Acta Neurochir (Wien) (2001) 143: 141–145

Acta Neurochirurgica

A more Basal Approach in Microvascular Decompression for Hemifacial Spasm: The Para-Condylar Fossa Approach

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Summary

Background. In view of the fact that a basal craniectomy in microvascular decompression (MVD) for hemifacial spasm (HFS) can minimize cerebellar retraction and expose the facial nerve root exit zone (FNREZ) directly from below without placement of tension on the seventh-eighth cranial nerve complex, we used a more basal approach in 32 patients with typical HFS.

Method. A slightly curved skin incision 5 cm in length and 2 cm posterior and parallel to the mastoid notch was made. The basal lateral occipital plate including the lateral one-fourth of the condylar fossa and the posterior one-fourth of the jugular process were removed. For the early drainage of cerebrospinal fluid through a small dural hole, the basal occipital plate posteromedial to the condylar fossa was removed. With this basal craniectomy, minimum elevation of the cerebellar tonsil and flocculus could expose FNREZ safely.

Findings. Thirty one of 32 patients displayed complete disappearance of spasm following surgery. One patient showed 70% decrease of spasm. Delayed transient facial weakness occurred in one patient. Audiometries showed no postoperative hearing decrease in any patient, even though no intra-operative monitoring of the cochlear function was undertaken.

Interpretation. Although this basal approach, the para-condylar fossa approach, is a slightly basal modification of the conventional procedure, it may minimize complications.

Keywords: Hemifacial spasm; microvascular decompression; skull base.

Introduction

Many authors have reported high success rates of MVD for HFS, however the reported surgical complication rates are variable and should be reduced further [1, 3, 6, 11, 12, 17, 20, 23]. The primary avoidable causes of surgical complications are undue tension on the eighth cranial nerve due to lateral to medial retraction of the cerebellum at the level of the eighth cranial nerve, unnecessary manipulations of the free nerve root portion of the seventh-eighth cranial nerve complex, and cerebellar injury due to inadequate drainage of cerebrospinal fluid (CSF) and/or excessive cerebellar retraction [3, 11, 12]. We think these errors basically result from an improper positioning of the craniectomy site.

The importance of removing the lower lateral corner of the occipital plate in order to expose the margin of the sigmoid sinus has been stressed by many authors [3, 7–9, 12], however the ideal extent of bone removal and the anatomical landmarks have not been described in detail. A keyhole approach implies that the choice of the correct craniotomy site has a key function in entering a particular intracranial room and in working there with a minimum of traumatization [16]. We applied this concept of a keyhole approach to the MVD for HFS in order to minimize complications.

To minimize cerebellar retraction and to gain a direct and wide exposure of the FNREZ from below without placing tension on the eighth cranial nerve, we placed a small craniectomy at the basal lateral occipital plate near the condylar fossa.

This report details the surgical steps of this basal approach and related anatomical landmarks, and discusses reasons why the removal of the basal lateral occipital plate near the condylar fossa is desirable.

Patients

Thirty two patients with typical HFS were operated on utilizing this basal approach between January 1997 and June 1999. The median age was 45 years (range 33–72 years). There were 19 male and 13 female patients. The side of HFS was the right in 17 patients and the left in 15 patients. All patients underwent magnetic resonance

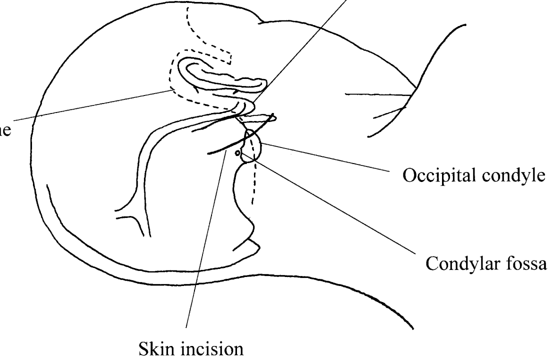

Fig. 1. Drawing showing skin incision and its relationship to anatomical landmarks

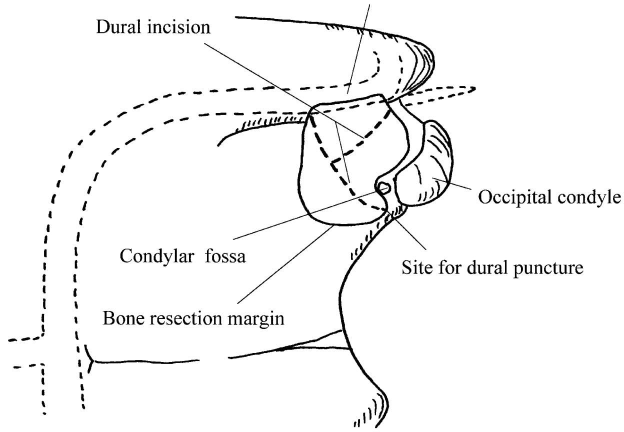

Fig. 2. Surgical sketch showing the extent of bony resection and related anatomical structures, the dural puncture site for early cerebrospinal fluid drainage, and the dural incision

imaging and magnetic resonance angiograpy before the operation, and pure tone audiometry before and after the operation. Intraoperative monitoring of the cochlear function was not performed in any patient.

Operative Technique

Position

Following endotracheal anesthesia, the patient was placed in the lateral decubitus position with an axillary roll and with careful padding of pressure points. A three-point head fixation device was applied. To expose the basal lateral occipital plate near the condylar fossa, the neck was flexed 15 degrees, the head was rotated 15 degrees away from the affected side and the vertex was dropped 20 degrees toward the floor with the chin approximately two finger-breadths from the sternum and the clavicle. The shoulder of the patient was taped down as much as possible.

Skin Incision

Surface landmarks, such as the mastoid process, mastoid notch, and the inferior nuchal line should be identified by palpation. A slightly curved skin incision 5 cm in length was made from the inferior nuchal line to 1 cm below the mastoid tip. This incision line was 2 cm posterior and parallel to the mastoid notch. The cranial 3.5 cm of the incision was inside the hairline and the caudal 1.5 cm of the incision was outside the hairline (Fig. 1).

Extradural Procedures

The superficial and deep muscles were dissected using electrocautary and a dural elevator to expose the basal occipital plate below the inferior nuchal line, lateral one-fourth of the condylar fossa and posterior one-fourth of the jugular process. The scalp and neck muscles were opened widely with multiple fishhook retractors. The atlanto-occipital joint capsule should not be opened. In case with prominent posterior condylar emissary vein, the vein and its pericranial covering were elevated from the lateral one-fourth of the condylar fossa with care.

A small basal craniectomy, 2.5 cm $\times$ 2 cm in size, extending from the inferior nuchal line to the junction of the lateral one-fourth and the medial three-fourths of the condylar fossa, was made with enough exposure of the medial margin of the sigmoid sinus. The posterior one-fourth of the jugular process located anterolateral to the condylar fossa was removed to expose the most distal portion of the sigmoid sinus. The basal occipital plate posteromedial to the condylar fossa was removed for early drainage of CSF from the cisterna magna (Fig. 2).

A small dural hole was placed at the posteromedial corner of the exposed dura over the cisterna magna. The arachnoid membrane of the cisterna magna was incised or punctured through the dural hole, and the CSF was drained sufficiently. Subsequent to confirmation of adequate cerebellar relaxation, a T-shaped dural incision was made. The dural flaps were sewn back out of the way (Fig. 2).

Intradural Procedures

With the basal craniectomy, slight elevation of the inferolateral surface of the cerebellar tonsil from the anteromedial corner with a narrow tapered brain retractor blade exposed the lower cranial nerves covered by the arachnoid membrane (Fig. 3). The arachnoid was incised sharply. Arachnoid dissection was advanced along the proximal portion of the ninth and tenth cranial nerves toward their origins to expose the choroid plexus of the lateral recess of the fourth ventricle. Slight elevation of the inferior surface of the flocculus and the choroid plexus away from the origin of the ninth cranial nerve exposed the FNREZ from below placing no tension on the eighth cranial nerve. The arachnoid over the free nerve root portion of the seventh and eighth cranial nerves was not dissected except in those rare cases where definite compressing vessels on the FNREZ are lacking.

Two to three tapes of soft, thin Teflon felt were placed between the compressing vessel and the FNREZ.

Closure

The dural opening was closed in a watertight fashion with interpositioning of a small free muscle fragment on the dural gap. The wound was closed layer by layer. In most cases, the entire procedure took from two to two and half hours.

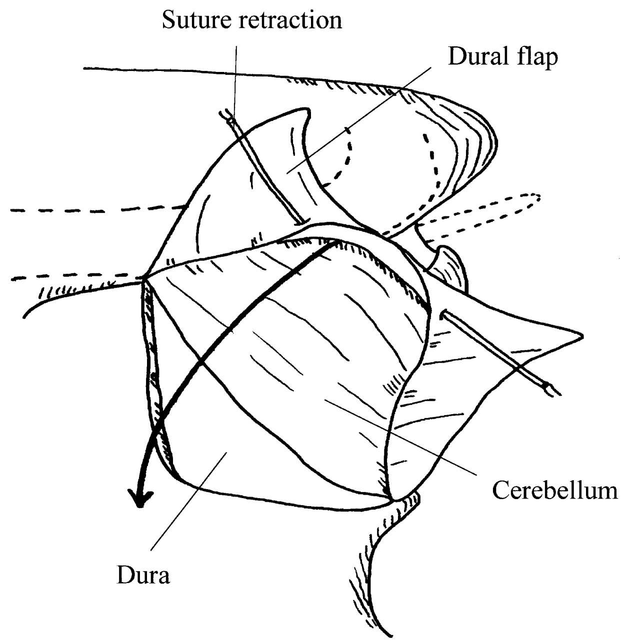

Fig. 3. Surgical sketch showing the direction of elevation of the cerebellar tonsil (arrow)

Results

The compressing vessels were the posterior inferior cerebellar artery (PICA) in 17 cases, the anterior inferior cerebellar artery (AICA) in 10 cases, the vertebral artery (VA) in 2 cases, the common trunk of AICA and PICA in 2 cases, and the VA and PICA in 1 case. There were no cases of distal compression.

Thirty of 32 patients showed complete disappearance of the HFS immediately after the operation. In one patient, the spasm disappeared immediately after the operation, but then returned on the 5th postoperative day and resolved completely in 3 months. However, one patient showed a 70% decrease of the spasm after the operation. There was no recurrence of the spasm during the median follow-up period of 21 months (range 12–40 months)

Analysis of pure tone audiometries taken before and after operation showed no postoperative decrease of hearing in any patient. Delayed transient facial weakness developed in one patient on the 11th postoperative day, but resolved completely in four weeks. There were no cases of CSF leakage or cerebellar injury.

Discussion

Since the first report of posterior fossa vascular decompression surgery for HFS by Gardner in 1960 [4], MVD has been refined technically and become an accepted method of treatment [1, 3, 7–9, 11]. Most authors have reported a greater than 90% success rate of MVD for HFS, but the reported surgical complication rates are not sufficiently low [1, 3, 6, 11, 12, 17, 20, 23]. Barker, *et al.*, [1] reported the results of MVD in 648 patients with HFS who had not undergone a prior MVD. Permanent facial weakness developed in 22 patients (3.4%) and permanent hearing loss in 21 (3.3%). In Fukushima's 2870 cases of MVD for HFS, permanent facial weakness and permanent hearing decrease occurred in 5.2%, and 3.8% of patients, respectively [3]. Considering the fact that HFS is not life threatening but only distressing to patients, the surgical complication rates should be reduced further.

The complications of MVD for HFS result from several sources [3, 5, 8, 11, 12]: 1) cerebellar injury due to inadequate CSF drainage and excessive cerebellar retraction; 2) injury to the eighth cranial nerve caused by undue tension placed on it; 3) cranial nerve injuries from unnecessary manipulation; or, 4) cranial nerve or brain stem dysfunctions caused by the compromise of the blood flow of the perforators. Of the various causes of complications, the improper positioning of the craniectomy site is critical since it results in excessive cerebellar retraction, undue tension on the eighth cranial nerve, and unnecessary premature exposure of the seventh-eighth cranial nerve complex.

The usefulness of intra-operative electrophysiological monitoring of the eighth cranial nerve has been reported [1, 5, 11–13, 15, 21]. Barker, *et al.*, reported that the incidence of hearing loss decreased from 4.8% to 1.9% since the introduction of routine intra-operative monitoring, although the downward trend was not statistically significant [1]. Kondo emphasized that the incidence of hearing loss had been reduced from 9.1% to 3.7% since the introduction of intra-operative electrophysiological monitoring of hearing and technical refinement [11]. It is clear that intra-operative electrophysiological monitoring can reduce the incidence of hearing loss but cannot prevent its occurrence.

Because the cochlear nerve has a long cisternal segment with central myelin, it is highly vulnerable to tension [9, 19]. Theoretically, hearing loss can be prevented if tension on the cochlear nerve can be avoided. Therefore a more basal approach, which can secure an early drainage of CSF and a direct exposure of the FNREZ from below without placement of tension on the cochlear nerve, may be valuable for the prevention of hearing loss and other complications. Even though the number of cases in this report is small, the efficacy of this basal approach may be demonstrated by the fact that none of 32 patients had decrease of hearing after the operation in spite of no intra-operative electrophysiological monitoring of the cochlear function and no deliberate use of intermittent retraction policy.

The key anatomical landmark for this basal approach is the condylar fossa. The condylar fossa is located just posterior and lateral to the occipital condyle. The floor of the condylar fossa is perforated by the posterior condylar foramen through which the posterior condylar emissary vein usually passes [10]. The jugular process is a quadrilateral plate which is located anterolateral to the condylar fossa. The superior surface of the jugular process has the sigmoid groove on which the terminal end of the sigmoid sinus courses forward and drains into the jugular bulb [2, 10, 22]. We removed the lateral one-fourth of the condylar fossa and the posterior one-fourth of the jugular process to minimize retraction and to approach the FNREZ directly from below. The lateral rim of the foramen magnum is located posteromedial to the condylar fossa [2]. With the basal occipital plate posteromedial to the condylar fossa removed, the lateral part of the cisterna magna can be reached and CSF can be drained easily from this cistern through a small dural puncture hole before dural incision.

We named this basal approach as the para-condylar fossa approach because the removal of the basal lateral occipital plate near the condylar fossa is the key extradural procedure in this approach.

In conclusion, although the para-condylar fossa approach is a slightly basal modification of the conventional infero-lateral retromastoid approach, it may minimize hearing loss and other complications in MVD for HFS.

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Comment

This article is an important one from a pratical point of view; the authors give a precise description of the para-condylar fossa approach for accessing the facial nerve Root Exit Zone (f.n. REZ). It is more and more recognized that the best approach for decompressing the f.n. REZ is a key-hole approach as basal and lateral as possible, especially because the offending artery is almost always located caudally. In addition such an approach, coming from below the REZ, avoids retracting the cerebellum lateral to medial, and consequently prevents stretching the seventh-eighth nerve complex. Although we follow the authors in their approach description (a somewhat similar one to Matsushima's), we disagree to some extent on two pratical points. 1°) We do not think it necesary to open the arachnoïd of, or puncture CSF in, the cisterna magna to deplete CSF. Gentle and progressive retraction of the infero-lateral aspect of the cerebellum hemisphere seems to us sufficient to depress cerebellum and avoid its injury. 2°) In spite of excellent results presented by the Korean authors, without hearing loss after surgery in any of their 32 patients, although they did not use BEAP monitoring, we do recommend not to abandon using intra-operative auditory recordings. As a mater of fact, electrophysiological warnings can be most helpful, not only the increase in latency of pic V (which means stretching of the VIIIth nerve), but also decrease in amplitude of Pic I (which is a critical warning-sign of cochlear ischemic «suffering» due to reduction in flow in the labyrinthine arterial territory). The authors have to be congratulated for their very accurate technique and their excellent result.

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