Magnetic resonance imaging of vascular compression in trigeminal neuralgia

Case report

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A case of trigeminal neuralgia is reported in which preoperative high-resolution magnetic resonance imaging demonstrated vascular compression of the trigeminal nerve. Surgery confirmed compression and indentation of the fifth nerve by a large branch of the superior cerebellar artery. Following microvascular decompression, the patient experienced no further pain. Magnetic resonance imaging may be useful in the evaluation of trigeminal neuralgia to identify a subgroup of patients who could benefit most from decompression.

Key Words: trigeminal neuralgia, magnetic resonance imaging, microvascular decompression

The clinical diagnosis of trigeminal neuralgia is usually not difficult to make, given the classic symptomatology that characterizes this syndrome; however, the pathogenesis of this condition remains in dispute. Dandy first observed the association of vascular abnormalities impinging on the trigeminal dorsal root. Jannetta reported a series of 414 patients without multiple sclerosis who underwent microvascular decompression for trigeminal neuralgia; 95% of these patients showed abnormal vessels compressing the trigeminal nerve. Other surgical series confirm these findings, and lend support to the hypothesis that vascular compression is the primary cause of trigeminal neuralgia. Adams, et al., cast doubt upon this theory by reporting that true vascular compression occurred in only 11% of their patients.

Medical treatment paradigms do not address the role of these mechanical irritative factors in the success or failure of medical therapy, either in clinical trials or experimentally. Resolution of this controversy could be critical to management decisions in patients who fail medical therapy: that is, whether or not to recommend microvascular decompression versus a radiofrequency or glycerol percutaneous rhizotomy. With the recent development of high-resolution magnetic resonance (MR) imaging, the means to accurately detect anatomical abnormalities in the vicinity of the trigeminal nerve are available. A case with MR imaging suggestive of vascular compression of the trigeminal nerve is presented.

Case Report

This 57-year-old man first experienced left third-division trigeminal neuralgia approximately 8 years before his present admission. Initially, his symptoms were mild and consisted of only a few painful episodes daily. However, several months prior to evaluation at Stanford Medical Center he developed progressively worse and more frequent pain. He was started on a course of carbamazepine, and this effectively controlled 90% of his pain. It was necessary to discontinue the carbamazepine after he developed leukopenia (white blood cell count 2.7/dl) and anemia (hemoglobin 9.9%). Dilantin and baclofen were tried but did not relieve his symptoms.

Examination. A trigger point for the pain was found over the left third division. He had slightly decreased sensitivity to pinprick over the left second and third divisions. Formal auditory assessment showed a mild sensorineural hearing impairment on the left, compared with the right, in the higher frequencies. The left acoustic reflex amplitude was notably less than on the right, suggesting mild left seventh and eighth nerve dysfunc-
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Fig. 1. Axial $T_1$-weighted images ($TR = 600$ msec, $TE = 20$ msec, $256 \times 256$ matrix, 3-mm slice thickness) of the posterior fossa. Left: Normal appearance of the right trigeminal nerve (black arrow). Right: The left trigeminal nerve is displaced laterally and bowed (black arrow). A prominent vascular loop (white arrow) is seen immediately adjacent to the proximal portion of the nerve.

The remainder of the neurological examination was normal. The patient decided on surgical treatment for this trigeminal neuralgia.

Magnetic resonance imaging was performed on a General Electric Signa system utilizing a 1.5-tesla superconducting magnet. Images were obtained in the sagittal, axial, and coronal planes. High-resolution, thin, $T_1$-weighted images were obtained in the axial plane through the level of the gasserian ganglia ($TR = 600$ msec, $TE = 20$ msec, $256 \times 256$ matrix, 3-mm slice thickness). The trigeminal nerves were well visualized bilaterally. A curvilinear signal-void focus, considered most likely to represent a prominent vascular loop of the superior cerebellar artery, was seen medial to the proximal portion of the left trigeminal nerve. In addition, the intracranial portion of the left fifth nerve was laterally displaced and bowed (Fig. 1). A contrast-computerized tomography (CT) scan performed at another institution in 1984 was reported to be normal.

Operation. The patient underwent a left retromastoid craniectomy. After the arachnoid covering the fifth nerve was opened, a large tortuous branch of the superior cerebellar artery was noted to compress and indent the fifth nerve anteriorly at the root entry zone. This arterial vessel was dissected off the trigeminal nerve and the adjacent brain stem. A piece of Teflon-coated felt was fashioned to fit around the fifth nerve and positioned to hold the arterial branch away from the nerve.

Postoperative Course. The patient's postoperative course was uneventful, and he had no further trigeminal neuralgia. Neurological examination showed normal sensory and motor function of the left fifth nerve. Auditory assessment demonstrated no change in auditory function. There were no other cranial-nerve or neurological deficits.

Discussion

Prior to the advent of MR imaging, radiological demonstration of small structures of the posterior fossa was unsatisfactory. Beam-hardening artifacts from the petrous bones markedly hamper CT scanning of the posterior fossa, even on thin sections. Plain films and polytomography are of limited use in the posterior fossa, because they can detect only the presence of bone erosion. The development of MR imaging has revolutionized the study of this region. $T_1$-weighted pulse sequences emphasizing cerebrospinal fluid/parenchymal contrast are extremely effective in delineating relatively small anatomic structures such as the brain-stem nuclei, cerebellopontine angles, and the fifth, seventh, and eighth cranial nerves. Additionally, $T_2$-weighted
sequences emphasizing subtle changes in tissue signal characteristics can be useful in the detection of early neoplastic and ischemic lesions when no morphological abnormalities are present. Thus, in the posterior fossa, MR imaging has advantages over CT in the evaluation of small soft-tissue structures, due to its multiplanar imaging capability and lack of bone artifacts.

Descriptions of imaging in patients with trigeminal neuralgia have been quite limited. In rare case reports, abnormal vessels near the fifth nerve have been demonstrated with angiography or CT cisternography.\textsuperscript{8-11} Obviously, such invasive procedures are not optimal screening studies in the routine evaluation of trigeminal neuralgia. Magnetic resonance imaging offers an easy, noninvasive method of preoperatively evaluating patients with trigeminal neuralgia by providing excellent visualization of the intracranial portions of the trigeminal nerves and cerebellopontine angles without the use of ionizing radiation.

Magnetic resonance imaging is potentially useful in the evaluation of trigeminal neuralgia, as it may provide critical anatomical data that could influence the clinical management of these patients. The current specificity and sensitivity of MR imaging in the setting of trigeminal neuralgia is as yet unknown. It remains to be determined whether this modality will provide useful preoperative data that could identify a subgroup of patients with vascular compression who might benefit most from decompression.

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**References**


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