

THE USE OF CERVICAL PLEXUS BLOCK IN THE DIAGNOSIS AND MANAGEMENT OF ATYPICAL CEPHALALGIA OF CERVICAL ORIGIN * † ‡

PAUL S. PENTECOST, M.D., AND JOHN ADRIANI, M.D.

New Orleans, Louisiana

HEADACHE or head pain is one of the most common complaints encountered in medical practice. The cause of the pain is usually obvious and appropriate treatment affords relief. There are, however, many patients with head and face pain, whose complaints do not fit into any of the classifications in common usage. The pain they describe is "atypical." Since such pain does not conform to accepted anatomical and physiologic teachings, it is often assumed that the pain is psychic in origin. No doubt emotional factors play an important part in pain problems. Still, anyone with prolonged pain invariably becomes emotionally upset no matter how stable he may have been before its onset.

There are many causes of headache or head pain. One particular cause which has not been emphasized is that certain head pains have their origin in the neck.

REVIEW OF THE LITERATURE

Telling (1) in 1911 described indurative headache related to fibrositis of the posterior cervical area. Patrick (2) in 1918 described head pain originating in the cervical region and radiating to the frontal areas of the head; exacerbations were related to exertion, rotation of the head and coughing. Gunther and Kerr (3) in 1929 described head pain due to arthritis of the cervical spine. Holbrook (4) in 1927 described a type of occipital head pain, radiating to the temple and frontal areas, which was due to hypertrophic arthritis of the upper cervical spine. Cyriax (5) in 1938 mentioned head pain originating in the neck. Hartsock (6) in 1942 also described head pain associated with cervical arthritis. Kelly (7) in 1942 reported 40 cases in which pain in the head due to intractable fibrositic or post-traumatic headache in the occipital and frontal areas was relieved by procaine injections. Jones and Brown (8) in 1944 likewise described a syndrome of head pain in which partial relief could be obtained by procaine injections in the cervical region.

* From the Department of Anesthesia, Charity Hospital, and the Department of Surgery Louisiana State University School of Medicine, New Orleans, Louisiana.

† Read before the annual meeting of the American Society of Anesthesiologists, Inc. Cincinnati, Ohio, October 26, 1954.

‡ Accepted for publication February 8, 1955.

Campbell and Parsons (9) in 1944 were able to induce pain by injecting 6 per cent saline solution into the cervical region. This pain was reproduced in the occipital and frontal areas in 85 per cent of cases. Davis (10) in 1945 showed that headache was a frequent symptom following injuries to the cervical spine. Little (11) in 1946 reported a group of patients with chronic head pain who had received various diagnoses. There was x-ray evidence of loss of cervical lordosis. Raney and Raney (12) in 1951 reported herniated cervical discs as a cause of head pain, and there are other reports on this subject too numerous to list here. Of course the converse can happen too. Numerous reports in the literature describe pain in the cervical area and in the ear resulting from pathologic disturbances in the nose, sinuses, teeth, tongue, pharynx and larynx.

In 1897 R. Zander (13) described in detail, careful and painstaking dissections of the nerves supplying the skin of the head. He dissected the trigeminal and the occipito-cervical nerves, using different specimens for each dissection. He traced each nerve fiber with a magnifying lens until he could no longer see the fiber well enough to follow it. At this point he took sections and found that the nerve fiber still consisted of from 6 to 20 bundles. From this work he concluded that the area of innervation of both the trigeminal and cervical nerves is so inconstant that no two heads are alike. Usually the right and left sides of the same head were not the same. He also noted that the distribution of the cervical nerves is much larger than is customarily assumed. The great occipital nerve seldom ends at the vertex and usually goes on as far as the forehead.

Mayfield and Hunter (14) reported cases in which sections of C2 or C2 and C3 showed peculiarities in sensory distribution. Islands of pain remained throughout the areas supplied by these nerves. Touch was present over the entire area and, in several cases, there was overlapping into the trigeminal field. It appears that the trigeminal nerve does not totally innervate as wide an area as has been assumed. In reality, as others have stated, the trigeminal nerve exclusively innervates only the central part of the face, corresponding to the area which is not bearded in the male. It appears also that the upper cervical nerves in some individuals, if not all, extend further forward than is usually taught.

This offers a logical explanation for some of the cases of atypical head and face pain. The cervical nerves form both an anterior and a posterior plexus. The ganglia of the first cervical nerve may be absent. The posterior root of the first cervical nerve is smaller than the anterior one, and in 8 per cent of subjects is entirely absent. The first and second cervical nerves emerge behind the lateral articular masses of the atlas and axis. The roots are not protected posteriorly by pedicles and facets which complete the root canal elsewhere in the vertebral column. The ganglia of these two nerves, instead of oc-

cupying a well-protected space in vertebral foramina, lie upon the vertebral arches of the atlas and axis. There is relatively little motion between the atlas and the occipital bone, since this joint serves mainly for forward and backward motion. The joint between the axis and atlas, however, is highly movable and the anterior primary branch of C2 is under normal circumstances subjected to considerable stress. The posterior primary branch of the second cervical nerve emerges between the rami of the atlas and the axis just posterior to the atlanto-axial joint. Being in such a location it may be traumatized by movements of the head which tend to proximate these bony surfaces. The second cervical roots supply sensation to a large portion of the scalp and overlap into the facial area. It is not unreasonable to assume that pathologic involvement of these roots may be responsible for some cases of head and face pain since they are subject to trauma.

Campbell and Parsons (9) state that intercommunications exist between the cervical plexus and the 7th, 8th, 9th, 10th, 11th and 12th cranial nerves and the superior cervical sympathetic ganglia. Huntington (15) in 1897 described the formation and distribution of the cervical plexus in monkeys. He noted that branches of the 2nd cervical nerve either join the hypoglossal nerve or enter its sheath and continue in a peripheral direction, passing with the nerve to the tongue and floor of the mouth. This may explain why some patients notice an area of anesthesia in the floor of the mouth when the 2nd cervical nerve is blocked. In one of our cases pain in the homolateral side of the tongue and floor of the mouth was relieved by blocking the 2nd cervical nerve. Prior blocking of the mandibular nerve and section of the trigeminal nerve had failed to relieve the pain. Wilfred Harris (16) in 1950 reported that in his 40 years of practice he had found it difficult at times to block the 3rd division of the trigeminal nerve satisfactorily.

ANALYSIS OF CASES

Our patients with head and face pain whose cases are presented in this report were referred to us at the Pain Clinic of Charity Hospital. Each had been studied in other clinics, either as out-patients or as in-patients. In all cases, other types of therapy had been tried with disappointing results. The symptoms described were atypical and did not conform to any patterns or classifications of the usual types of head pain.

These patients were first given *diagnostic nerve blocks* in an effort to determine the source of the pain. The various divisions of the trigeminal nerve were blocked because these patients had discomfort in what is ordinarily assumed to be the trigeminal area. In spite of successful blocking of appropriate branches of the trigeminal nerve however, the pain persisted or it was only slightly relieved. Our attitude, at first, was therefore that these patients were simply psycho-

neurotic. A review of early cases, however, disclosed a rather consistent set of symptoms. Many of these patients had had no difficulty prior to some accident in which the neck had been the site of trauma. In some cases the injury had been slight and practically forgotten.

Symptoms.—The pain frequently began in the sub-occipital area and spread upward over the occiput. In nearly all our cases the pain was unilateral. As the pain increased in severity, it spread to the forehead, the temporal region, behind the homolateral eye and into the ear. The pain was preceded in some instances by paresthesias in the occipital and temporal areas. The sub-occipital pain usually was described as dull, deep and aching. The pain in the forehead and temporal areas was of a different character, being either burning or sharp, lancinating pain. The attacks often occurred suddenly and frequently followed some movement of the head. Some patients complained that the attacks regularly awakened them in the early hours of the morning. In some instances the attacks were accompanied by giddiness or unsteadiness and occasionally by nausea. Many of the patients had a tendency to squint the homolateral eye during an attack of severe pain. Frequently the eye had a tendency to lacrimation. In the intervals between the severe attacks, the sub-occipital area and the upper neck felt uncomfortable.

Physical Examination.—On physical inspection, an area just medial to the mastoid process and another approximately 1.5 cm. lateral to the occipital protuberance were usually found to be the areas of greatest discomfort. These two areas corresponded to the courses of the lesser and greater occipital nerves, respectively. Pressure on these two points frequently elicited the pain in the forehead and temple. Pressure over the lateral side of the neck approximately 1.5 cm. below the tip of the mastoid process reproduced the entire pain syndrome. In some cases paresthesias over the occipital area were produced. Having the patient look up and turn his face toward the painful side often reproduced either the pain or the paresthesia. There was a tendency for the posterior cervical muscles to be spastic. X-rays of the cervical spine disclosed a diminution of the normal lordotic curve.

Results of Upper Cervical Nerve Block.—After failing to obtain beneficial results from trigeminal nerve block, we decided to block the upper cervical nerves in these cases. The first attempt was most gratifying. In performing the block the pain syndrome would be reproduced when the needle was in close proximity to the 2nd cervical nerve. After injecting the local anesthetic drug the pain promptly subsided. Most patients stated that the pain in the forehead disappeared first. Within a short time the sub-occipital pain also disappeared. Later we found that patients with pain in the temporal and mandibular areas or in the ear were relieved by blocking the 3rd cervical nerve in addition to the second. Patients with forehead pain which was relieved by blocking the 2nd cervical nerve noticed that their

foreheads seemed partially anesthetized. Some noticed an area of numbness in the floor of the mouth on the same side. Nearly all noticed and were annoyed by a numb area on the posterior pharyngeal wall, which some said felt like a wad of cotton in their throat. Blocking the greater and lesser occipital nerves was tried alternately with C2 and C3 blocks in several of these cases. These individuals volunteered that the relief was much more complete when the block was done in the side of the neck.

Cervical Plexus Block.—In view of these findings we decided to pursue the problem further. Prior to blocking, the pain and touch sensations were checked by use of a pin and camel's hair brush. The two sides of the face and scalp were carefully compared. After the needles were placed and their position checked by anterior, posterior and lateral x-ray films, the local anesthetic solution was injected. Following the block, the face and scalp were rechecked. The areas of anesthesia and diminished pain and touch sensations were again mapped. If Horner's syndrome appeared, due to accidental blocking of the superior cervical sympathetic ganglion, the mapping was postponed and done at a subsequent time. The area of anesthesia corresponded closely to that of the textbook distribution of the upper cervical nerves. In addition, there was consistently an area anterior to this which became partially anesthetized and which was well defined when the two sides were compared. In all cases in which forehead pain was relieved by a cervical block, the forehead on that side was less sensitive when compared to the other side. In some instances this area extended to the eyebrow. There was no difference prior to the block and after the effects of the local anesthetic receded. In patients who had pain no farther forward than the temple no difference in sensation could be elicited in the forehead after the block.

Illustrative Case.—One of our typical patients gave this sort of a history. The patient, J. W., was a 63 year old negro male. He was not relieved by a trigeminal section for pain in the right mandibular area, right side of his tongue and floor of the mouth and gum. Examination revealed only partial anesthesia of the right side of his face. Following a right C2 and C3 block, his face became totally anesthetic on that side and the pain, including that in his tongue and floor of his mouth, disappeared. Complete relief was obtained for varying periods of time by blocking these two nerves.

RESULTS IN 63 CASES

Thus far we have studied 63 patients. Six of this group were not benefited by any of the blocking procedures. Ten were made more comfortable by blocks of C2 and C3 but were not entirely relieved. The remainder were completely or almost completely benefited. Their transformation from dejected, irritable individuals, who obviously

were experiencing discomfort, to happy and pleasant individuals was gratifying. Sweating tests or iodine starch tests were not carried out. Stellate ganglion blocks were performed in some of the early cases, but with disappointing results. In some cases the head pain was aggravated by the stellate blocks.

TECHNIQUE

The technique of cervical blocking was that described by Rovenstine and Werthiem (17). Lidocaine was used as the local anesthetic in the first block. When multiple blocks were performed, the lidocaine was followed by 5 per cent ammonium sulfate. A longer period of anesthesia was obtained than when the local anesthetic was used alone. The longer lasting drugs with destructive actions such as alcohol, effocaine,[®] and 6 per cent phenol was scrupulously avoided. We felt we were not justified in injecting these agents into this vital area since they are known to have destructive power.

COMMENT

We are presenting these results to indicate primarily the diagnostic value of cervical plexus block in differentiating atypical head pain from that due to lesions involving the 5th, 7th, 9th, and 10th nerves. Obviously the pathologic disturbance causing the pain is not cured by the block. In a number of our cases in which the diagnosis of headache was ascribed to the neck, it was found that a cervical disk was causing the pain and operation was advised. Other patients were referred to the orthopedic services for application of traction or other physical therapeutic procedures.

In some of the cases one block gave relief for weeks. Apparently there is a breaking up of the vicious circle in the production of such head pain, although we are still puzzled as to its probable mechanism. Nonetheless, there were some patients, 5 out of 25, who were relieved by one block. It is possible that other nerves, such as the glossopharyngeal and the superior-laryngeal may be partially or completely blocked by diffusion of the anesthetic drug, the relief thus obtained being credited to the cervical block. We attempted to avoid diffusion by using a small amount of solution and by injecting posterior to the transverse process of C2 and C3. However, we feel certain that branches of the trigeminal nerve were not blocked by diffusion of the drug.

SUMMARY

Overlapping exists between the upper cervical nerves and the cranial nerves in the innervation of the head and face. Lesions in the neck, particularly those of the cervical vertebrae, give rise to head pain. This head pain is often believed to arise in the head and is ascribed

to lesions in the skull or afflictions of the trigeminal nerve. The role and value of cervical plexus block in the differential diagnosis and treatment of atypical cephalalgia is described.

REFERENCES

1. Telling, W. H.: Nodular Fibromyositis, an Everyday Affection, and Its Identity with So-called Muscular Rheumatism, *Lancet* 1: 154 (Feb.) 1911.
2. Patrick, H. T.: Induration on or Rheumatic Headache, *J.A.M.A.* 71: 82 (July 13) 1918.
3. Gunther, L., and Kerr, W. J.: Radicular Syndrome in Hypertropic Osteoarthritis of Spine; Analysis of 30 cases, *Arch.Int. Med.* 43: 212 (Feb.) 1929.
4. Holbrook, C. S.: Headache due to Arthritis of Cervical Spine, *South.M.J.* 20: 222 (March) 1927.
5. Cyriax, J.: Rheumatic Headache, *Brit. M.J.* 2: 1367 (Dec. 31) 1938.
6. Hartsock, C. L.: Headache from Arthritis of Cervical Spine, *M. Clin. North America* 24: 329 (March) 1940.
7. Kelly, M. (Perth): Headache, Traumatic and Rheumatic: Cervical Somatic Lesion, *M.J.Australia* 2: 479 (Nov. 28) 1942.
8. Jones, O. W., Jr., and Brown, H. A.: Treatment of Post Traumatic Head Pain: *J.Nerv. & Ment. Dis.* 99: 668 (May) 1944.
9. Campbell, D. G., and Parsons, C. M.: Referred Head Pain and its Concomitants; Report of Preliminary Experimental Investigation with Implications for Post-traumatic "Head" Syndrome, *J. Nerv. & Ment. Dis.* 99: 544 (May) 1944.
10. Davis, A. G.: Injuries of Cervical Spine, *J.A.M.A.* 127: 149 (Jan. 20) 1945; Correction 127: 936 (April 7) 1945.
11. Little, S. C.: Headache Associated with Injuries of Cervical Spine, Preliminary Report, *M.J.A. Alabama* 16: 110 (Sept.) 1946.
12. Raney, A. A., and Raney, R. B.: Facial Neuralgia and Headache, *Ann.West.Med. & Surg.* 2: 169 (April) 1948.
13. Zander, R.: Contributions to Knowledge of Skin Nerves of Head, *Anatomische Hefte* 9: 1 (Jan.) 1897.
14. Hunter, C. R., and Mayfield, F. N.: Role of Upper Cervical Roots in Production of Pain in Head, *Am.J.Surg.* 78: 743 (Nov.) 1949.
15. Huntington, G. S.: On Some Points in Formation and Distribution of Cervical Plexus in Cynomorphous Monkeys, *Tr. N. Y. Acad. Sci.* 16, March, 1897.
16. Harris, W.: Rare Forms of Paroxysmal Trigeminal Neuralgia and Their Relation to Disseminate Sclerosis, *Brit.M.J.*, 2: 1015 (Nov. 4) 1950.
17. Adriani, J.: Techniques and Procedure of Anesthesia, Springfield, Ill., Charles C Thomas 1946.