High-Field Magnetic Resonance Imaging of Meniscoids in the Zygapophyseal Joints of the Human Cervical Spine

Spine

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FROM ABSTRACT
Study Design.
Prospective in vitro study of meniscoids in the cervical zygapophysial joints.

Objectives.
To assess the use of high-field magnetic resonance imaging (MRI) as a potential tool for evaluating meniscoids of the cervical zygapophysial joints.

Summary of Background Data.
Pain originating from the cervical spine is a frequent condition. It has been suggested that pathologic conditions of meniscoids within the zygapophysial joints may cause pain.

Methods.
Six zygapophysial joints from one embalmed human body were investigated with a 3.0-T MR unit, equipped with a microimaging-set. MRIs were correlated with microanatomical sections.

Results.
High-quality images of the meniscoids were obtained for all joints examined.

There was a good correlation between the anatomic features derived from MRI and the microanatomical sections.

Conclusions.
High-field MRI was successfully implemented as a noninvasive method for imaging the meniscoids in cervical zygapophysial joints.

The results of this in vitro study indicate that high-field MRI may be feasible in evaluating patients with cervical pain possibly related to meniscoid pathology.

THESE AUTHORS ALSO NOTE:

The annual incidence of neck pain is about 14%.

"Cervical zygapophysial joints are well documented as a possible source of neck pain, and it has been hypothesized that pathologic conditions related to so-called meniscoids within the zygapophysial joints may lead to pain.”
Morphological and histological studies identify 3 types of meniscoids, which have the following characteristics and functions:

1) Meniscoids are also called synovial folds, and are intra-articular fat pads covered by the synovial membrane.

2) The meniscoids are a highly vascular supportive layer formed of fibrous and fatty tissue.

3) “The role of the meniscoids is to compensate for the incongruence of the articular surfaces, to cover intra-articular bony structures not covered by articular cartilage, and, thus, reduce friction.”

4) The meniscoids also help to ensure uniform distribution of pressure within the joints.

The meniscoids of the cervical facet joints contain nociceptors and may be a source of cervical facet joint pain.

Meniscoids may lead to pain and dysfunction by primarily 2 mechanisms:

1) Meniscoids become trapped between the articular surfaces of the zygapophysial joints. [Important]

2) Degenerative and/or traumatic changes of the meniscoids themselves produce pain.

The presence of meniscoids in the zygapophysial joints has been demonstrated histologically and imaged using a standard 1.5-T MRI scanner. However, the higher MR field strength 3.0 T MRI scanner improves significantly upon the imaging of meniscoids pathology. [Very Important]

“High-field MRI offers a promising method for clinically investigating meniscoid pathology as a possible source of cervical pain.”

The aim of this study was to assess high-field MRI as a potential tool for evaluating cervical zygapophysial joint meniscoids and provide a baseline for future in vivo studies in symptomatic patients.

The meniscoids was defined as “fatty and fibrous tissue structures lined by the synovial membrane, and projecting into the intra-articular space of the zygapophysial joint.”

After MRI, the specimens were microanatomically histologically evaluated.
RESULTS

The articular surfaces of the meniscoids were covered with synovial membrane, whereas the external surface, facing the joint capsule, was intimate with the fibrous capsule.

The proton density weighted image sequence was the best for the evaluation of the meniscoids regarding contrast and resolution.

“The meniscoids were depicted best in a sagittal slice orientation.”

“The meniscoids were well visualized with high-field MRI.”

DISCUSSION

“Prior MRI studies of the meniscoids in the zygapophysial joints suffered from low-image quality due to a lack of resolution. By using high-field MRI in this study, we were able to visualize clearly the meniscoids within the cervical zygapophysial joints at a higher resolution and improved image quality compared to earlier studies.” [Very Important]

“Once possible pathologies concerning the meniscoids are identified, suitable treatment options (e.g., manipulation therapy) will have to be investigated.” [Important]

“The meniscoids in C1-C2 differ from those in the rest of the cervical spine.”

The meniscoids “help to protect the osseous joint structures not covered by articular cartilage.”

Meniscoids may become entrapped between the articular cartilages of the facet joints. As a result, any attempted movement “leads to further strain of the capsule and accentuation of pain.” “Therefore, movements become inhibited by antalgic reflex muscle spasm, resulting in an acute locked neck syndrome. Manipulation therapy is believed to solve the problem by separating the apposed articular cartilages and releasing the trapped apex.” [Very Important]

Also, “entrapment of the meniscoid leads to functional blockade of the spinal segment and pain. The pain may be relieved by manipulative treatment involving gapping of the facet joint, so encouraging the meniscoid to return to its normal anatomic position in the joint.” [Very Important]

These authors suggest that “in vivo studies of cervical spine meniscoids” require “a coil with a small diameter, small field of views, and a high-imaging matrix.” “The price for this was that we could only depict one motion segment at once and that the acquisition time was long (24.3 minutes).”
CONCLUSIONS

“This study shows that by using high-field MRI, it is possible to obtain high-resolution images of meniscoid structures within the zygapophysial joints of the cervical spine in anatomic specimens.”

“Furthermore, the MRIs correlate well with microanatomical cross-sections in identifying different tissues and their distribution within the joint.”

“The proton density weighted sagittal image sequence used provides a basis for future in vivo studies evaluating cervical spine meniscoids in symptomatic patients with neck pain and functional disorders of the cervical spine.”

A good correlation between the anatomic features was derived from high-field MRI and the microanatomical sections.

KEY POINTS FROM DAN MURPHY

1) Pain originating from the cervical spine is a frequent condition.

2) Neck pain can be caused by pathologic conditions of meniscoids within the zygapophysial joints.

3) “Cervical zygapophysial joints are well documented as a possible source of neck pain, and it has been hypothesized that pathologic conditions related to so-called meniscoids within the zygapophysial joints may lead to pain.”

4) The meniscoids of the cervical facet joints contain nociceptors and may be a source of cervical facet joint pain.

5) Proton density weighted MRI image sequence is best for the evaluation of the meniscoid anatomy and pathology.

6) Meniscoids are best visualized with high-field MRI of 3.0 T strength.

7) Meniscoids are best depicted in a sagittal slice orientation.

8) The meniscoids in C1-C2 differ from those in the rest of the cervical spine.

9) Meniscoids may become entrapped between the articular cartilages of the facet joints. This causes pain, spasm, reduced movement, and “an acute locked neck syndrome.” “Spinal adjusting can solve the problem by separating the apposed articular cartilages and releasing the trapped apex.” [Very Important]
The meniscoids are attached to the bone and the fibrous joint capsule.