



Research Article

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A Study on the Effects of Drilling in Tympanomastoid Surgery

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ABSTRACT

This study was carried out to determine the relationship of sensorineural hearing loss and drilling in mastoid surgery at Ahvaz Jundishapur University of Medical Sciences in Iran. This was a prospective study conducted on 889 patients of chronic middle ear disease, which were surgically treated at the department of otolaryngology of Imam and Apadana Hospitals in Ahvaz during March 2008 to 2015. Drilling duration in tympanomastoid surgery was 22.1±15.1 minutes. The preoperative and postoperative bone conduction thresholds in frequencies 250 to 4000 Hz were obtained one day before and 6 weeks after the surgical procedure by one expert audiologist. The descriptive statistics (frequency, correlation) and inferential statistics (paired t-Test, Chi-square) were utilized to evaluate hearing loss after surgery. The significant level was considered at 0.05 in this study. A total of 889 patients were included in this study. Among them 613 (68.95%) were female and 276 (31.05%) of them were male. The male to female ratio was 1:2.4. The patients ranged in age from 3 to 78 years with a mean of 24.15 years. Statistically significant deterioration in bone conduction thresholds was found only with radical mastoidectomy. There was no change in mean bone conduction thresholds in 819 of patients. A total of 70 patients showed worsening of postoperative bone conduction thresholds. Our study has shown that the middle ear surgery in chronic otitis media in majority of the patients does not affect bone conduction thresholds. It is suggested that all ENT surgeon should do chronic otitis media surgery without being worried, but must take all the precaution.

Keywords: Sensorineural hearing loss, Mastoid surgery, Drilling, Ahvaz.

INTRODUCTION

Hearing loss occurs when there is loss of sound sensitivity produced by an abnormality anywhere in the auditory system. A wide variety of conditions can cause hearing loss, including otosclerosis, cholesteatoma, and others. Sensorineural hearing loss is considered as a consequence of chronic otitis media(1). The surgical treatment of chronic middle ear disease is associated with a risk of damage to the inner ear. The incidence of permanent sensorineural hearing loss after surgery is 1.2 to 4.5% (2-4). Various factors might be responsible for this untoward outcome. These include damage to oval or round windows during removal of cholesteatoma or granulations from these areas, excessive manipulation of ossicles resulting in their dislocation or fracture, acoustic trauma from drill generated noise or from suction, inadvertent opening of lateral semicircular canal while removing cholesteatoma matrix resulting in labyrinthine fistula, and inadvertently touching the ossicle with a rotating burr(5-8). The damage to hearing during surgery has disastrous consequences for both the patient and the surgeon. That is why this is the most frequently discussed issue while obtaining consent for ear surgery (1, 5). Various studies have confirmed the

association between surgery for the chronic ear disease and postoperative sensorineural hearing loss whereas others have shown that if proper precautions are taken, surgery do not significantly affect bone conduction thresholds(9-12). This study was carried out to determine the relationship of sensorineural hearing loss and chronic otitis media surgery at Ahvaz Jundishapur University of Medical Sciences in Iran.

MATERIALS AND METHODS

This prospective study consisted of 889 patients of chronic middle ear disease, which were surgically treated at the department of otolaryngology in Imam and Apadana Hospitals in Ahvaz during March 2008 to 2015. The diagnosis was performed by an expert ENT surgeon. One of the colleagues was responsible for measuring of drilling time from start till end of process. This study was approved by ethic committee of Ahvaz Jundishapur University of Medical Sciences and the research objectives were explained to all patients and written consent form was obtained from all patients. Surgeries were performed by on senior ENT surgeon. Drilling Device was NSK 20000 Japan and drilling duration in tympanomastoid surgery was 22.1 ± 15.1 minutes. The preoperative and postoperative bone conduction thresholds were obtained in frequencies 250 to 4000 HZ one day before and 6-8 weeks after the surgical procedure by one expert audiologist. The audiometer was AC40 interacoustics Denmark. Other variables like age, gender, kind of surgery, diagnosis of the lesion of the middle ear and mastoid and duration of drilling were investigated and evaluated too. Then descriptive and inferential statistics were utilized to evaluate hearing level before and after surgery. The data was analyzed in various ways to determine any statistical difference by applying paired t-test. Statistical significance was accepted if p value is <0.05 .

RESULTS

A total of 889 patients were included in this study, of them, 613 (68.95%) were female and 276 (31.05%) of them were male. The male to female ratio was 1:2.4. The patients ranged in age from 3 to 78 years old with a mean of 24.15 years. Statistically significant deterioration in bone conduction thresholds was found only with radical mastoidectomy. There was no change in mean bone conduction thresholds in 819 of patients. A total of 70 patients showed worsening of postoperative bone conduction thresholds. The performed surgery included modified radical mastoidectomy in 427 (48%) patients, mastoidectomy, tympanoplasty in 454 (51%), and radical mastoidectomy in 8 (1%) patient. Duration of diseases was 3-30 years. Table 1 showed difference of mean pre-operative and post-operative bone conduction thresholds at 500, 1000, 2000 and 4000 Hz and their statistical significance correlated with the surgical techniques employed. There was no change in mean bone conduction thresholds in majority of patients. The results are shown in Table 1. Statistically significant deterioration in mean bone conduction thresholds were found with modified radical mastoidectomy and radical mastoidectomy at the frequency of 4000 Hz.

Table 1. Difference of mean pre-operative and post-operative bone conduction thresholds at 500, 1000, 2000 and 4000 Hz and their statistical significance correlated with the surgical techniques employed

Surgical Technique	Frequency (Hz)	Mean Pre- operative Bone Conduction Thresholds	Mean Post-operative Bone Conduction Thresholds	P-value
Mastoidectomy and Tympanoplasty	500	18.25	19.45	N.S.
	1000	18.25	19.15	N.S.
	2000	21.20	24.12	N.S.
	4000	12.62	12.74	N.S.
Modified radical mastoidectomy	500	13.15	14.50	N.S.
	1000	19.50	21.50	N.S.
	2000	17.25	18.90	N.S.
	4000	10.16	12.68	<0.004
Radical mastoidectomy	500	13.25	14.12	N.S.
	1000	14.50	15.90	N.S.
	2000	37.12	24.18	<0.05
	4000	10.54	17.92	<0.05

DISCUSSION

The mastoid bone lies behind the ear and is usually made up of many open air cells. Infection of the middle ear may lead to infection of the mastoid (called mastoiditis) and these air cells fill up with pus. Left untreated, bone can even be destroyed and the infection could extend to other important areas of the head such as the brain(1, 13). If treatment with antibiotics does not clear up the infection, surgery may be needed. Another, and more common, reason for

mastoid surgery is in the case of a chronic draining ear or when a benign tumor called a cholesteatoma exists. Exactly how the surgery will be done will depend on which problem you have. Tympanomastoid surgery is needed for the chronic draining ear or in the case of a cholesteatoma. This surgery involves the middle ear space as well as the mastoid spaces(14). The surgical treatment of chronic middle ear disease can affect bone conduction thresholds in variety of ways. The results of our study showed that when mean preoperative bone conduction thresholds values were compared with the corresponding post-operative ones for individual frequencies of 500, 1000, 2000 and 4000 Hz, Statistically significant deterioration in mean bone conduction thresholds were found with Modified radical mastoidectomy and radical mastoidectomy at the frequency of 4000 Hz. The most affected frequency was found to be 4000 Hz. These results are supported by various other studies which showed that high tone hearing loss involving frequencies above 2000 Hz are the most common type of sensorineural hearing loss following surgery for chronic ear disease(14-16). Some other studies also identified 4000 Hz as the most commonly affected frequency(16-18). Iranfar *et al.*, Pignatero *et al.*, Volter *et al.*, Sakagami *et al.*, and Naderipour *et al.* have shown a significant difference in the frequency of 250 Hz(1, 5, 15, 18, 19). Tos *et al.* and Mozafari-nia(3, 6), and their co-workers have also pointed out that hearing loss is the consequence of the middle ear surgery. It looks; this discrepancy is due to study duration, sample size, post operation audiometry time, perfection of the audiometrist as well as the instrument type, surgery maneuvers, drill-generated noise and experience of surgeon. It was again evident that among all the surgical procedures considered in our study, only the open techniques like modified radical and radical mastoidectomies were associated with deterioration of bone conduction thresholds. This view is shared by many other studies(1, 5, 12, 15, 16, 20). Radical and modified radical mastoidectomies are usually required in the treatment of extensive cholesteatoma or granulations and also required considerably more bone work utilizing mastoid drill. These factors might be responsible for deterioration of postoperative bone conduction thresholds. However, some other authors do not support this view and believe that mastoid surgery has no effect on bone conduction thresholds(16, 19). Findings of this study can be used to develop new non-medication techniques for the treatment of middle ear diseases.

CONCLUSION

Our findings showed that the middle ear surgery in chronic otitis media in majority of the patients does not affect bone conduction thresholds. It is suggested that all ENT surgeon should do chronic otitis media surgery without being worried, but must take all the precaution.

Conflict of Interest

The authors have declared that no conflict of interest exists.

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