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The Triad of Nerve Root Enhancement, Thickening, and Displacement in Patients with Sciatica and Recurrent Disk Herniation in the Postoperative Lumbar Spine May Prompt Further Surgical Treatment in Patients with Failed-Back Surgical Syndrome

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The Triad of Nerve Root Enhancement, Thickening, and Displacement in Patients with Sciatica and Recurrent Disk Herniation in the Postoperative Lumbar Spine May Prompt Further Surgical Treatment in Patients with Failed-Back Surgical Syndrome

The general consensus in the literature is that a second surgical procedure can be beneficial in cases of recurrent herniated disk or bony canal compression if they match the level involved clinically,¹ but much debate remains. Imaging of the lumbar spine after disk herniation surgery is fraught with limitations and findings that may not be relevant to the patient's clinical and physical findings.² The so-called failed-back surgery syndrome (FBSS) occurs all too frequently and prompts the surgeon and radiologist to find treatable causes for failure of the patient's condition to improve. Successful surgical intervention is usually predicated on the triad of clinical symptoms, physical findings, and imaging matching.³ In this month's issue of the *American Journal of Neuroradiology*, the article by Dr. Yeon Soo Lee and colleagues, entitled "Symptomatic Nerve Root Changes on Contrast-Enhanced MR Imaging after Surgery for Lumbar Disk Herniation," nicely reviews the vast literature on the subject and expounds on the MR imaging findings that can guide the surgeon to consider additional exploration and treatment.

This retrospective study conducted in a blinded fashion correlated nerve root changes with clinical symptoms (radicular pain, presence of myotomal and/or dermatomal deficits, and loss of deep tendon reflexes in the lower extremities) to define the level of radiculopathy. The authors analyzed postoperative symptomatic patients with MR imaging findings of 1) nerve root enhancement (NRE), 2) nerve root thickening, or 3) nerve root displacement with or without recurrent disk herniation (RDH) or postoperative epidural fibrosis (PEF). Only some patients underwent electromyographic (EMG) correlation. Although these MR imaging findings are not novel, the authors of the current manuscript used an increased number of cases and statistical analysis of the nerve root findings alone and in combination.¹

Detailed evaluation of the authors' numbers is necessary to elucidate the essential findings. Of 140 operated disk space levels, 92 (66%) showed NRE. NRE was associated with the corresponding level of radiculopathy, with a sensitivity of 92%, a specificity of 73%, and a positive predictive value (PPV) of 84%. No statistical significance was found in patients with NRE and clinical symptoms less than 6 months after surgery, well outlined by many in the literature. NRE less than 6 months after surgery is not found to correlate with symptoms, is not considered abnormal, and can be related to the normal healing process. The current study was performed 8 days to 180 months after the original surgery (mean, 50 months), demonstrating a lack of standardized imaging time.

The operated disk levels with nerve root thickening had an

association with clinical symptoms 72% of the time. A total of 75% of these patients had associated NRE. Both nerve root thickening and NRE showed an 88% PPV in patients with recurrent symptoms. Nerve root displacement was seen in 64 of the 140 operated disk levels, 34 secondary to RDH and 30 in patients with PEF. Forty seven operated disk levels (73%) showed good correlation with clinical symptoms. Eighty seven percent of the symptomatic disk levels with nerve root displacement had NRE, not specified to cause, which is a limitation. However, displacement of nerve roots has also been documented in asymptomatic patients.¹ Also, Nygaard et al⁴ have not found NRE, thickening, or displacement to correlate with symptoms when RDH is excluded.

Of the 140 disk levels operated on, 39 cases showed RDH, and NRE was noted in 85% of the cases. These findings correlated with clinical symptoms 88% of the time. When RDH was combined with nerve root thickening, there was an 85% correlation with symptoms. With RDH and nerve root displacement, there was an 84% association with symptoms. The authors noted a 94% PPV with symptoms when RDH was associated with NRE, thickening, and displacement.

The clinical significance of PEF was not noted with 1 or 2 nerve root findings. However, the authors noted that 13 of 14 patients with PEF and all 3 nerve root changes had association with clinical symptoms. Lee et al only mention this briefly, though this is a significant step against current dogma that opposes PEF as a contributor to sciatica in the consideration for repeating surgical decompression.^{3,5} These findings warrant additional investigation.

As the authors concede, the study is limited by lack of comparison between preoperative and postoperative imaging and by failure to use asymptomatic patients as control subjects. Not all of the patients had EMG correlation. Also, more than half of the studies were performed on a low-field-strength magnet, with none performed on a 3T unit. Prospective standardized MR imaging interval evaluations are suggested. We personally find use of chemical fat saturation after gadolinium in the differentiation of PEF from normal epidural fat to be beneficial; however, not all radiologists agree. In addition, evaluation of the dorsal root ganglia may also be beneficial.⁶

In summary, NRE was shown to have a statistically significant correlation with postoperative sciatica. Furthermore, NRE in combination with either or both nerve root thickening and displacement increases the PPV for the level of symptoms. A clinical association of NRE with symptoms was closest for RDH when found together with nerve root thickening and displacement. When taken individually, these nerve root findings show slightly lesser degrees of statistical correlation with symptoms. When PEF is the cause, however, the association of nerve root findings with clinical symptoms shows statistical significance only when all 3 of these findings are present.

The enigma of FBSS remains, but Lee et al nicely outline that the triad of nerve root enhancement, thickening, and displacement as MR imaging findings in symptomatic patients may strengthen the argument to offer additional surgery with RDH and, possibly, postoperative fibrosis.

However, significant questions remain unanswered. Which patients with these descriptive radiographic findings should have a second operation? Does radiographic correlation with symptoms, in and of itself, justify reoperation? If so,

which operation will work best? In a society where increasingly expensive technology is being used and health care is becoming a larger portion of our gross domestic product, it is important for descriptive radiographic findings to have clear implications for the clinical care of the patient.

This study may provide a framework for additional clinical outcome studies. The authors are to be congratulated on a significant contribution to the body of literature on imaging of the postoperative spine.

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