

Tinnitus Outcome in Surgery for Vertigo

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Abstract: The effect of surgery for vertigo on tinnitus was evaluated in 90 patients who underwent surgery for disabling vertigo for Meniere's disease. The three procedures studied included a destructive labyrinthectomy, endolymphatic sac decompression and shunt, and vestibular neurectomy. Patients who underwent a vestibular neurectomy had a significantly better tinnitus outcome than those who underwent shunt surgery (50% vs 22.7%). The labyrinthectomy and the neurectomy groups showed an equal positive response of 50%. The severity of the preoperative hearing loss did not correlate with the tinnitus outcome in all groups. Patients who have serviceable hearing and require surgery for disabling vertigo appear to have a better chance of tinnitus control with the vestibular neurectomy rather than an endolymphatic sac decompression and shunt.

INTRODUCTION

Tinnitus is an integral component of most neurological disorders, particularly Meniere's disease. Most reports in the literature regarding surgery for Meniere's disease have focused on the success in vertigo control. In addition to the disabling vertigo, patients with Meniere's disease are quite distraught with tinnitus and commonly ask about the chances of their tinnitus improving following their surgery. The purpose of this paper is to review the tinnitus outcome in patients who had undergone surgery for the control of disabling vertigo from Meniere's disease. While the indications for surgery in these patients were the control of vertigo and not tinnitus, it is helpful to recognize the different tinnitus response rates comparing the three main procedures reviewed, namely, the destructive labyrinthectomy, the endolymphatic sac decompression and shunt, and the vestibular neurectomy. The availability of such data could play a role in the choice of surgery when tinnitus is a major symptom.

MATERIALS AND METHODS

A retrospective review of 110 patients with Meniere's disease who underwent surgery for the control of disabling vertigo between July 1984 and November 1994 was undertaken. There were 64 females and 46 males. Ninety (90) of these patients had chart information and follow-up data allowing inclusion in this study. A trans-mastoid labyrinthectomy was performed in 12 patients who had no serviceable hearing. Of those patients with serviceable hearing, 56 patients underwent a vestibular neurectomy and 22 patients a mastoid endolymphatic sac decompression and shunt. The choice of the surgical procedure in the hearing preservation group was not determined by the severity of the vertigo, but rather by the age of the patient, bilaterality of the disease, and the patient's preference. All patients suffered tinnitus to different degrees.

The patients were asked to grade their tinnitus severity from 1 to 5, (1 = worst and 5 = best) before, and a minimum of 2 years after their surgery. The range of the postoperative follow-up was 2 - 12 years, with an average of 8 years. The information was obtained from the patients' medical records and a questionnaire. Patients were also asked to rate their postoperative tinnitus response according to a scale of 1-4. 1 being worse, 2 meaning no change, 3 meaning improved, and 4 being cured. The degree of improvement was further elucidated in the vestibular neurectomy group. Only 12 patients responded to that question, rating their improvement as either significant or mild.

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The tinnitus response rate was then correlated with the different surgical procedures and submitted for statistical analysis.

RESULTS

Of the 12 patients who underwent a destructive labyrinthectomy, 4 (33.3%) reported a cure of their tinnitus, 2 (16.7%) reported an improvement, 6 (50%) reported no change, and none reported worsening. Of the 22 patients who underwent an endolymphatic sac decompression and shunt, 2 (9.1%) reported a cure, 3 (13.6%) improved, 16 (72.7%) experienced no change, and 1 (4.5%) reported a worsening. In the vestibular neurectomy group (56) 5 (8.9%) were cured, 23 (41.1%) improved, another 23 (41.1%) experienced no change, and 5 (8.9%) got worse (Table 1). Twelve patients in the neurectomy group responded to a question grading the degree of their improvement. Seven (58.3 %) reported significant improvement, while 5 (41.7 %) reported mild improvement.

A statistical analysis of the data was performed on 86 of the 90 patients studied. The 4 patients dropped, included 2 patients who had undergone a shunt and subsequently a vestibular neurectomy, and another 2 who had revision shunt surgery. The tinnitus response categories were then grouped into 2 main categories: cured or improved and same or worse.

When rating their postoperative tinnitus response from 1 - 4 (1 = worse, 4 = cured), the mean for the 86 patients was 2.5 with a standard deviation of 0.79. A chi square analysis of a positive response (cured or improved) vs. the 3 procedures revealed no significant difference ($p = 0.113$). However when the shunt group was compared to the neurectomy group, the neurectomy appeared to be more effective in tinnitus control ($p = .064$, borderline significant).

An analysis of variance comparing tinnitus response with the preoperative pure tone average (PTA) and the speech discrimination score (SDS) revealed no significant differences ($p = .4$ and $.6$, respectively).

A regression analysis comparing tinnitus outcome between the labyrinthectomy and the neurectomy groups yielded no significant differences ($p = .9$). However there was a significant difference between the neurectomy and the shunt groups, the neurectomy group showing a better outcome ($p = .04$). This is also confirmed by odds ratio of .9 for the labyrinthectomy/neurectomy, and .3 for the shunt/neurectomy.

An analysis of maximum likelihood estimates comparing the shunt and the neurectomy groups also confirmed that the neurectomy group did significantly better ($p = .04$). The preoperative PTA and SDS showed no effect on the tinnitus outcome.

DISCUSSION

Tinnitus continues to afflict millions of patients worldwide. Despite significant interest from the medical and scientific communities and the pressures from tinnitus sufferers, a cure or solution to this vexing problem continues to evade us. While some patients with severe tinnitus are ready to sacrifice their hearing to stop their tinnitus and regain their quiet existence, the unpredictability of the response prevents us from pursuing such therapy in the presence of serviceable hearing. A surgical solution for severe tinnitus has been proposed and investigated by multiple authors. Dandy in 1941 reported a 50% improvement in tinnitus following VIIIth nerve sections for Meniere's disease.¹ Fisch in 1976 reported a 75% improvement following a cochleovestibular neurectomy (CVN) compared to 65% following a vestibular neurectomy.² Silverstein in 1976 also reported a 75% improvement following a CVN,³ however, House and Brackmann reported a 45%,⁴ and Gardner a 48% improvement.⁵ Barrs and Brackmann reported in 1984 a 62% improvement after a CVN compared to 49% in vestibular neurectomies.⁶ In a review of tinnitus response in various inner ear procedures, Silverstein et al reported an overall improvement in 56% of patients, while 76% improved following a CVN.⁷ Pulec also reported complete relief of tinnitus in

Table 1. Number and Percentage of patients in each of the tinnitus outcome categories, cured, improved, unchanged, and worse, and in the combined categories of cured or improved and same or worse.

	# of Patients	Cured	Improved	Unchanged	Worse	Cured or Improved	Same or Worse
LAB	12	4 (33.3%)	2 (16.7%)	6 (50%)	0 (0%)	6 (50%)	6 (50%)
ELS	22	2 (9.1%)	3 (13.6%)	16 (72.7%)	1 (4.5%)	5 (22.7%)	17 (77.3%)
RVN	56	5 (8.9%)	23 (41.1%)	23 (41.1%)	5 (8.9%)	28 (50%)	28 (50%)
Total	90	11 (12.2%)	28 (31.1%)	45 (50%)	6 (6.6%)	39 (43.3%)	51 (56.7%)

LAB = Labyrinthectomy, ELS = Endolymphatic sac shunt, RVN = Vestibular neurectomy.

101 of 151 patients who underwent a CVN.⁸ In 1996, we introduced the concept of a selective cochlear neurectomy for the treatment of disabling tinnitus in patients who had a severe to profound hearing loss with preservation of their vestibular function.⁹ The literature suggests that the most effective procedures for controlling tinnitus would have to include transection of the cochlear nerve fibers. Such procedures however are not widely embraced particularly due to the inability of future cochlear implantation of these patients should they become candidate for an implant at some point.

The results of this investigation revealed a few salient points that were statistically significant. Patients who underwent a vestibular neurectomy had a better tinnitus response rate when compared to those who underwent a shunt (50% vs 22.7%). A destructive labyrinthectomy provided a similar tinnitus response rate to a neurectomy (50%). The severity of the preoperative hearing loss as measured by the PTA and the SDS did not affect the ultimate tinnitus response.

The superiority of the vestibular neurectomy over the endolymphatic sac surgery in the control of vertigo has been widely described. This study proves it to be a better procedure in tinnitus control as well. The mechanism by which a vestibular neurectomy influences tinnitus is not clear. Interruption of the efferent system is a likely possibility. The degree of decompression of the endolymphatic sac is not believed to play a role in the tinnitus outcome since the extent of exposure and decompression of the endolymphatic sac and surrounding posterior fossa dura we perform in sac surgery is similar to the exposure in retrolabyrinthine vestibular neurectomy.

A destructive labyrinthectomy offers no advantage over the vestibular neurectomy with regard to tinnitus control, and should be reserved to patients who have already lost their hearing beyond possible help from amplification. These patients, however, may have a better chance of tinnitus control with a cochleovestibular neurectomy.^{7,8}

We believe that the ultimate control of tinnitus will come from the discovery of a pharmacotherapeutic agent. Until basic research in this field can yield a clue, continued clinical research on the medical and surgical

management of tinnitus is necessary and helpful in guiding patients through their options.

CONCLUSION

The effect of surgery for vertigo in patients suffering from Meniere's disease on their tinnitus was evaluated in this retrospective study of 90 patients. The results of this study revealed that: 1) Patients who underwent either a labyrinthectomy or a vestibular nerve section had a 50% positive outcome (cured or improved). 2) With hearing conservation surgery, the vestibular neurectomy offers a significantly better chance of tinnitus cure or improvement when compared to endolymphatic sac surgery (50% vs 22.7%). 3) The severity of the preoperative hearing loss as measured by the PTA and the SDS showed no correlation with the tinnitus outcome.

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