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Radiograph assessment for patients with low back pain

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Introduction

Although 80% of North Americans may experience low back pain, most episodes are of short duration and many do not recur. Frequently, acute back pain resolves within 7 weeks of onset. History and physical examinations are the mainstays in evaluations. Examinations by radiography of the lumbar spine may be wise in some, although not all, cases. This statement provides guidelines for when evaluation by conventional radiography is and is not indicated for the evaluation of low back pain.

Key words and usage of terms

The term "x-ray" has developed into a universal phrase that is often used interchangeably for a variety of meanings. For purposes of this article, the following terms and definitions will be used in order to provide the most precise information possible.

X ray: (noun) a specific unit of electromagnetic radiation capable of penetrating tissue. Infrequently called roentgen ray. The adjective form is X-ray as in "X-ray film."

x-ray: (verb, often with capital X) to examine, treat or photograph with X rays.

x-radiation: (noun, often with capital X) exposure to X rays or radiation composed of X rays.

radiograph: (noun) a film image made by means of X rays. Synonymous with X-ray film.

radiography: (noun) the process of making radiographs.

Historical review

Radiography became available for evaluation of musculoskeletal problems early in the twentieth century. The ability to discern pathology that had only been presumed or found at autopsy led to widespread use of radiography to evaluate patients with back pain. Reliance on radiography predated understanding of lumbar pathology and related clinical presentations that have been gained from research, surgical observations and imaging techniques of more recent vintage.

Radiography became so important to patients and physicians that little criticism of its value has been published. Availability of good equipment for taking and processing radiographs has made evaluations quick, convenient and relatively inexpensive. Although avoidance of unnecessary radiation is an accepted general health dictum, exposure for 1 to 5 views of the lumbar spine with modern equipment has been considered safe except for pregnant women. The disadvantage of exposure to radiation and the expense of taking and interpreting films must be weighed against potential benefits.

Anatomy/pathophysiology

Exposure of film by x-radiation is relatively impeded by passage of the rays through body tissues. Dense, mineral-containing tissues such as bone impede more X-ray passage than do soft tissues.

Radiographic examinations allow physicians to judge the configuration and alignment of bones in the lumbar spine with high degrees of accuracy, thus ruling in or out the presence of such problems as malalignment, or changes in shape of the vertebrae from such causes as tumor, fracture or in-

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fection. Undisplaced fractures and stress fractures that do not change the shape of bone may usually, although not always, be revealed by X-ray films.

The configuration of spaces occupied by soft tissues, such as intervertebral disc and joint cartilage, may be appreciated even though the quality and shape of the soft tissues themselves are not well portrayed by X-ray films.

The alignment of vertebrae may be determined by the posture adopted by the patient so that films taken under the stresses of bending or weight bearing may reveal abnormal responses to such stresses and thus allow the physician to determine the presence or absence of hypermobility, or malalignment, that was not discoverable by radiography taken in a single posture. Because computed axial tomography (CAT) scan and magnetic resonance imaging (MRI) are routinely performed with the patient lying supine, spinal deformities, such as spondylolisthesis and retrolisthesis, which are responses to the upright posture, may not be detected when the patient is recumbent. Failure to take plain X-ray films in the upright posture as a means for cost containment may be self-defeating, especially in surgical planning. The need for weight-bearing images should not be overlooked in appropriate situations.

Characteristic radiographic findings of the causes of back pain, such as fracture, osteomyelitis and tumor, may lead to important changes in the prescription the physician will give for further testing and treatment. The presence or absence of hypertrophic changes in posterior elements, spondylolysis, spondylolisthesis or hypermobility may influence the prescription for a specific exercise regimen, modification of posture or limitation of activity early in the course of the treatment of back pain.

Children and student athletes present a separate special case. The onset of back pain may be the result of an acute or chronic response to stress on growing bones. Spondylolysis and spondylolisthesis may present as a result of an acute stress, whereas end plate deformities may be seen as the result of an abnormality of growing cartilage. Acute spondylolysis may be successfully treated with bracing and rest, thus obviating the potential for further surgical treatment as an adult if an established spondylolisthesis results. Similarly, early return to strenuous activity may not be encouraged if chronic epiphysitis is diagnosed.

Certain additional observations of relevance, such as presence of urolithiasis, cholelithiasis or aortic aneurysm, may sometimes be gained from the study of lumbar radiographs made for low back pain.

Clinical research

In 1981, Scavone et al. [1] published a retrospective review of over 1,000 lumbar spine radiographs in 871 patients. They wanted to compare what had been discovered from the patients' histories and physical examinations with what was learned from the X-ray films. Almost half the films were normal, and an additional 30% yielded information of questionable clinical significance. Thus, 75% of the radiographs yielded no useful information. Many of these were carried out in the emergency room and medicolegal considerations may have increased their use. In patients with a history of minor trauma, no fractures were seen except in elderly women; therefore, the authors concluded that radiographs are not indicated in young and middle-aged persons who are otherwise healthy. Follow-up examinations on 375 patients demonstrated no radiologic interval changes, suggesting that the value of such studies is questionable unless there has been change of symptoms.

Also in 1981, Scavone et al. [2] published a review of the diagnostic value of different radiographic views of the lumbar spine. In 782 patients, only 2.4% had uniquely diagnostic findings on spot lateral and oblique spine films. Therefore, the authors recommended that these views should be eliminated from routine lumbar spine series. Clearly, in the at-risk of the spondylolysis population (as determined by history), these studies are still useful.

In 1982, Liang and Komaroff [3] published a comparison of the benefits and costs of x-raying everybody with backache on the initial visit versus x-raying only those whose pain did not improve within an 8-week period. Patients with a prior history of tumor, previous back surgery or possible infection were excluded from this study, as were patients with histories of sciatica or examinations suggesting neurological deficit or abdominal disease. They concluded that, in general, risks and costs of x-raying everybody on the first visit do not seem to justify the small associated benefit.

In 1990, Costa et al. [4] studied the variability of interpretation of plain lumbar spine X-ray films in patients with low back pain and concluded that interpretation varied widely among different doctors within the same specialty. Doctors disagreed in the interpretation of minor changes on X-ray films, thus calling into question the routine use of plain radiographs in simple cases of low back pain.

Discussion

The review of these four papers illustrates a trend in the medical literature suggesting that fewer radiographs should be taken and that not much more can be learned by taking multiple views than is already apparent on simple front-and-side radiographs (anteroposterior [AP] and lateral views). A number of other articles reiterate these conclusions and have not been reviewed, because they simply restate these conclusions.

Future study

Prospective studies of radiographs done for patients selected by a rational protocol that document the values for the patient and physician would be of value to provide cost–benefit analyses and for critique of specific items in the protocol. For humanistic reasons, sham studies and denial of radiographic evaluation for those who clearly need it should

not be done. Analysis of the economic, social and psychological impact of taking X-ray films during the very early stages of back pain in certain carefully defined patients could be done by randomized, controlled, prospective, independently evaluated methods.

Conclusion/current recommendations

When is radiography for low back pain indicated?

For the patient with a first episode of low back pain present for less than 7 weeks who has not been treated or who is improving with treatment, radiography of the lumbar spine is not indicated unless one or more of the following circumstances are present:

Atypical history, including:

- child or student athlete
- age over 65
- history suggesting high risk for osteoporosis
- symptoms of urinary tract dysfunction
- symptoms of persisting sensory deficit
- worsening pain in spite of adequate treatment
- intense pain at rest
- pain worse at night
- fever, chills
- unexplained weight loss
- history of injury of sufficient violence to cause fracture
- history of repetitive stress of sufficient severity to cause stress fracture
- recurrent back pain with no x-radiation in the past 2 years
- previous lumbar surgery or fracture
- history of radiographic abnormality elsewhere reported to patient but with no films or reliable report reasonably available
- history of findings from other study (eg, bone scan or gastrointestinal series) that requires spine radiograph for correlation
- anticipation of need for another study or treatment that would be facilitated by preliminary radiograph (eg, epidural injection)
- patient unable to give a reliable history.

Atypical physical findings, including:

- significant motor deficit
- unexplained deformity
- radicular sensory deficit
- reflex deficit.

Special psychological or social circumstances, including:

- crippling cancer phobia focused on back pain
- inability to secure another evaluation within 7 weeks from the onset of pain
- need for immediate decision about career or athletic future
- high risk for violent injury
- need for legal evaluation.

The above list should serve as a guideline to which clinical judgment must be applied and is not to be construed as circumstances in which radiography is necessarily indicated for a patient with low back pain present for less than 7 weeks.

For the patient with recurrent low back pain, radiography is not indicated if it was done within the previous 2 years, unless one of the above conditions is present as a change from previous circumstances and if the physician believes repeat radiography is clinically warranted. Patients with a history of a brief, self-limited, previous episode of low back pain do not require radiographic examination within the first 7 weeks of the current episode if they are improving and have none of the above circumstances. Patients who have had a substantial previous episode or multiple episodes may require radiographs before 7 weeks.

What views of the lumbar spine should be taken? In general, AP and lateral views only should be done initially, but these should be done weight bearing if possible. Gravity-induced deformities and leg length discrepancies may be missed when the patient is x-rayed in a recumbent position. In patients with multiple recurrences, chronic pain or other historical or physical findings that suggest stenosis or instability, flexion/extension or Ferguson AP views may be part of an initial evaluation. Patients who have been found to have deformity by previous radiography, or those who have a history of prior lumbar surgery or are being evaluated for pseudarthrosis may require special views, such as right and left bending, standing lateral or cone flexion/extension views to provide extra detail. Oblique views may be indicated in patients whose history or physical findings suggest spondylolysis, stress fracture or pseudarthrosis if AP and lateral films have not adequately demonstrated a lesion.

Who should perform radiographic evaluation of the lumbar spine? Physicians whose training and experience qualify them as experts in the interpretation of lumbar X-ray films may describe the findings of radiographic evaluations, for example, radiologists and those physicians who are trained in the care of patients with low back pain. Clinical correlation of radiographic findings should be done by the physician who provides the care, either from his/her review of the films or from review of the description by a radiologist, or both. The radiography should be performed by a qualified X-ray technologist using approved equipment.

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