

ORIGINAL COMMUNICATION
**Investigation of Connective Tissue Attachments to the Cervical
Spinal Dura Mater**

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FROM ABSTRACT:

The connective tissue attachments to the cervical spinal dura mater originating from the ligamentum nuchae (LN) and rectus capitis posterior minor (RCPM) muscle were evaluated in 30 cadaveric spines.

Magnetic resonance images (MRIs) were correlated with the attachments in four cadaveric specimens.

Attachments from the LN to the RCPM were also identified.

The LN and the RCPM to dura attachments were found in all 30 specimens.

Our results indicate that:

- 1) The attachments between the LN and RCPM and the dura occur between vertebrae C1-C2 and the occipital bone and C1, respectively, and that they are substantial normal anatomic attachments.
- 2) Attachments between the LN and RCPM are usually present.
- 3) The attachments between the LN and dura mater can be identified on MRI.

These latter attachments may play a role in neck pain, making their MRI appearance clinically important.

THESE AUTHORS ALSO NOTE:

The lifetime prevalence of neck pain in the general population is 70%.

30% of the population will experience neck pain at some time during a year.

17% of patients who suffer from neck pain will continue to experience pain after 6 months.

In 1929, Von Lanz found connective tissue attachments from the posterior aspects of the atlanto-occipital joints, the posterior arch of the atlas, and the base of the spinous process and laminae of the axis to the posterior aspect of the spinal dura mater. **[Quite important to upper cervical chiropractors]**

These attachments may be related to neck pain of unknown etiology.

These authors performed a gross anatomic study of the suboccipital and upper cervical regions on 30 cadavers, and performed MRI of 4 of them.

RESULTS

Five connective tissue attachments were identified in this study:

- 1) The RCPM connective tissue attachment to the posterior cervical spinal dura mater was found between the occiput and C1 in all 30 cadavers.
- 2) Six specimens showed a broad attachment for the fibers originating from the RCPM, which included connections to the cranial dura mater at the posterior edge of foramen magnum.
- 3) The LN attached to the posterior spinal dura mater between the posterior arch of C1 and the spinous process of C2 in all of the cadavers. These attachments to the dura were found in the midsagittal plane gap between the left and right ligamenta flava.
- 4) Some connective tissue attachments were found from the base of the spinous process of C2 and from the region of the posterior arch of C1 to the posterior cervical spinal dura mater.
- 5) Another connective tissue bridge was found to link the RCPM to the LN. This attachment was found at the posterior arch of C1. It was found in 27 of the 30 cadavers. "Therefore, in 90% of specimens (27 of 30), a connective tissue complex was identified that linked the posterior spinal dura mater between the level of occiput-C1 to the RCPM, from the RCPM to the LN, and from the LN to the posterior spinal dura mater between C1-C2."

[Again, quite important for upper cervical chiropractic]

These authors noted that tractioning (pulling) on one of these connective tissue attachments produced movement in the other attachments. **[IMPORTANT]**

"The presence of the LN to dura mater connection between the posterior arch of C1 and the spinous process of C2 was clearly identified on all MRIs."

"The other connective tissue attachments were less clear and could not be verified on the post-dissection MRIs."

DISCUSSION

"Our work supports the view that the function of the LN-dura and RCPM-dura attachments may be to protect the posterior spinal cord from irritation due to infolding of the dura mater during craniocervical movements." **[IMPORTANT]**

"Perhaps the most interesting finding was the identification of a consistent connective tissue complex between the level of the occiput and axis, composed of three connective tissue bridges."

"Two of the connective tissue bridges attached to the posterior spinal dura mater (RCPM to dura and LN to dura), whereas the third linked the RCPM to the LN."

"In all 30 specimens, we were able to demonstrate posterior dural attachments arising from both the RCPM as well as the LN."

"All of the posterior dural attachments from the RCPM were found to traverse between occiput and C1 from their origin on the anterior aspect of the muscle."

"A broad connective tissue attachment was found to originate from the dense lamellar portion of the LN and pass between the posterior arch of C1 and the spinous process of C2 before inserting into the dura mater."

"This attachment linked the RCPM to the posterior spinal dura mater between C1 and C2 by means of the LN; that is, pulling on the RCPM with a pair of forceps resulted in tugging of the posterior spinal dura mater between C1 and C2."

"The LN to dural connection was consistently identified on MRI, even without tissue enhancement."

"Dural attachment sites could be injured during trauma or whiplash injuries, making their MRI identification important." **[IMPORTANT]**

These "dural attachments most likely perform a mechanical function by protecting the spinal cord from damage due to puckering of the dura mater during movements (especially extension) of the occiput and upper cervical spine."

Abnormal postural control in patients suffering from neck pain and whiplash injuries may be related to the tearing of these connective tissue bridges to the dura mater.

CONCLUSIONS

There exists an anatomic linking between the posterior aspect of the cervical dura mater to the RCPM and LN via connective tissue bridges.

These "dural attachments in the craniocervical region from muscle and ligament may have clinical significance in neck pain, whiplash (flexion-extension injuries), and other traumatic injuries, making their MRI appearance clinically important."

KEY POINTS FROM DAN MURPHY:

- 1) The lifetime prevalence of neck pain in the general population is 70%.
- 2) 30% of the population will experience neck pain at some time during a year.
- 3) 17% of patients who suffer from neck pain will still have pain at 6 months.
- 4) Attachments between the LN and RCPM and the dura occur between C1-C2 and the occipital bone and C1 are both normal and substantial.
- 5) These anatomic attachments may play a role in neck pain.
- 6) These dural attachments protect the posterior spinal cord from irritation from dural infolding during craniocervical movements, especially extension.
- 7) Pulling on the RCPM resulted in tugging of the posterior spinal dura mater between C1 and C2.
- 8) Dural attachment sites could be injured during trauma or whiplash injuries.

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