



# Older Patients Have Better Pain Outcomes Following Microvascular Decompression for Trigeminal Neuralgia

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**Scholarly Report submitted in partial fulfillment of the MD Degree at Harvard Medical School**

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**Scholarly Report Title:** Older Patients Have Better Pain Outcomes Following Microvascular Decompression For Trigeminal Neuralgia

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(a) My contribution to the project was mainly in the form of gathering the long-term follow-up data by calling each of the patients identified in the chart review and administering the informed consent and study survey; I joined the project after the idea of the project had already been conceived, and shortly before the abstract was submitted. I also helped to review/edit the manuscript before publication, as well as review revisions to our original submission prior to the paper's final acceptance.

(b)

### **Introduction, Rationale, Background**

Trigeminal neuralgia (TN) is a facial pain syndrome that can be classified as typical or atypical depending on the clinical presentation. Typical TN is characterized by paroxysmal attacks of pain lasting from a few seconds to a few minutes, which affects one or more branches of the trigeminal nerve; it most often affects the maxillary and mandibular divisions, and almost never crosses midline. The pain is classically described as intense, sharp, stabbing, or electric-like, and is often described as one of the most debilitating pain syndromes known. (In contrast, the pain in atypical TN is relatively more constant than paroxysmal, and is more often described as a burning, aching, or throbbing sensation.)

The first-line treatment for trigeminal neuralgia is pharmacotherapy, which consists primarily of anti-epileptic medications, such as carbamazepine (first-line), or gabapentin. However, surgical intervention is indicated in patients whose pain remains refractory to medical management, or for whom medication side effects outweigh the benefits of its use. Options for surgical management include less invasive, ablative procedures, such as percutaneous trigeminal rhizotomy and stereotactic radiosurgery, as well as the more invasive microvascular decompression (MVD). Several prior studies have demonstrated that MVD is the most durable form of treatment for TN, with a lower long-term rate of recurrence than percutaneous techniques or stereotactic radiosurgery<sup>1</sup>. Several studies have also evaluated the anatomic characteristics of the trigeminal nerve that are associated both with the development of TN, as well as with positive outcomes following microvascular decompression, namely, the presence of neurovascular compression, and a history of typical as opposed to atypical TN symptoms<sup>1</sup>.

While several studies have evaluated the safety of MVD in older and younger patients, the data on the efficacy of MVD in older patients is more limited. This is where we felt we could add value to the field, and therefore was the focus of our study. In particular, we sought to evaluate the relationship between age and efficacy of microvascular decompression in patients with a history of typical TN symptoms and demonstrated neurovascular compression on preoperative imaging.

### **Clinical Implications**

Our study showed that older patients had better outcomes following MVD than younger patients: specifically, older patients had a statistically significantly lower absolute Barrow Neurologic Institute (BNI) pain score following MVD compared to younger patients, as well as a statistically significantly larger decrease in their pain score from pre- to post-MVD than younger

patients<sup>1</sup>. The primary clinical implication of this work is the impact it may have on the treatment possibilities considered for older patients with TN.

Older patients often have greater systemic comorbidities than younger patients that make the risks associated with surgery greater, and therefore change the risk/benefit analysis of whether or not to pursue MVD in patients of this age group. This likely results in many older patients with TN being referred for less invasive but also less effective procedures. However, the prevalence of TN increases with age, with the greatest burden of disease from TN carried by the oldest patients. One then wonders how many patients with TN are being under-treated for their pain. By showing that older patients have better pain outcomes than younger patients, we hope our study adds additional weight to the risk/benefit analysis of whether or not to pursue MVD in older patients, and therefore increases the likelihood that patients are connected with the most appropriate treatment for their TN<sup>1</sup>.

### **Research Implications**

Our study sought to address a narrowly-defined question within the realm of TN and its treatment: is there an association between age and efficacy of MVD for TN. But what remains to be answered is, why?

While it is known that neurovascular compression is a strong predictor of trigeminal neuralgia, many people with evidence of NVC do not experience TN. Additionally, there are many people with TN and demonstrated NVC who do not experience durable pain relief following MVD. This was true of some of the patients in our study as well. Additionally, what is the explanation for the observed difference in efficacy of MVD between young and old patients when all who were included in our study had evidence of neurovascular compression on preoperative imaging?

One hypothesis for this observation suggests that there may be a difference in whether the nerve is compressed by an artery or vein. In our patient population, while it was not possible to determine the nature of the vascular structure on preoperative imaging, older patients were found to have an increased incidence of arterial neurovascular compression (as opposed to venous) as identified intraoperatively. Some studies have suggested that arterial compression is more likely to result in TN, and that arterial compression may result from morphologic changes that occur in the vessel secondary to atherosclerosis<sup>2</sup>. That older patients have an increased incidence of atherosclerosis may help then to explain the association of age and incidence of TN. However, our study found no significant association between arterial compression and TN, suggesting that arterial vs. venous compression was not the reason for the difference in outcome of MVD between young and old patients<sup>1</sup>.

Our team's working hypothesis for the observed difference between young and old patients reflected mainly anatomical and operative considerations<sup>1</sup>. Atrophy of the brain increases with age, which may have facilitated exposure of the cerebellopontine angle (CPA) (the anatomic space through which the trigeminal nerve passes where it is susceptible to compression by

adjacent vascular structures). With increased CPA exposure, it is possible a more thorough inspection and decompression of the trigeminal nerve was possible, therefore leading to improved outcomes<sup>1</sup>.

Several studies have evaluated the anatomical characteristics of NVC in patients with and without TN and have demonstrated that the location and severity of NVC plays an important role in determining whether a patient will experience TN.<sup>3,4</sup> A review in 2016 in the *American Journal of Neuroradiology* by Haller et al<sup>4</sup> does a good job of summarizing an emerging consensus to that end, and offers the following take-home points:

- (1) The location of NVC along the cisternal segment of the trigeminal nerve plays an important role in whether a person might develop symptoms of TN. The existing paradigm has been that NVC in the trigeminal root entry zone (TREZ, the proximal few millimeters of the cranial nerve to the brainstem) is what leads to TN. However, this paper helps to demonstrate that it is the transition zone between the central and peripheral myelin that is most vulnerable to mechanical irritation by NVC. For the trigeminal nerve, this transition zone does happen to overlap the TREZ, although this is not necessarily the case for all cranial nerves.<sup>4</sup>
- (2) The degree of NVC is also important in predicting whether TN will develop: TN is more common when associated with nerve displacement or atrophy (a greater degree of NVC), rather than if there is just neurovascular contact alone (without associated morphologic changes in the nerve).<sup>4</sup>

In our study, we included all patients (who met the age and symptom criteria) who had neurovascular compression demonstrated on pre-operative imaging; we made no distinction between whether the patient had arterial or venous compression, where along the nerve the compression was located, or with regard to the degree of compression or morphologic change, in large part because it is not feasible to make these distinctions with the imaging currently used in clinical practice. However, as we increase our understanding of the pathophysiology of TN and NVC syndromes, as well as our ability to more accurately image the trigeminal nerve in the clinical setting, we may be able to better identify patients that will most benefit from MVD.

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(c) Attached