THE TAARNHOJ* OPERATION:

RELIEF OF TRIGEMINAL NEURALGIA WITHOUT NUMBNESS

W. JAMES GARDNER, M.D. and J. PORTUGAL PINTO, M.D.
Department of Neurological Surgery

TAARNHOJ[1] in 1952 reported ten consecutive patients with trigeminal neuralgia who were treated by dividing the dural sheath enclosing the sensory root of the gasserian ganglion without dividing the nerve itself. This procedure afforded these patients relief of their tic douloureux without resultant anesthesia of the face. The reasoning which led Taarnhoj to attempt this procedure was suggested by the following case.

In April 1951 Taarnhoj observed a 31 year old man with typical trigeminal neuralgia of the third division. Because of the patient's age and the location of his pain, he suspected that the neuralgia was caused by an epidermoid in the right cerebellopontine angle, as had been previously reported by Olivecrona.[2] At operation an epidermoid about the size of a hazelnut was found which was compressing the trigeminal root. The epidermoid was removed and the trigeminal root was left intact. When last seen seven months after operation, the patient had no pain and had normal sensation in the face.

This experience led Taarnhoj to suspect that idiopathic trigeminal neuralgia might also be due to compression of the root of the nerve. In studying the anatomy of the nerve it appeared to him that the most likely spot where compression might occur was in the narrow channel formed by the dura as it passes over the upper margin of the petrous bone. Therefore, he decided to treat patients with trigeminal neuralgia by dividing the dural sheath enclosing the root and ganglion without dividing the root itself. All of his patients had relief of their tic pain when last seen from one to eight months after the operation.

Love[3] reported a case of a patient treated by this method in which an extradural approach instead of the intradural method of Taarnhoj was used.

We were not eager to try this new form of treatment because we doubted that it would stand the test of time. Everyone who has treated tic douloureux has seen many forms of therapy enthusiastically advocated in a preliminary report only to find that the author advocating the new treatment has found his enthusiasm waning about the time the article appeared in print. However, in December 1952 a patient appeared and requested "the new operation for trigeminal neuralgia which did not produce numbness." Nine years before this admission, the patient had had a total resection of the left sensory root for tic douloureux. Four and a half years later he developed tic douloureux on the

* *Pronounced "Tarnoy"*

right side, and on this side a partial resection of the sensory root afforded relief. A partial instead of a complete rhizotomy was performed because the patient complained so bitterly of the left facial numbness which followed the first operation and of the impossibility of chewing food on this side. In July 1952 the tic recurred on the right side. He had by this time developed definite symptoms and signs of multiple sclerosis which was undoubtedly responsible for his tic douloureux. In spite of extremely severe pain this patient was still unwilling to accept numbness of the right side of the face in exchange for relief. The physician who was treating his multiple sclerosis suggested "the new operation which would not produce numbness," and the patient wished to have it done. With this stimulus it was decided to apply Taarnhoj's procedure in this case, and in a series of patients with idiopathic trigeminal neuralgia.

In the past two months this operation has been performed upon nine patients with trigeminal neuralgia. We were surprised to find that not one of these patients has experienced a single paroxysm of trigeminal neuralgia after recovering from the anesthetic of the operation. Some of these patients had areas of mild sensory impairment in the trigeminal distribution apparently due to the trauma of dissecting the dura from the ganglion sheath and sensory root. As a rule this sensory loss cleared within a few days following the operation. The first patient operated upon had a mild postoperative aphasia which persisted for several days. In this case the transdural technic advocated by Taarnhoj was employed. In the subsequent cases the extradural approach devised by Frazier was employed and the dura was not incised until the sensory root was exposed. This approach, advocated by Love adds to the safety of the operation. Incision of the dural sheath is a more difficult technic than the Frazier-Spiller operation of resection of the sensory root. Also, it entails some risk of injury to the fourth cranial nerve, but if the results are lasting, the technic will be perfected, the risks minimized, and the numbness and painful paresthesias which sometimes follow the Frazier-Spiller operation, will be avoided.

Why does this procedure relieve the pain of tic douloureux? We have not opened the dural sheath over the ganglion itself but merely over the sensory root, and there seems to be adequate room in the sleeve for the fibers of the root. Furthermore, patients with tic douloureux seldom show evidence of impairment of sensory function as would be expected if the root were being compressed; nor does their pain resemble the pain of sciatica produced by compression of a lumbar nerve root by a protruded intervertebral disk. Tic douloureux is limited to the fifth nerve except for an occasional occurrence in the distribution of the glossopharyngeal nerve, and an extremely rare occurrence in the sensory root of the facial and of the vagus nerves.

The relief of tic douloureux by Taarnhoj's operation offers fascinating grounds for speculation regarding the etiology of this unusual type of pain. We would like to advance the theory that the pain of tic douloureux is due to the development of an artificial synapse in the sensory root fibers where the nerve crosses the apex of the petrous bone. This artificial synapse occurs as

the result of the demyelinizing processes and the development of sagging of the tentorium which accompany advancing age. Tentorial sag undoubtedly occurs with age as a result of the upright posture which man has adopted. The sagging of the tentorium where it merges with the roof of the dural sheath transforms the normal oval-shaped dural foramen which transmits the nerve into a relatively flat slit. This may be accentuated also by mild platybasia due to the osteoporosis which frequently occurs with the aging process. With this change in the shape of the dural foramen, the filaments of the sensory root, normally dispersed in the arachnoid sheath distended with cerebrospinal fluid, are held in contact with one another. Contact of the various nerve elements in the sensory root, together with demyelinization of some of the axis cylinders, permit short circuiting of the action current which accompanies the transmission of the nervous impulse, with the formation of an artificial synapse.

Two articles are especially pertinent to the elaboration of this theory. In 1944 Granit, Leksell and Skoglund[4] showed that an artificial synapse is produced in a mixed nerve by injury or pressure on the nerve. They found that this pressure may be so mild as not to produce interference with normal nerve transmission, and yet due to loss of the insulating myelin sheath, a portion of the impulse may pass from an efferent to an afferent fiber. For instance, in causalgia they believe that the efferent sympathetic impulse reaches the point of compression of the nerve and jumps across to the naked axis cylinder of the pain fiber. Thus the efferent sympathetic impulse is converted into an afferent pain impulse. According to Lewy, Groff, and Grant,[5] the trigeminal nerve in the cat, in addition to its well known somatic afferent fibers and the efferent fibers to the muscles of mastication, contains also some autonomic efferents which are cholinergic in character and therefore, probably parasympathetic. These supply muscle fibers in the tongue, the cat's whiskers, the upper lip, and the elevator of the eyelid. These two contributions together with the fact that trigeminal neuralgia is relieved by Taarnhoj's operation, suggest the following theory to explain the mechanism of tic douloureux.

A tactile stimulus originating in the trigger zone, commonly located in the whisker area, is carried in the somatic afferent fiber to the brain stem. Here it forms a reflex connection with autonomic cells which Lewy, Groff, and Grant, have shown are probably in the mesencephalic nucleus of the fifth nerve. This results in an efferent impulse which travels in the autonomic fibers accompanying the sensory root. When it reaches the artificial synapse at the point of compression of the nerve root, this impulse is short circuited into the naked pain fiber, and is reflected back into the brain stem as a painful impulse.

Thus we believe that tic douloureux, like causalgia, is the result of cross circuiting of autonomic impulses into somatic pain fibers. Tic douloureux is due to a preganglionic parasympathetic-sensory synapse while causalgia is due to a postganglionic sympathetic-sensory synapse. The difference in the character of the two types of pain may be explained by the fact that the sympathetic discharge is diffuse and prolonged while the parasympathetic discharge is discrete and of brief duration.

This theory explains beautifully the mechanism of the trigger action, and also why the pain of tic douloureux may be relieved by blocking the nerve peripheral to the ganglion even though the site of the lesion is proximal to the ganglion. It explains why the whisker area is so commonly a trigger zone. It explains why the pain of tic douloureux is limited to the fifth and ninth nerves. It explains why the paroxysms of glossopharyngeal neuralgia are more apt to be precipitated by tart flavors or even, in some instances, by merely thinking of them. It explains the association of tic douloureux with multiple sclerosis and why it occurs most frequently in the elderly. It explains how tic douloureux can be relieved by Taarnhoj's operation.

Fortunately, Taarnhoj is a young man. If he were as old as the senior author of this article, he would have realized that his idea couldn't possibly work and he wouldn't have tried it.

References

1. Taarnhoj, Palle: Decompression of the trigeminal root and the posterior part of the ganglion as treatment in trigeminal neuralgia; preliminary communication. J. Neurosurg. **9**:288-290 (May) 1952.
2. Olivecrona, H.: Cholesteatomas of cerebello-pontine angle. Acta. Psychiat. et neurol. **24**:639-643, 1949.
3. Love, J. G.: Decompression of the gasserian ganglion and its posterior root; a new treatment for trigeminal neuralgia; preliminary report. Proc. Staff Meet. Mayo Clin. **27**:257-258 (July 2) 1952.
4. Granit, R., Leksell, L. and Skoglund, C. R.: Fibre interaction in injured or compressed region of nerve. Brain **67**:125-140 (June) 1944.
5. Lewy, F. H., Groff, R. A. and Grant, F. C.: Autonomic innervation of face; experimental study. Arch. Neurol. & Psychiat. **39**:1238-1249 (June) 1938.