Pathoanatomical Changes of the Brachial Plexus and of C5-C6 Following Whiplash-Type Injury:
A Case Report

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FROM ABSTRACT: Study Design and Method. Case report.
Summary of Background Data:

Persistent neck pain and bizarre cranial symptoms are common sequelae of whiplash-type injuries.

Since soft tissue injuries of the neck are rarely fatal, only few pathoanatomical studies of such injuries have been conducted.

We report on a man who had been extensively investigated after a whiplash injury sustained in a traffic accident.

He died at the age of 42 of a heart attack 12 years after the injury.

The cervical spine was examined in great detail by cryosectioning and the brachial plexa were examined microscopically.

Results
There were marked isolated degenerative changes in the C5-C6 segment such as disc degeneration, uncovertebral osteophytosis, and zygapophyseal joint osteoarthrosis with subluxation, including degeneration of the meniscoid folds.

Contralateral to the C5-C6 changes, and consistent with symptoms and clinical signs, there were marked fibrotic perineural adherences in the brachial plexus.

Conclusions.
The findings might explain the development of chronic symptoms.

THESE AUTHORS ALSO NOTE:

"A considerable proportion of soft tissue injuries of the neck entail longstanding and disabling symptoms."

"The hypothesised sources of such symptoms include disc injuries, 'segmental dysfunction', injuries of the zygapophyseal joints, and thoracic outlet syndrome (TOS) due to scarring within and without the brachial plexus."

CASE REPORT

A 30-year-old male sustained a whiplash injury in a traffic accident.

His initial symptoms were neck stiffness and pain.

In the following years he continued to have neck symptoms with pain, and also developed non-segmental or root paraesthesia and left arm weakness.

Three years after the injury he began to suffer from headaches, dizziness, visual disturbances and right auditory symptoms, and signs of brainstem dysfunction with transient dysfunction involving cranial nerves IX, X and XII.

"All initial and subsequent radiograms of the cervical spine were normal." **[WOW!]**

Treatment with physiotherapy rehabilitation did not help.

Ten years after the injury, at age 40, he was disabled with "segmental dysfunction of the cervical spine." **[WOW, CHIROPRACTIC SUBLUXATION COMPLEX]**

His complaints were:
continuous neck pain radiating to the left am, weakness of the left arm, numbness and poor coordination of the left hand, migrainous attacks of headache, vertigo and fainting.

DIAGNOSTIC EXAMINATIONS

"Clinical examination revealed no neurological deficit." **[IMPORTANT]**

"Head rotation to the left was markedly reduced, forced rotation triggered severe vertigo and fainting."

Neck and shoulder muscles were very tender to palpation.

Pressure on C3 caused vertigo and fainting.

Oculomotor tests showed signs of brainstem dysfunction.

There was a positive left brachial plexus tension test (of Elvey).

Cervical flexion-extension films showed reduced motion at C5-C6 and reduced disc height at that level. **[Reduced Motion, Gate Theory]**

PATHOANATOMICAL FINDINGS

"There were no pathological changes in the brainstem or the spinal cord."

"The upper cervical spine, down to C4-C5 was macroscopically normal."

At C5-C6 segmental level:

(1) The disc was narrowed with posterior osteophytes and annulus thickening.

(2) The posterior osteophytes compressed the anterior cord epidural venous plexus.

(3) Large uncinate osteophytes compressed the right C6 nerve root.

(4) The right zygapophyseal joint showed marked degenerative changes: the joint capsule was shriveled and the meniscoid folds were retracted and fibrotic. **[Fibrosis Of Repair]**

(5) The right zygapophyseal joint "shows a slight subluxation." **[WOW!]**

The left brachial plexus perineurium was thicker, fibrotic, and markedly adhered to the nerve tissue. **[Fibrosis Of Repair]**

DISCUSSION:

The authors note that pertaining to chronic whiplash symptoms and disability:

"Clinical and radiographic examinations rarely yield objective signs of structural lesions apart from muscular tension and tenderness and restricted movement." **[IMPORTANT]**

The authors reference the following theories as to the possible source of the chronic whiplash symptoms:

(1) occult disc lesions
(2) advancing spondylotic changes
(3) fibrotic scarring in and around the brachial plexus
(4) dysfunction of the zygapophyseal joints
(5) cranial symptoms can be related to a "painful mechanical dysfunction of a motion segment in the mid-cervical spine." **[Chiropractic Subluxation Complex]**

There were "no pathological changes in the upper cervical spine either on radiograms or cryosections."

"At the C5-C6 level, however, both myelography and cryosections showed unequivocal pathological changes with disc degeneration and uncovertebral osteophytes compressing the root. In addition, the ipsilateral zygapophyseal joint capsule and the meniscoid folds were degenerated at this level, probably due to preceding soft tissue injuries." **[CAUSATION]**

Previous studies have shown uncinate and facet joint injuries in traffic accident victims and these "lesions are impossible to detect on radiograms, and also exceedingly difficult to diagnose with currently available CT or MRI technology." **[VERY IMPORTANT]**

"Late degenerative changes such as spondylosis of the disc and uncovertebral joints are widely considered to be late sequelae of 'missed' discoligamentous injuries."

Recent evidence indicates that the facet joints may be the primary source of chronic whiplash neck pain.

There is evidence that "an occult injury of the disc or zygapophyseal joint can develop into segmental dysfunction." **[Again, Chiropractic Subluxation Complex]**

X-rays of patients with significant symptoms after a soft tissue injury of the neck show that they had "all developed degenerative changes of the cervical spine 10 years later." **[IMPORTANT]**

Age-adjusted prevalence of degenerative changes is "significantly higher among patients who had sustained whiplash-type injuries than among non-traumatized subjects."

Facet joint arthrosis is uncommon and not an inevitable accompaniment of age.

This study "found arthrotic changes of the zygapophyseal joint and marked fibrosis and retraction of the meniscoid folds." **[Fibrosis of Repair]**

A 1993 study showed traumatic bruising of the meniscoids in the Cl-C2 joints in 50% of the specimens. **[Upper Cervical]**

This study supports posttraumatic TOS due to scarring in and about the brachial plexus. **[Fibrosis of Repair]**

Many patients with post-traumatic chronic symptoms and a positive brachial plexus tension test (of Elvey) have massive fibrosis in and around the brachial plexus at surgery. **[Fibrosis of Repair]**

KEY POINTS FROM DAN MURPHY:

(1) Some individuals who are involved in whiplash trauma will develop chronic symptoms.

(2) These chronic symptoms can become progressively worse with time, despite apparent appropriate treatment.

(3) The causes of the chronic symptoms and their progression are rarely demonstrated with x-rays, CT, or MRI.

(4) The causes of the chronic symptoms are also not usually revealed on standard neurological evaluations.

(5) The best evidence to show the injuries is possibly stress x-rays showing abnormal joint movement.

(6) In this study, the primary abnormal joint movement was hypomobility (reduced motion).

(7) Most chronic whiplash symptoms involve the neck and shoulder.

(8) Some chronic whiplash symptoms involve the head, cranial nerves, and upper extremities.

(9) Head and cranial nerve symptoms include headache, migraines, dizziness, visual disturbances, auditory symptoms, fainting, and dysfunction of cranial nerves IX, X and XII.

(10) These head and cranial nerve symptoms can exist without injury to the cranial nerves or brainstem, but as a consequence of a "mechanical dysfunction of a motion segment in the mid-cervical spine." **[WOW!]**

(11) The primary injuries causing chronic symptoms are:

(A) Segmental disc degeneration
(B) Uncinate osteophytes
(C) Facet joint osteoarthrosis
(D) Facet joint meniscus degeneration and fibrosis
(E) Facet joint subluxation and segmental dysfunction
(F) Spinal cord venous compression and vascular compromise
(G) Nerve root compression, adhesions, and fibrosis
(H) Brachial plexus (thoracic outlet) adhesions, fibrosis and scarring
(I) Traumatic bruising of the meniscoids in the Cl-C2 joints

(12) The best test for thoracic outlet / brachial plexus far adhesions and fibrosis was the brachial plexus tension test of Elvey.

(13) The facet joints are the primary source of chronic whiplash neck pain.

(14) Injury of the disc or facet joint can develop into segmental dysfunction.

(15) Soft tissue trauma accelerates degenerative changes of the cervical spine leading to chronic symptoms.

(16) Normal facet joints do not develop degenerative changes with advancing age.