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Lumbar Disc High Intensity Zones on MRI

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There is a particular finding on T2-weighted MRI images that signals an annular tear in the lumbar intervertebral disc. The finding has been called a "high intensity zone" (HIZ) and appears on sagittal, thinly sliced T2-weighted MR images.

Correlation studies have been completed that compared the findings of CT discography (an invasive test that outlines internal disc derangement and tears in the annulus) with the HIZ. The HIZ was found to correlate to grade 4 internal disc derangement.

Grade 0 = contrast media restricted to annulus

Grade 1 = contrast media/tear extends radially into the inner third of the annulus

Grade 2 = media/tear extends to middle third of the disc

Grade 3 = media/tear extends circumferentially through the annulus

Grade 4 = as in grade 3, except extends <30 degrees from center of disc

A significant amount of patients had a direct correlation with concordant pain response on discography and the HIZ as seen on MRI. This suggests that HIZ is a marker for annular tears and internal disc derangement, giving clinicians a possible MRI marker for discogenic pain with or without referred lower extremity pain.

Since studies have shown that asymptomatic people can have positive MRIs for disc herniations and bulges, the HIZ may be a very useful marker for identifying those patients with discogenic pain. This is significant because many patients may present with disc herniations without evidence of nerve root compression, yet they complain of not only low-back pain, but referred extremity pain as well. There is growing evidence to support that referred leg pain does not require root compression from the disc herniation. In fact, many enzymes and biochemical agents have been isolated and have shown to be capable of causing nerve root pathology and conduction delays just by the mere presence of the toxic nuclear material which leaches through the annulus.

The annulus of the disc has been shown in dissection studies by Bogduk to be innervated by the branches of the sinuvertebral nerve to a depth of about two-thirds. In a recent study in Lancet, a significant number of patients with chronic back and leg pain were shown to have annular branches that penetrated to the inner one-third of the annulus and even the nucleus pulposus. This implies that if there is annular distention from internal disc derangement, nociception will occur and be mediated by the sinuvertebral nerve.

In a discogenic study on low back pain and sciatica by Millette et al., internal disc derangement was demonstrated to be often responsible for patients with low-back pain and leg pain. The researchers injected dye into the discs of their patients which reproduced the patients' pain pattern (a positive and concordant discogram), then injected lidocaine, which abolished the patients' pain pattern. This study implies that patients with low-back and leg pain are most likely suffering from discogenic pain, with an annular tear and internal nuclear migration triggering nociception via the sinuvertebral nerve.

The HIZ was found to have an 87% sensitivity and 95% specificity by Schellhas, et al. April and Bogduk also found the HIZ to be associated with a grade 4 on the discogram scale (significant nuclear migration in the disc). The sensitivity was found to be 82%; specificity, 89%; and a positive predictive value of 95%.

In a more recent study by Ito, et al., HIZs were found to be reliable predictors of painful discs with a sensitivity of 87%. They concluded that HIZs are combined annular tears. Bogduk stated that the HIZ is a sign of annular disruption and that discogenic pain is related to annular disruption. In another recent study by Smith et al., a contrasting finding of low interexaminer reliability was noted for HIZ.

In my experience, I have found the HIZ to be a reliable marker for acute discogenic pain. One recent patient who had an MRI that showed a large disc herniation with an extruded disc fragment but no HIZ responded well to a few weeks of conservative nonoperative care. He then had a relapse with severe pain, spasm, antalgia and nondermatomal leg pain. A new MRI disclosed an HIZ at the same disc level, with resorption of the disc fragment and regression in the size of the old herniation. This illustrates that the acute exacerbation was most likely the result of an acute annular tear. He continued conservative treatment and rehabilitation and has been fine since.

Conclusion

The HIZ of the lumbar disc as seen on T2-weighted MRI scans appears to be a reliable and predictive marker for annular disruption and internal disc derangement that is often responsible for low-back pain and

leg pain. However, as in any advanced imaging finding, clinical correlation is necessary.

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