EXTRAFORAMINAL THORACIC LIGAMENT ATTACHMENTS: PREVENTATIVE AGAINST SPINAL NERVE COMPRESSION

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INTRODUCTION

It is important to know the anatomy of the extraforaminale region to better understand the role of the ligaments in mechanics and biomechanics in relation to the physiological and pathological loads on the spinal nerves. Recent work describes ligamentous connections between lumbar extraforaminal spinal nerves and nearby structures, extraforaminal ligament attachment (ELA).

In a previous study we found extraforaminal attachments between the cervical and thoracic spinal nerves and the tissues surrounding the intervertebral foramina. The aim of this study is to describe the load absorbing capacity of the thoracic extraforaminal ligaments.

METHODS

Two human bodies embalmed by vascular perfusion with a medium containing 2.2% formaldehyde were dissected from the first cervical to the twelfth thoracic vertebra as far as the intervertebral foramen. Sonomicrometry crystals were attached to the surface of the second to eleventh thoracic spinal nerve.

Two crystals were placed on the spinal nerve proximal of ELA (Fig. 1): crystal 1 and 2, distal of ELA: crystal 3, crystal 4. Crystals 5, 6 were respectively placed on the ventral, dorsal part of ELA. Crystal 7 was placed on ELA on the crossing point with the spinal nerve. The distance between these crystals was measured by sonomicrometers.

In the first specimen the spinal nerves were subjected to traction: 0-6 N, and the elongation of the spinal nerve proximal to ELA was measured with or without ELA.

In the second specimen the ligaments were unimpaired or intersected in turns. Unimpaired: all even ligaments on the left side and odd ligaments on the right side. Intersected: all even ligaments on the right side and odd ligaments on the left side. The spinal nerves were loaded till rupture occurred.

RESULTS

More elongation proximal of ELA is seen when ELA is intersected. In Figure 2 elongation of the intersected and unimpaired ELA on the levels Th2, 4, 6, and 10 are shown.

All thoracic spinal nerves tear distal of the extraforaminal ligament attachment (ELA) when ELA is unimpaired. After removal of ELA all the spinal nerves are teared out of the intervertebral foramen. With a mean force with ELA of 31.8 N and ELA intersected 23.4 N. Table 1.

DISCUSSION

The present study, however, for the first time describes mechanical properties of thoracic extraforaminal ligament attachments to the nerve root outside the intervertebral foramen. There's a load absorbing capacity in cranial and caudal direction is measured.

Clinical Relevance: In literature, protective mechanisms by pre-, inter- and extraforaminal structures such as the ligaments of Trolard, Hofmann, Spencer and the denticular ligaments have been described counteracting nerve traction within the spinal canal. The here described extraforaminal ligament attachments convey traction to the transversal processes, and hence distracts tensile forces from the intraforaminal nerve roots. The spinal nerves are protected against compression when moving the nerves in cranial and caudal direction, for example in the respiration.

Ongoing investigations focusing on histology, and imaging to deepen the clinical relevance.

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REFERENCES


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