Differences in Lumbar Spine Measures as a Function of MRI Posture in Low Back Pain Patients

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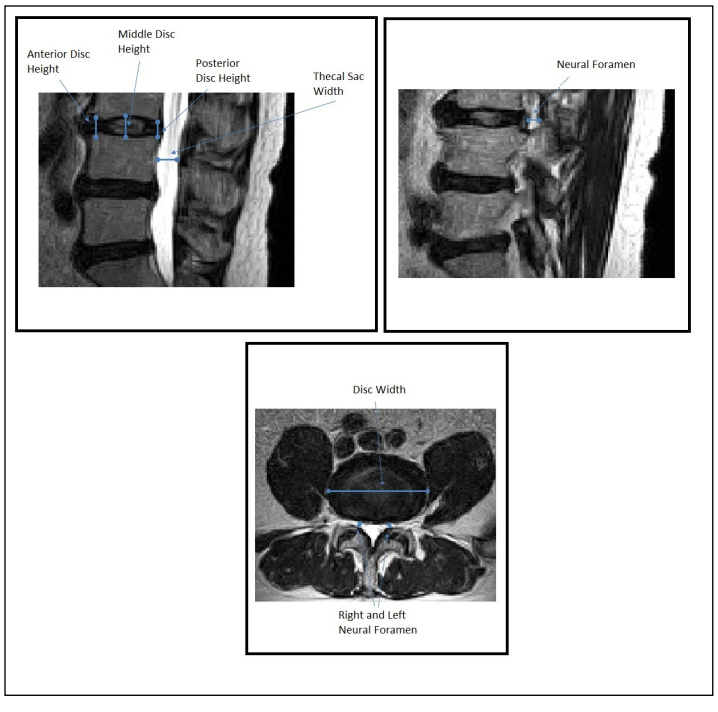
Introduction

Low back pain is the leading cause of disability worldwide. MRI is a commonly used diagnostic tool; however it does not consistently correlate with the patient's symptoms. Traditionally, MRIs are performed in a supine position that unloads and decompresses the spine. MRIs performed in various positions may give a more dynamic view of the cause of symptoms.

Methods

Thirty-four low back pain patients who were sent for a standard MRI agreed to participate. In addition to the standard supine posture, the MRI was taken in 6 experimental postures including sitting upright, flexed, and extended, standing upright, flexed and extended. Two raters took various measurements at L3/L4, L4/L5 and L5/S1 for a total of 126 measures. Each subject served as their own control.



Results

The preliminary findings showed that 94% of the measures were not significantly different between the two raters.

In the sagittal view, 55 of the 108 measures were significantly different between the experimental and standard postures. The sagittal view anterior disc height in sitting neutral posture was significantly smaller than the standard posture by almost 2 mm. Both the left and right side neural foraminal height measures were significantly different at all levels.

In the axial view, 11 of the 18 measures were significantly different between the experimental and the standard supine postures. In the sitting neutral posture, the left and right neural foramen height was on average 0.70 mm larger.

Table 6. The mean differences, standard deviations, and p-values for the three different postures in the axial view.

		Standard Supine vs. Sitting Neutral			Standard Supine vs. Standing Neutral		
Measures	Lumbar Level	Mean Difference (mm.)	Standard Deviation	P-Value	Mean Difference (mm.)	Standard Deviation	P-Value
Disc Width	L3/L4	-0.0054	0.3714	0.9885	-0.8357	0.2596	0.0045*
Right Neural Foraminal Height		-0.7326	0.2466	0.0068*	0.0967	0.1634	0.5615
Left Neural Foraminal Height		-0.5246	0.1520	0.0023*	0.3107	0.1369	0.0357*
Disc Width	L4/L5	-0.7463	0.3436	0.0400*	-0.5197	0.3378	0.1396
Right Neural Foraminal Height		-0.9964	0.2694	0.0016*	-0.1742	0.2158	0.4340
Left Neural Foraminal Height		-0.9296	0.2661	0.0026*	0.0879	0.2776	0.7565
Disc Width	L5/S1	-1.0487	0.2401	0.0002*	-0.6706	0.2161	0.0059*
Right Neural Foraminal Height		-0.5952	0.2242	0.0156*	-0.3647	0.2020	0.0888
Left Neural Foraminal Height		-0.4189	0.1647	0.0199*	-0.3525	0.1816	0.0690

Conclusions

This research quantifies the differences in spine structure measures that occur in various experimental postures. The additional information gathered from an upright MRI and its depiction of various structures under axial loading situations may correlate more reliably with symptoms leading to a more accurate diagnosis.

Learning Objectives

Recognize the differences posture can make on MRI measurements and their effect on clinical correlation.

References

1.Hoy D, March L, Brooks P, et al: The global burden of low back pain: estimates from the global burden of disease 2010 study. Ann Rheum Dis online First 3/24/2014. Doi 10.1136/annrheumdis-2013-204428.
2.Deyo R, Mirza S, Martin B: Back pain prevalence and visit rates estimates from U.S. national survey, 2002. Spine 31: 2724-2727, 2006
3.Friedman B, Chilstrom M, Bijiur P, Gallagher E: Diagnostic testing and treatment of low back pain in United States emergency departments. Spine 35: E1406-E1411, 2010
4.Deyo R, Mirza S, Turner J, Martin B: Overtreating chronic back pain: time to back off? J. Am. Board Fam. Med. 22: 62-68, 2009
5.Wassenaar M, van Rign R, van Tulder M, et al: Magnetic resonance imaging for diagnosing lumbar spinal pathology in adult patients with low back pain or sciatica: a diagnostic review. Eur Spine J 21: 220-227, 2012
6.Endean A, Palmer K, Coggon D: Potential of magnetic resonance imaging findings to refine case definition of mechanical low back pain in epidemiological studies. Spine 36: 160-169, 2011
7.Suri P, Boyko E, Goldberg J, Forsberg C, Jarvik J: Longitudinal association between incident lumbar spine MRI findings and chronic low back pain or radicular symptoms: retrospective analysis of data from the longitudinal assessment of imaging and disability of the back (LAIDBACK). BMC Musculoskeletal Disorders 15: 152, 2014. Doi: 10.1186/1471-2474-15-152.
8.Chou D, Samartzis D, Bellabarba C, et al: Degenerative magnetic resonance imaging changes in patients with chronic low back pain. Spine 36: s43-s53, 2011
9.de Graaf I, Prak A, Bierma-Zeinstra S, Thomas S, Peul W, Koes B: Diagnosis of lumbar spinal stenosis a systematic review of the accuracy of diagnostic tests. Spine 31: 1168-1176, 2006
10.SAS Institute: SAS/STAT user's guide version 6, 4th ed. Cary NC. 1990
11.Madsen R, Jensen TS, Pope M, Sorensen JS, Bendix T: The effect of body position and axial load on spine canal morphology: an MRI study of central spinal stenosis. Spine 33: 61-67, 2008
12.Karadimas E, Siddiqui M, Smith F, Wardlaw D: Positional MRI changes in supine versus sitting postures in patients with degenerative lumbar spine. J Spinal Disord Tech. 19: 495-500, 2006
13.Lee S, Hargens A, Fredericson M, Lang P: Lumbar spine disc heights and curvature: upright posture vs. supine compression harness. Aviat Space Environ Med 74: 512-516, 2003
14.Alyas F, Connell D, Saifuddin A: Upright positional MRI of the lumbar spine. Clinical Radiology 63: 1035-1048, 2008
15.Nowicki BH, Haughton VM, Schmidt TA, et al: Occult lumbar lateral spinal stenosis in neural foramina subjected to physiologic loading. Am J Neuroradiol. 17: 1605-1614, 1996.
16.Weishaupt D, Schmid MR, Zanetti M, et al: Positional MR imaging of the lumbar spine: does it demonstrate nerve root compromise not visible at conventional MR imaging? Radiology 215: 247-253, 2000
17.Tarantino U, Fanucci E, Iundusi R, et al: Lumbar spine MRI in the upright position for diagnostic acute and chronic low back pain: statistical analysis of morphologic changes. J Orthopaed Traumatol. 14: 15-22, 2013