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The American College of Radiology will periodically define new practice parameters and technical standards for radiologic practice to help advance the science of radiology and to improve the quality of service to patients throughout the United States. Existing practice parameters and technical standards will be reviewed for revision or renewal, as appropriate, on their fifth anniversary or sooner, if indicated.

Each practice parameter and technical standard, representing a policy statement by the College, has undergone a thorough consensus process in which it has been subjected to extensive review and approval. The practice parameters and technical standards recognize that the safe and effective use of diagnostic and therapeutic radiology requires specific training, skills, and techniques, as described in each document. Reproduction or modification of the published practice parameter and technical standard by those entities not providing these services is not authorized.

Revised 2017 (Resolution 7)*

ACR–ASSR–SPR–SSR PRACTICE PARAMETER FOR THE PERFORMANCE OF SPINE RADIOGRAPHY

PREAMBLE

This document is an educational tool designed to assist practitioners in providing appropriate radiologic care for patients. Practice Parameters and Technical Standards are not inflexible rules or requirements of practice and are not intended, nor should they be used, to establish a legal standard of care¹. For these reasons and those set forth below, the American College of Radiology and our collaborating medical specialty societies caution against the use of these documents in litigation in which the clinical decisions of a practitioner are called into question.

The ultimate judgment regarding the propriety of any specific procedure or course of action must be made by the physician or medical physicist in light of all the circumstances presented. Thus, an approach that differs from the practice parameters, standing alone, does not necessarily imply that the approach was below the standard of care. To the contrary, a conscientious practitioner may responsibly adopt a course of action different from that set forth in the practice parameters when, in the reasonable judgment of the practitioner, such course of action is indicated by the condition of the patient, limitations of available resources, or advances in knowledge or technology subsequent to publication of the practice parameters. However, a practitioner who employs an approach substantially different from these practice parameters is advised to document in the patient record information sufficient to explain the approach taken.

The practice of medicine involves not only the science, but also the art of dealing with the prevention, diagnosis, alleviation, and treatment of disease. The variety and complexity of human conditions make it impossible to always reach the most appropriate diagnosis or to predict with certainty a particular response to treatment. Therefore, it should be recognized that adherence to these practice parameters will not assure an accurate diagnosis or a successful outcome. All that should be expected is that the practitioner will follow a reasonable course of action based on current knowledge, available resources, and the needs of the patient to deliver effective and safe medical care. The sole purpose of these practice parameters is to assist practitioners in achieving this objective.

¹ *Iowa Medical Society and Iowa Society of Anesthesiologists v. Iowa Board of Nursing*, ___ N.W.2d ___ (Iowa 2013) Iowa Supreme Court refuses to find that the *ACR Technical Standard for Management of the Use of Radiation in Fluoroscopic Procedures* (Revised 2008) sets a national standard for who may perform fluoroscopic procedures in light of the standard's stated purpose that ACR standards are educational tools and not intended to establish a legal standard of care. See also, *Stanley v. McCarver*, 63 P.3d 1076 (Ariz. App. 2003) where in a concurring opinion the Court stated that "published standards or guidelines of specialty medical organizations are useful in determining the duty owed or the standard of care applicable in a given situation" even though ACR standards themselves do not establish the standard of care.

I. INTRODUCTION

This practice parameter was revised collaboratively by the American College of Radiology (ACR), the American Society of Spine Radiology (ASSR), the Society for Pediatric Radiology (SPR), and the Society of Skeletal Radiology (SSR).

Radiography of the spine is a proven and useful procedure for evaluating the vertebrae, disk spaces, facet and uncovertebral joints, neural foramina, and paravertebral soft tissues. This practice parameter outlines the principles for performing high-quality radiography of the cervical, thoracic, lumbar, sacral, and coccygeal spine and related osseous and soft-tissue structures to the extent they are visualized with radiography.

In many circumstances, especially when there is significant risk for spine injury, computed tomography (CT) or magnetic resonance imaging (MRI) is the initial imaging modality.

In patients with a clinical suspicion for spinal cord injury or compromise, MRI is preferred over CT and radiography.

The goal of these radiographic examinations is to identify or exclude anatomic abnormalities or disease processes of the spine and related tissues. The examinations should be performed with the minimum radiation exposure [1,2] necessary to produce a diagnostic study.

All radiographic examinations should be performed in accordance with the [ACR–SPR Practice Parameter for General Radiography](#) [3].

II. INDICATIONS

Indications include, but are not limited to, the evaluation of the spine for [4-25]:

1. Spinal Trauma
 - a. Pain
 - b. Neurologic symptoms
 - c. Instability
 - d. Limitation of motion
 - e. Nontraumatic (insufficiency and stress) fractures
 - f. Pathologic fractures
2. Spinal arthropathy
 - a. Degenerative arthropathy
 - b. Inflammatory arthropathy
 - c. Neuropathic arthropathy
 - d. Crystal-induced arthropathy
3. Spinal infection
 - a. Discitis
 - b. Osteomyelitis
 - c. Abscess
4. Spinal neoplasms and tumor-like conditions
 - a. Primary bone and soft tissue tumors
 - b. Metastatic disease
 - c. Multiple myeloma
 - d. Pagets disease
 - e. Aneurysmal bone cysts
 - f. Sarcoidosis, Langerhans cell histiocytosis, and other granulomatous conditions
5. Metabolic disorders
 - a. Osteoporosis
 - b. Renal osteodystrophy and complications related to dialysis
6. Congenital and acquired disorders
 - a. Scoliosis, kyphosis, flatback, truncal imbalance, olistheses

- b. Spondylolysis and spondylolisthesis
 - c. Congenital anomalies
 - d. Basilar invagination
6. Surgical and pre-procedure planning, including intraoperative localizing images
 7. Postoperative and postprocedural evaluation

For the pregnant or potentially pregnant patient, see the [ACR–SPR Practice Parameter for Imaging Pregnant or Potentially Pregnant Adolescents and Women with Ionizing Radiation](#) [26].

III. QUALIFICATIONS AND RESPONSIBILITIES OF PERSONNEL

See the [ACR–SPR Practice Parameter for General Radiography](#) [3].

IV. SPECIFICATIONS OF EXAMINATION

The written or electronic request for spine radiography should provide sufficient information to demonstrate the medical necessity of the examination and allow for its proper performance and interpretation.

Documentation that satisfies medical necessity includes 1) signs and symptoms and/or 2) relevant history (including known diagnoses). Additional information regarding the specific reason for the examination or a provisional diagnosis would be helpful and may at times be needed to allow for the proper performance and interpretation of the examination.

The request for the examination must be originated by a physician or other appropriately licensed health care provider. The accompanying clinical information should be provided by a physician or other appropriately licensed health care provider familiar with the patient’s clinical problem or question and consistent with the state’s scope of practice requirements. (ACR Resolution 35, adopted in 2006)

This section discusses radiographic evaluation of the spine. Spinal radiography should be performed with appropriate collimation. Further imaging examinations may be indicated based on the clinical assessment and/or evaluation of the radiographs.

A. Cervical Spine Examination

1. Adults [20-22,27-29]
 - a. Routine examination consists of anteroposterior (AP) and lateral views. More limited examinations may be performed for specific indications. A swimmer’s lateral view should be performed if necessary to assess the lower cervical segments and cervicothoracic junction alignment.
 - b. In patients who have had trauma, and for whom cervical spine CT is nondiagnostic or otherwise unavailable the entire cervical spine from the craniocervical junction to at least the superior end plate of T1 should be assessed. Upright views are preferred but may not be possible if the patient’s condition does not permit.
 - c. In some clinical circumstances, additional evaluation may include some or all of the following: open mouth view, oblique views (for assessment of the neural foramina), pillar views (for assessment of the facets), flexion and extension lateral views (for assessment of cervical instability).
 - d. If the patient has limited cervical range of motion on physical examination, flexion and extension radiographs may be inadequate to exclude instability and MRI should be obtained.
 - e. If a cervical spine collar is present, it is the responsibility of the referring physician or referring physician’s designee to remove the cervical spine collar and replace as appropriate.
2. Children [6,17,18,23-25,30-34]
 - a. Routine examination includes AP and lateral views. Lateral radiographs should be obtained in true lateral position with the neck in extension if possible, and preferably during inspiration. Some pediatric centers omit the frontal view.

- b. Oblique views are not recommended due to the added radiation and low diagnostic yield.
- c. Flexion and extension lateral views are often not possible in younger children.
- d. Odontoid views are difficult to acquire in children younger than 5 years because of their short necks and imposition of the mandible on the spine and are not recommended [23].
- e. Cervical spine injury in young children most commonly occurs from the occiput through C3 and typically involves the ligaments or cartilaginous plates more than osseous structures. Therefore, normal cervical spine radiographs do not exclude ligamentous or spinal cord injury [23-25].
- f. In older children with chronic cervical instability (especially those with Down's syndrome), lateral radiographs of the cervical spine centered at the craniocervical junction are taken in 3 positions: active flexion, active extension, and the standard neutral view [6,31-34].
- g. In the event additional imaging is needed, MRI, or occasionally CT, may be considered [10,28].

B. Thoracic Spine Examination

1. Adults

- a. A standard Routine examination includes AP and lateral views. Lower cervical or upper lumbar anatomy should be visualized to assure accurate numbering of thoracic levels.
- b. Additional evaluation may be needed in some clinical circumstances and may include some or all of the following: swimmer's lateral view, of the upper thoracic region. oblique views, flexion-extension lateral views, lateral bending views, and coned view of the thoracolumbar junction.

2. Children

- a. Routine examination includes AP and lateral views.
- b. Additional views may be obtained for specific clinical indications.

C. Lumbosacral Spine Examination in Adults and Children

1. Adults

- a. A Standard examination includes AP and lateral views. Some may choose posterior/anterior (PA) view instead of an AP view to reduce radiation dosage.
- b. In many adults and occasionally in older children, Additional evaluation may be needed and may include some or all of the following: Both oblique views, coned lateral view of the lumbosacral junction, angled AP view of the lumbosacral junction, and upright flexion and extension. lateral views may be particularly helpful to assess for abnormal motion.
- c. The upper part of the sacrum is included in the standard lumbosacral examination. When a more complete evaluation of the sacrum, coccyx, or sacroiliac joints is needed, a cephalad-angled AP (Ferguson) view of the sacrum and bilateral oblique views may be obtained [19].

2. Children

- a. Standard examination includes AP and lateral views. A posterior-anterior (PA) view may be used to reduce radiation dose.
- b. Oblique views are not recommended because of the added radiation and low diagnostic yield.
- c. Additional evaluation may be obtained for specific clinical indications.

D. Scoliosis Examination in Adults and Children

1. Adults

- a. Erect PA (or AP) views of the entire thoracolumbar spine should be obtained, either with a single long computed radiography (CR) or screen-film cassette or with separate computed radiography, digital radiography, or screen-film captures physically or electronically stitched together.
- b. Additional evaluation may be obtained for operative planning or post-operative evaluation.

2. Children

See the [ACR–SPR–SSR Practice Parameter for the Performance of Radiography for Scoliosis in Children](#) [35].

E. Examination of Infants

1. Neonates and infants are usually evaluated with ultrasound [36,37] (see the [ACR–AIUM–SPR–SRU Practice Parameter for the Performance of an Ultrasound Examination of the Neonatal and Infant Spine](#)) [38] or MRI if congenital abnormality is highly suspected clinically or based on other imaging.
2. Interpretation of cervical spine radiography is difficult in infants because of epiphyseal variants, incomplete ossification of synchondroses including the apex of the odontoid, normal ligamentous laxity resulting in pseudosubluxation of C2 on C3, and the propensity of ligamentous rather than bone injury. Normal lack of ossification of the anterior arch of C1 precludes radiographic evaluation of the atlantodental spine.

F. Limited Examinations

1. For some clinical indications (eg, intraoperative or postsurgical follow-up), a limited examination of the area of clinical concern may provide sufficient information.
2. The goal is to limit patient radiation exposure.

V. DOCUMENTATION

Reporting should be in accordance with the [ACR Practice Parameter for Communication of Diagnostic Imaging Findings](#) [39].

VI. EQUIPMENT SPECIFICATIONS

See the [ACR–SPR Practice Parameter for General Radiography](#) [3].

VII. RADIATION SAFETY IN IMAGING

Radiologists, medical physicists, registered radiologist assistants, radiologic technologists, and all supervising physicians have a responsibility for safety in the workplace by keeping radiation exposure to staff, and to society as a whole, “as low as reasonably achievable” (ALARA) and to assure that radiation doses to individual patients are appropriate, taking into account the possible risk from radiation exposure and the diagnostic image quality necessary to achieve the clinical objective. All personnel that work with ionizing radiation must understand the key principles of occupational and public radiation protection (justification, optimization of protection and application of dose limits) and the principles of proper management of radiation dose to patients (justification, optimization and the use of dose reference levels)

http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1578_web-57265295.pdf

Nationally developed guidelines, such as the ACR’s [Appropriateness Criteria](#)[®], should be used to help choose the most appropriate imaging procedures to prevent unwarranted radiation exposure.

Facilities should have and adhere to policies and procedures that require varying ionizing radiation examination protocols (plain radiography, fluoroscopy, interventional radiology, CT) to take into account patient body habitus (such as patient dimensions, weight, or body mass index) to optimize the relationship between minimal radiation dose and adequate image quality. Automated dose reduction technologies available on imaging equipment should be used whenever appropriate. If such technology is not available, appropriate manual techniques should be used.

Additional information regarding patient radiation safety in imaging is available at the Image Gently® for children (www.imagegently.org) and Image Wisely® for adults (www.imagewisely.org) websites. These advocacy and awareness campaigns provide free educational materials for all stakeholders involved in imaging (patients, technologists, referring providers, medical physicists, and radiologists).

Radiation exposures or other dose indices should be measured and patient radiation dose estimated for representative examinations and types of patients by a Qualified Medical Physicist in accordance with the applicable ACR technical standards. Regular auditing of patient dose indices should be performed by comparing the facility's dose information with national benchmarks, such as the ACR Dose Index Registry, the NCRP Report No. 172, Reference Levels and Achievable Doses in Medical and Dental Imaging: Recommendations for the United States or the Conference of Radiation Control Program Director's National Evaluation of X-ray Trends. (ACR Resolution 17 adopted in 2006 – revised in 2009, 2013, Resolution 52).

VIII. QUALITY CONTROL AND IMPROVEMENT, SAFETY, INFECTION CONTROL, AND PATIENT EDUCATION

Policies and procedures related to quality, patient education, infection control, and safety should be developed and implemented in accordance with the ACR Policy on Quality Control and Improvement, Safety, Infection Control, and Patient Education appearing under the heading *Position Statement on QC & Improvement, Safety, Infection Control, and Patient Education* on the ACR website (<http://www.acr.org/guidelines>).

Equipment performance monitoring should be in accordance with the [ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Radiographic Equipment](#) [40] and the [ACR–AAPM Technical Standard for Diagnostic Medical Physics Performance Monitoring of Fluoroscopic Equipment](#) [41].

Radiographic Quality Control in Adults and Children

1. Examinations of the spine should completely demonstrate the designated portion(s) of the spine or the levels of clinical interest in a limited examination.
2. Images not of diagnostic quality should be repeated.
3. Each image should be permanently labeled in accordance with the [ACR–SPR Practice Parameter for General Radiography](#) [3].

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