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Point/Counterpoint

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Optimal Noninvasive Imaging for Suspected Zygapophyseal (Facet)-Mediated Low Back Pain

CASE SCENARIO

A 46-year-old healthy man presents with an 8-week history of axial low back pain without precipitating trauma. He was initially seen in the physiatry spine clinic, and at that time he described right lower back pain without radiation into the legs. Clinical examination was positive for sharp, localized right lower back pain that was exacerbated with lumbar extension and right quadrant loading and relieved with lumbar flexion. Pertinent negative findings included a normal neurologic examination and no neural tension signs, including the straight leg raise and slump test. Flexion/extension radiographs revealed mild disk height loss at L4-L5, no pars interarticularis fractures, and no evidence of dynamic instability. The patient was prescribed nonsteroidal anti-inflammatory drugs (meloxicam, 15 mg) and muscle relaxants (cyclobenzaprine, 5 mg) at night to help with sleep. He has since completed 8 weeks of physical therapy with a combination of Williams flexion exercises, deep tissue massage, and pelvic traction; however, his pain persists. He presents to discuss further diagnostic imaging and possible interventional treatments. What imaging examination is most appropriate to identify the likely pain generator? Dr Jason Talbott will take the position that functional nuclear medicine imaging is the appropriate examination. Dr J. Levi Chazen will take the position that magnetic resonance imaging is most appropriate at this stage.

Jason Talbott, MD, Responds

This case illustrates the all too frequent clinical scenario of a patient with axial low back pain that is refractory to conservative interventions. Although the clinical symptoms and physical examination findings are suggestive of symptomatic osteoarthritis (OA) of the lumbar zygapophyseal (facet or z joint), localizing the precise level remains a major challenge. Confirming z-joint OA as the primary pain generator is elusive even with a thorough history, physical examination, and anatomic imaging. It is estimated that 15%-40% of all low back pain is related to z-joint disease [1]. Although characteristic clinical examination findings including morning stiffness and pain exacerbated by extension, bending, and rotation but relieved with flexion have been described, these indicators of z-joint arthropathy are nonspecific [2,3]. In fact, with use of diagnostic blocks of the z joint, Schwarzer and colleagues [2] found that no combination of history or physical examination features can accurately predict pain arising from the z joint, calling into question the notion of a clinical facet joint syndrome. Although diagnostic blocks remain the gold standard for identifying symptomatic z-joint—mediated pain, a diagnostic block is an invasive and time-consuming procedure that is not feasible as a screening tool for all patients presenting with nonspecific low back pain. Clearly, the need exists for accurate, noninvasive biomarkers of symptomatic lumbar z-joint arthropathy. I believe that bone scintigraphy with single proton emission computed tomography (SPECT) and positron emission tomography (PET) are the ideal imaging choices for confirming z-joint—related low back pain.

With the widespread utilization of computed tomography (CT) scanning and magnetic resonance imaging (MRI) in the 1980s, extensive literature now exists with respect to cross-sectional imaging characterization of z-joint degeneration. Anatomic and structural features of z-joint arthropathy on CT and MRI have naturally been pursued as potential biomarkers of z-joint—mediated pain, and many MRI and CT-based grading schemes for

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z-joint arthropathy have been devised [4-6]. However, the diagnostic specificity of these morphologic findings is lacking. Both CT and conventional MRI sequences routinely used in clinical practice are limited to demonstrating structural alterations in the z joint, such as cartilage loss with joint space narrowing, bony hypertrophy, synovial and capsular thickening, and intra-articular fluid accumulation [4]. It is well known that these same structural alterations of the z joint may occur in asymptomatic persons. Thus structural degenerative changes are common in the asymptomatic population and may be part of the normal aging process [7]. In a large prospective longitudinal trial including 148 asymptomatic study participants, Jarvik and colleagues [8] found that new low back pain symptoms developed in 67% of participants during a 3-year interval, but MRI features of z-joint arthropathy had no correlation with clinical symptoms. Many studies have corroborated these findings, showing a lack of specificity for anatomic changes of the z joint with respect to symptomatic pain and disability [3,9,10]. Despite the lack of data supporting MRI for accurate identification of symptomatic lumbar z-joint disease, MRI evaluation for suspected z-joint arthropathy contributes significantly to the rapidly increasing cost of low back pain care [11].

As an alternative to structural imaging techniques such as conventional MRI, physiologic imaging modalities, including bone scintigraphy with SPECT and PET, have shown great promise as biomarkers for z-joint–related pain [12]. Although these techniques initially were established to evaluate bone tumors and malignant disease, their role in benign degenerative disease is being increasingly recognized [12]. With bone scintigraphy, a radioactive tracer such as technetium-99m methylene diphosphonate (Tc-99m MDP) is injected intravenously into a patient, who then undergoes imaging with a gamma camera that detects and localizes the accumulated radiotracer in the body. Acquisitions may be performed as planar 2-dimensional projections (similar to radiographs) or as 3-dimensional images (similar to CT) with SPECT. Tc-99m MDP is incorporated into hydroxyapatite of bone matrix and reflects the degree of osteogenic activity in bone. When combined with CT, precise localization of radiotracer uptake can be achieved to detect a specific bony structure with high physiologic turnover and hyperemia related to inflammation [13]. Thus SPECT provides metabolic physiology data that are not achieved with conventional MRI. The radiation dose is relatively low, with a typical bone scan equaling approximately 2-5 mSv (similar to a noncontrast head CT scan).

Several studies have validated the diagnostic capacity for bone scintigraphy with symptomatic z-joint OA [13-15]. In a prospective, randomized controlled trial, Pneumaticos et al [13] reported that 87% of patients obtained symptomatic relief when MDP-SPECT was used to target lumbar z-joint injections. Conversely, among patients with clinical symptoms suggesting z-joint arthropathy but no suspicious z-joint uptake on SPECT, only 12% had relief when injections were targeted on the basis of clinical symptoms alone. SPECT also was shown to increase the specificity of injections, resulting in a decrease in the number of targeted injections by 50%. Cost analysis was favorable when compared with treatment without SPECT [13]. The high accuracy of SPECT for diagnosing symptomatic z-joint OA has been demonstrated by other investigators [14,15]. These data are supported by a larger literature showing the value of SPECT for identifying active synovial inflammation in a variety of synovial joints [16-18].

In summary, I support the recommendation for Tc-99m MDP SPECT in our patient with clinically suspected lumbar z-joint arthropathy. Although a head-to-head study comparing conventional MRI and SPECT for targeting lumbar z-joint–mediated pain has not been performed, the present literature suggests that the metabolic physiology data afforded with SPECT more accurately diagnoses symptomatic joints and predicts a successful treatment response. Available data suggest that conventional MRI will nicely characterize static, structural abnormalities that may be part of the normal aging process but will not accurately localize the site of "facetogenic" pain with high confidence. Increased acceptance of SPECT and other emerging physiologic imaging techniques will improve the diagnosis and treatment of z-joint–related low back pain. In doing so, we may improve care by increasing the efficacy of targeted treatments and lower the impact of imaging costs relating to our growing low back pain epidemic.

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