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Case 21-2006: A 61-Year-Old Man with Left-Sided Facial Pain

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PRESENTATION OF CASE

A 61-year-old man was seen in a specialty clinic at this hospital because of facial pain. The patient had been in his usual state of health until eight months earlier, when intermittent facial pain developed. The pain had two components. One was a very sharp, electrical or lancinating pain that was precipitated by eating, talking, or touching his moustache; it involved the entire left side of the face but was most prominent over the maxilla, lips, and lower jaw. The other component was a duller, throbbing pain present in the same areas that had been relatively unremitting since it began. Magnetic resonance imaging (MRI) of the brain showed no intracranial masses or other abnormalities; there appeared to be contact between the superior cerebellar artery and the left trigeminal nerve. Carbamazepine and gabapentin were begun; they diminished but did not eliminate the sharp pain and had no effect on the dull pain. The patient found the effect of the medications unpleasant and believed that they clouded his thinking. He was referred to the neurosurgical outpatient service of this hospital for further evaluation and care.

The patient had no history of head injury, visual changes, tinnitus, vertigo, or hearing loss. He had lost 6.8 kg (15 lb) of weight during the previous eight months because of pain induced by eating. He had hypertension, hypercholesterolemia, and sleep apnea. He had had multiple minor surgical procedures involving the face, including gum surgery, laser surgery of his uvula for sleep apnea, and a tonsillectomy as a child. He had no known drug allergies. He worked as an engineer at a computer company, rarely consumed alcohol, and had quit smoking 25 years earlier, after a 30-pack-year history. His current medications were carbamazepine (1000 mg per day), gabapentin (900 mg per day), atenolol (12.5 mg per day), and hydrochlorothiazide (25 mg per day).

On physical examination, he appeared well but uncomfortable owing to the facial pain. The blood pressure was 140/88 mm Hg, the pulse 66 beats per minute, and the temperature 36.3°C. The neck was supple, the lungs were clear on auscultation, and the heart rate and rhythm were normal. The abdomen was soft and nontender.

On neurologic examination, the patient was awake, alert, and oriented. The visual fields were full, the extraocular eye movements were intact, and the pupils were equal and reactive to light. Temporal and masseter-muscle contractions were equal in symmetry and strength. Facial sensation was intact and symmetric to light touch

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and a sharp stimulus, although there was a sensitivity to light touch over the left maxillary and mandibular distribution of the trigeminal nerve. The face was symmetric, and the hearing was intact bilaterally. The voice was normal, without hoarseness, and the uvula was at the midline. The strength of the trapezius and sternocleidomastoid muscles was equal, and the tongue was at the midline. The remainder of the examination was normal. The gait, balance, coordination, and motor strength were normal. The reflexes were 2+ bilaterally, and there was no clonus.

A diagnostic and therapeutic procedure was performed.

DIFFERENTIAL DIAGNOSIS

Dr. Fred G. Barker II: The differential diagnosis in this man with chronic facial pain includes inflammatory, infectious, and neoplastic processes. Although I am aware of the diagnosis, the case provides an opportunity to review the causes of facial pain. Common causes of chronic facial pain include broken teeth, dental caries, root abscesses, and other abnormalities of the teeth, gingiva, maxilla, or mandible. Local causes of eye pain include glaucoma, orbital cellulitis, and tumors of the facial bones. These can be ruled out by examination and, when necessary, the use of appropriate imaging studies. This patient had no evidence of any of these disorders.

Another common cause of pain in the distribution of the trigeminal nerve is postherpetic facial pain. This pain tends to be burning and to have many characteristics of neuropathic pain; if superimposed paroxysms of more severe pain are present, these can lead to a mistaken diagnosis of trigeminal neuralgia. The diagnostic feature is a history of herpes zoster in the affected region of the face. There are many causes of local injury to the trigeminal nerve such as facial trauma, fractures of the facial bones, and sinus surgery. Tumor infiltration of the nerve anywhere anterior to the gasserian ganglion can result in similar symptoms. This patient does not have a history of herpes zoster or trauma, but a tumor must be ruled out.

Other nerves that innervate portions of the face can give rise to pain syndromes. The most common of these is glossopharyngeal neuralgia. This syndrome is about one sixth as common as trigeminal neuralgia; it does not have the lancinating electrical quality associated with trigemi-

nal neuralgia, and the paroxysms of pain tend to be longer. The triggers include yawning or swallowing food. The onset of the pain in this syndrome is often preceded by a sensation of something stuck in the throat. A very rare syndrome of geniculate neuralgia or nervus intermediate neuralgia is characterized by pain deep in the ear or in the pinna, and there can be a trigger zone in the external auditory canal. Rarely, patients report an associated metallic taste. This patient's symptoms do not fit these syndromes.¹

Vascular causes of facial pain include temporal or giant-cell arteritis, with the familiar diagnostic feature of tenderness over the temporal artery. Migraine can affect the frontal region and can be confused with an ophthalmic distribution in trigeminal neuralgia. The ill-defined entity of Raeder's paratrigeminal neuralgia, or Tolosa-Hunt syndrome, arises from inflammatory disorders of the dura in or around the cavernous sinus and can be evaluated with the use of imaging studies. Autoimmune disorders, the most common of which is systemic lupus erythematosus, can cause pain in the midportion of the face that is usually steady and aching and is easily distinguished from trigeminal neuralgia. This patient's symptoms do not have features of any of these disorders.¹ Having eliminated other causes of facial pain, we can narrow the differential diagnosis in this case to trigeminal neuralgia and a condition that is called "atypical facial pain."

TRIGEMINAL NEURALGIA

Trigeminal neuralgia characteristically occurs in patients in their late 50s; conditions associated with an increased incidence of this disorder include contralateral trigeminal neuralgia and hypertension. Criteria for the diagnosis of trigeminal neuralgia are given in Table 1.² Trigeminal neuralgia is characteristically paroxysmal, with paroxysms lasting from a few seconds to two minutes. Typically, there is a trigger zone on the face or in the mouth that when touched, predictably and stereotypically provokes the pain. The pain is almost always completely confined to the trigeminal zone. Pain that extends down the throat may be caused by a combination of trigeminal neuralgia and glossopharyngeal neuralgia, and it may not be relieved unless both conditions are treated. If the pain extends behind the ear into the neck, into the shoulder, or down the arm, the condition is not trigeminal neuralgia.¹

Trigeminal neuralgia affects only one side of the face during each paroxysm. Rarely, patients may have bilateral trigeminal neuralgia, but the onset of the disease and the occurrence of the paroxysms of pain are always asynchronous. Pain that affects both sides of the face simultaneously is not due to trigeminal neuralgia. Trigeminal neuralgia is associated with minimal facial numbness or none, and there are no other associated neurologic deficits. Numbness may develop in patients who have had the condition for a long time or as a consequence of surgical treatment, in which case the numbness may be severe.³

The divisions of the trigeminal nerve are affected with varying frequency: the mandibular branch (V3) is affected in half the patients with trigeminal neuralgia, the maxillary branch (V2) in two thirds, and the ophthalmic branch (V1) in a sixth.¹ Trigeminal neuralgia never affects the V1 and V3 distributions without also affecting the V2 distribution. This patient's pain involves the V2 and V3 branches, and possibly also the V1 branch.

CAUSES OF SECONDARY TRIGEMINAL NEURALGIA

An important consideration in the care of a patient who has the clinical syndrome of trigeminal neuralgia is to rule out a structural cause of the pain. The most common causes of secondary trigeminal neuralgia are multiple sclerosis and acoustic neuroma; tumors and cysts in the cerebellopontine angle may also cause trigeminal neuralgia.⁴

ATYPICAL FACIAL PAIN

Atypical facial pain is characterized by steady, aching or throbbing pain, described as pressure and a sensation of swelling in the face. However, there may be a paroxysmal component, causing confusion with trigeminal neuralgia, and the borderline between these two syndromes is not always clear. This patient's pain has both a paroxysmal and a steady component, which suggests the differential diagnosis of atypical facial pain. In contrast to trigeminal neuralgia, atypical facial pain has a strong female predominance and is probably the most common diagnosis among women with facial pain who are younger than 45 years of age. Other features that are useful in distinguishing atypical facial pain from trigeminal neuralgia are the frequent extension beyond the trigeminal distribution, bilateral facial pain,

Table 1. Clinical Criteria for the Diagnosis of Trigeminal Neuralgia.*

Paroxysmal attacks of pain that last less than two minutes
Pain with at least four of the following characteristics
Distribution along one or more divisions of the trigeminal nerve
Sudden, intense, sharp, superficial, stabbing, or burning in quality
Severe intensity
Precipitation from trigger zones or by certain daily activities
An absence of symptoms between paroxysms
Absence of neurologic deficit
Characteristic pattern of attacks in individual patients
Other causes of facial pain ruled out on the basis of the history, physical examination, and special investigations (when necessary)

* Adapted from the classification system of the International Headache Society.²

the absence of true trigger zones on the face, a subjective report of numbness, dependence on narcotics, an inability to work because of pain, disruption of social relationships, the presence of clinical depression, and an association with a painful condition such as fibromyalgia. Although this patient's steady, background facial pain suggests atypical facial pain, the other characteristic features are absent.

The patient's pain is strongly suggestive of typical trigeminal neuralgia. It is unilateral, paroxysmal, electrical, and confined to the trigeminal distribution and has the typical sensory trigger near the nasolabial fold. There is no marked numbness on physical examination. In patients with typical trigeminal neuralgia, the most pertinent imaging study is MRI, which is obtained primarily to rule out multiple sclerosis and cerebellopontine-angle tumors.

DR. FRED G. BARKER II'S DIAGNOSIS

Left trigeminal neuralgia.

DIAGNOSTIC DISCUSSION

Dr. James D. Rabinov: MRI of the brain was performed with standard T₁-weighted and T₂-weighted sequences and with 3-mm axial and coronal sequences through the brain stem and skull base after the administration of gadolinium (Fig. 1). Routine images through the brain show a small, healed infarct in the right pons. An axial T₁-weighted image obtained after the administration of

Figure 1. MRI of the Brain.

An axial image of the brain stem after the administration of gadolinium shows normal enhancement of the venous plexus in Meckel's cave (Panel A, arrows). There is a linear enhancement crossing the fifth cranial nerve to the left of the left pons, consistent with a crossing blood vessel (open circle). A coronal image through the brain stem (Panel B) shows a curvilinear enhancing structure (arrow), possibly a vein, along the lower margin of the left fifth cranial nerve. In Panel C, the left superior cerebellar artery (arrow) is in contact with the fifth cranial nerve. The circle of Willis is normal.

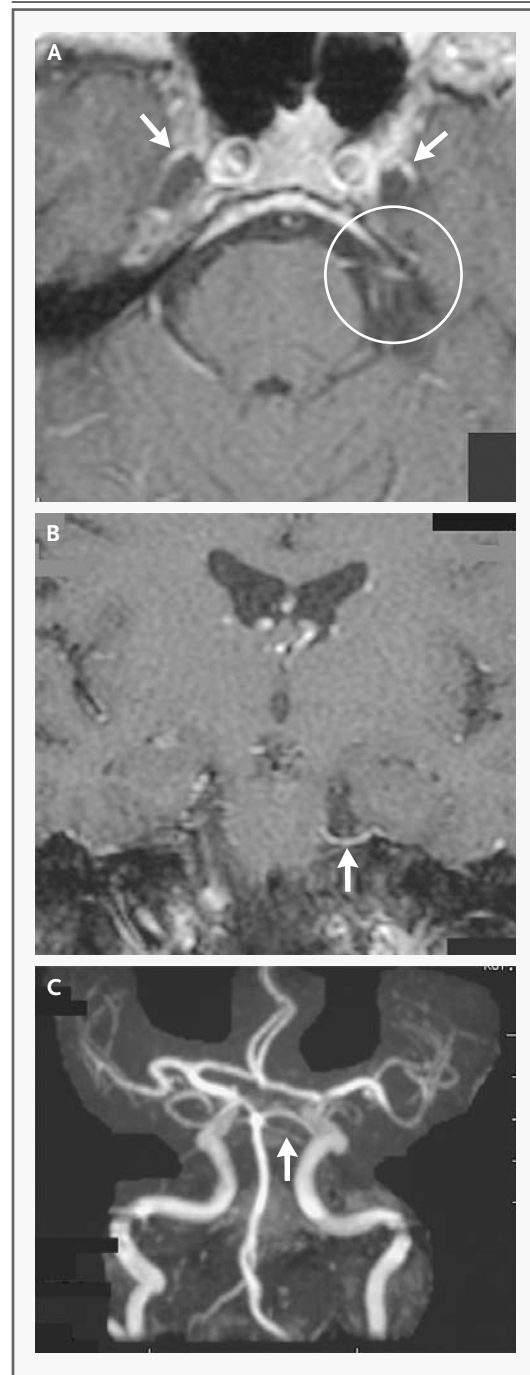
gadolinium shows that Meckel's cave is intact. The fifth cranial nerve is shown on the left; one can see a linear enhancement orthogonal to the nerve suggestive of a crossing vessel (Fig. 1A). The images obtained after the administration of gadolinium show normal enhancement of the venous plexus around the fibers of the ganglion in Meckel's cave. Coronal images show the fifth cranial nerves to the right and left of the pons. One slice forward, there is a curvilinear enhancing structure along the undersurface of the left fifth cranial nerve, which may be a vessel (Fig. 1B). On magnetic resonance angiography, the circle of Willis is normal and the left superior cerebellar artery appears to be in contact with the fifth cranial nerve (Fig. 1C).

Constructive interference in the steady state is an MRI sequence that allows evaluation of 0.6-mm slices through the cerebrospinal fluid spaces around the brain and cranial nerves, and this technique can be useful in the evaluation of cranial nerves.⁵ Although the technique was not used in this case, it can detect the presence of a blood vessel impinging on a cranial nerve.

Computed tomography and bone scanning with technetium-99–labeled methylene diphosphonate were performed to evaluate the skull base because of a question of abnormal bone marrow signal in the sphenoid; no abnormality of the bone was found. In summary, the findings in this case rule out multiple sclerosis or a cerebellopontine-angle tumor and are consistent with the presence of trigeminal neuralgia, possibly with a blood vessel impinging on the fifth cranial nerve.

DISCUSSION OF MANAGEMENT

Dr. Emad Eskandar: The pathophysiology of trigeminal neuralgia is not completely understood. How-



ever, there is increasing evidence that demyelination in the root's entry zone of the trigeminal nerve has an important role in the genesis of abnormal neuronal activity that is perceived as pain. Histologic studies have revealed that compression of the nerve root by an overlying blood vessel results in focal demyelination in the region of

compression, with close apposition of demyelinated axons and an absence of intervening glial processes. Similar foci of nerve-root demyelination and juxtaposition of axons have been found in patients with multiple sclerosis causing trigeminal neuralgia. Experimental studies indicate that this anatomical arrangement favors the ectopic generation of spontaneous nerve impulses and their ephaptic (field-effect) conduction to adjacent fibers.⁶

Compression of the nerve by an impinging blood vessel may be the cause of most cases of trigeminal neuralgia. This finding has led to the development of microvascular decompression surgery as a treatment for this disorder.⁷ In this patient, imaging studies show that the superior cerebellar artery may have been compressing the trigeminal nerve.

Seventy percent of patients with trigeminal neuralgia have good initial pain control with carbamazepine.⁸ Among the remaining 30 percent, almost all the patients have good control of pain with the use of other medications, including lamotrigine, phenytoin, gabapentin, oxcarbazepine, topiramate, baclofen, and clonazepam.^{9,10} Unfortunately, the mean time to recurrence while a patient is receiving pharmacotherapy is approximately one year.¹⁰ This patient's pain was not effectively relieved with carbamazepine and gabapentin, and these medications produced undesirable side effects.

Patients such as this one, with poor control of pain while taking medications, are eligible for surgical intervention. The interventions include percutaneous rhizotomy of the trigeminal nerve¹¹ or microvascular decompression of the nerve.¹² Both types of procedure appear to have a similar short-term efficacy of approximately 80 percent, but the long-term effects of microvascular decompression appear to be superior.¹³ However, since microvascular decompression is a longer, more invasive operation, it is generally believed to be more appropriate for younger patients, whereas a percutaneous rhizotomy is usually preferable in patients older than 70 years.^{14,15}

PERCUTANEOUS RHIZOTOMY

Percutaneous rhizotomy of the trigeminal nerve can be achieved with the use of radiofrequency ablation, a chemical lesion created with ethanol or glycerol, or with balloon compression. The tech-

nique most commonly reported is a radiofrequency thermal lesion, an outpatient procedure that is usually performed with the use of fluoroscopic guidance with anesthesia support. An electrode is passed through a specialized needle into the gasserian ganglion, and a permanent radiofrequency-induced lesion is made. Patients have an area of subtle anesthesia in the affected distribution after successful ablation. The main risk of such ablative procedures is numbness in the ophthalmic division, which can result in loss of the protective corneal reflex and subsequent corneal injury. The treatment can be repeated if symptoms recur.

MICROVASCULAR DECOMPRESSION

Microvascular decompression is performed with the patient under general anesthesia; the procedure typically lasts about three to four hours, and most patients are discharged home within two or three days after surgery. This patient is relatively young and otherwise healthy and hence a good candidate for microvascular decompression, and this is the diagnostic and therapeutic procedure that was performed.

A 2 to 3 cm in diameter suboccipital craniotomy was performed just below the junction of the transverse and sigmoid sinuses. The trigeminal nerve was visualized with the use of a microscope (**Video Clip 1, available with the full text of this article at www.nejm.org**). A loop of the superior cerebellar artery was found to be compressing the nerve. This is the most common finding in cases of trigeminal neuralgia (76 percent of cases); less commonly, another artery is identified (14 percent), or a vein (12 percent).¹² The loop of artery was successfully mobilized away from the nerve and held in place by means of polytef (Teflon) pledgets. The patient had an uneventful recovery and was discharged home on the third postoperative day. At three months' follow-up, he had no facial pain and required no medication.

Ten years after surgery, 70 percent of patients are free of pain without medication. Factors that have been shown to be significant predictors of eventual recurrence include female sex, symptoms lasting more than eight years, compression of the trigeminal root's entry zone by a vein instead of an artery, and the lack of immediate postoperative cessation of pain.¹²

A Physician: How useful is imaging in the diagnosis of trigeminal neuralgia? Vessels may be seen in contact with the trigeminal nerve in persons without pain.

Dr. Barker: I think that nearly all patients who have the clinical syndrome of typical trigeminal neuralgia have a blood vessel compressing the nerve. It is the surgeon's job to find that blood vessel, even if it is not visible on imaging. In my own practice, if I look at the studies before I know which side the pain is on, I find that I can almost never confidently distinguish the normal from the abnormal side. However, it is important to know whether the vertebral or basilar artery is compressing the nerve, since the risks of operation are higher in those instances than when the superior cerebellar artery is involved.¹⁶

Dr. Eskandar: I expect that as imaging studies

improve we will have more reliable measures and more robust sensitivity and specificity.

ANATOMICAL DIAGNOSIS

Left trigeminal neuralgia.

No potential conflict of interest relevant to this article was reported.



A video clip is available with the full text of this article at www.nejm.org. The clip shows the procedure used to decompress the trigeminal nerve.

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