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Original Article

Tinnitus Pre and Post Translabyrinthine Acoustic Neurinoma Surgery

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OBJECTIVE: Tinnitus in one of the most common complaints of patients with acoustic neurinoma, which could lead to early diagnosis. Because postoperative tinnitus can have a profound effect on patients' quality of life, candidates for surgery should be thoroughly informed about the possible effect of the operation on their tinnitus status. Questionnaires were the only source of information for tinnitus evaluation in previous studies, most of which were retrospective.

MATERIALS and METHODS: Twelve patients with unilateral tinnitus and hearing loss and definite diagnosis of acoustic neurinoma were operated via translabyrithine tumour resection. One week before and 3 months after complete translabyrinthine removal of tumour, tinnitus evaluation test was performed and pitch match of tinnitus and loudness match of tinnitus were measured. Then patients were asked to complete two Persian validated questionnaires, Tinnitus Handicap Inventory-Persian and Tinnitus Questionnaire-Persian.

RESULTS: Psychoacoustic and psychometric aspects were improved in three patients, did not change in one patient, and worsened in one patient. In three patients, tinnitus disappeared and in four patients without preoperative tinnitus, it did not occur.

CONCLUSION: Partial improvement in postoperative tinnitus was seen but prediction about tinnitus after surgery is not possible yet. Nonetheless, postoperative tinnitus is not bothersome and does not affect patients' lives.

KEY WORDS: Tinnitus, acoustic neurinoma, translabyrinthine, psychometric, psychoacoustic

INTRODUCTION

Tinnitus in one of the most common complains of patients with acoustic neurinoma, which could lead to early diagnosis. According to previous studies, about 60-80% of patients with acoustic neurinoma complain of tinnitus before surgery [1-6].

Small acoustic neurinomas may cause unilateral hearing loss, tinnitus, and vertigo. However, few studies have been conducted on their postoperative occurrence [2, 7] and few reports have focused on tinnitus during follow-up of untreated patients [8]. Additionally, the extent of complaints after treatment is difficult to predict [8]. Few studies have been conducted on the qualitative and quantitative effects of surgery on tinnitus. However, tinnitus may improve, persist, or even worsen after treatment, regardless of surgical approach [2, 4, 9-11], and there is a low chance for its complete resolution or appearance after surgery.

Most of the conducted studies are retrospective [4, 5, 8-10, 12] and questionnaire-based [4, 8-10], using self- administered questionnaires [8] or via telephone interviews [5], mostly gathering information from patients after a considerable delay, so their validity is under question. As already mentioned, questionnaires were the only source of information for tinnitus evaluation in previous studies, so the information is suspected to be affected by psychosocial and/or postsurgical elements.

Preoperative counselling of patients also tends to ignore tinnitus as a possible side effect, concentrating primarily on the rates of mortality and serious morbidity. This apparent medical indifference can be explained in part by the difficulty of measuring, describing, and classifying this subjective complaint [8]. However, because postoperative tinnitus can have a profound effect on patients' quality of life, candidates for surgery should be thoroughly informed about the possible effect of the operation on their tinnitus status. We analysed psychoacoustic and psychometric aspects of tinnitus before and after acoustic neurinoma resection via a translabyrinthine approach in a prospective study.

MATERIALS and METHODS

This study was conducted on patients with unilateral probable diagnosis of acoustic neurinoma, confirmed by audiological and MRI findings. Audiological findings were unilateral or asymmetric bilateral sensorineural hearing loss plus asymmetric speech discrimination score

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(SDS). Cases were selected from Hazrate-Rasoul neurotology clinic outpatients from 2011 April to 2013 March. Patients with unilateral unserviceable hearing loss who underwent translabyrinthine tumour resection for the first time were included in this study. Patients with bilateral acoustic neurinoma, neurofibromatosis, chronic otitis media, revision surgery, and brain stem and dural involvement were excluded. All patients were evaluated by pure tone audiometry (PTA), speech reception threshold (SRT), SDS, acoustic reflex, and tympanometry, with accurate bone and air conduction threshold measurements per frequency, to perform a tinnitus evaluation test with the contralateral ear. Otoacoustic emission (OAE) test was done for cochlea involvement evaluation as a criterion for preservation of hearing or not.

Twelve patients were candidates for the operation. One week before and 3 months after complete translabyrinthine removal of tumour, a tinnitus evaluation test was performed and pitch match of tinnitus (PMT) and loudness match of tinnitus (LMT) were measured. Then patients were asked to complete two Persian validated questionnaires, THI-P [13] and TQ-P, in bed. All information needed to complete the questionnaires was transferred to the patients and their questions were answered by an expert.

Pre- and postoperative psychoacoustic data (PMT and LMT) were gathered and compared. THI-P is a 25-item questionnaire with 'yes' (4 points), 'no' (0 points), or 'sometimes' (2 points) answers. The scores are added to yield a classification of tinnitus annoyance: slight (0-16); mild (18-36); moderate (38-56); severe (58-76); or catastrophic (78-100) and divided into three subscales (emotional, functional, and catastrophic) according to specific questions, as a quantitative score in each scale.

TQ-P is a 52-item questionnaire with 'yes' (2 points), 'no' (0 points), or 'sometimes' (1 point) answers. After analysis with compatible software, quantitative data were mined from TQ-P questionnaires in eight subscales (emotional distress, cognitive distress, emotional and cognitive distress, intrusiveness, auditory perceptual difficulties, sleep disturbance, somatic complaints, and general score) as quantitative data. All pre- and postoperative psychometric data were analyzed with paired t-test.

RESULTS

Cases consisted of 12 patients (four females and eight males) with an average age of 51.7 years (mean 26-64 years), with five right side and seven left side tumours. No complication was seen after surgery. None of the patients left follow-up. Table 1 shows the pre- and postoperative psychoacoustic data (PMT and LMT).

THI-P Test Analysis Results

Emotional and functional distress were not significantly different pre and post surgery (p=0.141 and 0.154, respectively) but there was a significant decrease in the catastrophic subscale (p=0.019). Total THI-P scores with and without five-grade classification showed no significant difference pre and post surgery (p=0.129 and 0.88, respectively).

TQ-P Test Analysis Results

There was a significant decrease in emotional distress (p=0.046), cognitive distress (p=0.019), emotional plus cognitive distress (p=0.025), auditory perceptual difficulties (p=0.032), and general score (p=0.026), but differences between pre- and postsleep disturbance (p=0.1), somatic complaint (p=0.072), and intrusiveness (p=0.099) were not significant.

Table 1. Tinnitus evaluation test results (LMT and PMT)

Post operation LMT	Pre operation LMT	Post operation PMT	Pre operation PMT	Patients
10 dbSL	10 dbSL	8 KHz	4 KHz	1
3 dbSL	1 dbSL	8 KHz	3 KHz	2
2 dbSL	4 dbSL	8 KHz	2KHz	3
5 dbSL	7 dbSL	8 KHz	125 Hz	4
-	3 dbSL	-	3 KHz	5
-	3 dbSL	-	8 KHz	6
-	8 dbSL	-	750 Hz	7
1dbSL	3 dbSL	8 KHz	3 KHz	8
-	-	-	-	9
-	-	-	-	10
-	-	-	-	11
-	-	-	-	12

LMT: loudness match of tinnitus; PMT: pitch match of tinnitus

DISCUSSION

How does the surgical removal of an acoustic neurinoma influence tinnitus? Because postoperative tinnitus can have a significant effect on patients' quality of life, it should be borne in mind when considering surgery for an acoustic neurinoma.

Currently, the relevance of tinnitus on operation is not clear to us. Goel et al. [14] reported that only one of 42 patients who underwent surgery to preserve hearing experienced worsening of tinnitus. According to Catalano and Post [15], tinnitus disappeared postoperatively in 11 of 23 patients but developed in four of 28 patients. Henrich et al. [5] reported that tinnitus was eliminated in 29%, lessened in 18%, remained unchanged in 39%, and increased in 14% of patients with preoperative tinnitus, whereas 17% of patients with no preoperative tinnitus experienced it postoperatively. In the series of Silverstein et al. [16], tinnitus was improved in 38%, unchanged in 37%, and aggravated in 25%.

Most of the previous studies have assessed surgical approaches other than translabyrinthine, like middle cranial fossa [8, 17], suboccipital retrosigmoid [12, 16], and microneurosurgery [18]. In 1992, Baguley [4] retrospectively studied a series of 129 patients who had undergone translabyrinthine removal of a unilateral acoustic neurinoma and completed a postal questionnaire about pre- and postoperative tinnitus. The results suggest that it is possible to advise a patient undergoing this form of surgery that if they have no tinnitus preoperatively, they are unlikely to develop it, and if they do, it will not be severe enough to significantly affect their quality of life. If a patient has mild or moderate tinnitus, it is most likely to stay the same or become less intense. If a patient has severe tinnitus, it is very likely to improve and not affect their future quality of life. In 1997, Andersson [9] studied the effects of translabyrinthine acoustic neurinoma surgery on tinnitus in a consecutive sample of patients operated on between 1988 and 1994 with a postal questionnaire. He found that

the risk for developing tinnitus when no preoperative tinnitus was present was 35%, and the chance of tinnitus disappearing when present preoperatively was 15%. In 2005, Baguley again studied changes in tinnitus after translabyrinthine vestibular neurinoma excision prospectively, by administration of the Tinnitus Handicap Inventory (THI) preoperatively and at 3 and 12 months postoperatively. Tinnitus handicap is neither alleviated nor exacerbated by translabyrinthine surgery [19]. In our study, psychoacoustic and psychometric aspects were improved in three patients, did not change in one patient, and worsened in one patient. In three patients, tinnitus disappeared, and in four patients without preoperative tinnitus, it did not occur.

Previous studies were retrospective except a few (Goel on the retrosigmoid approach and Baguley 2005 on the translabyrinthine approach), while our prospective study eliminates biases due to patients' forgetfulness.

Twelve patients were involved in our study. The small number of cases could be explained by the short duration of the study (23 months) and the prospective design. Sample size was affected by low referral of outpatients in the study period and among them, only a few met the study inclusion criteria.

Previous studies were based on self-administered questionnaires, interviews on the phone, and oral history, which affects their validity. An exception is two studies, Baguley in 2005 and Fahy in 2002, which showed that tinnitus might be of relatively minor importance in the overall quality of life of patients following acoustic neurinoma surgery, and it remains unpredictable which patients will improve, which will show no change, and which will deteriorate [10]. In our study, we used two validated Persian questionnaires to assess tinnitus not only from a general perspective, but also for assessing the different aspects of its morbidity in patients' lives. Like previous studies, we did not find a significant change in THI grading after surgery. None of the previous studies used the TQ questionnaire and audiometric parameters to evaluate tinnitus.

In some questionnaires, a few fields were left blank, probably because the 52 questions of the TQ are a rather high number to be filled in by patients during every visit. Using the two shorter versions, the TQ 12 and the Mini-TQ, in further studies seems reasonable. The TQ 12, developed by Hiller and Goebel [20] according to an optimal combination of high item-total correlations, reliability, and sensitivity in assessing changes, consists of 12 items that correspond to items 5, 9, 17, 24, 28, 34, 35, 36, 39, 43, 47, and 48 of the TQ. The Mini-TQ consists of 10 items, corresponding to items 4, 11, 15, 17, 24, 34, 35, 39, 47, and 48 of the TQ [20]. In our study, according to TQ-P, tinnitus-induced cognitive and emotional distress and auditory perceptual difficulties were decreased after surgery. Insignificant changes in somatic complaint and sleep disturbance were due to their absence or low effect before surgery.

New onset tinnitus did not occur in our study, although some studies have reported new onset tinnitus after surgery.

TQ-P and THI-P scores were not in agreement but were consistent with audiometric changes (LMT) and for each patient, as shown in a previous study [21]. Tinnitus evaluation test is good for confirming the presence of tinnitus and as a guide for postoperative tinnitus treatment. Preoperative frequencies were variable from 125 Hz to 4000 Hz, but shifting to 8000 Hz was seen in patients with postoperative tinnitus.

We followed patients for only 3 months after tumour resection because in the Baguley study [19], no significant differences in group data were found when comparing 3-month postoperative data with 12-month postoperative data.

In this study, we were not concerned about the age and size of the tumour but Kohno [22] supposed that prognosis of postoperative tinnitus was influenced by age, tumour size, preoperative hearing acuity, type of preoperative hearing disturbance, and conditions of the cochlear nerve after tumour resection. Worse prognosis of postoperative tinnitus in the preoperative tinnitus group was found with younger patients, smaller tumour size, better preoperative hearing function, and normal or retrocochlear type of hearing disturbance. Fahy [10] found that neither tumour size nor age at the time of the operation had a statistically significant association with the impact of surgery on tinnitus.

In conclusion, in this study, partial improvement in postoperative tinnitus was seen but further studies on tinnitus after surgery with a greater sample size are needed for an overall verdict. Nonetheless, in our limited cases postoperative tinnitus was not bothersome and did not affect patients' lives, according to psychometric tests. New studies should be conducted based on psychoacoustic aspects of tinnitus to verify the efficiency of treatment.

Ethics Committe Approval: Ethics committee approval was received for this study from the ethics committee of ENT-Head and Neck Research Center, Iran University of Medical Sciences.

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

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REFERENCES

1. Wiegand DA, Fickel V. Acoustic neuroma-The patient's perspective: Subjective assessment of symptoms, diagnosis, therapy, and outcome in 541 patients. Laryngoscope 1989; 99: 179-87.
2. Berliner KI, Shelton C, Hitselberger WE, Luxford WM. Acoustic tumors: Effect of surgical removal on tinnitus. Am J Otol 1992; 13: 13-7.
3. Parving A. Tinnitus before and after surgery for an acoustic neuroma. In Tos M, Thomse J, eds. Acoustic Neuroma. Proceedings of the First International Conference on Acoustic Neuroma (Copenhagen, Denmark), Amsterdam/New York: Kugler Publications, 1991: 891-4.

4. Baguley DM, Moffat DA, Hardy DG. What is the effect of translabyrinthine acoustic schwannoma removal upon tinnitus? J Laryngol Otol 1992; 106: 329-31. [CrossRef]
5. Henrich DE, McCabe BF, Gantz BJ. Tinnitus and acoustic neuromas: Analysis of the effect of surgical excision on postoperative tinnitus. ENT J 1995; 74: 462-6.
6. Harcourt J, Thomsen J, Tos M. Translabyrinthine vestibular schwannoma surgery: Postoperative tinnitus and cochlear nerve integrity. Auris Nasus Larynx 1997; 24: 21-6. [CrossRef]
7. Howitz MF, Johansen C, Tos M, Charabi S, and Olsen JH. Incidence of vestibular schwannoma in Denmark, 1977-1995. Am J Otol 2000; 21: 690-4.
8. Kanzaki J, Satoh A, Kunihiro T. Does Hearing Preservation Surgery for Acoustic Neuromas Affect Tinnitus? SKULL BASE SURGERY 1999; 9: 169-76. [CrossRef]
9. Andersson G, Kinnefors A, Ekvall L, and Rask-Andersen H. Tinnitus and translabyrinthine acoustic neuroma surgery. Audiol Neurootol 1997; 2: 403-9. [CrossRef]
10. Fahy C, Nikolopoulos TP, and O'Donoghue GM. Acoustic neuroma surgery and tinnitus. Eur Arch Otorhinolaryngol 2002; 259: 299-301.
11. Wiegand DA, Ojemann RG, and Fickel V. Surgical treatment of acoustic neuroma (vestibular schwannoma) in the United States: report from the Acoustic Neuroma Registry. Laryngoscope 1996; 106: 58-66. [CrossRef]
12. Kameda K, Shono T, Hashiguchi K, Yoshida F, Sasaki T. Effect of tumor removal on tinnitus in patients with vestibular schwannoma. J Neurosurg. 2010; 112: 152-7. [CrossRef]
13. Mahmoudian S, Shahmiri E, Rouzbahani M, Jafari Z, Keyhani M, Rahimi F, et al. Persian language version of the "Tinnitus Handicap Inventory": translation, standardization, validity and reliability. Int Tinnitus J 2011; 16: 93-103.
14. Goel A, Sekhar LN, Langheinrch W, Kamerer D, Hirsch B. Late course of preserved hearing and tinnitus after acoustic neurilemoma surgery J Neurosurg 1992; 77: 685-9. [CrossRef]
15. Catalano PJ, Post KD. Elimination of tinnitus following hearing preservation surgery for acoustic neuromas. Am J Otol 1996; 17: 443- 5.
16. Silverstein H, Haberkamp T, Smouha E. The state of tinnitus after inner ear surgery. Otolaryngol Head Neck Surg 1986; 95: 438-41.
17. Haid CT. Acoustic Tumor Surgery and Tinnitus. International Tinnitus Journal1998; 4: 155-8.
18. Heerma H, Braun V, Richter HP. Effect of microneurosurgical operation in acoustic neurinoma on symptoms of vertigo and tinnitus. HNO 2000; 48: 372-7. [CrossRef]
19. Baguley DM, Humphriss RL, Axon PR, Moffat DA. Change in tinnitus handicap after translabyrinthine vestibular schwannoma excision. Otol Neurotol. 2005; 26: 1061-3. [CrossRef]
20. Hiller W, Goebel G. Rapid assessment of tinnitus-related psychological distress using the Mini-TQ. Int J Audiol 2004; 43: 600-4.
21. Baguley DM, Humphriss RL, Hodgson CA. Convergent validity of the tinnitus handicap inventory and the tinnitus questionnaire. J Laryngol Otol 2000; 114: 840-3. [CrossRef]
22. Kohno M, Shinogami M, Yoneyama H, Nagata O, Sora S, Sato H. Prognosis of tinnitus after acoustic neuroma Surgery-Surgical Management of Postoperative Tinnitus. World Neurosurg 2012: 1878-8750.