A REVIEW OF CERVICOGENIC HEADACHE
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Preamble

This type of headache is perhaps the last known and yet the most common of chronic headaches.

A simple explanation of cervicogenic headache is to consider this as headache ensuing from the cervical spinal structures such as cervical ligaments, cervical zygapophyseal joints, cervical discs and/or annulus fibrosus, and cervical muscles. The official definition as utilized by the North American Cervicogenic Headache Society and which is proposed for the 3rd edition of the International Association for Study of Pain, Taxonomy of Chronic Pain Conditions, is quoted below:

DEFINITION:
Referred pain perceived in any region of the head caused by a primary nociceptive source in the musculoskeletal tissues innervated by cervical nerves.

Clinical Features:
1. Pain, other than lancinating pain, typically dull or aching in quality, located in the occipital, parietal, temporal, frontal or orbital regions of the head, or in any combination of these regions, unilaterally or bilaterally.
2. Some indication of an abnormality in the cervical spine such as neck pain, focal neck tenderness, impaired cervical motion, aggravation of the headache by neck movements or a history of neck trauma.

Diagnostic Criteria:
1. Identification by clinical examination or by imaging of a cervical source or cause of pain known on the basis of valid, antecedent studies to be reliably associated with the genesis of head pain; or
2. Complete relief of head pain following controlled, local anaesthetic blocks of one or more cervical nerves or structures innervated by cervical nerves.
Pathology:
Not yet determined but may involve injuries or other diseases affecting the bones, joints, ligaments or muscles of the cervical spine. Such disorders may not be readily apparent on conventional imaging studies because of the limited resolution of the techniques available.

Remarks:
This rubric embraces referred pain to the head seen in otherwise identifiable disorders of the cervical spine such as atlanto-axial rheumatoid arthritis; but if a specific condition can be reliably diagnosed there is no need to invoke the rubric of "cervicogenic headache".

Introduction:
Chronic headaches (more than 15 days a month for over six months) are not uncommon. They occur in about 5% of the population.

One of the biggest barriers to effective treatment of headaches in general is that the cause of headaches is simply not known in most cases. A small percentage of cases are clearly caused by tumors or intracranial vascular damage, but the cause of the commonly diagnosed headaches such as migraine headaches or tension-type headaches has never been ascertained.

In the past 15 years however, a small number of medical scientists began to suspect that damaged neck structures could cause headaches. This body of knowledge has now grown, thanks largely to the work of Bogduk and Sjaastad.(1,6,9-18)

Blume, and more recently Gawel and Rothbart (7,8,23) have described their clinical experiences. And Apkarian has demonstrated the anatomical connection that permits neck pain to be perceived as headache(9).
Cervicogenic headache will be discussed under the following headings:

1. Incidence of Cervicogenic Headaches.
2. Structural Anatomy.
4. Symptoms and Signs.
5. Diagnostic Tests.
6. Available Treatment.

1. INCIDENCE OF CERVICOGENIC HEADACHES
The incidence of cervicogenic headaches is unknown. It is because until recently the medical profession has not been aware of this entity. Physicians are not taught to consider or explore neck structures when investigating headaches. The result is that what is probably a common condition is only rarely diagnosed.

In our clinic we see about 800 new headache patients per year. Approximately 80% of these patients end up being diagnosed as having cervicogenic headache. Of these patients almost none are referred with this diagnosis. They are usually referred with diagnoses such as tension-type headache and migraine headache and sometimes without a label at all.

2. STRUCTURAL ANATOMY
The muscles supporting the vertebrae and attaching to the base of the skull as well as ligaments (anterior and posterolongitudinal ligaments together with alar ligaments), zygapophyseal joints, and annulus fibrosus, are all highly innervated. The annulus fibrosus which is the portion surrounding the soft central disc material, has been widely overlooked as having powerful innervation, and fissures or tears in this structure are almost impossible to pick up on imaging.

The nerve pathways have been well described by Bogduk\(^{11,15,16}\).

In the upper neck, these nerves travel via the C1 to C4 nerves to the dorsal horn of the appropriate level. Nerve impulses are then transmitted to the ipsilateral and contralateral spinal thalamic tracts. The impulse is then passed through the thalamus to the cortex and thus we have the usual model of how nociceptive pain is perceived.
3. **HOW IRRITATION OF THE NECK STRUCTURES COMES TO BE PERCEIVED AS HEADACHE**

The trigeminal nerve is responsible for facial pain and head pain. One of the trigeminal nuclei, specifically the spinal trigeminal nucleus, extends caudally through the brain stem and becomes contiguous with the dorsal columns down to about the C3 level.

Thus, as the upper three cervical nerves enter the dorsal columns, their fibres synapse with the descending fibres of the spinal trigeminal nucleus. The intermingled impulses then travel to the cortex as described above. The cortex is unable to discern which geographic area the impulses come from, so that impulses from the C1 to C3 neck structures are indistinguishable from trigeminal impulses. In other words we have the classical neurologic condition of "referred pain".

Recently it has been shown that painful impulses from lower cervical structures can also be perceived as headaches. This is probably because impulses from these structures travel cephalad to the level of C2-C3 before entering the spinal cord.

4. **SYMPTOMS:**

There is a strict classification by symptomatology for the various types of headaches. This classification was prepared by the International Headache Society in 1988 and is the usual means by which headachecologists diagnose and compare headaches.

One of the interesting and confusing phenomena about cervicogenic headache is that the symptoms can present as migraine headaches, tension-type headaches, or even cluster headaches. This throws the whole IHS classification into disarray.

After all migraine headaches are thought to arise from the brain and possibly from the brain stem’s structures. Yet many migraine headaches arise from trauma to the neck and if surgical means can be employed to stop impulses from the damaged neck structures, the migraines are relieved.
The same phenomenon exists with headaches presenting the tension-type features or even cluster headache features.

Clearly then it is important to differentiate those migraine or tension or cluster headaches which are arising from some intracranial cause, from those which are arising from damaged neck structures. The approach to treatment will be very different for intracranial headaches versus cervicogenic headaches.

5. **DIAGNOSIS**

This should be carried out using the standard routine of history, physical examination, and investigations.

6. **HISTORY**

The age of onset should be ascertained and also the frequency and duration of the headaches. The relationship of the onset with any neck trauma is very important and should raise the index of suspicion of cervicogenic headache if there is a close relationship.

The character such as throbbing, dull, constant or intermittent, etc., should also be ascertained.

7. **PHYSICAL EXAMINATION**

This always starts with a neurologic examination and especially examination of the cranial nerves to rule out space occupying lesions or cranial nerve lesions.

On examining the neck, the degree of active flexion, extension, rotation, and lateral bending should all be tested.

In cervicogenic headache, the neck is often thrust forward because this is the most comfortable position for the patient. Decrease in flexion raises suspicions of damaged cervical disc or annulus fibrosus. Decrease in extension, should raise suspicions of facet joint disease.
Palpation:
Palpation should include the area of the greater occipital nerve. These nerves are tender in cervicogenic headaches. The paracervical and scalene muscles are usually swollen and are tender in cervicogenic headaches. Palpation of facet joints can be easily learned with proper instruction. These are often tender. And very often an especially tender area gives a good idea of the level at which the facet joint pathology resides.

8. OTHER INVESTIGATIONS

CT scan of the brain:
If not already done, this should be carried out to exclude space occupying lesions.

X-rays, CT myelograms and MRIs:
The problem with all imaging tests is that pathology can exist and not show up on the test. Alternatively pathology may show up but may be unrelated to the pathology which is causing the pain. After all it is well known that x-rays of many people may show degenerative spinal changes, but the patients may be asymptomatic. Thus these are not good tests in identifying the source of pain.

9. DIAGNOSTIC BLOCKS
These are the gold standard in pain conditions, for ascertaining the source of pain.

If a structure is damaged or irritated and is sending pain signals (nociceptive pain), then blockade with local anesthetic will block that pain for the duration of action of the local anesthetic. This is the basis of diagnostic nerve blocks.

The diagnostic nerve blocks utilized are as follows:

1. Occipital nerve blocks:
The greater occipital nerve is the main sensory nerve supplying the C2 nerve. Thus the greater occipital nerve blocks impulses along the C2 nerve. Thus a greater occipital nerve blocks impulses along the C2 nerve. The point of entry to the dorsal horn at the C2 level is a very important relay area for carrying pain impulses. If the occipital block relieves a patient’s headache, this is suggestive of cervicogenic headache.
2. **Facet joint diagnostic blocks:**

Facet damage has been shown by Bogduk\(^{(22)}\) to be the commonest single cause of chronic neck aches. Chronic headaches are often found to also be due to facet damage.

The test is carried out under fluoroscopic control. About \(\frac{1}{2}\) cc of local anesthetic is injected to the nerve supplying the facet joint in question. If relief of the headache is achieved for the duration of action of the local anesthetic, the test is positive. And thus indicates that the facet joint is the source of the headache. It should be noted that because of false positive and false negatives, further testing is required in certain cases. However, discussion of this is beyond the scope of this article.

3. **Provocative and relieving discography:**

As noted above, MRIs do not help in ascertaining whether certain discs are the source of headache and/or neck ache, especially if there is damage of the annulus fibrosus.

The only accurate technique is to inject dye into the suspected disc and see if this provokes the pain that the patient has been complaining of. Then with the needle still in place, local anesthetic should be injected to determine if there is immediate relief of the pain.

This technique was used in the past and fell into disrepute. This was largely because it is a very painful procedure. And because it was often not carried out with good enough technique. However, it is rapidly becoming recognized again as the technique "par excellence" for correlating disc and annulus fibrosus damage with pain.

**TREATMENT**

Unfortunately where there has been severe chronic damage to various structures such as discs, facet joints, ligaments and muscles, these structures will not heal. Thus, the most logical way of relieving the pain is by stopping nociception (pain impulses) from the damaged structures. This can often be achieved by repeated nerve blocks. And when these no longer work, then surgery needs to be contemplated. The following surgical procedures can be used. However, it should be noted that at present we do not have good multicentred controlled outcome studies.
And thus until these have been done we rely on the anecdotal reports of highly experienced surgeons with a large series of patients. This situation is of course, not ideal.

i. **Surgery for facet joint damage:**
   facet joint rhizolysis has been quite widely used in Canada, the U.S., Australia and Europe. The results depend to a large extent on the experience of the surgeons. Most experienced surgeons report about 60% success rate with duration up to two years. At this point the surgery may need to be repeated. Some patients do obtain permanent relief.

ii. **Cervical discotomy and fusion at one or more levels.**
   Many surgeons report good results with this technique where discography was used to ascertain the number of levels requiring surgery.

iii. **Occipital neurotomy procedure.**
   This procedure was pioneered by Blume
   If a diagnostic occipital block relieves the headache for two weeks, then this usually indicates that this procedure will be successful in providing good long term relief. In 600 patients over 15 years, Blume reports about 80% success rate for this procedure.

iv. **C2 Ganglionectomy.**
   In certain selected cases this is the usual operation. Lozano and Rothbart have shown that this is a good procedure for lancinating post-traumatic headaches.

**CONCLUSION**
The knowledge about headache may be the most important and exciting knowledge about headache etiology of this century. It allows us to define structural damage and attempt to treat it. Unfortunately, we are not yet at this stage of having good outcome studies for the surgical procedures and this awaits further investigation. Nevertheless, there is a rich body of anecdotal experience which can give us a good start toward properly controlled outcome studies.
REFERENCES


