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Original article

Endoscope-assisted decompression of facial nerve for treatment of hemifacial spasm

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ABSTRACT

Microvascular decompression has become the sole method for a curative treatment of primary hemifacial spasm. Finding the responsible conflicting artery is not always easy as its location can be deeply situated within the cerebellopontine/medullary fissure at the facial root exit zone. Sole or additional offending vessel(s) may be at the meatus of the internal auditory canal (5% of the cases). Identifying the compressive vessel(s) and performing decompression is in most cases possible without cerebellar retraction by classical microsurgical techniques. However, in a number of patients the neurovascular conflict may be hidden in spite of the direct illumination of the operative microscope. Therefore, assistance by endoscopy can be useful and contribute as a minimally invasive approach. The author reports his own experience in a series of 553 patients operated on over the past three decades. A total of 93.6% had complete relief of their spasm (11% after repeated surgery). Relief was delayed in 20.8% of these patients. Recurrence was rare (0.3%). There was no mortality and morbidity was low: deafness occurred in 0.6%. There was no permanent postoperative facial palsy. CSF leakage amounted to 1% in the last period of surgery. In conclusion, the author advocates combining the use of both the endoscopy for exploration and the microscope for decompression.

1. Introduction

The concept of vascular compression of the facial nerve at the origin of the so-called primary hemifacial spasm (HFS) and its surgical correction by microsurgical vascular decompression (MVD) were introduced as early as the sixties by James Gardner. In spite of an active promotion of MVD surgery since the seventies by Jannetta, the controversy regarding the etiology and surgical treatment have continued to persist for some time [1]. The two main reasons for that are: on the one hand vascular loops lying in contact with the acousticofacial nerve bundle is a common anatomical finding (cf. anatomical chapter), on the other hand it is the inability in some cases to clearly identify an offending vessel despite the illumination and magnification of the operating microscope.

The fundamental importance of endoscopy is that it allows precise exposure of all neurovascular components in the cerebellopontine angle (CPA) [2] without the need for cerebellar retraction. Incorporating the endoscope into the standard surgical armamentarium has made an important contribution to the minimally invasive approach for MVD of the facial nerve [3]. Minimally invasive surgery attempts to minimize skin incision, bone opening and harmful retraction of the neural structures. The underlying assumption is not that "smaller is better" but that "smaller is safer".

Minimally invasive surgery must meet five distinct criteria to achieve acceptance as a new current standard [4]:

- the technique must be less invasive than currently used techniques while maintaining safety;
- the efficacy of the technique should be similar to or better than that of standard techniques;
- the technique should lead to a shorter recovery time for the patient, both in terms of length of hospital stay and time required to resume daily tasks;
- the technique must be cost-effective;
- the procedure must be technically feasible for the majority of surgeons both in terms of the level of surgical skill required, as well as the availability of affordable new equipment.

Endoscopy is used in combination with the operating microscope. It has the advantage of offering an unobstructed panoramic

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view of all components of the CPA, unlike the uniaxial one offered by the operating microscope. It "displaces" the surgeon's eye inside the CPA and allows "looking around corners".

The minimally invasive keyhole retrosigmoid approach is preferred for endoscopic microvascular decompression because it provides a direct and fast approach to the CPA. Retrolabyrinthine or middle fossa approaches have also been used.

1.1. History of endoscopy in the cerebellopontine angle

The first comprehensive description of endoscopy in the CPA was reported in 1917 by Doyen who described an endoscopic technique for selective fifth nerve section in trigeminal neuralgia [5]. His description is worth quoting: "The occipital bone was perforated with a 20 mm burr, the dura was opened and the cerebellum retracted; an intracranial endoscope was then introduced, showing the trigeminal root about 5–6 mm above the acusticus and about 14 or 15 mm beyond it". He described a speculum specifically used for this purpose, to be inserted between the posterior surface of the petrous bone and the cerebellum as well as special instruments.

Another description of an endoscopic technique was reported in 1974 by Prott, advocating a transmastoid retrolabyrinthine approach to the CPA for vestibular neurotomy [6]. In 1979 Oppel and Mulch described a similar approach for selective trigeminal root section [7].

Endoscopic anatomy of the CPA was described on ten fresh cadavers by O'Donoghue and O'Flynn in 1993, using a range of sinus endoscopes [8]. They described four "endoscopic levels":

- level 1 is the uppermost level, which holds the trigeminal nerve (Fig. 1a) and its related vascular structures: superior cerebellar artery (SCA), the Dandy vein and accessories. This corresponds to the place for endoscope-assisted decompression of the trigeminal nerve;
- level 2 contains the neurovascular acousticofacial bundle (Fig. 1b), situated approximately 55 mm deep into the retrosigmoid craniotomy site. The loops of the anterior inferior cerebellar artery (AICA) can be clearly visualized. Their relationships to the neural structures and the porus acusticus are extremely variable and sometimes very complex. This is the site of the most delicate vascular decompression because the real role of AICA as an offending vessel is not always obvious and its displacement from the cranial nerves is always questionable;
- level 3 contains the lower cranial nerves (CNs) (Fig. 1c): the ninth, tenth, eleventh CNs and related structures: the posterior inferior cerebellar artery (PICA) and the vertebral artery. This is the key level for endoscope-assisted vascular decompression for a hemifacial spasm, offering a clear identification of the course of the offending artery(ies);
- level 4 is at level of foramen magnum. It contains the spinal root of the accessory nerve and the hypoglossal nerve as well as the vertebral artery (Fig. 1d). In cases of the dolicho-vertebral or a basilar artery embedded in the neural structures this level should be exposed.

Mckennan in 1993 described the use of the endoscope for viewing the lateral recess of the internal auditory canal to verify complete excision of an acoustic neuroma and continuity of the facial and cochlear nerves [9]. In 1993 Magnan et al. stimulated renewed interest in endoscopic surgery in the CPA with the use of contemporary endoscopes and video-endoscopic equipment [10]. The wide angle of the endoscope's illumination provides a complete panoramic view of all the structures crossing the CPA and represents an indispensable tool for a successful neurovascular decompression. In all surgical decompression procedures of the facial nerve, the endoscope-assisted technique "clarifies the exact site of the clinically significant compression" [11]. In 2008, there was a reported study to assess the endoscope-assisted microsurgical technique as a transitional step between traditional open techniques and fully endoscopic techniques [12]. In 2001, Eby et al. published a fully endoscopic decompression of the facial nerve [13], and then of the trigeminal nerve [14]. But to date, fully endoscopic vascular decompression of the facial nerve was restricted to only very rare favorable conditions as it cannot offer a safe and rational response in all cases [15].

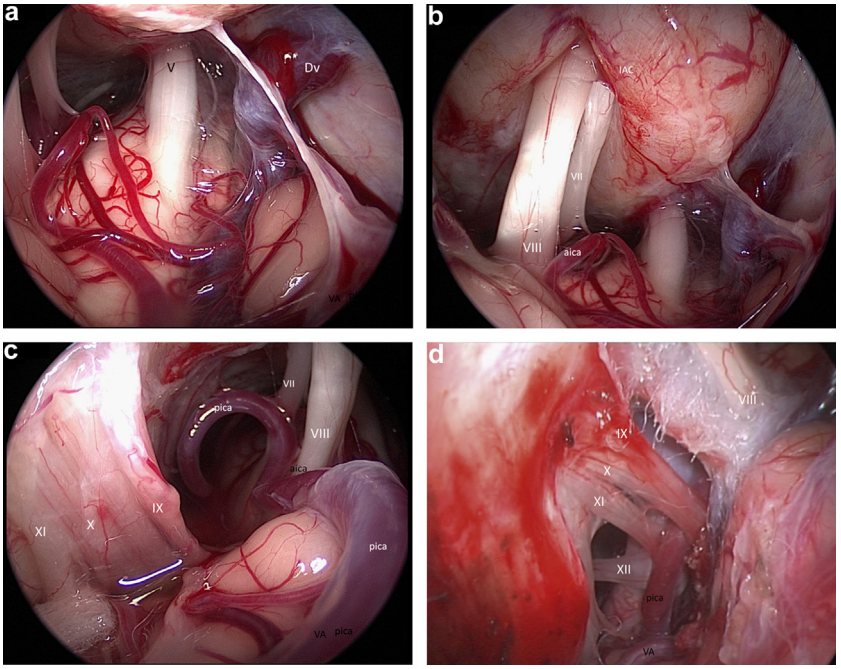

Fig. 1. The four "endoscopic levels", on the left side: a: trigeminal area. No artery in contact with the trigeminal nerve (V). Dv: dandy vein; b: acousticofacial area. Note the entrance of the auditory (VIII) and facial (VII) nerves in the internal auditory canal (IAC). Anterior inferior cerebellar artery (AICA); c: lower cranial nerve area: glossopharyngeal (IX), vagal (X), accessory (XI) nerves. Posterior inferior cerebellar artery (PICA); d: foramen magnum area: hypoglossal nerve (XII), vertebral artery (VA).

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