

## Degree of Nerve Atrophy on Preoperative Imaging Predicts Outcome after Microvascular Decompression for Trigeminal Neuralgia

## Jonathan Miller MD; Yifei Duan; Jennifer A. Sweet MD

University Hospitals Case Medical Center, Case Western Reserve University School of Medicine, Cleveland, Ohio



## Introduction

Trigeminal neuralgia (TN) is often associated with nerve atrophy along with vascular compression, but its prognostic significance is unclear. Objective: We evaluated whether cross-sectional area of different portions of the trigeminal nerve on preoperative imaging could be used to predict outcome after microvascular decompression (MVD).

### Methods

Twenty-six consecutive patients with unilateral Burchiel Type 1a TN underwent high-resolution MRI followed by MVD. Preoperative images were reconstructed and reviewed by two blinded examiners. For each nerve, a computerized automatic segmentation algorithm was used to calculate the coronal cross-sectional area at two locations along the nerve: (1) root entry zone, and (2) distal nerve at the porus trigeminus (Figure 1). Findings were correlated with outcome at 12 months.

# Figure 1. Example of segmentation technique



A-C demonstrate measurement of the proximal nerve and D-F demonstrate measurement of the distal nerve. (A, D)
Axial image of the trigeminal nerve with a line at the point of coronal reconstruction.
(B, E) Trigeminal nerves are shown on the right (arrow) and left (arrowhead). (C, F)
Automatic segmentation of the nerves by the software program.

### Results

17 patients were pain-free off medications following MVD. Across all patients, the coronal cross-sectional area of the symptomatic trigeminal nerve was significantly smaller than the asymptomatic side in the proximal part of the nerve, which was correlated with degree of compression at surgery (Figure 2). Atrophy of the distal trigeminal nerve was more pronounced in patients who had residual pain than those with excellent outcome (Figure 3). Among the 7 patients who had greater than 20% loss of nerve volume in the distal nerve, only two achieved long-term freedom of pain off medications.

## Conclusions

Trigeminal neuralgia is associated with atrophy of the root entry zone of the affected nerve that correlates with vascular compression and improved outcome after MVD. However, loss of volume in the distal portion of the nerve is associated with worse outcome after MVD.



(A) Proximal and distal nerve crosssectional area ipsilateral and contralateral to trigeminal neuralgia symptoms. The ipsilateral nerve was smaller at both proximal and distal nerve segments, although only the proximal segment reached statistical significance. \*p<0.05, paired-sample Student's t-test. (B) The degree of atrophy of the proximal nerve was significantly correlated with degree of compression seen at surgery.



Atrophy of the proximal trigeminal nerve was slightly greater in patients who were pain-free postoperatively (not statistically significant). Atrophy of the distal trigeminal nerve was significantly more pronounced in patients with residual postoperative pain (p<0.05).

### Learning Objectives

 Descibe the significance of nerve atrophy on outcome after microvascular decompression.
 Outline the characteristics of the radiographic appearance of the trigeminal nerve in trigeminal neuralgia.

3. Discuss the potential for preoperative radiographic evaluation to influence patient selection.