

**NEUROGENIC ATROPHY OF SUBOCCIPITAL MUSCLES AFTER A
CERVICAL INJURY:
A Case Study**

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FROM ABSTRACT

This case report describes abnormalities in bilateral rectus capitis posterior minor muscles in one individual with persistent head and neck pain.

These findings are muscle atrophy, fatty infiltration on magnetic resonance imaging, and electromyographic abnormalities compatible with denervated muscle.

The objective of the study contained herein was to determine if fatty infiltration on magnetic resonance imaging of the rectus capitis posterior minor muscle is the result of disuse or denervation.

Electromyography and magnetic resonance imaging data were collected from normal and atrophied muscles.

Electromyography and magnetic resonance imaging abnormalities compatible with denervation atrophy were detected.

Although we cannot rule out aging or other unknown causes, we suspect that denervation is caused by nerve damage from trauma to the C1 dorsal ramus as a consequence of entrapment within the rectus capitis posterior major muscle.

THESE AUTHORS ALSO NOTE:

"Motor vehicle accidents, accounting for 12.2% of patient volume in injury-related emergency department visits, produce whiplash-type distortions of the cervical spine that can result in pathological lesions that are capable of producing chronic pain."

These authors have reported on a group of chronic pain patients who have a higher incidence of atrophy of the rectus capitis posterior minor (RCPMI) muscles, accompanied by fatty infiltration as seen on magnetic resonance imaging (MRI), compared with a control group.

Disuse or neurogenic atrophy is the most likely cause of the fatty infiltration noted in these chronic pain patients.

This article reports the first case of abnormal electromyography (EMG) in RCPMI muscles shown to have fatty infiltration on MRI.

CASE REPORT

The subject (PEG) injured his neck in 1963, a cracking sound was heard, but no discernible injuries were perceived. Immediate cervical spine x-rays were negative.

The patient had recurrent right suboccipital headaches since the accident up to the present time (35 years), with radiation to the right side of the head and the retro-orbital area.

The patient had dizziness when looking up for prolonged periods of time and was diagnosed with benign positional vertigo.

MRI TECHNIQUE

MRI images from control subjects show boundaries that are well defined, and the muscles themselves are of uniform intensity.

MRI images from the muscles from the chronic pain subject shows that it has been infiltrated with fatty tissue.

The fatty infiltrating was best viewed in the proton density-weighted and T2-weighted images.

NEEDLE EMG FINDINGS

EMG and MRI data were collected from the chronic pain subject. Approximately 20% of all insertions showed abnormal activity.

The MRI of the control subject's RCPMI muscles was normal.

DISCUSSION

"The nature of EMG data, in conjunction with fatty infiltration of the RCPMI muscles on MRI, strongly suggests neurogenic atrophy of the RCPMI muscles."

"The presence of positive sharp waves are almost exclusively generated from muscles that have had motor axon loss and strongly suggests that there are denervated muscle cells in the RCPMI muscle."

The authors "suspect that the cause of this denervation is attributable to nerve damage from trauma."

"The neurogenic findings noted in the chronic pain patient have "not been reported in control subjects."

"The anatomy of the upper cervical spine suggests that, in some individuals, the distal portion of the C1 dorsal ramus may become entrapped by the more superficial RCPMA(rectus capitis posterior major) muscle."

The suboccipital muscles are innervated on their dorsal surfaces; however, "the branch to the RCPMI muscles may innervate its muscle ventrally or by penetrating the RCPMA muscle."

"We suggest that, during extreme flexion/extension/rotation of the atlanto-axial-occipital motion segment, there is stretching and/or contraction of the RCPMA muscles that causes traumatic constriction and/or entrapment of the C1 dorsal ramus."

"We would expect the consequences of entrapment to affect structures distal to the point of entrapment, which is what we have observed."

Damage to a peripheral nerve is capable of producing painful conditions.

There are several possible hypotheses why C1 nerve entrapment might produce symptoms:

- 1) There is no dermatome associated with C1, but it is reasonable to assume that A-delta and C-pain fibers innervate the muscles, bone, and surrounding connective tissues.
- 2) C1 has a rudimentary dorsal root ganglion, and electrical stimulation of C1 dorsal rootlets in awake patients elicits retro-orbital and frontal pain.

"These provide evidence for the existence of proprioceptive and nociceptive pathways from C1 to the spinal cord."

"Entrapment could cause deafferentation pain, or painful impulses could originate from ectopic foci at the site of entrapment."

"An alternative hypothesis could be related to disruption of normal function of the myodural bridge linking the RCPMI muscles with the pain-sensitive dura mater."

CONCLUSIONS

"We have presented evidence on MRI scan and with EMG results consistent with denervation atrophy of the RCPMI muscles."

"Anatomy suggests entrapment of the C1 dorsal ramus as a possible site of injury."

KEY POINTS FROM DAN MURPHY

- 1) Cervical spine injured patients with chronic pain exhibit both atrophy fatty infiltration of the rectus capitis posterior minor muscles on magnetic resonance imaging, and electromyographic abnormalities showing muscle denervation.
- 2) The fatty infiltration was best viewed in the proton density-weighted and T2-weighted images.
- 3) The denervation to the rectus capitis posterior minor muscles is caused by nerve damage from trauma to the C1 dorsal ramus as a consequence of entrapment within the rectus capitis posterior major muscle. This is neurogenic atrophy of the rectus capitis posterior minor muscles.
- 4) The injury to the C1 dorsal ramus and consequent atrophy of the rectus capitis posterior minor muscles can cause the following symptoms:
 - A) Suboccipital headaches with radiation to the retro-orbital area.
 - B) Dizziness with prolonged postures.
 - C) A diagnosis of benign positional vertigo.
- 5) During extreme flexion/extension/rotation of the atlanto-axial-occipital motion segment, there is stretching and/or contraction of the rectus capitis posterior major muscles that causes an entrapment of the C1 dorsal ramus.
- 6) C1 nerve root has no dermatome.
- 7) Electrical stimulation of C1 dorsal roots elicits retro-orbital and frontal pain.
- 8) There exists a proprioceptive and nociceptive pathway from C1 to the spinal cord. This is very important to chiropractors.
- 9) The site of entrapment can elicit painful impulses.
- 10) The dura matter is pain sensitive, and it is connected to the rectus capitis posterior minor muscles.
- 11) Rectus capitis posterior minor muscle atrophy can disrupt the normal function of the myodural bridge linking the rectus capitis posterior minor muscles with the pain-sensitive dura mater.

COMMENTS BY DAN MURPHY

- 1) This is yet another study showing that soft tissue injury, atrophy, and fatty degeneration are best imaged with "proton density-weighted" MRI.
- 2) As the pathology noted in this study is an "entrapment," management should be mechanical rather than pharmacological.