Surgical Treatment of Trigeminal Neuralgia

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KEYWORDS

• Trigeminal neuralgia • Microvascular decompression • Percutaneous radiofrequency rhizotomy
• Percutaneous glycerol rhizotomy • Percutaneous balloon compression

KEY POINTS

- Microvascular decompression offers superior long-term pain outcomes for patients with type I trigeminal neuralgia; however, it is associated with the highest rate of serious complications.
- For patients with recurrent pain after microvascular decompression or who are poor operative candidates, percutaneous radiofrequency rhizotomy is the best option among the percutaneous procedures.
- Percutaneous radiofrequency rhizotomy offers the best initial and long-term pain response rates and has the advantage of being able to selectively target affected trigeminal divisions.
- Stereotactic radiosurgery may be useful in patients who fail multiple operative procedures or who have multiple sclerosis–associated trigeminal neuralgia.

INTRODUCTION

Trigeminal neuralgia (TN) is characterized by severe, episodic pain in the distribution of the trigeminal nerve. Type I TN is characterized by episodic lancinating pain, and type II TN has a constant pain component. A variety of methods are used to measure pain severity in TN, with one of the most common being the Barrow Neurologic Institute (BNI) pain scale, which ranges from a score of I indicating no pain and not taking any medications to V indicating severe pain with no relief. Although pharmacologic treatment with medications such as carbamazepine is the first-line therapy, for patients who have resistant pain or who cannot tolerate medications owing to adverse effects a number of operative interventions are available. These include microvascular decompression (MVD), percutaneous radiofrequency rhizotomy (PRR), percutaneous glycerol rhizotomy (PGR), percutaneous balloon compression (PBC), and stereotactic radiosurgery (SRS), including gamma knife radiosurgery (GKRS) or cyberknife. These procedures have varying success rates and risk profiles. We review the evidence supporting the risks and benefits of the various operative modalities.

MICROVASCULAR DECOMPRESSION

Success Rates

MVD involves performing a suboccipital craniotomy to find and resolve the underlying trigeminal nerve compression (Fig. 1). MVD offers excellent pain control results. The rate of initial pain control is 80.3% to 96%.[1–4] One prospective study found that 92.5% of patients were pain free without medication at average 28 month follow-up.[5] In another study at mean of 38 months of follow-up, 85% of patients maintained adequate pain control.[4] At 5 years, 72% to 85% have good pain control.[1–3,6] One of the largest studies of MVD with long-term follow-up found that at 10 years 70% of patients had complete pain relief and 4% had partial pain relief.[7] Another study with very long-term follow-up found that at 15 years 73.4%

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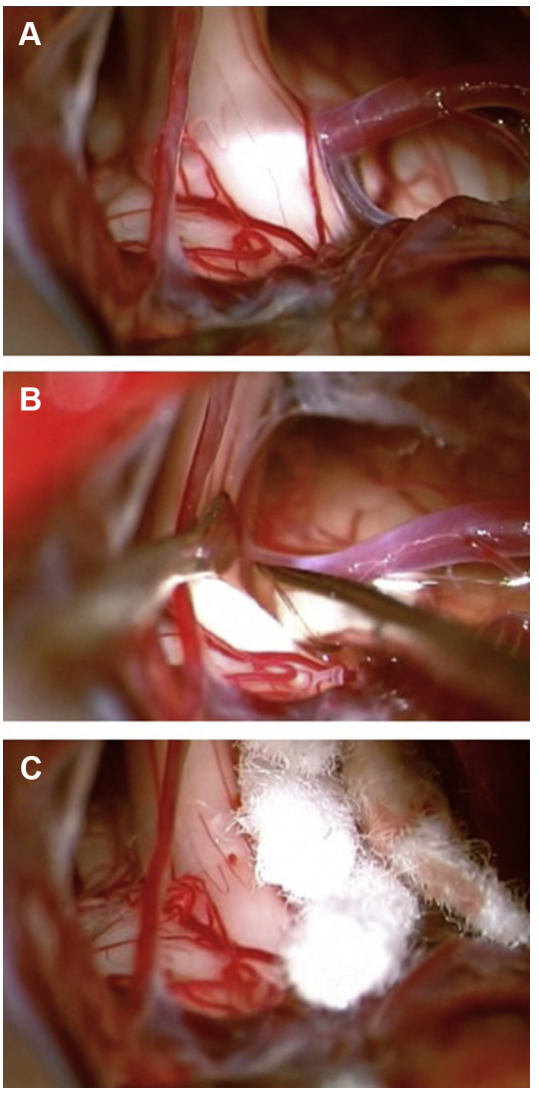

Fig. 1. Microvascular decompression. A suboccipital craniotomy is performed to expose the borders of the transverse and sigmoid sinuses. The dura is incised and cerebrospinal fluid carefully drained to expose the cerebellopontine angle. (*A*) The trigeminal nerve is seen draped over a compressive artery. (*B*) The artery is dissected away from the nerve. (*C*) Teflon pledgets are placed between the nerve and compressive artery to maintain their separation.

of patients were pain free.[8] Pain relief after MVD is generally instantaneous, although a delay of up to 1 month before the benefit is evident has been reported.[4,9]

MVD has highest success rates in patients with type I TN.[9] Type II TN may have more advanced underlying nerve damage contributing to worse immediate and long-term outcomes.[2,9,10] Arterial versus venous compression may also be associated with TN type and is associated with better outcomes after MVD.[10,11] In patients with episodic pain that evolves into constant pain, MVD may still provide significant pain relief, especially for the episodic component of pain.[12] However, freedom from pain is less likely if constant pain comprises more than 50% of the pain experienced.[12]

A greater degree of neurovascular compression has been associated with better long-term outcomes in some studies,[8] as has the presence of preoperative trigger points.[2] Patients with immediate postoperative pain relief, male gender, absence of venous compression, and shorter disease duration may have better outcomes.[7,13] Bilateral pain is correlated with worse outcomes.[2] MVD is less effective for multiple sclerosis (MS)-related TN, with 50% experiencing complete pain relief and 10% partial pain relief at a mean of 2 years of follow-up.[4]

Because MVD is more invasive than other surgical procedures for TN, its safety and efficacy in older patients has been debated. One study suggested that although all ages had the same rate of initial pain relief (>95%), patients over age 60 had a shorter time to recurrence.[14] However, the older patient group had a longer duration of symptoms before surgery, which may have contributed to worse outcomes. Another study found lower recurrence rates in elderly patients.[15] Older patients may have better outcomes after repeat MVD.[16] Young patients may have worse outcomes after MVD, perhaps related to a lower incidence of arterial compression at the time of surgery.[3,17]

MVD can be successful as a repeat procedure for appropriately selected candidates who have recurrence of TN after initial MVD or other surgical procedure, although rates of pain relief are likely lower than with initial MVD,[3,18] with 90.3% to 93.3% initial complete pain relief,[18,19] 67% success rate at 12 months,[16] and 42% excellent results at 10 years.[7] Another study that included partial sensory rhizotomy in repeat MVD found 10% good outcome at the 4-year follow-up.[13] Patients with previous ablative procedures have worse outcomes after MVD, with 64% reported excellent outcome at a mean of 5.1 years of follow-up.[13]

Complications

Although MVD is the most invasive operative procedure for TN, in experienced hands the complication rate is relatively low. There is a 4% rate of serious complications.[9] Mortality rate is reported at 0.15% to 0.8%.[7,9,14,20,21] There is a lower complication rate and lower rate of mortality or