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MRI with Contrast: What's New?

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Intravenous gadolinium-DTPA has been used to differentiate between recurrent disc protrusion and postsurgical scar formation or fibrosis in cases of failed back surgery. Scar is vascular and the gadolinium-DTPA should be visible within it, whereas recurrent disc, being primarily nonvascular, should not be greatly enhanced.

Another role of Gd-DTPA enhanced MR imaging may be in evaluating cases of discogenic pain, a condition in which disc degeneration or internal disruption (such as radial tears in the annulus) may be productive of headaches, neck pain, back pain, or extremity pain. In such cases, there is no frank herniation of disc material. One method of evaluating discogenic pain is with discography, although this method has been increasingly criticized. Along these lines of thought, Jinkins et al.¹ have described other abnormalities on MR which may be responsible for lumbar discogenic pain and the so-called "autonomic syndrome." They postulated that lateral disc bulging or extrusion and anterior disc bulging or extrusion can be productive of pain syndromes via compression of sympathetic fibers or paravertebral autonomic structures. They also felt that central herniations (which was their term for Schmorl's nodes) would result in vertebrogenic pain.

In many cases annular tears can be imaged on standard T2-weighted (unenhanced) MR images. However, Ross et al.² have demonstrated the effectiveness of Gd-DTPA enhanced MR imaging for more effectively visualizing annular tears, finding significantly more annular tears with enhanced MR than were seen with the T2-weighted images alone. This is presumably the result of granulation tissue that grows into endplates or damaged discs.

Recent double-blinded studies have demonstrated that contrast enhancement provided the diagnosis in 50 percent, changed the diagnosis in 40 percent, and increased diagnostic confidence in 95 percent of the studies.³ Gadolinium and other paramagnetic contrast agents can highlight epidural, intradural, extramedullary and intramedullary compartments⁴ due to their strong ability to enhance proton relaxation.⁵

And, because these agents are intravascular, they can be used to demonstrate breaches in blood-brain or blood-nerve barriers. For example, selective enhancement of disc-impinged nerve roots⁶ and spondylosis-compressed cauda equina⁷ have been demonstrated.

As result of faster acquisition times (less than six minutes in some applications),^{8,9} MR angiography is beginning to offer an alternative to more invasive traditional angiographic procedures.¹⁰ The value of visualization of the brachial plexus region by MRI has been demonstrated recently,^{11,12} and deviation of the brachial plexus, a finding suggestive of thoracic outlet syndrome (TOS), is said to have a sensitivity of 79 percent and a specificity of 87.5 percent.¹³ Band-like structures emanating from the transverse processes of C7, long associated with TOS, could be seen in 76 percent of the cases. Vascular causes of TOS can also be imaged with MRI.¹⁴

MR imaging will eventually replace myelography and CT myelography since numerous comparative studies matching CT, CT-myelography, and MRI have demonstrated that no statistically significant differences in sensitivity and specificity exist, and since MRI is more cost-effective and less invasive than myelography.^{15,16}

Another time-honored modality which has been threatened by the phenomenal technical expansion of MRI is the EMG. Two recent studies have demonstrated the ability of MRI to delineate areas of denervation in skeletal muscle through a conspicuous hyperintensity in the image.^{17,18} Though unreliable in acute conditions, subacute and chronic changes showed prolonged T1 and T2 times, atrophy, and readily apparent fatty infiltration.¹⁹

MR advances have allowed researchers to chart the flow of CSF²⁰ and the pulsatile movements of the brain^{21,22} -- subjects bound to either challenge or reinforce the current schools of thought in the field of craniopathy.

Although most studies have not found an association between clinical improvement and radiological improvement, both CT and MRI have provided the vehicle to unobstrusively measure the natural history of disc herniation, and both have demonstrated that disc herniations frequently regress with conservative care. Reports range from case reports to small samples of patients and recount 67 percent,²³ 76 percent,²⁴ and 78 percent²⁵ resolution. These findings should have a significant impact on the way we view prognosis and the way we approach impairment rating. They should also significantly influence the decision making process regarding spinal surgery.

Early studies of CT findings have been the provenance of ongoing confusion and this deserves some comment. In 1984, a paper appeared in the journal Spine noting that in the over 40 age group, more than 50 percent of the scans of normal "subjects" displayed some abnormality.²⁶ The subsequent (incorrect) spin applied to this statistic from various sources was the "50 percent of all normal people have a disc bulge or herniation." However, the abnormalities describes by the original authors included facet arthrosis and spondylosis -- not merely bulge or herniation. Spinal disorders, such as disc herniation were seen in only 19 percent in the under 40 age group. This is in line with more recent reports that describe the normal incidence of asymptomatic bulge or herniation in the range of 4-28 percent.²⁷ It is also likely that the authors were hampered by the general lack of experience with CT in the early 1980s and by the relatively poor resolution of early generation software. Most importantly, however, is the fact that these epidemiological studies are generally limited by relatively small sample size, some degree of selection bias, and nonheterogenous mixes of subjects. Their significance to clinical chiropractic or medicine is easily distorted, particularly by defense attorneys keen to cast doubt on the veracity of patients' complaints of pain. In the clinical setting, we are most concerned with correlating the findings of disc bulges or herniations with both the patients' subjective complaints and our objective examination findings (and perhaps electrodiagnostic procedures). The actual incidence of asymptomatic disc abnormalities is then of lesser importance. These misinterpretations of the literature, which have become the grist of many defense doctors and lawyers, become rather hollow arguments when such clinical correlation is confirmed.

References are available at no charge through the Spine Research Institute of San Diego. You may call (619) 293-7873.

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