The Role of the Nervus Intermedius in Facial Neuralgia*

Report of Four Cases with Observations on the Pathways for Taste, Lacrimation, and Pain in the Face

ERNEST SACHS, JR., M.D.

Department of Neurosurgery, Dartmouth Medical School, Mary Hitchcock Memorial Hospital, and the Hitchcock Clinic, Hanover, New Hampshire

There is a kind of facial pain that is not tic douloureux which frequently confounds and discourages the physician. Usually this pain is unilateral, comes on at night within an hour or so after sleep, affects mostly males, lasts from a half hour to several hours, and may be associated with ipsilateral lacrimation and nasal engorgement, as first described by Harris in 1926. Such a characteristic clinical picture may represent a separate syndrome, or simply "a particular variety of headache." Many of these patients are relieved by ergotamine drugs given prophylactically as described by Symonds, and others are helped by methysergide. Sometimes the attacks are so frequent and refractory to all medical treatment that surgical treatment is justified.

The many authors who have discussed this subject have given various names to the syndrome. These include atypical facial neuralgia (an all-inclusive term), ciliary or periodic migrainous neuralgia, Sluder's neuralgia, spheno-palatine neuralgia, Horton's erythromelalgia of the head or histaminic cephalgia, cluster headaches, or greater superficial petrosal neuralgia. This varied nomenclature surely indicates the confusion and ignorance regarding the cause of this condition.

Our report concerns four patients, two of whom have been followed for more than 10 years after sectioning of the nervus intermedius. These have been the only cases we have subjected to this operation and appear to represent a syndrome of neuralgia of the nervus intermedius that was relieved by sectioning this much neglected nerve. The predominantly parasympathetic nature of the attacks probably accounts for the variation in symptoms from patient to patient, the diffuse-ness of the pain as compared to true trigeminal neuralgia, the difficulty of diagnosis, and the tendency to classify these patients as neurotic.

Case Reports

Case 1. This 43-year-old woman was first seen in 1951 because of right-sided face and head pain of 7 years' duration. She was emotionally unstable and had suffered from headaches for years. She obtained no relief from ergot derivatives and became addicted to narcotics, having taken as much as 1200 mg of Demerol a day. The pain was not like tic douloureux. It started in the right maxillary area, spread to the entire right face and ear, with unilateral lacrimation and nasal discharge. It lasted from a few hours to as long as 24 hours and occurred during the day or night. She was free from pain for a month or so, and then had "clusters" of severe attacks, each lasting 4 to 8 hours. She had numerous hospital admissions for these attacks, but attempts to relieve her pain and drug addiction were unsuccessful. In 1952, the right facial pain had become associated with a severe lancinating pain in the right ear.

Neurological examination and x-rays of the skull were normal.

Operation. In 1952, postulating that the ear and facial pain might be due to a tic douloureux-like phenomenon in the nervus intermedius, we explored the 7th, 8th, and 9th cranial nerves and nervus intermedius under local anesthesia. All of these nerves appeared normal. They were separately stimulated by touching with a forceps. Stimulation of the nervus intermedius reproduced the pain in the ear and right face; it was therefore sectioned. During this maneuver, as the 7th nerve was being retracted while cutting the nervus intermedius, the patient inadvertently moved because of pain and, to our dismay, the 7th

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nerve was torn. In the course of ascertaining that the hemostasis was complete, when the remaining 8th cranial nerve was touched, she again had ear and face pain. We were so surprised by this finding that the maneuver was repeated a number of times to make sure that she was not perceiving pain by some other means, such as the stretching of blood vessels, dural stimulation, or retraction, but she insisted that it was only touching the 8th nerve which caused the pain. After much thought and discussion with the patient, and with her understanding, this nerve also was sectioned, giving her a permanent unilateral deafness. After this, the pain could not be produced.

A facial-hypoglossal anastomosis was successfully done 1 week later with good recovery of facial motion in 6 months. Her sense of taste was lost on the anterior two-thirds of the tongue on the right.

**Postoperative course.** Since operation 15 years ago, there has been no pain in the ear or face. Drug withdrawal, which had not been possible before, was accomplished.

**Case 2.** This 56-year-old man was admitted to the neurosurgical service in 1952 because of attacks of severe left-sided facial pain once or twice each night for 16 years. Histamine, administered during the course of a study for gastrointestinal complaints in 1948, had produced a typical attack. The attacks usually occurred at night, awakened him soon after falling asleep, and lasted \( \frac{1}{2} \) to 4 hours. The pain was localized to the left cheek and was associated with ipsilateral lacrimation and nasal congestion and a tic-like stabbing pain on the left side of the forehead. There were occasional remissions for a few weeks or months. He had been treated by means of stellate blocks, sphenopalatine blocks, ergotamine drugs, and psychotherapy, to no avail.

A left supraorbital neuroectomy eliminated the tic-like pain but the patient still had the parasympathetic attacks of pain involving the left maxillary area as well as the anesthetic area in the forehead. In June, 1952, a left greater superficial petrosal neuroectomy was carried out; the pain did not disappear immediately, but there was complete relief after several weeks. When the pain returned in 3 years (1955), the left greater superficial petrosal neuroectomy was repeated, at his insistence. Again after some delay, the pain disappeared. He then remained pain-free for 2 years, when the attacks of lacrimation and pain recurred.

**Operation.** This time (1957), in an effort to obtain more permanent relief and a more proximal section of the parasympathetic fibers entering the greater superficial petrosal nerve, we sectioned a normal-looking left nervus intermedius in the posterior fossa.

**Postoperative course.** The attacks again disappeared, and did not recur. It was most curious that the patient did not have the expected loss of taste or loss of steady secretion of tears by the Schirmer test. The 7th nerve was normal, but there was a permanent unilateral nerve deafness, apparently due to retraction of the 8th nerve in the course of exposing the nervus intermedius. He also had an unaccountable postoperative total loss of sense of smell. Lacrimation remains normal, and at age 75, the patient is delighted with his freedom from pain for the past 10 years, after the preceding 16 years of misery.

**Case 3.** For 2½ years, this 65-year-old man had experienced attacks of deep aching pain in the left side of his face and upper and lower gums aggravated by cold drinks. Each attack lasted \( \frac{1}{2} \) to \( \frac{3}{4} \) hour. He had several attacks each week, sometimes several a day, and had never been more than 5 weeks without pain. He was bothered by an upper denture which he had worn for 30 years. The pain, which built up and subsided gradually, radiated to the mastoid and temporal area, the eye, and the angle of the jaw. There was no associated lacrimation, nasal congestion, or pain in the ear. There was no trigger area or tic-like quality. One Carbogot each night at bedtime gave some relief, but the attacks really were resistant to all forms of therapy.

Neurological examination was negative except for a mild, left, conductive type of hearing loss of long duration. Skull films including Stenvers views were negative. The temporomandibular joints both showed some degenerative disease.

**Operation.** Nervus intermedius section was advised but with some reservation because this was not a true case of "cluster" headache. On July 7, 1966, the left nervus intermedius was sectioned under general anesthesia.

**Postoperative course.** The patient was immediately relieved of his pain and went home on the fourth postoperative day. Postoperatively, taste was normal. A quantitative
Schirmer test for lacrimation showed no lacrimation on the left. He has had no pain in the 15 months since operation.

Case 4. A 36-year-old man had had right facial and head pains ("upper half headache") for 5 years, occurring as daily headaches for 6 to 8 weeks of each year. He then experienced the attack which brought him to the hospital; it had lasted 6 months and was a constant, boring, aching pain in the right cheek, eye, forehead, temple, and behind the right ear. It had been variously diagnosed as atypical migraine, atypical facial neuralgia, and tension headache. It did not respond to Cafergot, Sansert, or tranquilizers. The neurological examination and skull films were completely normal. Preoperative tests of taste, hearing, and lacrimation were normal.

Operation. On January 5, 1967, under general anesthesia, using the Zeiss binocular operating microscope, we sectioned the right nervus intermedius. This was the only case in our series to show an abnormality in the cerebellopontine angle, namely, a very large internal auditory artery which lay between the 7th and 8th cranial nerves, completely obscuring the 7th nerve and nervus intermedius. To check for interconnections between the 7th and 8th nerves, the magnification of the microscope was turned up to 40× from the usual 6×, at which time tiny strands could be seen running between the 7th and 8th nerves. We could not be sure whether these strands were nerve fibers or strands of arachnoid or perineurium, but all gross arachnoid had been easily removed from the nerves prior to this observation.

Postoperative course. The patient was immediately relieved of his pain. Lacrimation (Schirmer test) was greatly reduced, and taste was lost on the anterior two thirds of the right side of the tongue. He has been pain-free for the 10 months since operation, which is too short a follow-up to be significant, but at least it can be said that nothing had stopped his constant pain for the 6 months prior to section of the nervus intermedius.

Discussion

A number of interesting and challenging points are brought up by a study of these cases. (Figure 1 shows the classical diagram of the facial nerve and its connections.)

1. How and why has the pain been stopped and not recurred after sectioning the nervus intermedius? We shall not attempt to repeat the complete reviews of the literature now available.17,18 Ramsay Hunt,10 of course, devoted years of his life and many papers to prove that geniculate neuralgia was an affliction involving the nervus intermedius. We, too,14 studied such a case at autopsy. Others have relieved pain in the ear by sectioning the nervus intermedius.3,5,18

In their classical paper in 1932, Chorobski and Penfield4 made fundamental observations on the cerebral vasodilator nerves and their pathway from the medulla, including comments on the pial and intracerebral vascular plexus. In detailed histological studies of the nervus intermedius, they found it contained two distinct bundles of nerve fibers. One was a large bundle of myelinated fibers that accompanied the motor fibers of the 7th nerve into the geniculate ganglion and sent no fibers to the petrosal nerve; the other was a small entirely separate bundle of unmyelinated fibers, which went through the geniculate ganglion without interruption and was continuous with the greater superficial petrosal nerve. This had been described by Cajal19 and others. Chorobski and Penfield4 stated that there were no nerve cells in this bundle nor any connection with the cells of the geniculate ganglion. Section of the nervus intermedius or the greater superficial petrosal nerve prevented ipsilateral (parasympathetic) dilatation of cerebral arteries when the 7th or 10th nerves were stimulated proximally on either side.

The greater superficial petrosal nerve, being a mixed nerve,2,11,12 contains sensory sympathetic afferents from the internal carotid nerve as well as parasympathetic secretory motor efferents to the lacrimal gland and nasal mucosa, and vasodilator fibers to the nasal mucosa which synapse in the sphenopalatine ganglion. Perhaps the pain relief following nervus intermedius section is due to the interruption of vasodilator efferents. It seems improbable that interruption of the sympathetic fibers in the nervus intermedius and the greater superficial petrosal nerve is a factor, since cervical sympathectomy has been so ineffective in this condition.4 This nerve then could be the pathway that mediates the parasympathetic pain of Horton’s ("histaminic") or Gardner’s ("petrosal") neuralgia.
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Since there is no synapse between the nervus intermedius and the greater superficial petrosal nerve, the question arises as to why there has been no regeneration of the nervus intermedius or return of the symptoms after cutting it in any of our cases, as there is after cutting the greater superficial petrosal nerve. The answer may be that the nerve fibers cannot "find their way back" to the nucleus (solitarius) in the brain stem as with retrogasserian section of the fifth nerve. The delay in disappearance of the pain noted after each preliminary operation in Case 2 has been observed by Gardner and others. It is unexplained, but may be due to delayed generation of the postganglionic nerve, which may still conduct until atrophy has occurred. The time interval would fit this hypothesis.

2. Why is taste preserved in some cases? Contrary to expectation, the patient in Cases 2 and 3 did not lose the sense of taste on the anterior two-thirds of the ipsilateral side of the tongue after the nervus intermedius had been sectioned. Gardner found this in one of his cases and felt he had divided the nerve. Some fascinating and forgotten observations by Bischoff in 1865, corroborated by White and Sweet, may explain this phenomenon. Ernst Philipp Eduard Bischoff won a prize in 1863 for an essay presented before the Faculty of Medicine in Munich under the title, "Mikroskopische Analyse der Anastomosen der Kopfnerven" (Microscopic Analysis of Anastomoses of Cranial Nerves). Bischoff reviewed the literature on this interesting subject, and reproduced over 100 drawings of his own microscopic dissections in which he "teased" apart the nerves. He paid particular attention to anastomoses between the 7th and 8th cranial nerves and the nervus intermedius of Wrisberg (Fig. 2) and quoted some 14 earlier authors who had also seen these anastomoses. Despite some typographical errors, Bischoff's drawings are clear, and

Fig. 1. Classical diagram of the 7th nerve and its connections indicating why greater superficial petrosal neurlectomy is an incomplete section of the nervus intermedius components. It also shows why taste and lacrimation are usually lost when the nervus intermedius is cut. (Courtesy of Lea and Febiger. Publishers, Gray's Anatomy, 28th ed.)
Fig. 2. Bischoff's dissections of the 7th and 8th nerves showing anastomotic fibers: a = the facial nerve, b = the auditory nerve, e = the nervus intermedius, and d = the genu of the facial nerve with the origin of the greater superficial petrosal nerve. (Reproductions from Bischoff, 1865. Note his errors in labeling Figs. 4, 5, and 7.)

the anastomosing strands from one nerve to the next are clearly delineated (note particularly Bischoff's Figs. 4, 5, and 7). Chorobski and Penfield\(^2\) and White and Sweet\(^7\) have confirmed the existence of these fibers which we have also described in Case 4.

Figure 3 presents a possible explanation for the preservation of taste after cutting the nervus intermedius in our Cases 2 and 3, as in Gardner's case.\(^6\)

3. Are there pain fibers in the 8th nerve? Stimulation of the 8th nerve at the operating table in Case 1 caused pain in the ear after the nervus intermedius had been cut. This was eliminated after sectioning the 8th nerve. This unorthodox finding was very hard to explain. A number of distinguished neuroanatomists and neurophysiologists whom we queried did not know of any pain fibers in the 8th nerve, and we assumed that there had been some error in our observation. However, upon finding that Bischoff\(^1\) in 1865 had noted anastomoses between the 7th and 8th nerves, and that the vestibular portion of the 8th nerve may carry part of the nervus intermedius, that Chorobski and Penfield\(^2\) noted anastomosing branches between the 7th and 8th nerves, and that White and Sweet\(^7\) had confirmed the existence of these fibers, we felt that perhaps we had not been wrong after all. We therefore suggest that the 8th nerve may carry the "pain" fibers of the nervus intermedius. In Case 1, stimulation of the 8th nerve reproduced pain after the 7th nerve and nervus...
intermedius had already been cut; section of the 8th nerve stopped that pain. Referring to the hypothetical scheme in Fig. 3, we can postulate that the pain fibers carried by the nervus intermedius in Case 1 had escaped being cut because they anastomosed proximal to the point where it was sectioned. These fibers may have been traveling with the 8th nerve and were therefore stimulated when this nerve was touched, and were interrupted when the 8th nerve was sectioned.

4. Why does normal lacrimation sometimes persist after section of the nerve? The patient in Case 2 still had normal tearing in the ipsilateral eye after section of the nervus intermedius had relieved the pain. The nervus intermedius classically is thought to carry the visceromotor fibers to the lacrimal gland. Furlow noted in his well-documented case of tic douloureux of the nervus intermedius that, although taste was eliminated, the patient still had normal tearing. He reasoned that "another pathway for lacrimation must exist", but did not propose one. It is possible that the anastomosing fibers from the 7th and 8th nerves mentioned above provide this pathway, which may also carry afferent fibers for taste and pain.

It is important to realize that this operation carries serious risks and should not be undertaken lightly. These observations are reported to make the facts available. Their interpretation is open to question.

Summary

We have reported four cases of intractable face and head pain, relieved by section of the nervus intermedius. These cases may represent a syndrome of nervus intermedius neuralgia. Evidence from these cases and the related literature has been presented to support an hypothesis that in some cases anastomotic fibers between the 7th and 8th cranial nerves and nervus intermedius may contain afferent and efferent fibers for taste, pain, and lacrimation.

Finally, we have emphasized the dangers of the operation and cautioned that it must not be considered a panacea for "atypical facial neuralgia." The conclusions cannot be definitive, and further experimental work on this subject is necessary.

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References


