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Fully Endoscopic Microvascular Decompression for Trigeminal Neuralgia

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Trigeminal neuralgia (TN) is a chronic, progressive facial pain disorder characterized by severe paroxysmal episodes in the distribution of the trigeminal nerve. The most common cause of TN is compression of the trigeminal nerve by a vascular structure within the posterior fossa at the dorsal root entry zone (DREZ). Initially described by Dr. Peter Janetta, microvascular decompression has been clearly demonstrated to be a safe and effective treatment for TN with excellent immediate and long-term pain relief. Although neuroimaging has advanced significantly allowing for improved pre-operative visualization of the trigeminal nerve and determination of vascular conflict, most neurosurgeons continue to practice the MVD procedure in a very similar manner to Dr. Janetta’s 1967 description. While the retrosigmoid craniotomy and operative microscope allows for an excellent view of the posterior aspect of the trigeminal nerve within the cerebellopontine angle, visualization of the anterior aspect of the nerve is limited. Additionally, adequate visualization of the DREZ may be difficult and require additional retraction of the cerebellum, potentially resulting in complications such as hearing loss and cerebellar injury. As neurosurgical experience with the endoscope has grown, a variety of authors have described performing microvascular decompression with endoscopic assistance which involves using the endoscope to inspect the trigeminal nerve for sites of compression but performing the decompression under the microscope. While the main advantage of the endoscopic approach compared to the microscopic approach is improved visualization of the trigeminal nerve from the DREZ to Meckel’s cave including its inferior, anterior and superior surfaces, evolution of the procedure to a fully endoscopic approach has the additional benefits of being less invasive with minimal soft tissue dissection and cerebellar retraction allowing for reduced patient discomfort and accelerated recovery. In this technical review, we describe our approach to performing a fully endoscopic microvascular decompression including the surgical nuances that allow the procedure to be performed safely and efficiently.

SURGICAL PLANNING AND INSTRUMENTATION

The indications for the fully endoscopic MVD do not differ from those of the microscopic approach. However, surgical instrumentation varies considerably beyond use of the endoscope. The asterion represents an...
INCISION AND CRANIOTOMY

We typically perform an approximately 2cm linear or curvilinear retroauricular incision enabling placement of a 14mm diameter burr-hole-type craniectomy at the sigmoid-transverse junction (Figure 2). In patients with thicker skin and musculature, the curvilinear incision is preferred as the slight posterior extension does not allow the soft tissue and self-retaining retractor to restrict the angle of the endoscope along the posterior petrous bone. If instrumentation optimized for endoscopic utilization is not available, we recommend using a slightly increased craniectomy size of approximately 18mm. Minimal muscular disruption is performed due to the more superior location of the craniotomy and a self-retaining retractor or stay-sutures can be used to retract the skin edges. The burr hole is drilled with a 6mm-round cutting bit providing approximately 2mm of exposure of the inferior aspect of the transverse sinus and posterior aspect of
maneuverability. Additionally, the endo-
scopic view may be compromised by a
prominent suprameatal tubercle. The
lateral cerebellar surface is covered with
a rubber dam to allow for easy repetitive
introduction of instruments without incur-
ing cerebellar surface injury. Although
cottonoids can serve a similar function,
their thickness can prove obtrusive during
this minimally invasive approach. Similar
to the microscopic approach, bimanual
manipulation of the trigeminal nerve and
offending artery is then performed with
buffering of the nerve with a small piece
of polytetrafluoroethylene (Figure
4).

Once the decompression has been
performed, circumferential inspection of
the trigeminal nerve should be repeated
with angled endoscopes to ensure no
further areas of compromise, including
the DREZ, prior to endoscope removal.

DURAL AND BONY
RECONSTRUCTION

Similar to the microscopic approach,
the sigmoid sinus. Failure to adequately
remove bone over the sinuses will limit
the final positioning of the endoscope
and may necessitate increased cerebellar
retraction.

EXPOSURE AND
DECOMPRESSION OF THE
TRIGEMINAL NERVE

The dura is then opened in a C-shaped
fashion extending from the transverse
sinus edge to the sigmoid sinus edge
followed by a bisection of the dura toward
the sigmoid-transverse sinus junction.
The dural leaflets are then retracted with
stay-sutures. Similar to the skin incision,
the posterior opening of the dura over
the cerebellum allows the endoscope
to be inserted with increased degree of
freedom and to achieve the optimal angle
for visualization and instrument mane-
uvverability. The supero-lateral aspect of
the cerebellum is then gently retracted
and the endoscope advanced into the
cerebellopontine angle along the tento-
rium under endoscopic visualization.

As access to the cisterna magna is not
possible, temporary placement of a
fixed retractor may be necessary at this
point to allow for the arachnoid above
the cranial nerve 7/8 complex to be
sharply dissected and cerebrospinal fluid
gently aspirated to facilitate cerebellar
relaxation. The trigeminal nerve is then
inspected from the DREZ to Meckel’s
cave for any sights of vascular compres-
sion with the 0-degree and angled
endoscopes dynamically (Figure 3). At
this point, the fixed cerebellar retractor
is removed and the endoscope reposi-
tioned to its optimal location, typically
along the tentorial edge allowing for
instruments to be passed more inferiorly.
No further cerebellar retraction is neces-
sary throughout the procedure, although
sacrifice of the superior petrosal vein is
frequently necessary to achieve optimal
positioning of the endoscope. Placement
of the endoscope along the posterior
petrous face allows for an excellent view
of the inferior aspect of the trigeminal
nerve but requires a more oblique angu-
luation of the endoscope that restricts
maneuverability. Additionally, the endo-
scopic view may be compromised by a
prominent suprameatal tubercle. The
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DURAL AND BONY
RECONSTRUCTION

Similar to the microscopic approach,
careful attention to dural closure is
important to prevent post-operative cerebrospinal fluid leakage, however, with the endoscopic approach, the dura can typically be repaired primarily as there is no thermal injury to the dura. The craniectomy site is inspected for any air cells and waxed appropriately followed by reconstruction with a 14mm titanium burr hole cover plate (Figure 1).

REFERENCES
