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Indication and Timing of Surgery for Cochleovestibular Neurovascular Compression Syndrome

Tomomi Okamura[1]*, Takafumi Nishizaki[1], Norio Ikeda[1], Shigeki Nakano[1], Makoto Ideguchi[1], Natsumi Fujii[1] and Takeshi Okuda[2]

[1]Department of Neurosurgery, Ube Industries Central Hospital, 750 Nishikiwa, Ube, Yamaguchi 755-0151, Japan
[2]Department of Otolaryngology, Ube Industries Central Hospital, 750 Nishikiwa, Ube, Yamaguchi 755-0151, Japan

Abstract

Objective: Optimal surgical indications for cochleovestibular neurovascular compression syndrome (CNVC) remain controversial. We examined the surgical indications and timing of surgery for CNVC. Methods: The surgical outcomes of 30 patients (32 sides) with vertigo, tinnitus and hearing loss were evaluated. CNVC was diagnosed according to five items for clinical features with a scoring system of 1 or 0 based on the following features: a history, neurological and otological findings, an ABR evaluation, and vascular contact with the eighth cranial nerve on MR or air CT imaging. Patients with scores of 4-5 were diagnosed with CNVC. In addition, three modulation types of tinnitus using median nerve stimulation were evaluated in CNVC (28 sides) and other diseases (12 sides), and classified as suppression (S-type), no change (N-type), and excitation (E-type). Results: At early time, results of 16 sides evaluated using the modulation test before surgery for CNVC, the relationship between modulation of tinnitus and surgical results was evaluated. The ratio of the tinnitus intensity early after the surgery to that before the surgery was significantly lower for the S-type than for the other two types ($P<0.01$). At one year follow-up, the results of 32 sides were excellent in 8 sides, good in 19 sides, fair in 2 sides and poor in 3 sides. The duration of preoperative symptoms in the excellent group (1.9 ± 6.7 years) was shorter than that in the good group (5.8 ± 5.8 years). Results of CNVC with a chief complaint of vertigo and the duration of symptoms over 15 years and CNVC with a chief complaint of tinnitus and the duration of symptoms over 3 years was not always satisfactory. Conclusion: Indications for good outcomes are limited and need to consider not only the duration of symptoms, but also the modulation of tinnitus. Our findings suggest that the timing of surgery for CNVC with a complaint of vertigo should be within about 15 years, but that for CNVC with tinnitus should be within 3 years of onset of symptoms. Furthermore, some patients with S-type of less than 6 years are good candidates for surgery.

Keywords: Vertigo; Tinnitus; Hearing loss; Eighth cranial nerve; Cochleovestibular neurovascular compression; Syndrome; Auditory brainstem response; Microvascular decompression; Median nerve

Introduction

Pressure on the vestibular nerve caused by a vascular loop may be a possible cause of intractable vertigo [1]. Jannetta et al. [2] named the disease entity caused by vascular compression of the vestibular nerve as "disabling positional vertigo (DPV)". We performed surgery on 30 patients with cochleovestibular neurovascular compression syndrome (CNVC), and carefully followed-up these patients for more than 1 year. Patients with CNVC had vertigo, tinnitus, or hearing loss. Regarding vertigo, the study by Jannetta et al. [2] on DVP is historical. There are several reports on the surgical results microvascular decompression (MVD) [3-13] for CNVC; however, surgical indications remain controversial. Therefore, the aim of the present study is to clarify surgical indications and the timing of surgery for CNVC. Furthermore, three types of modulation of tinnitus by a median nerve stimulation, namely, suppression (S-type), no change (N-type) and excitation (E-type) were examined with special reference to surgical indications and the timing of surgery.

Materials and Methods

This study consists of two main parts: the first part reviewed some problems in the operative experiences of 30 patients (32 sides) with CNVC. Then, the modulation of tinnitus by a median nerve stimulation was performed and three types (S-, E-, and N-types) were induced.

The diagnostic assessment of CNVC was performed according to the following scoring system. Five items for clinical features related to the combination of vertigo, tinnitus, or hearing loss were evaluated and given a score of 1 or 0; 1) a long history of recurrent vertigo, tinnitus, or hearing loss; 2) neurological findings related to positional vertigo, nystagmus, tinnitus, or hearing loss; 3) neuro-otological findings of audiometry, tinnitus, or vestibular testing; 4) auditory brainstem response (ABR) evaluation with the detection of a low 25-75% II wave amplitude on the contralateral side and delayed interpeak latencies in I-III or I-V waves (typically a low II wave amplitude with double peaks and a wide-based form) during an ABR evaluation using 80-and 90-dB clicks; and 5) the detection of vascular contact with the eighth cranial nerve on magnetic resonance imaging (MRI)-constructive interference in steady state (CISS) or air computed tomography imaging. The sum of these scores was evaluated. In patients with more than one of the features of items 1), 2) or 3), scores were evaluated based on the most representative of these items. Patients with scores of 4-5 had CNVC.

ABR finding were as follows. A low 25-75% II wave amplitude on the contralateral side was observed in 28% (9/32 sides), a delay in the I-III interpeak latency with a low amplitude of the II wave in 44% (14/32 sides), and a delay in the I-III and I-V interpeak latencies with a low amplitude of the II wave in 9% (3/32 sides). The results of the ABR evaluation were within normal limits in 19% (6/32 sides). Concerning the relationship between symptoms and ABR findings, the mean duration of tinnitus combined with ABR II low amplitude (25-75% to the contralateral side wave) was 1.3 years (0.5-2.5 years). On the contrary, the mean duration of tinnitus with a delay in I-III interpeak

***Corresponding author:** Tomomi Okamura, Department of Neurosurgery, Ube Industries Central Hospital, 750 Nishikiwa, Ube, Yamaguchi 755-0151, Japan, Tel: 0836-51-9338; Fax: 0836-51-9252; E-mail: okam123@lime.ocn.ne.jp

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latencies and a low amplitude of the II wave was 5.1 years (0.5-20.0 years). Furthermore, the mean duration of tinnitus with a delay in I-III, I-V interpeak latencies with a low amplitude of the II wave was 9.9 years in mean (3.7-20.0 years).

Surgical Results

We encountered 30 patients (32 sides) with CNVC between 1988 and 2006 (Table 1). Sixteen patients were males and 14 were females, with an age range between 26 and 79 years and mean age of 57.0 years. Thirty patients (32 sides) underwent MVD by small retromastoid craniectomy [11]. One patient underwent bilateral surgery and one patient underwent reoperation. The 30 patients (32 sides) who underwent surgery had vertigo or motion intolerance [3] for between 0.3 and 17 years (mean=5.4) and tinnitus for between 0.1 and 20 years (mean=4.7). Results are described as early (one month) and one year postoperative follow-ups. In the early postoperative follow-up, 16 out of 22 sides (73%) were free of vertigo or motion intolerance. In the evaluation of tinnitus at early postoperative time, improvement in tinnitus was evaluated based on the postoperative to preoperative tinnitus intensity ratio. A ratio of 0.0-0.3 was regarded as marked improvement, a ratio of o.4-0.7 as moderate improvement, and a ratio of 0.8-1.0 as slight improvement. Hereby, results by the duration of symptoms is shown. For 11 sides with the duration less than 2 years, marked improvements in the intensity of tinnitus were achieved in 8 sides (73%), moderate improvements in the intensity of tinnitus were achieved in 1 side (9%), and mild improvements or worsening were achieved in 2 sides (18%). For 8 sides with the duration between 2-4 years, marked improvements in the intensity of tinnitus were achieved in 2 sides (25%), moderate improvements in the intensity of tinnitus were achieved in 3 side (38%), and mild improvements or worsening were achieved in 3 sides (38%). For 1 side with the duration between 4-6 years, marked improvement in the intensity of tinnitus was achieved in 1 side. At one year follow-up, outcomes were classified into 4 groups: excellent, good, fair, and poor. An excellent outcome corresponded to the complete disappearance of vertigo and tinnitus. A good outcome corresponded to the complete disappearance or marked improvements in vertigo and marked or moderate improvements in tinnitus. A fair outcome corresponded to the complete disappearance of or improvements in vertigo and mild improvements in tinnitus. A poor outcome corresponded to the complete disappearance or improvements in vertigo and no changes in or the deterioration of tinnitus. Eight out of 32 sides (25.0%) were evaluated as excellent, 19 (59.3%) as good, 2 (6.3%) as fair, and 3 (9.4%) as poor. Hearing improvement of 5 dB or more was achieved in 6 out of 21 sides (29%). In 5 sides showing significant improvement in hearing, the patients began to be able to use a phone on the affected side and improvements in tinnitus were closely related to those in sleep disturbance. A good outcome also typically involved the disappearance of high-pitched tinnitus (>4000 Hz). Poor outcomes for tinnitus were noted in 3 out of 32 sides (9.4%). When one of the causes of the poor outcome of tinnitus was granuloma due to Teflon felt, reoperation was successfully performed and the tinnitus ratio improved from 1.4 to 0.6. The deterioration of tinnitus was observed in 2 patients with poor outcomes; however, their hearing level was preserved. These 2 patients had symptoms for more than 17 years. The duration of symptoms was 2-4 years in 11 sides, which included 1 with a fair outcome, 1 with a poor outcome, and 1 with a excellent outcome. The duration of symptoms was 4-6 years in 1 sides, which showed an excellent outcome.

Outcome of surgery	n	Female	Male	Age	Duration of Symptom (years)
Excellent	8(25.0%)	5	3	57.1 ± 5.7	1.9 ± 0.7
Good	19(59.0%)	7	12	51.6 ± 3.0	5.8 ± 1.5
Fair	2 (6.3%)	1	1	52.2	1.7
Poor	3(9.4%)	1	2	56.0 ± 3.6	6.8 ± 5.1
CNVC=cochleovestibular neurovascular compression syndrome; n=number of sides					

Table 1: Characteristic and surgical results of CNVC.

Modulation of Tinnitus by a Median Nerve

Subjects for this study were selected from among 35 patients (40 sides) with tinnitus. In addition to CNVC, there were 8 patients with idiopathic tinnitus, 2 with infarction, and 2 with acoustic neuroma (Table 2). The ages of these patients ranged between 27 and 73 years, with a mean of 60.3 years [14]. Three modulation types (S-, E-, and N-types) were induced (Figure 1). Patients underwent a modulation test while seated in a sound-insulated room. We used a Nicolet Viking IV stimulator (Nicolet Co., Madison, WI, USA) to deliver rectangular 0.2-ms electrical impulses through an electromyographic circular

Type (n)	Disease (n)	Surgical patients of CNVC(n)
S(14)	CNVC(14)	7
N(17)	Idiopathic tinnitus (8), CNVC (5), Infarction (2) and acoustic neuroma (2)	2
E(9)	CNVC(9)	7
S=suppression type; N=no change type; E=excitation type; n=number of sides; CNVC=cochleovestibular neurovascular compression syndrome		

Table 2: Types of tinnitus modulation by median nerve stimulation in 40 patients(40 sides).

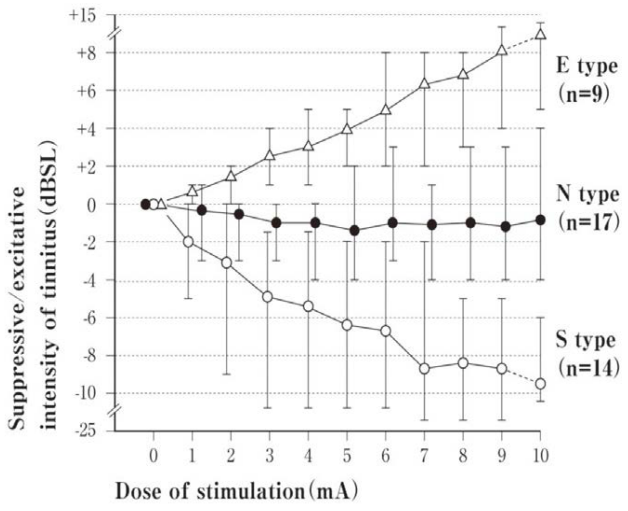


Figure 1: Changes in tinnitus intensity and results of statistical analyses. Changes in tinnitus intensity (dB) during a median nerve electrical stimulation from 0 to 9 mA on 40 sides and from 0 to 10 mA on 35 sides. The stimulation dose (mA) was plotted on the Y-axis and the suppressive/excitative intensity of tinnitus (dBSL) was plotted on the Y-axis. The dB value of tinnitus before the stimulation was set to 0 on the Y-axis. Changes ranged between 26 and 92.5 dBSL in the N-type group (mean=71.7), between 33 and 86 dBSL in the S-type group (mean=66.7), and between 49.5 and 93 dBSL in the E-type group (mean=69.2). Error bars indicate the extent of actual value changes against the dBSL value before the stimulation. Indications of the range of changes in the intensity of tinnitus (dB) were as follows: open triangles, closed circles, and open circles, corresponding to the mean values of tinnitus for N-, S-, and E-type responses, respectively. The homogeneity of variance from 0 to 9 mA for the 3 groups was assessed using ANOVA, and a significant difference was observed between the N-, S-, and E-types ($P<0.001$). Furthermore, the Student's *t*-test revealed a significant difference in each paired dose of the stimulation between 2 and 9 mA among the N-, S-, and E-types ($P<0.05$). (From a previous study [14] published with permission).

pad on the forearm in order to stimulate the median nerve. The stimulus rate was 1.0 Hz/s. Stimuli were applied in 1-mA intervals from 0 to 10 mA. Patients with forearm discomfort due to increases in the stimulus intensity were tested at a maximum of 9 mA. Several assessments were performed at each interval in order to ensure the reliability of the response obtained. Changes in the intensity of tinnitus were assessed using the pitch-match loudness balance method with an audiometer (Type AA78; RION, Tokyo, Japan). Sounds were delivered to the ipsilateral ear of patients with a normal to moderately decreased hearing level and to the contralateral ear of patients with severe hearing loss. Changes in tinnitus intensity on the affected side were evaluated by the stimulation of both the ipsilateral- and contralateral median nerves.

Statistical Analysis to Tinnitus

We examined the relationship between surgical results and the modulation of tinnitus by the median nerve stimulation in 16 patients; furthermore, the relationship between tinnitus modulation by the median nerve stimulation and duration of tinnitus was examined. The mean durations of symptoms were 1.8 years for S-type tinnitus (0.3-6.0 years), 8.1 years for E-type tinnitus (0.5-20.0 years), and 2.7 years for N-type tinnitus (1.3-4.0 years). In the early postoperative time, the mean ratios were 0.3 for S-type tinnitus (0-0.9), 0.8 for E-type tinnitus (0.6-1.3), and 0.43 for N-type tinnitus (0.25-0.5). The duration of symptoms was shorter for S-type tinnitus than for the other 2 types. The post/preoperative ratio of S-type tinnitus was significantly lower than those for the other 2 types ($P<0.01$), and the tinnitus of S-type was completely abolished in 4 sides (50%). In one year postoperative follow-up, excellent outcomes were achieved by 3 patients with S-type tinnitus, no patients with E-type tinnitus, and one patient with N-type tinnitus. A poor outcome was noted in 1 patient with E-type tinnitus who had symptoms for 2 years (Tables 3a,3b and 3c).

Illustrative Cases

Case 1 (**S-type**): **A** 46-year-old female had a history of Meniere's disease 8 years earlier. She also had a history of intermitted short attacks of positional vertigo and left tinnitus 0.7 years ago (score: 1). A neurological examination revealed the induction of irritative strong nystagmus to the left side combined with vertigo by the inclination of her upper body to her left side (score: 1). A neuro-otological examination showed left hearing loss (15-27 dB with a dip on the middle auditory area) and high-low pitched tinnitus (Figure 2A, score: 1). An ABR evaluation revealed a low amplitude (20-50% on the right side) and double-peaked left II wave with a left delayed I-III interpeak latency (Figure 2B, score: 1). An operative view before microvascular decompression (MVD) showed, and an ecstatic anterior inferior cerebellar artery (AICA) inside the VII-VIII triangle [11] is visible (Figure 2C). An operative view After MVD. The dotted line shows the course of the AICA before MVD (Figure 2D). A postoperative ABR evaluation revealed the recovery of the low amplitude and double-peaked left II wave (Figure 2E).

Case 2 (**E-type**): A 34-year-old man with no remarkable medical history. He developed attacks of recurrent vertigo 2 years ago, followed by left high-pitched tinnitus, and MVD was performed. After 1.5 years, he developed tinnitus in the right ear (score: 1).

	Type	preoperative				postoperative			
S. NO	Age/ Sex	Du.Ti.	HL (dB)	Ti (dBSL)	ABR	Ratio (early)	HL (early)	HL	Comment (1 year)
1	61/ F	2.0	55~70	72	Abn-II	0.9	50~60dB	50dB	Fair
2	44/M	1.3	19	76	Abn-I	0.8	20dB	20dB	Good
3	69/F	1.4	33	60	Abn-II	20	33dB	21dB	Excellent
4	46/F	0.7	27	70	Abn-I	0	21dB	16dB	Excellent
5	67/ F	0.3	13	61	Abn-I	0	13dB	14dB	Excellent
6	69/F	6.0	51	58	Abn-I	0	46dB	19dB	Excellent
7	63/F	0.4	14	95	Abn-I	0.4	15dB	18dB	Good
8	69/M	2.5	43	81	Abn-I	0.5	35dB	35dB	Good
Mean		1.8				0.3			

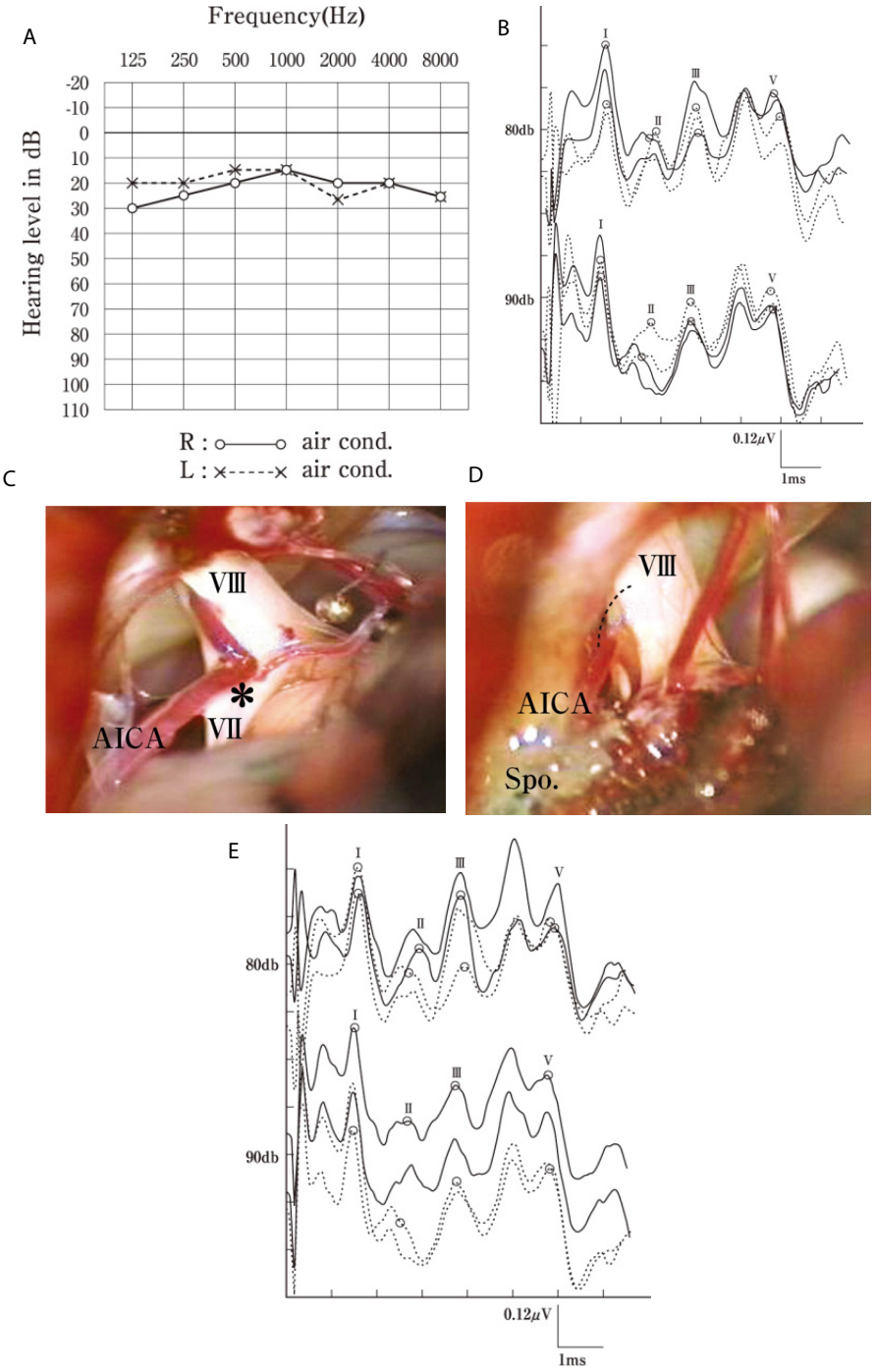
Table 3a: Surgical results of cochlear symptoms related to the tinnitus modulation by median nerve stimulation.

	Type	preoperative				postoperative			
S. NO	Age/ Sex	Du.Ti.	HL (dB)	Ti (dBSL)	ABR	Ratio (early)	HL (early)	HL	Comment (1 year)
1	58/ M	1.6	18	66	Abn-I	1.3	23dB	15dB	Poor
2	35/M	5.5	5	51	N	0.7	11dB	12dB	Good
3	65/F	20.0	40	107	Abn-II	0.8	45dB	45dB	Good
4	51/F	15.0	39	77	Abn-II	0.8	41dB	53dB	Good
5	56/ F	0.5	38	81	Abn-II	0.7	20dB	11dB	Good
6	56/F	6.0	25	51	N	0.6	23dB	25dB	Good
Mean		8.1				0.8			

Table 3b: Surgical results of cochlear symptoms related to the tinnitus modulation by median nerve stimulation.

	Type	preoperative				postoperative			
S. NO	Age/ Sex	Du.Ti.	HL(dB)	Ti (dBSL)	ABR	Ratio (early)	HL (early)	HL	Comment (1 year)
1	51/ F	4.0	36	117	Abn-I	0.5	45dB	41dB	Good
2	73/M	1.3	31	90	Abn-I	0.25	25dB	25dB	Excellent
Mean		2.7				0.43			
Du. Ti=duration of tinnitus (years); HL=hearing level; Ti(dBSL)=tinnitus (dB sensory level); ABn-I=abnormality in the localized II wave of ABR; Abn-II=delay in I-III or I-V interpeak latencies; Ratio=post/preoperative tinnitus intensity rato; early=postoperative one month.									

Table 3C: Surgical results of cochlear symptoms related to the tinnitus modulation by median nerve stimulation.



VIII=eighth cranial nerve, VII=seventh cranial (facial) nerve, asterisk showing the VII-VIII triangle, Spo.=sponge.

Figure 2: A: Audiometry on Case 1. B: Preoperative ABR evaluation of Case 1. The II wave shows a 20-50% lower amplitude than that on the contralateral side, and a double-peaked wide-based wave (*dotted lines*). Delays in I-III and I-V interpeak latencies using 80-dB and 90-dB clicks. C: Operative view before microvascular decompression (MVD), and an ectatic anterior inferior cerebellar artery (AICA) is visible inside the VII-VII triangle [11]. D: Operative view after MVD. The dotted line shows the course of the AICA before MVD. E: Postoperative ABR. The amplitude of the II wave recovered to the preoperative level (*dotted lines*).

He had high-pitched tinnitus (50 to 56 dB at 8000 Hz) in the right ear and bilateral E-type tinnitus. On his audiometry before the operation of left side shown was 5 dB in the ear (Figure 3A). An ABR recording obtained at the same time is shown in Figure 3B (score: 1). Preoperative audiometry (Figure 3C) and ABR revealed a low amplitude (50-75% on the right side) and double-peaked left II wave with a left delayed I-III interpeak latency (Figure 3D, score: 1). MRI-CISS revealed close contact between an arterial loop and the eighth cranial nerve (score:1). At the time of surgery, an ectatic AICA inside VII-VIII triangle was identified as the offending artery (Figure 3E). The artery was moved to decompress the nerve, and the dotted line shows the course of the AICA before MVD (Figure 3F). His hearing level (2-4 dB) was preserved and N-type tinnitus was noted postoperatively.

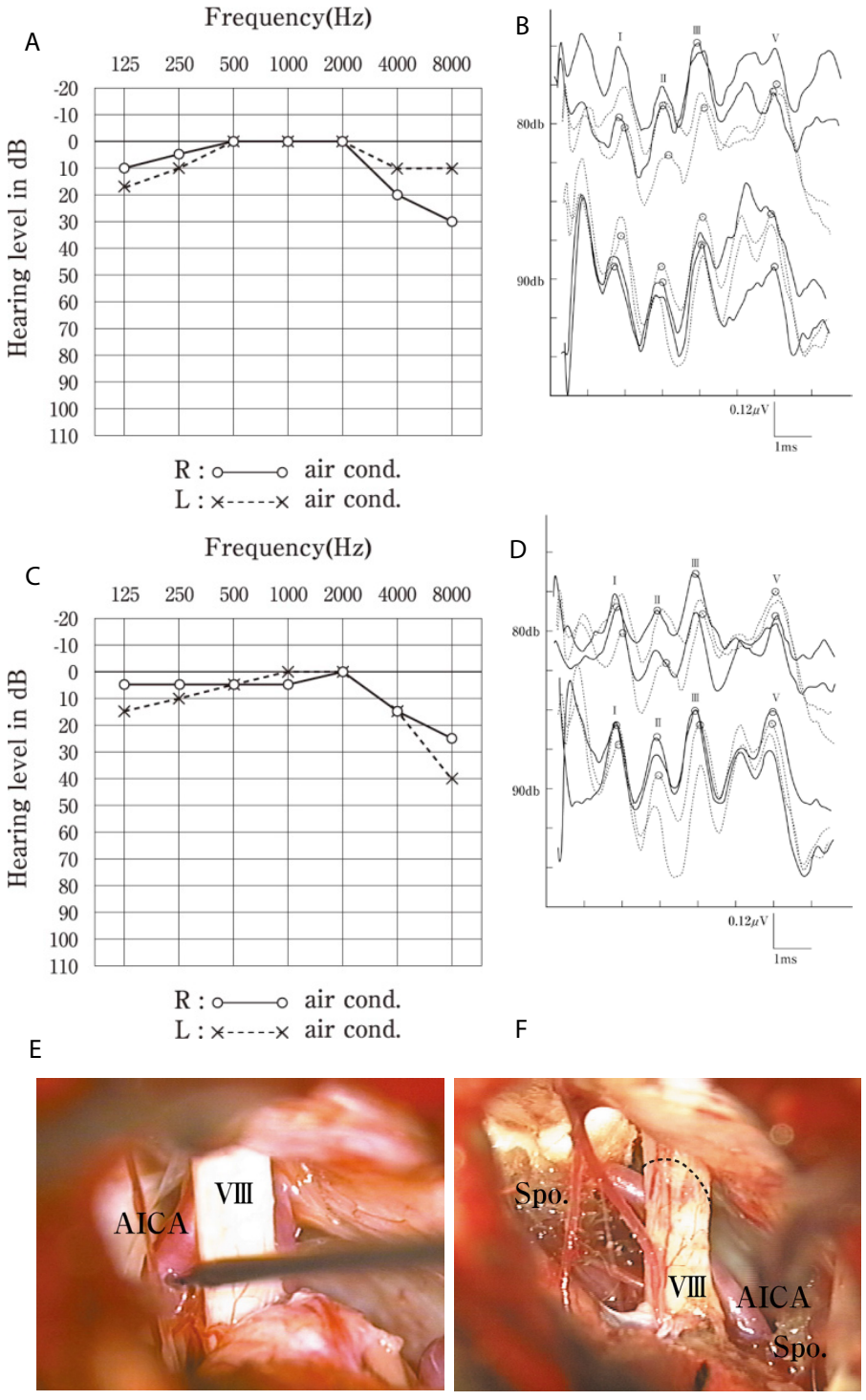


Figure 3: A: Audiometry of Case 2 before surgery on the left side. B: Preoperative ABR. The II wave shows a 50-75% lower amplitude than that on the contralateral side (*dotted lines*). C: Audiometry before surgery on the right side. D: ABR evaluation before surgery on the right side. The II wave shows a 50~60% lower amplitude to that on the previous right side (*dotted lines*) using 80-dB clicks, and delays in I-III and I-V interpeak latencies. E: The operative view before MVD is shown, and the ectatic AICA passing inside the VII-VII triangle is visible. F: Operative view after MVD of the AICA with a decompressed condition, and the dotted line shows the AICA before decompression.

Discussion

Several diagnostic processes [4,7-8,12,13] related to the features of CNVC have been reported: recurrent vertigo, intractable tinnitus, and the progressive hearing loss. Neuro-otological examinations involving vestibular testing and an ABR evaluation [2,8] are very important. MRI [10] and CT [9] also contribute to the diagnosis of CNVC. An ABR evaluation may provide important diagnostic information on CNVC. Wave II is evoked from the central segment of the cisternal segment, and peak III is generated in the cochlear nucleus. Vascular compression

results in tinnitus and, ultimately, hearing loss. We proposed an important configuration in which low amplitude, double-peaked, wide base wave II was demonstrated. Mφller et al. [4,8] described the diagnostic significance of a delay in I-III and I-Vinterpeak latencies. Among our ABR criteria, a low amplitude of II wave (25-75% of the amplitude of contralateral wave II) is important. This finding is an early change, and subsequently, a delay in I-III or I-V inter-peak latencies occurs. We encountered 3 patients with poor outcomes. One poor outcome was due to granuloma by Teflon felt, and was improved to a good outcome by reoperation. In another patient with symptoms for 17 years who showed a poor outcome, vertigo completely disappeared, and the hearing level was maintained, but tinnitus was aggravated (postoperative to preoperative intensity ratio,1.3). The other patient with a poor outcome showed a similar course. These poor result patients may have been caused impaired neuroplasticity [14,15]. Surgery may not have been indicated in such cases.

Our interest in somatosensory responses to median nerve stimulation arose from a previous study [16]. In tinnitus, various somatosensory responses [15,16] to median nerve stimulation are important. Some findings regarding the dorsal cochlear nucleus (DCN) [17,18] and neural mechanism of tinnitus involving the median nerve have been reported. Differences between responses responses to short-time stimulation and those to long-time stimulation in experimental models are of great interest. These differences are involving of the common aspect to modulation of tinnitus by a median nerve. The pathology of CNVC appears to involve various cochlear nerve functions. Experimental studies using chronic tinnitus models [15,17,18] on the DCN may provide insights into the modulation of tinnitus by the median nerve. A stimulation by tone exposure or acoustic trauma shares similarities with that by the vascular compression of CNVC operative changes in CNVC. Furthermore, the background of CNVC with the N-type response may be caused by the intermediate phase of the changes in DCN.

The diagnosis of CNVC is important prior to surgical indications, and its diagnosis by a scoring system is easy and useful. A score of 4-5 is diagnostic of CNVC. Indications for a good outcome differ for vertigo, tinnitus, and hearing loss. While indications for vertigo are broad, those for tinnitus are limited. Regarding hearing loss, progressive hearing loss within several months is the best indication. However, the cure rate of patients with tinnitus who underwent MVD was found to depend on the duration of symptoms, which is consistent with the findings of Mφller et al. [4]. Improvements were reported in a study [6] conducted on MVD in patients with vertigo for 20 years; in this study, the cases persisting for 17 years or more included 2 sides with poor outcomes. The cochlear nerve is particularly fragile to any surgical procedure and risks are associated with all manipulations. Poor outcomes may be attributed to inappropriate plastic changes [11,15] or endoneurial fibrosis in patients with symptoms for 16 year [19]. Regarding significant improvements in vertigo, Mφller et al. [7] reported good outcomes in 163 cases of unilateral DPV. Mφller [6] reported excellent outcome in a patient with symptoms persisting for more than 20 years. But, other surgical reports of CNVC with a chief complaint of vertigo and the duration of symptoms over 15 years was not always satisfactory. Our study suggests that the timing of surgery for CNVC with chief complaint of vertigo should be within about 15 years of onset. The timing of surgery for CNVC with chief complaint of tinnitus should be limited as some reports. Significant improvements in the intensity of tinnitus were achieved in some patients with symptoms for less than 2 years, as described by Sakaki et al. [5], Bookes [9], and Yap et al. [13], and in those with symptoms for between 2 and 4 years, as found by Sakaki et al. [5] and Ryu et al. [10]. Significant improvements [10,14] in tinnitus has been reported even in patients persisting 4-6 years. However, such patients have been rare. A study [5] during the same period showed a patient with a poor outcome. With symptoms for between 4 and 6 years were reported. In the present study, 5 sides with symptoms persisting for 2-3 years that were not evaluated using the modulation test, 4 sides showed good outcome, and 1 side showed a poor outcome. As described above, this poor outcome was due to the surgical procedure.

Excellent outcomes for the intensity of tinnitus were achieved by 13 out of 72 patients (18.1%) with symptoms for 2.9 ± 1.5 years, as reported by Mφller et al.[7], and the report [8] recommended surgery to patients with incapacitating tinnitus within less than 4 or 5 years. De Ridder et al. [20] described that surgery should be performed before the end of the 4th years after while the visual analogue scale for tinnitus intensity is still low (VAS, 5 or 6). As the timing of surgery, some proposals between 3 and 5 years are reported, and several approaches for the timing of surgery are important for this subjective symptom. But, some surgical reports of CNVC with a chief complaint of tinnitus and the duration of symptoms over 3 years was not always satisfactory. Based on our results, the timing of surgery for tinnitus in patients with CNVC should be within 3 years of the development of symptoms, and some patients with S-type tinnitus for less than 6 years are good candidates for surgery.

In conclusion, indications for good surgical outcomes are limited and it is necessary to consider not only the duration of symptoms, but also the modulation of tinnitus by a median nerve. The timing of surgery for CNVC with a chief complaint of vertigo should be within about 15 years of onset of symptoms, but CNVC with a chief complaint of tinnitus should be within 3 years. Furthermore, some patients with S-type tinnitus for less than 6 years are good candidates for surgery.

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