

Chapter 3 – Diagnostic Imaging

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Diagnostic Imaging

Radiographic Examination: Standards and Indications

Position Statement

Radiography should only be performed on the basis of clinical necessity as judged by the attending clinician educator. Following are several standards and indications for ordering imaging studies. These standards and indications are offered to assist in decision making utilizing the best available current evidence. Furthermore, they are based on the well-recognized principle that exposure to unnecessary ionizing radiation represents a health hazard.

The following standards and indications are consistent with the rules of conduct when employing radiography procedures common throughout the health care community and are consistent with those recommended by the Center for Devices and Radiological Health, Food and Drug Administration of Health and Human Services.

A. Standards for Radiographic Examination

The primary purpose of the radiographic examination is to help confirm or exclude clinically suspected pathologic conditions such as neoplasm, infection, fracture, dislocation, scoliosis, metabolic, arthritic disorders and moderate or severe motion segment changes (as evidenced by history, physical examination, neurological/orthopedic examination and chiropractic analysis procedures). Every radiographic examination should be justified by meeting the following criteria:

1. The radiographic examination will increase information about the patient's complaint.

2. The radiographic examination will result in alteration of prognosis or alter the patient management.

3. The benefit of the radiographic examination will outweigh the iatrogenic hazards of ionizing radiation exposure.

4. The radiographic examination will be a more useful test than alternative, less invasive diagnostic procedures.

B. Selection of Radiographic Examinations in Chiropractic Practice: Technical Considerations

1. Minimum Number of Views

   Two opposing views of any body part, generally obtained at 90 degrees to each other, constitute the usual minimum for radiographic study. It is recommended that the standard series for any body part be performed. Additional views may

include supplementary, non-standard projections when clinically warranted and in pediatric patients where comparison views may be indicated.

2. NYCC Standard Projections

Table 1 lists the views considered standard radiographic projections.

Table 1: Standard Radiographic Series

Region	Views		
Cervical	APOM	AP	Lateral
Thoracic		AP	Lateral
Lumbar		AP	Lateral
Pelvis		AP	Frog-Leg
Hip		AP	Frog-Leg
Shoulder	Internal Rotation	External Rotation	
Acromioclavicular Joint	Bilateral non-weighted	Bilateral Weighted	
Clavicle	AP	Semi-Axial	
Elbow	AP	Lateral	External Oblique
Wrist	AP	Lateral	Medial Oblique
Hand	AP	Lateral	Medial Oblique
Finger(s)	AP	Lateral	Medial Oblique
Hip	AP	Frog - Leg	
Knee	AP	Lateral	Internal Oblique
Ankle	AP	Lateral	Internal Oblique
Foot	AP	Lateral	Internal Oblique
Toe(s)	AP	Lateral	Medial Oblique

3. Minimization of Radiation Exposure

All radiographic examinations should be performed using all available methods of radiation exposure reduction including, whenever possible, gonad shielding, added filtration, lead aprons, optimum collimation, fixed optimum kV technique, and precise patient positioning. The principle of achieving the maximum diagnostic quality with radiation exposure as low as reasonably achievable (ALARA) should be closely followed.

Occupationally exposed persons (clinician educator, intern, staff member) aware that they are pregnant must notify the Radiation Safety Officer and/or clinic director of the pregnancy. The individual should then be directed to speak with a radiation physicist or the appropriate government agency regarding the consequences of taking radiographs while pregnant.

Holding of a patient by a clinician educator, intern, staff member, or patient's family during a radiation exposure is not allowed. Patient's requiring such assistance should be referred to a facility that is equipped to monitor the exposure to the person doing the holding.

C. Selection of Radiographic Examinations in Chiropractic Health Center Practice: Specific Situations

1. Progress Re-evaluation

   Repeat radiographic examination should not be routinely performed without significant observable clinical indications as determined by the attending clinician educator.

2. Female Patients

   When the possibility of pregnancy exists, females with reproductive potential should only be radiographed during the first ten days following the onset of the menstrual cycle. It is standard protocol to obtain a signed release from female patients regarding where they are in the 10-day rule and/or that they confirm that they are not pregnant.

3. Pregnant Patients

   No radiographs will be performed on any patient suspected to be pregnant. If radiographs are deemed necessary, the patient should be referred to a facility that is equipped to monitor fetal exposure.

4. Radiation Safety Policy for Pregnant Employees and Clinic Interns

   It is the responsibility of any radiation worker who is pregnant or believes that she may be pregnant to notify the Chief of Staff in writing as soon as possible. Federal and state regulations require that special precautions be taken to limit exposure to radiation sources when an occupationally exposed woman could be pregnant.

   The dose to the fetus resulting from occupational exposure of a declared pregnant woman may not exceed 500 mRem for the entire pregnancy. The fetal dose regulations apply only to a woman who has voluntarily informed her employer, in writing, of her pregnancy and the estimated date of conception. Pregnant radiation workers should consider fetal monitoring during pregnancy if they are directly involved in obtaining radiographs in our clinics. It is recommended that the pregnant radiation worker avoid higher radiation exposure procedures such as x-ray fluoroscopy.

   Clinic interns who are pregnant or believe that they may be pregnant should not be involved in taking radiographs and should not be in the x-ray laboratory while radiographs are being performed.

5. Pediatric Patients

   Clinical indications for radiographic examination of infants and children follow the same criteria as for adults. Clinical history and examination findings dictate the need for radiography.

6. Recumbent Radiography

   Most radiographs of the spine and pelvis are obtained in the upright, standing position. All radiographs must be performed with the intention of obtaining images of maximum possible quality. In certain cases, recumbent radiography may be necessary in order to obtain maximum radiographic quality. Some such situations would include radiographing patients that are too feeble or in too much pain to stand without moving during the exposure or the obese patient that requires excessively long exposures.

7. Full-Spine Radiography

   Standard spinal radiographic series include sectional radiographs of each individual spinal region. Radiographs of the full-spine (cervical, thoracic, and lumbar) should only be ordered in cases of suspected scoliosis or when clinically indicated for multi-level pathology. Full-spine radiographs are not indicated as a routine procedure for postural or biomechanical analysis.

8. Advertising and Incentives

   Any offer or advertising of free or reduced-fee radiographs to actual or potential patients are considered unethical and inappropriate.

D. Specific Indications for Spinal Radiographs

Table 2 includes red flags obtained in the history and physical examination that represent a high risk for pathology and that are indications for spinal radiography.

When radiographs are obtained for the following reasons, the standard examination includes AP and lateral radiographs, except the cervical spine, in which an AP open mouth is also considered part of the standard series. Oblique views are only indicated for further evaluation after the standard series has been obtained. (See Table 3.)

TABLE 2: Indications for Spinal Radiographic Examinations

Back pain plus any one of the following	Significance
A. HISTORY	
Age greater than 50 years	Tumor, aortic aneurysm
Trauma sufficient to cause fracture	Fracture
History of osteoporosis	Compression fracture
History of cancer	Skeletal metastatic disease
Unrelenting pain at rest	Cancer, infection, fracture
Unexplained weight loss	Cancer, infection
History of corticosteroid use	Compression fracture, infection
Immunosuppression	Infection
Diabetes mellitus	Infection
Intravenous drug abuse	Infection
Alcohol abuse	Infection, fracture
Suspected or confirmed inflammatory arthropathy	Seronegative spondyloarthropathy
History of spine surgery	Infection
Unresponsive to treatment (4 weeks)	Tumor, infection, fracture
B. PHYSICAL EXAMINATION	
Neurologic deficit	Tumor, infection, neurologic disorder
Fever of unknown origin above 100 F	Infection
Dermopathy (psoriasis, melanoma)	Psoriatic arthropathy, metastasis
Cachexia	Cancer, infection
Deformity and immobility	Structural abnormalities
Lymphadenopathy	Cancer, infection
Motor or sensory deficit	Neurologic disorder
Scoliosis	Scoliosis
C. LABORATORY EXAMINATION	
Elevated erythrocyte sedimentation rate	Inflammation: cancer, infection, fracture
Elevated alkaline phosphatase	Cancer, infection, Paget's disease
Elevated prostate specific antigen	Prostate cancer
Positive rheumatoid factor	Rheumatoid arthritis
Positive HLA B27 antigen	Seronegative spondyloarthropathy
Elevated serum calcium	Osteolytic metastatic disease, myeloma
Serum gammopathy	Myeloma

E. Specific Indications for Oblique Spinal Radiographs

TABLE 3

Indications
A. CERVICAL SPINE
Extensive degenerative disease
Radiculopathy
Cervical spondylotic myelopathy
Suspected fracture
Further evaluation of equivocal findings on standard AP and lateral radiographs in consultation with the radiologist
B. LUMBAR SPINE
Suspected spondylolysis
Further evaluation of equivocal findings on standard AP and lateral radiographs in consultation with the radiologist

F. Specific Indications for Flexion-Extension Spinal Radiographs (To be obtained only after routine radiographs are scrutinized.)

TABLE 4

Indications
Suspected segmental instability
Failed surgical fusion
Inflammatory spondyloarthropathy
High risk ligament laxity populations

Magnetic Resonance Imaging

G. Criteria for Ordering Magnetic Resonance Imaging

Magnetic Resonance Imaging (MRI) is generally considered to be the single best advanced imaging modality of the spine and peripheral joints. The primary purpose of MR Imaging is to serve as a follow up to confirm or exclude clinically relevant findings and is ordered only after an appropriate conventional radiographic examination has been performed and interpreted.

A referral to an appropriate healthcare provider is indicated in cases necessitating emergency care or those strongly suggesting a diagnosis outside the scope of Chiropractic practice. Consultation with a radiologist is suggested before proceeding with this advanced imaging.

Table 5 lists red flags obtained in the history, physical examination, and / or on conventional radiographic examination that represents a high risk for pathology and that are indications for MR Imaging. Table 6 lists the major contraindications for MR Imaging.

TABLE 5: Indications for MR Imaging

Patients must meet at least one of the following criteria
A. Spine
Clinical suspicion of spinal cord or cauda equina compression syndrome
Primary malignant spinal bone tumors
Known or suspected primary spinal cord tumors (malignant or non-malignant)
Suspected vertebral, paraspinal, or intraspinal metastases
Suspected osteomyelitis or septic arthritis
Suspected pathologic vertebral body compression fracture
Suspected spinal fracture and/or dislocation secondary to trauma (CT may be better)
Suspected spinal cord injury secondary to trauma
Known or suspected myelopathy
Unstable or complex congenital anomalies or deformities of the spine
Instability and degenerative disease of the spine that has not responded to 4 weeks of conservative therapy
Persistent back pain with or without radiculopathy with no improvement after 4 weeks of conservative care
Rapidly progressing neurological deficit and/or motor weakness
Clinical evidence of spinal stenosis (CT may be just as useful)
Evaluation of recurrent symptoms after spinal surgery
Rapidly progressing left-sided or atypical scoliosis
Platybasia / basilar impression
Enlarged sella as seen on cervical spine radiographs (Brain (MR) Imaging indicated)
Posterior vertebral body scalloping seen on radiographs
Unexplained /painless swollen joints (Charcot's joint)
B. Extremities
Suspected internal joint derangement
Suspected osteonecrosis
Unexplained regional osteoporosis
Suspected bone bruise or bone marrow edema
Unexplained soft tissue mass
Stress, occult, or minimally displaced fractures

Table 6: Contraindications to MR Imaging

Heart pacemaker
Metallic foreign body (or suspicion of metallic foreign body) in the eye
Cochlear implants
Ferromagnetic surgical clips
Severe claustrophobia (Open MRI may be an option)
Metallic devices that severely alter the resolution of the scan
Morbid obesity (Open MRI may be an option)

Computed Tomography

H. Criteria for ordering Computed Tomography

Computed Tomography (CT) is an advanced imaging modality that utilizes ionizing radiation. It is generally considered to be the gold standard imaging modality for the chest, abdomen, pelvis, complex osseous anatomy, and in musculoskeletal disorders when contraindications for MRI exist. The primary purpose of CT, as in MRI, is to serve as a follow up to confirm or exclude clinically relevant findings and is ordered only after an appropriate radiographic examination has been performed and interpreted.

A referral to an appropriate heath care provider is indicated in cases necessitating emergency care or those strongly suggesting a diagnosis outside the scope of Chiropractic practice. Consultation with a radiologist is suggested before proceeding with this advanced imaging.

Table 7 list red flags obtained in the history, physical examination, and / or on radiographic examination that represents a high risk for pathology and that are indications for CT.

Table 7: Indications for CT

Follow-up to questionable chest, abdomen, or pelvic pathology
When an MR Imaging is contraindicated or unavailable
Suspected spinal fracture and/or dislocation secondary to trauma
Bony spinal stenosis (congenital / degenerative)
Unstable or complex congenital anomalies or deformities of the spine (MR Imaging may be better)

Radionuclide Bone Scintigraphy

I. Criteria for Radionuclide Bone Scintigraphy (Bone Scan)

Bone Scintigraphy is an imaging modality that utilizes a radiopharmaceutical and a gamma camera to produce a physiologic skeletal survey. It has high sensitivity and low specificity and is generally used to document presence or absence of disease and whether diseased areas are polyostotic or monostotic. Other important indications for the use of bone scintigraphy in chiropractic is to document suspected or confirmed osseous metastasis, occult feature or infection.

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