Imaging Techniques in the Evaluation of Vascular Causes for Trigeminal Neuralgia

Ciaverella, D. P. * Nesbit, G. M. * Limonadi, F. * Burchiel, K.
Oregon Health Sciences University, Portland, OR

Purpose
Trigeminal neuralgia can arise from numerous causes and is associated commonly with vascular compression syndromes. Much has been written on the subject in relationship to surgical treatment for these patients using micro-vascular decompression. The purpose of this study is to evaluate imaging techniques to demonstrate both the arterial and venous vascular anatomy in relationship to the trigeminal nerve.

Materials & Methods
Twenty-eight patients (5 male, 23 female, age range 30–67 years) were evaluated prospectively using a combination of MR techniques. These techniques included high resolution 3D time-of-flight (3D TOF) MR angiography sequences, using a 512 x 512 matrix, zero-fill interpolation, and 0.5 mm partition thickness. In the initial 4 patients, multiple 3D TOF sequences were performed with varying flip-angles to optimize the contrast of the time-of-flight enhancement and the 5th nerve with respect to the cisternal cerebrospinal fluid. In the following 18 patients, a 3D fast spin echo T2 (3D T2) sequence also was performed to demonstrate both the arterial and venous anatomy, and the trigeminal nerve with respect to the CSF. In the more recent 6 patients, a gadolinium-enhanced 3D SPGR (3D Gad) sequence was added to delineate the venous and arterial anatomy. These sequences were evaluated prospectively by neuroradiologists with standard clinical knowledge and retrospectively reviewed blinded to the side of the symptoms. A final retrospective review is being performed in correlation with the findings at surgery, which are documented and recorded on video format directly from the operating microscope.

Results
The surgical findings revealed arterial compression in 17 patients, venous compression in 9, tumor in 1, and no vascular compression in 1. The initial prospective evaluation indicated positive findings in only three fourths of the arterial compression patients and the tumor patient. The venous compression patients’ studies were either incorrectly interpreted as arterial compression or negative. The 3D TOF sequence correctly identified all arterial causes of trigeminal compression, however it did not detect the venous causes. The addition of the 3D T2 sequence suggested the venous causes in two thirds, but could not differentiate arteries from veins. The gadolinium-enhanced sequence identified the venous causes but, like the 3D T2 sequence, could not differentiate arteries from veins. The combination of 3D TOF and 3D Gad delineated the arterial, venous and cranial nerve anatomy to the greatest degree.

Conclusion
High-resolution, 3D TOF MR angiography is quite good in demonstrating arterial compression, however it is poor at detecting venous compressive abnormalities. The initial evaluation using
3D FSE T2 and gadolinium-enhanced sequences in combination with the TOF sequence yields much higher positivity in these patients. Further correlation with surgical findings and the surgical outcome data is pending.