovascular accident.

Discussion

In this study, we assessed the efficacy of type 1 tympanoplasty in elderly patients. Recently, several authors have reported that the outcome of tympanoplasty in the geriatric population is the same as in younger populations (6-8). In this study, the postoperative hearing outcomes were such that the surgeries were considered successful. Although the results of the hearing tests were much better in the control group, the study group also showed improvements in AC and BC in comparison to the preoperative state.

Preoperatively, mixed-type hearing loss with a pre-existing elevation in the BC threshold was common in the study group. These findings are similar to other reports (6-8). Aging and duration of chronic inflammation of chronic otitis media (COM) are likely the main reasons for this finding. Gyo *et al.*(4) have reported that hearing results were worse in elderly patients following tympanoplasty, even though the incidence of graft failure did not differ significantly by age. In the present study, the mean postoperative BC threshold was improved in comparison to the preoperative BC threshold. This result suggests that surgical manipulation and suction did not induce aggravation of the cochlear function. And mild improvement of postoperative BC is considered by Carhart effect (13). Ahn *et al.* (7) and Demirci *et al.* (8) have previously reported that ABG decreased significantly following tympanoplasty in patients of all ages. Our results were not similar to these reports. In the present study, though the postoperative AC and BC were improved in comparison to the preoperative state, the ABG did not improve significantly. We believe that these results were due to age-related changes of the tympanic membrane and interossicular joint. Histopathologically, the interossicular joints show pathological age-related changes in which the chondroid cartilage undergoes a change to the chondro-osseous matrix (14, 15). Physiologically, the middle ear transmission system becomes stiffer with age (15, 16). Therefore, the middle ear damping system in elderly individuals is less effective than in young adults.

We believe that the intraoperative dexamethasone injection and middle ear packing using dexamethasone-

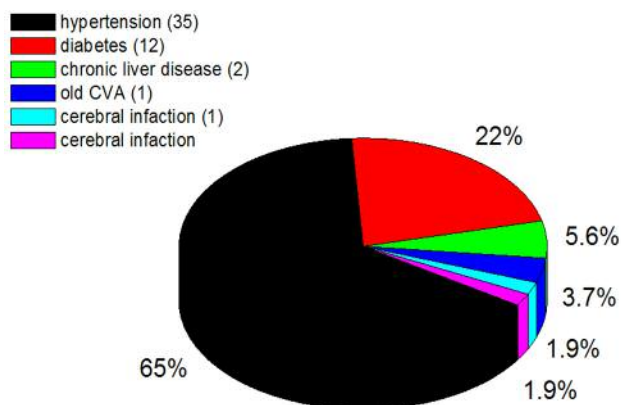


Figure 1. Distribution of underlying disease in study group.

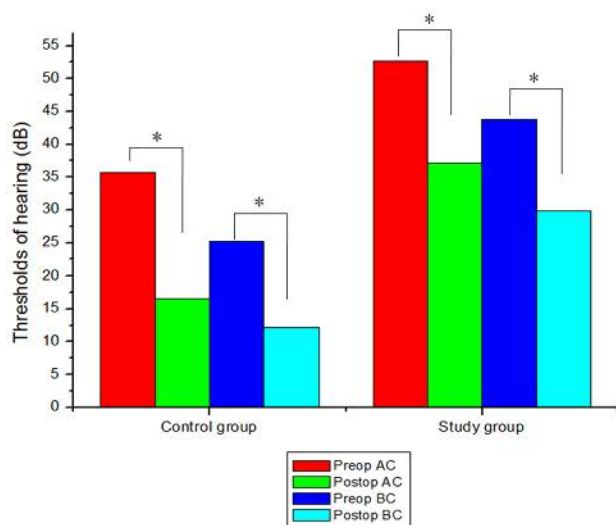


Figure 2. Intergroup comparison before and after tympanoplasty. Asterisk indicates the statistically significant differences ($p<0.05$).

impregnated gelfoam were helpful in protecting the cochlea. Dexamethasone is widely used for cochlear protection during ear surgery for cholesteatoma, complicated labyrinthine fistula, and cochlear implant surgery (11, 17). Dexamethasone has also antifibrotic action (18) and a prophylactic effect on postoperative nausea and vomiting in patients undergoing tympanomastoid surgery (19). In terms of hearing outcomes, middle ear packing using dexamethasone-soaked gelfoam is helpful for postoperative middle ear ventilation (11). Dexamethasone is widely used for topical injection into the joint cavity in the orthopedic field (20, 21). Middle ear packing using dexamethasone-

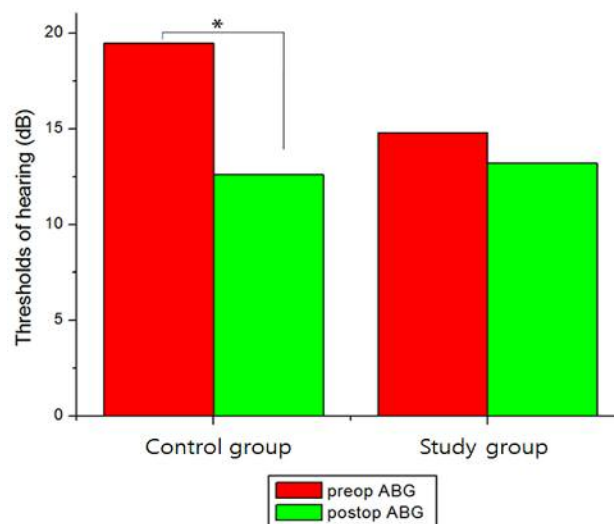


Figure 3. Although postoperative ABG was improved there was no statistically significant differences between the study group and the control group. Asterisk indicates statistically significant differences ($p<0.05$).

soaked gelfoam may also protect the chondroid cartilage of the interossicular joint from minor surgical trauma.

Our results show that postoperative AC and BC were improved in comparison to the preoperative state, but that ABG did not improve significantly. The damping system of the middle ear in elderly patients is less effective; therefore, gentle manipulation is recommended and the use of intraoperative dexamethasone injection as well as dexamethasone-soaked gelfoam packing may be helpful.

Conclusion

Although significant improvement of ABG was not achieved, postoperative AC and BC were improved. Intraoperative dexamethasone injection and dexamethasone soaked gelfoam packing in the middle ear was effective for prevention of deterioration of BC after operation.

Conflicts of Interest

The Authors declare no competing financial interest.

Authors' Contributions

CJ built the conception and designed the clinical study. TU, HL, SJ and KP contributed to acquisition of clinical data. THU performed the statistical analysis. CJ and TU interpreted the results. TU drafted manuscript. HL, SJ and KP assisted the study. TU and CJ wrote the manuscript. All Authors read and approved the final manuscript.

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