

## Original Article

# Lower cranial nerve palsy after the infrafloccular approach in microvascular decompression for hemifacial spasm

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## Abstract

**Background:** The infrafloccular approach was introduced as a variation in microvascular decompression (MVD) for hemifacial spasm. However, the rate of postoperative lower cranial nerve (CN) palsy can be high. This study investigated the surgical factors in relation to the occurrence of postoperative lower CN palsy.

**Methods:** The case records of 103 patients who underwent MVD were reviewed. Dissection around the lower CNs to approach the root exit zone of CN VII was divided into two steps – incision of the rhomboid lip at the root of the lower CNs and separation of CN IX and flocculus/choroid plexus. The correlations of these steps and other characteristics to the occurrence of lower CN palsy were analyzed.

**Results:** Ten of the 103 patients suffered from postoperative transient lower CN palsy. The rhomboid lip was incised in 30 cases (29.1%), separation of CN IX and flocculus or choroid plexus was necessary in 24 cases (23.3%), and both steps were required in 7 cases (6.8%). The steps showed no correlation with postoperative lower CN palsy. Posterior inferior cerebellar artery (PICA) as the offending vessel was significantly correlated with postoperative lower CN palsy ( $P < 0.05$ ).

**Conclusions:** Our study showed that the offending PICA was the only significant factor for postoperative lower CN palsy. Therefore, correct dissection around the lower CNs, particularly for complicated PICA, is necessary to reduce the risk of postoperative lower CN palsy.

**Key Words:** Infrafloccular approach, lower cranial nerve palsy, microvascular decompression, PICA

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## INTRODUCTION

Microvascular decompression (MVD) is an established neurosurgical procedure for the treatment of hemifacial spasm (HFS). In our facility, MVD is performed with the transposition method through the recommended lateral suboccipital infrafloccular approach<sup>[4]</sup> to achieve adequate exposure of the root exit zone (REZ) of the

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cranial nerve (CN) VII. This approach is advantageous to ensure wide surgical space and prevent postoperative hearing disturbance, however, postoperative lower CN palsy occurred in 8–10% of cases.<sup>[1,6]</sup> This complication is thought to result from stretching the lower CNs, especially in patients with HFS associated with the vertebral artery (VA),<sup>[6]</sup> however, the detailed surgical anatomy of the lower CNs has not been evaluated.

The lateral suboccipital infrafloccular approach was introduced as a variation approach in MVD for HFS. The approach requires strict caudolateral direction of the surgical access;<sup>[4]</sup> adequate intracranial observation of the REZ of the CN VII requires complete exposure of the corner formed by CN VIII and CN IX [Figure 1, left]. Such access can only be achieved with dissection around the lower CNs, which requires two dissection steps around the lower CNs. The first step is dissection of the root of the nerves [Figure 1 right, purple arrow]. The choroid plexus is present at the root in most cases and occasionally the rhomboid lip is present. Incision of the lip is necessary to avoid unnecessary stretching of the lower CNs.<sup>[3]</sup> The second step is dissection of the rostral margin of CN IX [Figure 1 right, red arrow]. CN IX may be tightly adherent to any large flocculus or choroid plexus present, so complete separation of CN IX and such structures is necessary. These steps allow the correct surgical trajectory to be achieved, but these dissection processes can cause lower CN palsy.

The offending arteries are another important factor affecting the lower CNs in this surgery. In most cases, the anterior inferior cerebellar artery (AICA), the posterior

cerebellar artery (PICA), and the vertebral artery (VA) are observed in the surgical field, and single or multiple arteries can be adequately mobilized. In the surgical view, the VA is situated inside the lower CNs, so manipulation through the lower CNs is often necessary for correct mobilization.<sup>[6]</sup> The AICA rarely affects the lower CNs, but the PICA occasionally forms a complex with the lower CNs.<sup>[5]</sup> Therefore, manipulation of the lower CNs is often necessary in the decompression process.

This study evaluated the lateral suboccipital infrafloccular approach for MVD, and investigated the correlation of the offending vessels to the occurrence of postoperative lower CN palsy.

## MATERIALS AND METHODS

### Patients

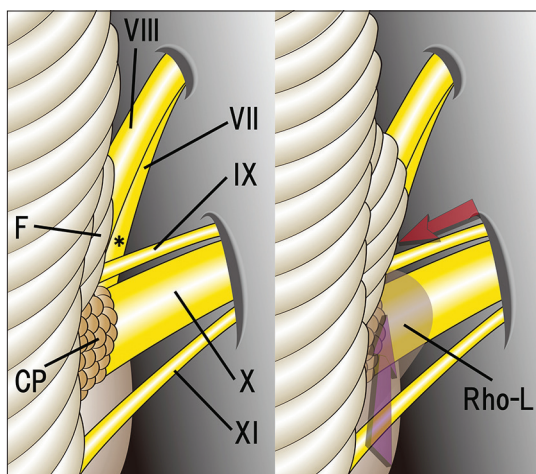
The clinical records of 107 consecutive patients with HFS who underwent MVD at Mitsui Memorial Hospital between January 2014 and September 2015 were retrospectively reviewed. Two patients with recurrent HFS who underwent reoperation and 2 patients without available operative videos were excluded. Consequently, this study included 103 patients. Table 1 summarizes the clinical characteristics of the 103 patients including the offending vessels.

### Microvascular decompression and dissection process around lower cranial nerves

MVD was performed with the transposition method through the infrafloccular approach under routine monitoring of brainstem auditory evoked potentials. Detailed surgical procedures were described previously.<sup>[1]</sup> Operative videos were closely reviewed and checked for the following two steps: (1) Rhomboid lip was observed and incised at the root of the lower CNs; and (2) adhesion of CN IX to the flocculus or choroid plexus was present and required separation.

### Evaluation of hemifacial spasm and complications

HFS was evaluated in March 2016 and the outcome was divided into 3 categories – no spasm, remarkable reduction in spasm, and no change in spasm. Postoperative hearing function was evaluated by the otolaryngologist as described previously.<sup>[1]</sup> Patients with



**Figure 1:** Illustrations showing surgical exposure of the root exit zone (REZ) of the CN VII. Left: REZ of the CN VII (asterisk) approached through the angle formed with CN VIII and CN IX. Right: Dissection (purple arrow) along the rootlets of the lower CN. Dissection (red arrow) along the rostral margin of CN IX. Labels VII, VIII, IX, X, and XI show CN VII (facial nerve), VIII (vestibulocochlear nerve), IX (glossopharyngeal nerve), X (vagus nerve), and XI (accessory nerve), respectively. F = Flocculus; CP = Choroid plexus; Rho-L = Rhomboid lip

**Table 1: Summary of demographic and clinical characteristics**

Variable	Value
Age at operation, mean (range), years	50.8 (24-75)
Female/male	69/34
Right/left	56/47
Offending vessel	
AICA	68
PICA	44
VA	24

symptoms of lower CN palsy, such as dysphasia and/or hoarseness, were also referred to the otolaryngologist for evaluation of laryngeal and pharyngeal function. Any neurological deficit persisting at March 2016 was recorded as permanent. Patients with lower CN palsy were further analyzed to assess the symptom and duration.

### Statistical analysis

Fisher's exact probability test was used to assess the correlations between the presence of postoperative lower CN palsy and the following parameters independently; sex, side, dissection steps (1) and (2) above, and type of offending vessels. The *t*-test was used to assess the correlation between the presence of postoperative lower CN palsy and age. IBM SPSS Statistics version 23.0 for Microsoft Windows was used for the analysis, and *P* values of less than 0.05 were interpreted as significant.

## RESULTS

### Dissection around the lower cranial nerves

The rhomboid lip was incised in 30 cases (29.1%), separation of CN IX and flocculus or choroid plexus was necessary in 24 cases (23.3%), and both steps were required in 7 cases (6.8%). Therefore, dissection around the lower CNs was necessary in a total of 47 cases (45.6%). However, no significant relationship to postoperative lower CN palsy was found.

### Outcome of hemifacial spasm and complications

The follow-up period was 6 to 26 months. HFS had completely disappeared in 91 patients, was remarkably reduced in 8 patients, and not changed in 4 patients. Two patients suffered from permanent hearing disturbance, complete loss in one, and mild hearing disturbance in one. Manipulation of the distal segments of CNs VII and VIII was necessary during the decompression process in both patients. Seven patients suffered from transient mild facial palsy which recovered shortly. Ten patients had transient lower CN palsy.

### Ten patients with transient lower cranial nerve palsy

Table 2 demonstrates the characteristics of the 10 patients with postoperative lower CN palsy. Only the PICA as the offending vessel had a significant correlation. All patients suffered hoarseness and 4 patients also had dysphasia. These patients were referred to the otolaryngologist during the hospital stay and continued to be examined after discharge from the hospital. No patient had major problems in daily life after discharge. The symptoms had completely recovered in 6 months in 8 patients, but lasted longer than 6 months in 2 patients. Of these 2 patients, Case 9 suffered from hoarseness and severe dysphasia, which lasted about a month, so stayed in the hospital longer, but the symptom gradually improved. The subjective symptoms and the laryngeal and pharyngeal functions observed by the otolaryngologist recovered completely in a year. Case 10 suffered from light hoarseness for longer than 6 months, but the symptom did not affect her daily life.

## DISCUSSION

Lower CN palsy after MVD for HFS is often transient and can be affected by other factors such as intubation during anesthesia, so the frequency may have been underestimated. In this study, for the evaluation of the postoperative lower CN palsy, two dissection steps were focused on [Figure 1]. The rhomboid lip was observed and correctly incised in 29.1% of cases, which is comparable to previous findings.<sup>[7]</sup> Including separation of CN IX from the flocculus or choroid plexus, dissection around the lower CNs was necessary in almost half of the cases (45.6%). However, we found no significant relationship with postoperative lower CN palsy. Therefore, dissection around the lower CNs helped to avoid unnecessary stretching of the nerves rather than damaging the nerves.

**Table 2: Ten patients with transient lower CN palsy after MVD**

Case no	Age (years)	Side	Side (R/L)	Lower CN palsy		Dissection steps around the lower CNs		Offending vessel		
				Symptom	Duration (mos)	Rho-L incision	CN IX separation	AICA	PICA*	VA
1	75	F	R	hoarseness	<6	-	-	-	+	-
2	49	F	L	hoarseness, dysphasia	<6	+	-	+	+	-
3	46	F	L	hoarseness	<6	+	-	-	+	-
4	29	F	R	hoarseness, dysphasia	<6	-	-	-	+	-
5	56	F	L	hoarseness	<6	-	-	-	+	+
6	55	F	L	hoarseness	<6	-	+	+	-	-
7	60	F	R	hoarseness	<6	-	-	+	+	-
8	37	F	R	hoarseness, dysphasia	<6	-	-	-	+	-
9	37	M	R	hoarseness, severe dysphasia	>6	-	-	+	+	+
10	75	F	L	hoarseness	>6	+	+	-	+	-

\**P*<0.05. F: Female, M: Male, R: Right, L: Left

HFS associated with offending VA was reported to occur with higher incidence,<sup>[6]</sup> whereas our study revealed offending PICA as the only significant factor for postoperative lower CN palsy. The PICA has the most complex and variable course among the cerebellar arteries,<sup>[5]</sup> and occasionally penetrates between the lower CNs and adhesives. If such a complicated PICA is responsible for HFS, complete transposition may require the PICA to be pulled out between the lower CNs. The high rate of lower CN palsy in our study is thought to be the result of this process. Therefore, we have recently emphasized careful dissection if a complicated PICA has to be mobilized.

Efficacy and adverse effects in the transposition method through the infrafloccular approach should be monitored continuously in the future. The transposition method should continue to be superior to the interposition method as long as the ultimate purpose of MVD is termination of vascular pulsation to CN VII, especially transposition of the VA to prevent recurrence.<sup>[2]</sup> However, if the transposition method through the infrafloccular approach increases the rate of lower CN palsy and has less surgical success, this procedure may not be justified. In the present study, the rate of complete disappearance and remarkable reduction in HFS reached more than 95% despite the short follow-up periods. In summary, the incidence of hearing impairment was low but that of lower CN palsy was high in this approach. Whereas CN VIII is solely responsible for ipsilateral hearing, and damage to the fragile nerve can result in permanent hearing impairment, lower CN palsy can be compensated by the contralateral function, and was reversible in all our patients. Therefore, we have not abandoned our policy.

In conclusion, a relatively high rate of lower CN palsy, although transient, was observed after the infrafloccular approach. Careful dissection around the lower CNs, particularly for complicated PICA, is essential to avoid such complications.

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### Conflicts of interest

There are no conflicts of interest.

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