Practice parameters: Magnetic resonance imaging in the evaluation of low back syndrome

(Summary statement)

Report of the Quality Standards Subcommittee of the American Academy of Neurology

Overview. The Quality Standards Subcommittee (QSS) of the American Academy of Neurology develops practice parameters for neurologists to use in evaluating clinical disorders, particularly with regard to selecting diagnostic procedures and treatment. In choosing topics for practice parameters, the QSS considers several factors including prevalence of disease, frequency of use of procedures, costs, membership requests, existence of controversy, urgency, external constraints, and others. This document is based on the background paper developed by Carl Ellenberger, MD.^{1*}

Justification. Modern management of the "low back syndrome" (LBS) may have altered the syndrome itself. Proliferating diagnostic and therapeutic modalities, activities of nonmedical practitioners, and the growth of the disability compensation systems may have become determinants in the natural history of the condition. Magnetic resonance imaging (MRI), by virtue of its high sensitivity and increasing availability, may further alter the natural history of LBS. The improved sensitivity of MRI has not yet led to a coherent strategy of optimum clinical management of LBS. Because symptoms referable to the spine are common, often a cause of disability, and expensive to evaluate, determining the role of MRI in the management of patients with LBS is desirable.

Description of process. MEDLINE was searched for the years 1977 to 1991 using the key words "magnetic resonance imaging," "radiculitis," "disk prolapse," "sciatica," "intervertebral disk displacement," "prolapsed disk," "herniated disk," "low back pain," and others. Over 1,000 references were identified. On the basis of relevance to the sensitivity and specificity of diagnostic imaging, 199 articles were reviewed in their entirety, and 108 of the

most pertinent were included in this report. Thirteen of the articles were classified as class II evidence (see Definitions). The issues addressed by this group of 13 papers varied and, in most cases, the results did not directly relate to the question of MRI of LBS. The remaining articles were technical or described uncontrolled observations. Some of the articles, especially recent reviews by Modic et al and the Quebec Task Force on Spinal Disorders, cited more than 1,000 articles that provided a better understanding of the mechanism and management of LBS. Table 1 lists organizations from which comments were solicited during the development of this practice parameter.

Summary. Background. This review uses a broad definition of LBS to include local symptoms and signs, or pain radiating from the low back or remote from the low back to the buttock or thigh in a pattern thought to relate to disorders in the lumbosacral spine. Not included are motor or sensory deficits or pain radiating below the knee thought to relate to impairment of conduction at the level of lumbar or sacral nerve roots caused by changes in the lumbosacral spine (ie, radiculopathy). The underlying pathologic process in most cases can include disk degeneration, herniation of the intervertebral disks, osteoarthritis of the apophyseal joints, fractures and dislocations of vertebrae, osteoporosis, or spondylolisthesis, or there may be no identifiable lesion. Clinical presentation cannot always be relied on to distinguish LBS from the less common alternative causes, including intradural and extradural neoplasms, congenital spine abnormalities, and infections. The examiner should suspect alternative diagnoses when the patient is less than 20 or more than 50 years old, or has a history or signs of trauma, neoplasm, fever, neurologic deficit, or recurrent pain.

See also page 594

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* The background paper by Carl Ellenberger, Jr., MD, is available upon request at the American Academy of Neurology office (612/623-2439).

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Table 1. Medical societies invited to comment on this practice parameter (* indicates those who provided comment)

American Society of Internal Medicine
 American Academy of Family Physicians*
 American Academy of Physical Medicine and Rehabilitation*
 American Association of Neurological Surgeons
 American Academy of Orthopedic Surgeons*
 American Society of Neuroimaging*
 American Society of Neuroradiology*
 North American Spine Society*

Scope of the problem. Disorders of the lumbar spine are among the most common medical problems in Western countries, affecting up to 80% of people at some time during their lives. Two percent of the population consults a doctor each year because of low back pain, and up to 25% of working men are affected in any given year. By the age of 50 years, 85% to 95% show evidence of degenerative disk disease at autopsy. Not surprisingly, LBS is an extremely common cause of disability, worker's compensation, and medical and medical-legal expense.

Pathophysiology. MRI may make it possible to define the range of age-related changes of the intervertebral disks and changes related to environmental and other factors (even smoking). Intrinsic factors (genetic, nutritional, hormonal, personality, emotional, and others) undoubtedly affect the vulnerability of the spine to environmental factors. The pain of sciatica is frequently attributed to compression of a spinal root by a herniated intervertebral disk. Radicular pain has been thought to be caused by compression of either the dorsal root ganglion or chronically injured roots. Nerve-root compression can, by various neurophysiologic mechanisms, induce motor weakness, altered sensibility, or pain. Mechanical nerve fiber deformation and consequent changes in nerve root microcirculation lead to intraneural edema and demyelination, and these effects of injury are critical factors for the pain of nerve-root compression. Some have thought that, despite the absence of nerve-root compression, anterior and central disk extrusions may cause a clinical syndrome.

Cause of symptoms. Despite advances in understanding the degenerative process and our improved ability to visualize it in vivo, a major obstacle to the management of patients with LBS is the uncertainty regarding the origin of symptoms in any particular patient. Some patients have local or radicular symptoms or signs but no evident morphologic changes using available diagnostic techniques. Many asymptomatic individuals have degenerative changes (50% to 60%) and even disk herniations (20%) without clinical symptomatology. Physical considerations alone cannot explain the incidence and morbidity of the entire problem of LBS. In a prospective study of more than 3,000 workers, complaints of back pain were associated

Table 2. Lumbar spine imaging procedures in clinical use*

Plain radiography
 Multiple views
 Computed tomography (CT)
 Plain CT
 CT myelography
 CT with 3-dimensional reconstruction
 Myelography
 Magnetic resonance imaging
 Discography
 Radionuclide bone scanning
 Plain bone scan
 Single photon emission computed tomography (SPECT)
 Thermography†
 Visual
 Computed
 Epidural venography
 Cineradiography

* Adapted with permission from Deyo RA, Bigos SJ, Marravilla KR. Diagnostic imaging procedures for the lumbar spine. *Ann Intern Med* 1989;111:865-867. [Erratum appears in *Ann Intern Med* 1989;111:1050.]

† See AAN's TTA Subcommittee's "Assessment: Thermography in Neurologic Practice" (*Neurology* 1990;40:523-525) regarding its assessment of the clinical utility of thermography.

not only with individual physical factors but with psychosocial and workplace factors.

Natural history. In the majority of cases (more than 80%), symptoms related to LBS are self-limited but recurrent. The Quebec Task Force for Spinal Disorders (QTFSD; see reference 17 in the background paper,¹ page 594, this issue) noted that 74% of patients responded to conservative therapy (analgesics, spasmolytics, short-duration bed rest, and physiotherapy) and returned to work within 4 weeks of the onset of symptoms. An additional 9% responded to continuation of these measures and added occupational therapy with return to work by 7 weeks. Saal and Saal, using an "aggressive rehabilitation program," were able to return 92% of the patients to work, including 87% of a subgroup with demonstrated disk extrusions. Modern neuroimaging studies have shown that regression of disk herniation and even regression of free disk fragments do occur.

Differential diagnosis and management. Uncertainty regarding localization usually remains after the office examination. Consideration of the temporal course of symptoms can help narrow the differential diagnosis. Recurring episodes of pain suggest isolated LBS, whereas persistent pain or progressive radicular deficits suggest other disorders. Progressive painless motor or sensory deficits referable to the lumbosacral segments or spinal cord are less likely due to degenerative structural changes, especially in patients with systemic diseases.

After the office examination, decisions regarding further diagnostic efforts must be guided by clinical localization, differential diagnosis, and knowledge of natural history. Table 2 lists ancillary tests that can confirm or refine the clinical examination.

Wide variation exists in the application of these procedures, which have varying degrees of sensitivity, but all fall short of 100% specificity in relating the abnormalities to clinical symptoms and signs.¹ The probability of spontaneous improvement of symptoms is substantial; resolution of disk herniations detected by CT or MRI has been observed. Results of any test, in turn, must be assessed in light of the high incidence of abnormalities in the asymptomatic population. In many cases, it may not be possible to attribute a symptom to a particular abnormality demonstrated by testing procedures, so that in the majority of patients the origin of back pain remains unknown. This obstacle and the other considerations above are the reasons the overall value of these tests in patients with LBS remains uncertain. QTFSD found that among various diagnostic procedures available (not including MRI), the only test with usefulness demonstrated by a randomized controlled trial was CT in patients with confirmed spinal stenosis. Tests demonstrated useful by nonrandomized controlled trials were plain x-rays and inflammatory screening (ie, erythrocyte sedimentation rate) in patients with symptoms persisting longer than 7 weeks. Diagnostic usefulness of these tests was not found in other circumstances, particularly those in which the duration of symptoms was less than 7 weeks.

Recommendation. Although MRI has been proved equal to or more sensitive and accurate than other diagnostic methods in the diagnosis of herniated disks, no studies yet exist to permit application of these results to an improved surgical or nonsurgical management strategy. Based on this review and the high likelihood of improvement of LBS when conservative management is employed, the following is recommended as a *guideline*:

Nonsurgical therapy is recommended before the application of further diagnostic imaging procedures in adult patients with LBS of less than 7 weeks' duration when, after clinical evaluation by history and physical examination, (1) the most likely diagnosis is confined to symptomatic low back pain alone, (2) there is no evidence of motor, sensory, reflex, sphincter, or autonomic deficit, and (3) there is no evidence of significant trauma, infection, or neoplasia. After 7 weeks, patients still symptomatic may undergo further clinical investigation.

The few available nonrandomized and retrospective studies suggest that MRI is the procedure of first choice. One recent study found that plain CT is equally accurate for detecting "herniated nucleus pulposus-caused nerve compression," but MRI, with its multiplanar and variable signal capabilities, is a more comprehensive way of evaluating the total extent of degenerative change and displaying tumors, fibrosis, cysts, arachnoiditis, and all other potential causes of low back symptoms. Nevertheless, MRI is still unable to reliably indicate the exact cause of the symptoms in many cases and has not altered the fundamental observation of the

DEFINITIONS

Classification of evidence

Class I. Evidence provided by one or more well-designed randomized controlled clinical trials.

Class II. Evidence provided by one or more well-designed clinical studies such as case-control studies, cohort studies, and so forth.

Class III. Evidence provided by expert opinion, nonrandomized historical controls, or one or more case reports.

Strength of recommendations

Standards. Generally accepted principles for patient management that reflect a high degree of clinical certainty (ie, based on class I evidence or, when circumstances preclude randomized clinical trials, overwhelming evidence from class II studies that directly addresses the question at hand or from decision analysis that directly addresses all the issues).

Guidelines. Recommendations for patient management that may identify a particular strategy or range of management strategies and that reflect moderate clinical certainty (ie, based on class II evidence that directly addresses the issue, decision analysis that directly addresses the issue, or strong consensus of class III evidence).

Practice options or advisories. Other strategies for patient management for which there is unclear clinical certainty (ie, based on inconclusive or conflicting evidence or opinion).

Practice parameters. Results, in the form of one or more specific recommendations, from a scientifically based analysis of a specific clinical problem.

QTFSD that in the great majority of patients, LBS is an episodic and recurrent disorder. Because the results of MRI are unlikely to alter the expectant management of this group, employment of this modality before 7 weeks may not be cost effective or medically necessary. Charges and costs for all imaging procedures vary locally, and MRI may not necessarily be the most expensive.

Recommendations for future research. Researchers need to address the role of medical intervention for LBS in a large-scale, long-term, prospective study comparing the results of various methods of conservative treatment, no treatment, and operative treatment. This will demand well-designed outcome assessment studies that will in turn require close cooperation and collaboration among various specialties involved in the care of patients with low back pain. Other fundamental problems remain to be solved: (1) relating symptoms to imaging abnormalities, (2) selecting candidates for surgical treatment, (3) managing treatment failures and patients with chronic disabling pain, (4) eliminating overuse and abuse, and (5) gathering patient preference data.

Recommendation for next review. With the proliferating MRI technology and burgeoning MRI literature, review of the literature should be initiated within 2 years of publication of this paper with revision of the practice parameter as necessary.

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Reference

1. Ellenberger C. MR imaging of the low back syndrome. *Neurology* 1994;44:594-600.

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