AJNR

Low Back Pain

W.G. Bradley, Jr.

AJNR Am J Neuroradiol 2007, 28 (5) 990-992
http://www.ajnr.org/content/28/5/990

ACR APPROPRIATENESS CRITERIA

Low Back Pain

W.G. Bradley, Jr.,
for the Expert Panel on
Neurologic Imaging

Acute low back pain (LBP) with or without radiculopathy (pain radiating down the leg[s]) is one of the most common health problems in the United States and is the leading cause of disability for persons younger than age 45. The cost of evaluating and treating acute LBP runs into billions of dollars annually, not including time lost from work.[1]

Because of the high prevalence and high cost of dealing with this problem, government agencies have sponsored extensive studies that are now part of the growing body of literature on this subject. One of the earlier comprehensive studies was carried out in Quebec and was reported in the journal *Spine* in 1987.[2] The US Department of Health and Human Services convened a 23-member multidisciplinary panel of experts to review all of the literature on this subject, grade it, and develop a "Clinical Practice Guideline," which was published in December 1994.[3] States have also convened similar panels in recent years, largely because of the rapidly rising workers' compensation claim burden being imposed on state budgets by LBP management.[4]

It is now clear from the above studies and others that *uncomplicated* acute LBP is a benign, self-limited condition that does not warrant any imaging studies.[5] Most of these patients are back to their usual activities within 30 days.[1-3] The challenge for the clinician, therefore, is to distinguish that small segment within this large patient population that should be evaluated further because of suspicion of a more serious problem.

Indications of a more complicated status, often termed "red flags," include the following[2,6]:

1) Recent significant trauma, or milder trauma, age >50
2) Unexplained weight loss
3) Unexplained fever
4) Immunosuppression
5) History of cancer
6) IV drug use
7) Prolonged use of corticosteroids, osteoporosis
8) Age >70
9) Focal neurologic deficit progressive or disabling symptoms
10) Duration greater than 6 weeks

Radiographs

Radiographs are recommended when any of the above red flags are present.[3,4] Lumbar radiographs may be sufficient for the initial evaluation of the following red flags[3,4]:

1) Recent significant trauma (at any age)
2) Osteoporosis
3) Age >70

The initial evaluation of the LBP patient may require further imaging if red flags such as suspicion of cancer or infection are present.[3,4]

Isotope Bone Scans

The role of the isotope bone scan in patients with acute LBP has changed in recent years with the wide availability of MR imaging and especially contrast-enhanced MR imaging. The bone scan is a moderately sensitive test for detecting the presence of tumor, infection, or occult fractures of the vertebrae but not for specifying the diagnosis.[3,4] The yield is *very* low in the presence of normal radiographs and laboratory studies, and highest for patients with known malignancy.[7] The test is contraindicated in pregnancy.

High-resolution isotope imaging, including single-photon emission CT (SPECT), may localize the source of pain in patients with articular facet osteoarthritis before therapeutic facet injection.[8] Similar scans may be helpful in detecting and localizing the site of painful pseudoarthrosis following lumbar spinal fusion.[9]

Unenhanced and contrast-enhanced MR imaging has the ability to demonstrate inflammatory, neoplastic, and most traumatic lesions as well as show anatomic detail not available on isotope studies.[10] Gadolinium-enhanced MR imaging reliably shows the presence and extent of spinal infection and is useful in assessing therapy.[11] MR imaging has therefore taken over the role of the isotope scan in many cases where the location of the lesion is known. The isotope scan remains invaluable when a survey of the entire skeleton is indicated (eg, for metastatic disease).

Magnetic Resonance Imaging, Computed Tomography, Myelography, Myelography/CT

Uncomplicated acute LBP (no red flags) does not warrant the use of any of these imaging studies.[2-4] The early indiscriminate use of expensive imaging procedures in this common clinical setting has caused large increases in worker's compensation costs and in some cases has led to the perception that CT and MR imaging of the lumbar spine are not worth the cost.[10,12,13] Adding to this controversy is the fact that nonspecific lumbar disk abnormalities are common, and can be demonstrated readily on myelography, CT, and MR imaging, even in asymptomatic patients.[14-17]

The appropriate use of these imaging procedures is an important challenge that has been extensively addressed in the major reviews referenced herein.[2-4] For example, LBP complicated by "red flags" suggesting infection or tumor may justify early use of CT or MR imaging even if radiographs are nega-

Address correspondence to William G. Bradley, Jr, MD, PhD, Department of Quality & Safety, American College of Radiology, 1891 Preston White Dr, Reston, VA 20191-4397.

Clinical condition—Low back pain	MRI (lumbar spine, without contrast)	MRI (lumbar spine, without and with contrast)	CT (lumbar spine, without contrast)	CT (lumbar spine, without and with contrast)	X-ray (lumbar spine)	CT Myelogram	Myelogram	Bone scan
Uncomplicated, no red flags	2	2	2	N/A	2	2[a]	2[a]	2
Low velocity trauma, osteoporosis, and/or age >70	8	3	6[b]	N/A	6	1[a]	1[a]	4
Suspicion of cancer, infection or immunosuppression	8	7	4	N/A	5	2[a]	2[a]	5
Radiculopathy	8	5[b]	5	N/A	3	5[a,b]	2[a]	2
Prior lumbar surgery	6	8[c]	6[b]	N/A	5[d]	5[a]	2[a]	5
Cauda equina syndrome	9[e]	8[e]	N/A	4[b,e]	3	6[a,b]	2[a]	2

Note:—Appropriateness criteria scale from 1 to 9, 1 = least appropriate, 9 = most appropriate; [a], indicates CT and myelography often combined; [b], useful if MRI contraindicated or nondiagnostic; [c], differentiate disk versus scar; [d], flex/extension may be useful; [e], use of contrast depends on clinical circumstances

tive.[3] The most common indication for the use of these imaging procedures, however, is the clinical setting of LBP complicated by radiating pain (radiculopathy, sciatica) or cauda equina syndrome (bilateral leg weakness, urinary retention, saddle anesthesia), usually due to herniated disk and/or canal stenosis.

Magnetic Resonance Imaging

MR imaging of the lumbar spine has become the initial imaging technique of choice in complicated LBP, displacing myelography and CT in recent years. MR imaging is particularly efficacious for detecting "red flag" diagnoses, particularly by using the STIR and fat-saturated T2 fast-spin-echo sequences. MR with contrast is useful for suspected infection and neoplasia. In postop patients, enhanced MR imaging allows distinction between disk and scar when there is extension of tissue beyond the interspace.

Computed Tomography

CT scans provide superior bone detail but are not quite as useful in depicting disk protrusions when compared with multiplanar MR imaging. With the added value associated with high quality reformatted sagittal and coronal plane images, CT is useful for depiction of spondylolysis, pseudoarthrosis, scoliosis, and for postsurgical evaluation of bone graft integrity, surgical fusion, and instrumentation.[18]

Myelography/CT

"Plain" myelography was the mainstay of lumbar herniated disk diagnosis for decades. It is now usually combined with postmyelography CT. The *combined* study is complementary to plain CT or MR imaging and occasionally more accurate in diagnosing disk herniation, but suffers the disadvantage of requiring lumbar puncture and contrast injection.[19-22] It may also be useful in surgical planning.

Thermography, Diskography, CT Diskography

Expert panels agreed that these imaging modalities were either too nonspecific (thermography) or carry additional risk (diskography) that is not warranted in view of the efficacy of other less invasive imaging procedures.[3,4] When other studies fail to localize the cause of pain, diskography may occasionally be helpful. Although the images often depict nonspecific aging or degenerative changes, the injection itself may reproduce the patient's pain, which may have diagnostic value.[23]

Definitions

Acute low back pain. Lumbosacral pain of less than 6-weeks duration or without progressive or disabling symptoms.

Radiculopathy. Dysfunction of a nerve root, usually caused by compression or irritation of the root.

Spinal stenosis. Narrow bony canal that may cause radiculopathy, or cauda equina syndrome.

Herniated disk. Herniation of the disk material beyond the confines of the interspace.

Sciatica. Pain radiating down the leg(s) below the knee along the distribution of the sciatic nerve, usually due to mechanical pressure and/or inflammation of lumbosacral nerve root(s).

Cauda equina syndrome. Compression of multiple nerve roots, often resulting in bilateral motor weakness (legs), urine retention, saddle anesthesia.

Review Information

This guideline was originally developed in 1996. The last review and update was completed in 2006.

An ACR Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologists, radiation oncologists, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should dictate the selection of appropriate imaging procedures or treatments. Only those examinations generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other coexistent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the FDA have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination. The complete work of the ACR Appropriateness Criteria may be accessed on the ACR website at www.acr.org/ac.

Appendix

Expert Panel on Neurologic Imaging: William G. Bradley, Jr, MD, PhD, Principal Author, University of California-San Diego, San Diego, Calif; David J. Seidenwurm, MD, Panel Chair, Radiological Associates of Sacramento, Sacramento, Calif; James A. Brunberg, MD, University of California-Davis Medical Center, Sacramento, Calif; Patricia C. Davis, MD, Panel Vice-Chair, Northwest Radiology Consultants, Atlanta, Ga; Robert Louis De La Paz, MD, Columbia University Medical Center, New York, NY; Pr. Didier Dormont, Hôpital de la Salpêtrière, Assistance-Publique-Hôpitaux de Paris, Paris, France; David B. Hackney, MD, Beth Israel Medical Center, Boston, Mass; John E. Jordan, MD, Little Company of Mary Hospital, Torrance, Calif; John P. Karis, MD, SW Neuro-Imaging, Phoenix, Ariz; Suresh Kumar Mukherji, MD, University of Michigan Health System, Ann Arbor, Mich; Patrick A. Turski, MD, University of Wisconsin, Madison, Wis; Franz J. Wippold II, MD, Mallinckrodt Institute of Radiology, St Louis, Mo; Robert D. Zimmerman, MD, New York Hospital-Cornell University Medical Center, New York, NY; Michael W. McDermott, MD, University of California-San Francisco, San Francisco, Calif, American Association of Neurological Surgeons; Michael A. Sloan, MD, MS, Carolinas Medical Center, Charlotte, NC, American Academy of Neurology.

References

1. Luo X, Pietrobon R, Sun SX, et al. **Estimates and patterns of direct health care expenditures among individuals with back pain in the United States.** *Spine* 2004;29:79–86
2. **Scientific approach to the assessment and management of activity-related spinal disorders. A monograph for clinicians. Report of the Quebec Task Force on Spinal Disorders.** *Spine* 1987; 12(7 Suppl):S1–S59
3. **Acute low back problems in adults: assessment and treatment. Agency for Health Care Policy and Research.** *Clin Pract Guidel Quick Ref Guide Clin* 1994; (14)iii-iv,1–25
4. **Florida medical practice guidelines for low back pain or injury. State of Florida Agency for Health Care Administration;** 1996; Tallahassee, Florida.
5. Ren XS, Selim AJ, Fincke G, et al. **Assessment of functional status, low back disability, and use of diagnostic imaging in patients with low back pain and radiating leg pain.** *J Clin Epidemiol* 1999; 52:1063–71
6. Staiger TO, Paauw DS, Deyo RA, et al. **Imaging studies for acute low back pain. When and when not to order them.** *Postgrad Med* 1999;105:161–62, 165–166, 171–172
7. Schutte HE, Park WM. **The diagnostic value of bone scintigraphy in patients with low back pain.** *Skeletal Radiol* 1983;10:1–4
8. Even-Sapir E, Martin RH, Mitchell MJ, et al. **Assessment of painful late effects of lumbar spinal fusion with SPECT.** *J Nucl Med* 1994;35:416–22
9. Holder LE, Machin JL, Asdourian PL, et al. **Planar and high-resolution SPECT bone imaging in the diagnosis of facet syndrome.** *J Nucl Med* 1995;36:37–44
10. Jarvik JG. **Imaging of adults with low back pain in the primary care setting.** *Neuroimaging Clin N Am* 2003;13:293–305
11. Post MJ, Sze G, Quencer RM, et al. **Gadolinium-enhanced MR in spinal infection.** *J Comput Assist Tomogr* 1990;14:721–29
12. Gilbert FJ, Grant AM, Gillan MG, et al. **Does early imaging influence management and improve outcome in patients with low back pain**? A pragmatic randomised controlled trial. *Health Technol Assess* 2004;8(17):iii, 1–131
13. Jarvik JG, Hollingworth W, Martin B, et al. **Rapid magnetic resonance imaging vs radiographs for patients with low back pain: a randomized controlled trial.** *JAMA* 2003;289:2810–18
14. Hitselberger WE, Witten RM. **Abnormal myelograms in asymptomatic patients.** *J Neurosurg* 1968;28:204–06
15. Wiesel SW, Tsourmas N, Feffer HL, et al. **A study of computer-assisted tomography. I. The incidence of positive CAT scans in an asymptomatic group of patients** *Spine* 1984;9:549–51
16. Boden SD, Davis DO, Dina TS, et al. **Abnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation.** *J Bone Joint Surg Am* 1990;72:403–08
17. Jensen MC, Brant-Zawadzki MN, Obuchowski N, et al. **Magnetic resonance imaging of the lumbar spine in people without back pain.** *N Engl J Med* 1994;331:69–73
18. Williams AL, Gornet MF, Burkus JK. **CT evaluation of lumbar interbody fusion: current concepts.** *AJNR Am J Neuroradiol* 2005;26:2057–66
19. Modic MT, Masaryk T, Boumphrey F, et al. **Lumbar herniated disk disease and canal stenosis: prospective evaluation by surface coil MR, CT, and myelography.** *AJR Am J Roentgenol* 1986;147:757–65
20. Jackson RP, Cain JE Jr, Jacobs RR, et al. **The neuroradiographic diagnosis of lumbar herniated nucleus pulposus: II. A comparison of computed tomography (CT), myelography, CT-myelography, and magnetic resonance imaging.** *Spine* 1989;14:1362–67
21. Kent DL, Haynor DR, Larson EB, et al. **Diagnosis of lumbar spinal stenosis in adults: a meta-analysis of the accuracy of CT, MR, and myelography.** *AJR Am J Roentgenol* 1992;158:1135–44
22. Shafaie FF, Wippold FJ 2nd, Gado M, et al. **Comparison of computed tomography myelography and magnetic resonance imaging in the evaluation of cervical spondylotic myelopathy and radiculopathy.** *Spine* 1999;24:1781–85
23. Colhoun E, McCall IW, Williams L, et al. **Provocation discography as a guide to planning operations on the spine.** *J Bone Joint Surg Br* 1988;70:267–71