

Cervical interbody arthrodesis for the treatment of cervico-brachial syndrome

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The cervico-brachial syndrome is so complex in its etiology that Professor Barcia Goyanes⁴, in a comprehensive analysis, found 24 causes of this syndrome. However in our study we will only refer to those cases in which there is a clear relationship between a vertebral injury and the syndrome as reported by the patient.

CLINICAL SYNDROME

Although the symptoms can become confused, we will divide the main symptoms into 2 large groups.

1. Those in which pain chiefly affects the upper limb, the cervico-scapular region or the corresponding half of the chest.

2. Those in which the neck pain is accompanied by 3 neuro-circulatory symptoms: headaches, vertigo and nausea³¹.

Each of these symptoms may be combined with others. In one case there may be predominance of pain irradiating to the upper limb and headaches and in others predominance of neck pain and vertigo. And so on and so on. It is possible to see many different combinations in patients with complex syndromes caused by the melding and mixing of these symptoms which are, in short, caused by vertebral alterations.

SYMPTOM ANALYSIS

1 Pain irradiating to the upper limb. In the first place, it must be said that this pain allows complete movement of the whole limb. Sometimes the pain is nocturnal, with a tingling sensation that wakes the patient and forces them to change their position in bed or to get up and take some exercise until the sensation passes and there is a decrease in the intensity of the pain. At other times, the pain increases or decreases according to the position of the cervical spine; in some patients the pain is scapular, towards the deltoid region and the dorsal surface of the arm; in others there is pain in the forearm and hand; and in yet others, the pain is

felt on the internal surface of the arm and forearm down to the fingers. This means that the pain does not follow a trunk distribution, from the brachial plexus, but a root distribution, since it is the spinal roots that are directly affected.

2 *Headaches.*- The headaches are of a cervico-occipital type, involving from the mid-parietal region to the frontal region, obliging the patient to close their eyes, although they do not feel sleepy.

3 *Vertigo.*- Vertigo is felt by the patient when making certain head-movements; sometimes when moving the head from side to side and sometimes when moving the head up and down. We can consider the pain of cervical origin when, in addition to the radiographic injuries mentioned below, the central nervous system and ear sensorial system are completely normal on exploration.

4° *Nausea.*- Nausea is almost always related to the presence of vertigo; it is rare to find a cause for nausea other than vertigo in cases of cervico-brachial syndrome. If there should be nausea without vertigo, it is always related to other diseases (Menière syndrome).

If we keep in mind that all headaches without a brain lesion are caused by vasodilation of the cerebral arteries, the headache seen in cervico-brachial syndrome will undoubtedly be of a reflex type and mainly located at the base of the brain, in the circle of Willis, which originates in the vertebral arteries, always affected by some pathological condition of the cervical spine.

The anatomy of this region, although very complex, is well known, and for this reason we will only highlight certain anatomic details of interest which are germane to our hypothesis on the etiology of these cervico-brachial syndromes.

1. The spine, along the length of the spinal canal, decreases in thickness due to the spinal nerves that leave it. However, the spinal canal formed by the vertebrae is, on the contrary, of a more or less constant diameter. The space between the dura mater and the periosteum is filled with adipose tissue and small veins. Therefore, given the larger diameter of the cervical spine, the padding is minimum in the cervical region.

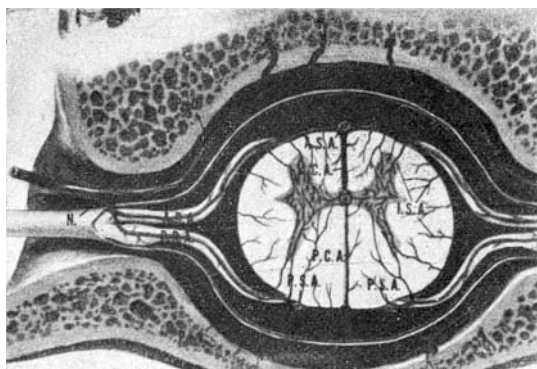


Figure 1. Blood supply of the spinal cord and spinal nerves. It is interesting to see the anatomy of the spinal branch of the vertebral artery. (taken from Netter).

Anteriorly, the dura mater is almost directly against the posterior common vertebral ligament, and beyond that against the posterior facet of the discs.

2. The spinal nerves, when they exit through the intervertebral foramen are not alone, they are accompanied by some veins and a medium-sized artery, a branch of the vertebral artery. This artery enters the intervertebral foramen anteriorly to the spinal nerve, and has a posterior branch of great importance that is responsible for the blood-supply of the posterior spinal ganglia, the spinal roots and the myelomere corresponding to the anterior and posterior spinal arteries (fig. 1).

This spinal branch of the vertebral arteries that provides the blood-supply for these significant structures, anastomoses with the corresponding artery of the opposite side, forming an arterial peridural circle that contributes to the blood supply of the vertebrae (Netter).

This arteriole has two important characteristics: it is the only branch that supplies the posterior spinal ganglia and it ends in the corresponding myelomere, as do all vessels of the central nervous system.

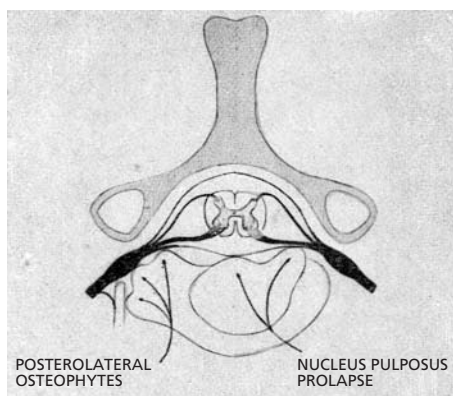


Figure 2. Causes of irritation of the spinal nerves.

The vegetative nervous system that accompanies the artery is of great importance because the artery is a branch of the spinal artery, a branch of the subclavian artery, which on emergence receives a considerable nerve network from the third stellate ganglion.

Although cervical arthritis may be an X-ray finding without any clinical symptoms, usually we have patients with different clinical symptoms due to spinal cervical nerve alterations accompanied by the respective X-ray images of the condition.

X-RAY STUDIES

It is necessary to take functional X-rays, that is to say lateral ones in positions of maximum flexion and extension; and it is necessary to establish if, as well as arthritis, there is hyper-mobility or instability of the cervical spine.

The presence of disc lesion is evident, there is a decrease of disc height, with a bone reaction that widens the superior and inferior facets of the affected vertebrae, osteophytes are seen on the anterior and the posterior border, sometimes with evident protrusion into the spinal canal. The discs most frequently affected are the 5th, 6th and 7th; the 4th and 5th may also be affected but to a lesser degree. Sometimes 2 to 3 discs are affected, sometimes only one.

The clinical syndrome may be due to nerve irritation or nerve compression at the intervertebral foramen due to a posterolateral osteophyte or a central or lateral disc hernia, or to vertebral instability with excessive mobility that also causes cervical syndrome.

Therefore, when assessing X-ray studies, disc arthritis is as valuable a finding as the instability of a vertebra (figure 2).

However, be it a case of osteophytes or disc hernias or vertebral instability, the solution is an arthrodesis of the affected joint, and we will describe the technique in detail.

SURGICAL TECHNIQUE

An Incision is made along the length of the sternocleidomastoid muscle, either on the left or the right (we usually perform it on the right to make it easier to work with the right hand). Some authors make a horizontal incision following the skin folds. as in goiter surgery, trying to leave a small scar, especially in women¹⁸.

The platysma and the sternocleidomastoid muscles are sectioned and an obtuse dissection is made of the space between the sternocleidomastoid and the vascular-nervous bundle laterally and the trachea and esophagus medially (figure 3).

At the lower end of the incision are the thyroid and the prethyroid muscles, which are turned inwards; the omohyoid muscle is may either be separated and pushed down or

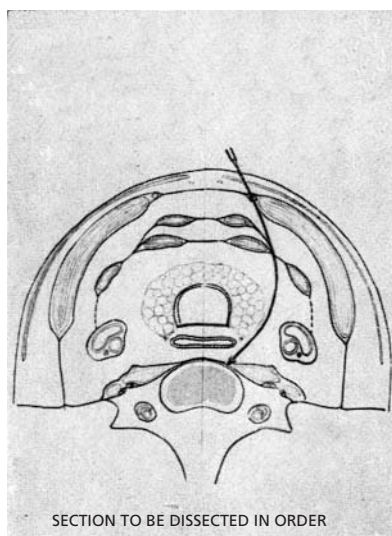


Figure 3.

(when it is inverted over the last cervical discs) sectioned and later sutured.

Now the surgeon is facing lax connective tissue and the prevertebral aponeurosis or deep cervical aponeurosis, this is sectioned from the top down, and it is now possible to see the prevertebral space with the prevertebral muscles and the anterior common vertebral ligament that cover the anterior face of the vertebral bodies and the discs.

The surgeon tries to locate the disc, seen with lesions on the X-ray, with the balls of their fingers. Usually anterior lesions are evident and easy to identify; but in other cases we take a lateral X-ray after placing a needle in the thickness of the disc to make sure we have located the right one.

Once the disc is located, the anterior common vertebral ligament, the prevertebral muscles and the *annulus fibrosus* of the affected disc are sectioned and the affected disc is emptied using a thin bone curette.

From this moment on, we use special instruments, a modification of those designed by W. P. Barnés⁵ for posterior approach intervertebral lumbar arthrodesis.

Once the disc has been denucleated, we introduce a metal stem, which separates the vertebral bodies and serves as a guide for the burr; we burr a bone-joint cylindric space that includes part of the upper vertebral body and part of the lower vertebral body, up to the posterior common vertebral ligament (Figure 4). We extract the 2 half-cylinders, and with a bone curette, we carry out a complete *toilette* of the borders of the plateaus and of the posterior facet of the vertebral bodies to eliminate, as much as possible, all osteophytes and other elements that could cause compression or irritate the delicate vascular or nervous structures.

We then fixate the inter-body vertebral joint introducing a bone cylinder from the iliac crest in the cavity we had previously fashioned; the diameter of this bone cylinder is

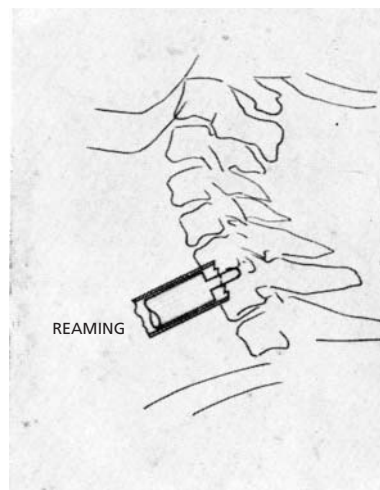


Figure 4.

exactly the same as that of the cavity. In this way, fixation is perfect (Figure 5).

If there are 2 or more diseased discs, the operation must be repeated for each one of them. We close the wound by suture of the superficial cervical aponeurosis and the skin leaving no drainages-

Lastly, we place the patient in a Schanz collar brace with cotton-wool and bandages.

The clinical response to this surgery is outstanding. When we visit the patient the day after the operation we find an optimistic person whose pains and aches have disappeared as if by the waving of a magic wand, and not the prostrated overwhelmed person we expected to find. As time passes, and the inflammation caused by surgery decreases, the outstanding outcome is more apparent.

After 8 days, sutures are removed and a Schanz collar brace with light spica bandaging is put in place. At this point some authors claim no immobilization is needed^{17, 30}. We believe it is, even if only for a short period of time, for 2 reasons:

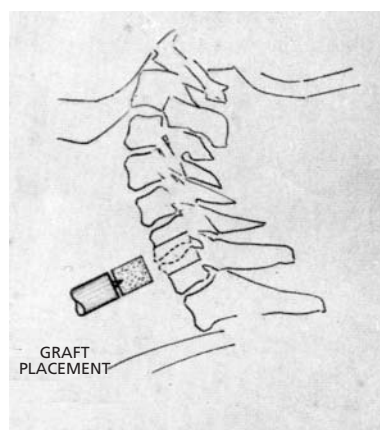


Figure 5.



Figure 6 B. Case # 1. E. A. G. X-ray in extension. Perfect ankylosis.



Figure 6 C. Case # 1. E. A. G. X-ray in flexion. Perfect ankylosis.

a) Sometimes the graft may protrude forwards slightly and this affects results.

b) If we immobilize the patient, we see that after 4 weeks the graft has become stable and we are able to see perfect bone ankylosis on X-rays.

Which means that better results are seen with immobilization than without.

STUDY OF THE ETIOLOGY

In view of this rapid and surprising result, it is necessary to find a satisfactory explanation of this rapid development of the healing process.

We therefore ask ourselves: Do osteophytes and disc hernias compress nerve roots, or do they just cause irritation?

Given the large number of sympathetic symptoms, it is possible to hypothesize that there may direct excitation of nerves of the vegetative system.

It is improbable that anterior osteophytes directly compress the prevertebral sympathetic chains, since these are lateral to the cervical spine, and in any case would be displaced forwards.

It is more probable that a postero-lateral osteophyte may compress the vascular-nervous bundle as it passes through the intervertebral foramen.

It is evident that there is compression of the nerve root when the osteophyte reaches a certain size, but when disc arthritis begins, the osteophyte is small and the first element affected is the artery, because it is on a more anterior plane. As can be guessed, there is direct irritation of the periarterial nervous plexus. The reaction to stimulation is vasoconstriction, not caused by compression but by the response of the peri-arteriolar sympathetic plexus. This vasoconstriction causes a decrease of the blood flow, and consequent hypoxia of the respective area, which in its turn triggers hyperexcitability of the nerve cells that are irrigated by this artery (posterior spinal ganglia, etc.).

This may explain in part the diffuse paresthesias we find on clinical examination of these patients.

The distal nerve-endings of Barbmann's pseudounipolar neurons of the posterior spinal ganglion are easily excited due to hypoxia of the neuron body, and this is translated into tingling and odd sensations, accompanied by a feeling of heat or cold throughout the upper limb.

But the response to excitation of the sympathetic plexus does not end here. In addition to local vasoconstriction, there may be reflex impulses of the axon in an opposite direction within the nerve endings to that normally followed by impulses, which cause inhibition of the neuron which in turn causes vasodilatation of the vessels it innervates, that is to say of the main trunk of the vertebral artery and its endocranial roots, which could explain the headaches that we frequently see in association with the usual symptoms in these patients with cervical disc arthritis.

Moreover, based on the outcomes seen: In 2 of our operated patients, not only did the problems of obviously cervical origin resolve, but the discomfort they felt in their lower limbs also disappeared, and one patient, a 65 year old man, recovered his capacity to have erections, which had been lost some time before.

We cannot explain these results based on a direct spine compression, as we said before, but as due to the irritation of a perioarteriolar sympathetic plexus of the artery previously described, that passes through the intervertebral foramen anteriorly to the spinal nerves. A more or less pronounced vasoconstriction causes hypoxia of the roots of the spine and of the nerve conduction fascicles that depend more directly on the arteriole for nutrition. The distribution of oxygen translates into a decrease of conductivity and ac-



Figure 7 A. Case # 6. M. Y. F. Instability of the 5th cervical vertebra.



Figure 7 B. Case # 6. M. Y. F. Instability of the 5th cervical vertebra.

tivity of the sympathetic nuclei of the spine that are in the lateral roots, which could explain the disorders some of these patients report in their lower limbs.

RESULTS

We have operated 18 patients without any failures, complications, graft protrusions (mentioned by some authors¹⁷), or motor complications¹². We have only had 2 cases that suffered a sensation of pain in an upper limb that disappeared at 8 days in one case and at 3 weeks in another. We think this may have been due to a hematoma compressing the spinal nerve.

In 2 cases of women with only 1 disc affected, the discomfort and pain was so bad that after being seen by a psychiatrist, they requested surgery as a last resource, even having undergone radiotherapy for a year with no result.

In 3 patients with 2 discs involved, the results have been equally outstanding.

TO SUMMARIZE

We consider that arthrodesis of the cervical spine by the anterior approach is the treatment of choice for cervico-brachial syndrome, both in the spinal nerve type as in the condition in which sympathetic symptoms predominate,

SUMMARY

We describe the technique for the treatment of cervico-brachial syndrome caused by cervical disc arthritis us-



Figure 7 C. Case # 6. M. Y. F. Four weeks after surgery. Compact block of cervical vertebrae 4, 5 and 6a.

ing an anterior approach and an impacted bone graft.

We analyzed symptoms and outcomes, and have come to the conclusion that either in the case of an osteophyte or a cervical disc hernia, it is important to suppress disc mobility to prevent irritation of the cervical nerve roots, which is the cause of the pain reported by patients.

BIBLIOGRAPHY

There are 32 references that the author can make available on request.

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