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HOW I DO IT - NEUROSURGICAL TECHNIQUES

# Lateral basal approach with a supine, no-retractor method for microvascular decompression for hemifacial spasm

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**Abstract**
*Background* We describe the details of our unique surgical procedures for microvascular decompression for hemifacial spasm.
*Methods* A patient is just laid supine, skipping the complicated preparation for the lateral or park-bench position. The subfloccular approach from a small cranial window situated on the more lateral and basal side of the occipital cranium enables the surgeon to reach all the segments of the facial nerve root without cerebellar retraction by a spatula.
*Conclusions* We believe this approach is ideal for the safe and precise decompression of any part of the facial nerve root.

**Keywords** Hemifacial spasm · Microvascular decompression · Supine position · No retractor

## Relevant surgical anatomy (Fig. 1)

The optimal place for the cranial window on the lateral bottom of the occipital cranium is covered by the laminar muscles at the craniocervical junction. The sternocleidmastoideus muscle (SCM) lies under the skin, which is attached to the margin of the mastoid bone and the superior nuchal line. Underneath, the splenius capitis muscle (SC) and longissims capitis muscle (LM) attach to the margin of the mastoid bone. These laminar muscles are contained in the deep cervical fascia (DCF). The fatty layer between the lamina prevertebralis and superficialis (investing layer) of the DCF is easily recognized caudal to the margin of the SC [1]. This interlaminal space of the DCF is composed of thick and fatty connective tissue. The DCF attaches to the mastoid process and the occipital bone around the digastric groove under the SC and LC, extending to the carotid sheath deep under the posterior center of the digastric muscle (PDM). The occipital artery (OA) is always preserved in this layer under the PDM. In the deepest layer, the superior oblique muscle (SO) runs between the lateral base of the occipital cranium and the lateral process of the atlas.

## Description of the technique

### Position setting

In the supine position, the patient's neck is flexed and rotated contralaterally as much as possible (mostly 40–60°). The vertex is slightly tilted toward the floor.

### Superficial manipulations (Fig. 1)

Under an operative microscope, the curved incision is designed 6 to 7 cm long and placed behind the root of the mastoid process (Fig. 2). The digastric groove is palpable over the skin. After the skin incision, the SCM is dissected from the mastoid process at its attachment and is partially cut off to provide a free muscle flap for dural plasty and mastoid air cell packing at closure. The SC and LC are also cut down from the

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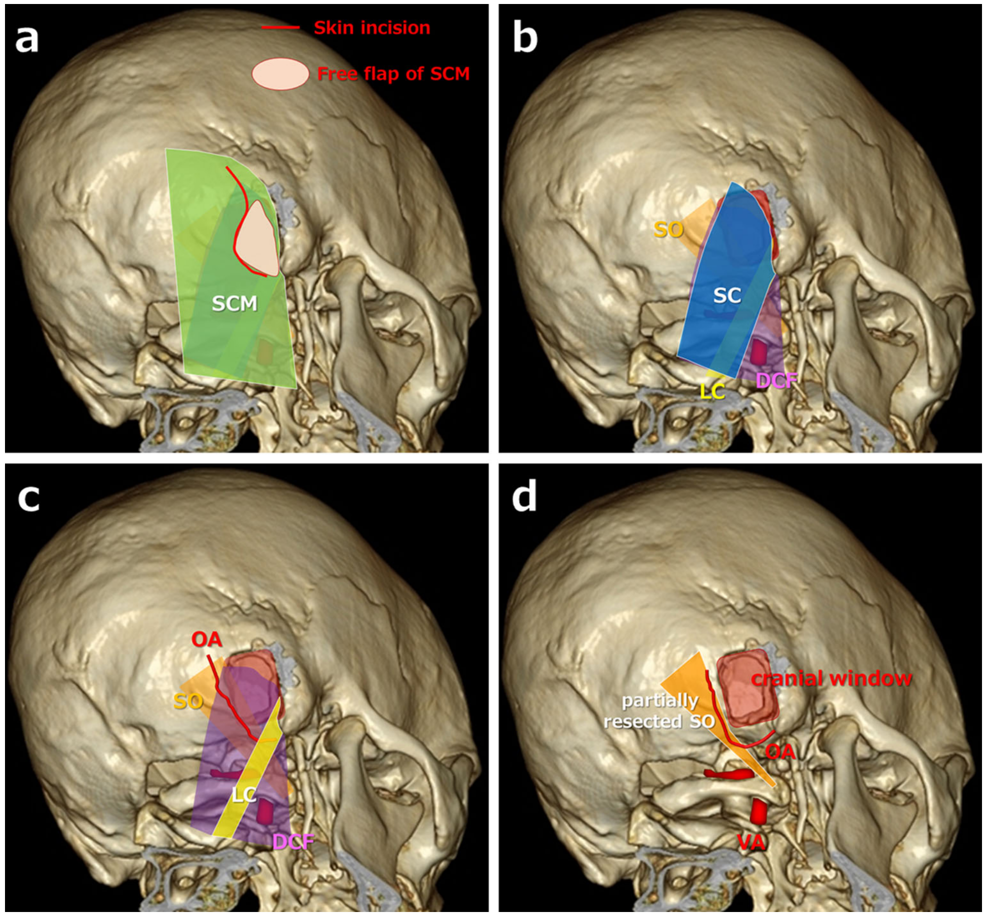


**Fig. 1** Pictures depicting the procedures for preparing the muscle in the craniocervical junction. Peeling off of the muscles proceed from **a** to **d**

mastoid eminence to widely expose the retromastoid space. Then, the interlaminal fatty layer of the DCF should be thoroughly separated, preserving the OA. Finally, the boney surface for the optimal craniectomy is visible at the very lateral part of the suboccipital skull base. A partial dissection of the SO is sometimes needed to develop enough space for the craniectomy in patients with thick and short necks. A burr hole should be placed at the root of the mastoid process just medial to the digastric groove. The 2.5 cm × 1.5-cm craniectomy is made and extended to the posterior margin of the jugular process with a high-speed drill and rongeur, partially exposing the medial curve of the sigmoid sinus. The posterior margin of the jugular process is the medial limit of the craniectomy, which covers the most distal part of the sigmoid sinus. Then, the cranial window is made at the lateral bottom of the occipital cranium.

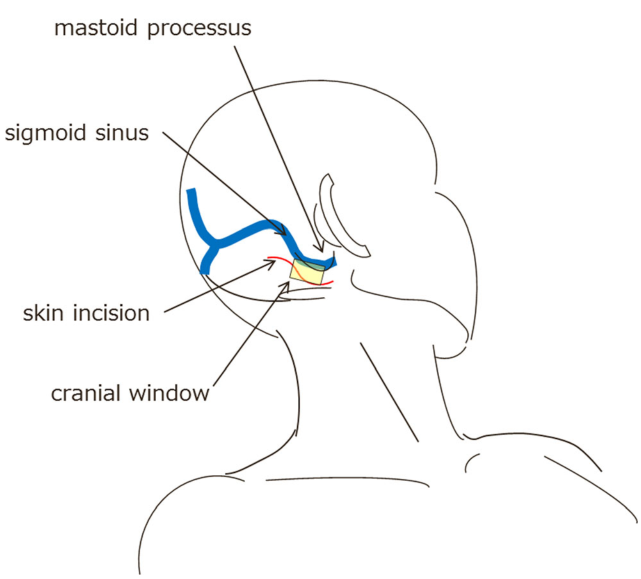


**Fig. 2** Drawing depicting the positions of the skin incision and cranial window on the right side

## Intradural procedures

The dura mater is incised in an inverse U shape. After the cerebrospinal fluid (CSF) drainage from the lateral part of the cerebellomedullary cistern, the arachnoid dissection should be advanced over the choroid plexus until the origins of the lower cranial nerves are exposed. This procedure induces the cerebellum to sink down by its own weight. The radical split between the choroid plexus of the lateral recess and origin of the IXth cranial nerve is crucial. Consequently, the gentle cephalad elevation of the flocculus with a suction tip allows the surgeon a widely opened subfloccular view. By the unique combination of our design of the skin incision, muscle separation procedures and position of the cranial window, the facial nerve tract behind the root of the IXth nerve can be treated without a spatula. Our view from the lateral bottom also enables the surgeon to treat the origin of the facial nerve root even from the caudoventral side of the lower cranial nerves, if necessary. The facial nerve is decompressed by the insertion of an Ivalon prosthesis with the aid of fibrin glue, transforming the loops of the culprit vessels.

### Closure

After ensuring intradural hemostasis, the fascia of the free SCM flap is used for dural plasty. The opened mastoid air cells are packed with residual muscle pieces from the SCM flap and shielded by fibrin glue. A titan plate is used for the cranioplasty. The SC and LC are sutured back together to the remaining fascia on the mastoid bone.

## Indications

Recent studies have revealed that the facial nerve root is already exposed on the surface of the brainstem at the pontomedullary junction, several millimeters proximal to the root entry/exit zone (REZ) [2]. It is also suggested that these superficial segments and subsequent peripheral portion are susceptible to vascular compression [2, 3]. For complete decompression, the facial nerve root should be thoroughly treated from its origin at the pontomedullary junction to the peripheral portion just a few millimeters distal from the REZ.

The traditional retrosigmoid approach has contributed a lot to microvascular decompression (MVD) surgery since Gardner and Jannetta [4, 5]. This approach enables the surgeon to reach the REZ over the retracted flocculus. However, much more cerebellar retraction is needed especially for management of the origin at the pontomedullary sulcus, which seems to invite surgical complications [6]. In the present method, the surgeon can treat all the segments of the facial nerve root without cerebellar retraction by a spatula.

## Limitations

In the beginning of the intradural procedure, the operating table is elevated up to the height of the surgeon's face, and the microscopic view is directed horizontally to the operation field, searching for an appropriate subarachnoid space. The surgeon needs to keep both hands raised up to the shoulder until the rupture of an arachnoid membrane and CSF drainage let the cerebellum sink down. The surgeon should be patient for a little while, but usually gets used to it soon.

## How to avoid complications

In our method, a patient is just laid supine, and the complicated preoperative position setting is eliminated. A horseshoe-shaped headrest is used instead of the three-point head fixation device. Therefore, patients are free from neck or brachial plexus injury caused by over-rotation. During the entire intradural procedure, no spatula is needed. By up-down positioning and rotation of the operating table, the surgeon can treat all the concerned area of the facial nerve root, including its peripheral portion, without a spatula. Intraoperative brainstem auditory evoked response monitoring is routinely applied to all patients.

An attempt at primary closure of the shrunken original dura of the posterior fossa is likely to result in CSF leakage. Additionally, mastoid air cells are frequently opened in our lateral basal approach. Therefore, the free SCM flap is essential for dural plasty and air cell packing.

## Specific perioperative considerations

Patients are diagnosed by their typical symptoms. Magnetic resonance (MR) imaging is performed in all patients. Constructive interference in steady-state (CISS) imaging and time-of-flight (TOF) MR angiography reveal offending vessels and the dominance of the sigmoid sinus. Patients also undergo pure tone audiometry before and after surgery. In cases in which the provable culprit vessels are not diagnosed by preoperative MR imaging, the surgeons are strongly advised to examine the true root exit zone at the pontomedullary junction (RExZ), the attached zone on the surface of the pons (AZ) and the peripheral zone (PZ) of the facial nerve tract, other than the REZ.

## Specific information to give to the patient about surgery and potential risks

A computed tomography scan is performed immediately after surgery. Patients are free from bed rest on the first postoperative day. They are also followed by MR imaging at the 7th postoperative day. The author has operated on more than 200 cases and never had a major surgical complication such as a hearing disturbance or cerebellar injury. Even the patient with the history of cervical cord injury could be treated safely by our supine, no-retractor method.

## Key points

(1) The inferior curve of the skin incision is designed to prevent the overhang of the skin edge.
(2) The SCM and SC with the LC are peeled off in layers to find the interlaminal fatty tissue of the DCF.

(3) Thorough separation of the DCF enables access to the lateral skull base.
(4) If necessary, the SO should be dissected at the attachment to the transverse process of the atlas, avoiding injury of the vertebral artery.
(5) Extend the cranial window up to the posterior end of the jugular process to expose the lateral bottom of the occipital cranium.
(6) Be patient, looking at the surgical field in a horizontal direction until seeing the CSF drainage from the first rupture of the basal cistern.
(7) The arachnoid dissection induces the cerebellum to sink down by its own weight with our method.
(8) Thorough split between the choroid plexus of the lateral recess of the fourth ventricle and the origin of the IXth cranial nerve makes an optimal subfloccular corridor to the VIIth nerve root without using a spatula.
(9) Treat all of the tract of the VIIth nerve root.
(10) Design the transformation of the arterial complex of the posterior circulation.

**Conflict of interest** None

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