

Study of Osteoporotic Fractures

Protocol for Radiographic Studies of Visit 3

Outline of modifications with respect to visit 1:

The specifications as detailed in the protocol of August 28, 1986, will remain unchanged. The primary aim in terms of quality assurance will be to **reproduce the original measurement technique as closely as possible**. However, we also feel that it might be helpful to describe the optimum measurement procedure in somewhat more detail in order to create an awareness for the problems that have to be encountered.

If in the past a center has not followed the detailed approach, that will be described in a radiography quality assurance protocol, but systematically used a different but also well specified approach we recommend that this different approach be presented for review by the coordinating center. Most likely we will recommend to continue with the old approach.

If, however, a center has used a less defined approach that may occasionally have differed from our suggested method we will recommend to follow the new well defined protocol.

The new protocol includes:

- more detailed specification of the x-ray equipment to be used to ensure the use of state of the art technology,
- a detailed description of patient positioning with particular emphasis on
 - use of supporting devices to avoid sagging of the spine,
 - proper centering of the central ray to minimize image distortions due to suboptimal projection angles,
- suggestions for placement of lead shields to avoid unnecessary irradiation,
- a listing of criteria for assessing image quality to be used for in-house quality assurance purposes.

While we do not think that this protocol update represents substantial modifications of the original protocol we hope, however, that it will help to enhance the quality of the scans and reduce inter-center differences in the measurement approach.

If you have any questions regarding this protocol, please get back to either Claus Glüer at (415) 476-5551 or Ken Faulkner at (415) 476-9805 before you start with patient examinations. This will give us a chance to contact the other centers in time.

Standard imaging parameters for conventional X-ray examinations of the thoracic and lumbar spine (lateral view)

The proposals for standard projections in radiological diagnostics are partly based on the recommendations issued by the Central Executive board for Science, Research and Development of the Commission of the European Economic Community, Section for Medical Radiation Exposure, that were formulated at the International Workshop on "Optimization of Image Quality and Radiation Exposure of Patients in Radiological Diagnostics" (Oxford, Sept. 27-29, 1988). Patient position and technical notes are partly from R. Eisenberg, 'Radiographic Positioning' (Little, Brown and Company; Boston/Toronto/London), (1989).

Thoracic spine

Lateral projection

1. Imaging technique (recommendations)

- | | |
|--------------------------|--|
| a. Imaging system | - Bucky screen technique |
| b. Focus size | - ≤ 1.3 mm |
| c. Total filtering | - ≥ 3.0 mm Al-equivalent value |
| d. Scattering grid | - $r = 12/40$ |
| e. Film/foil combination | - Sensitivity range 200 |
| f. Film/focus distance | - 40 inches (invariable !!) |
| g. Imaging voltage | - 65-70 kVp; |
| h. Exposure time | - Breathing technique; 2 second exposure |

2. Film size

14 x 17 in. cassette

3. Patient position

- Place patient on table in lateral position (left lateral if possible to reduce magnification of overlying heart shadow) with legs flexed for comfort and support.
- Place support under patient's head.
- Place both arms at right angles to anterior surface of body (if arms are raised higher, scapulae may superimpose upper thoracic vertebral bodies), and flex elbows for comfort.
- Place supports between knees and ankles and under knee next to table (for support and to aid in maintaining lateral position).
- Place lead shield over lower part of the patient to protect gonads.

4. Part Position

- Place support under midlumbar region to place long axis of spine parallel to table.
- Adjust body to lateral position (shoulders, hips, knees, and ankles superimposed).

- c. Align midaxillary (coronal) plane of body to midline of table.
- d. To assure lateral position, stand at head of table and look down the patient's back and hips to make certain that there is vertical superimposition of shoulders and hips.
- e. Center cassette (in Bucky tray) to level of 7th thoracic vertebral body (level of two fingerbreadth (1 inch) caudal of the tip of scapula when arms elevated); top of cassette should be about 2 in. (5 cm) above shoulders to include the 7th cervical vertebra.

5. Central Ray

- a. Direct central ray perpendicular to 7th thoracic vertebra or to midportion of cassette (1 cm or more collimation must be seen on the roentgen film).
- b. Close collimation and placing lead sheet on table behind area of thoracic vertebra aid in reducing scattered radiation.

6. Patient Instruction

Have patient breathe quietly for exposure (this allows blurring of the overlying ribs and lung detail by motion. However, this requires complete immobilization of the patient and a long exposure time).

7. Criteria for assessing image quality

- a. Line-shaped visualization of the upper and lower plates in the central ray and demonstration of the intervertebral spaces.
- b. Complete superposition of the posterior edges of the vertebral bodies.
- c. Clear visualization of the oval arch roots.
- d. Demonstration of the vertebral arches and intervertebral foramina.
- e. Clear demonstration of the cortex and trabecula of the spongiosa
- f. Visualization of adjacent soft tissue.
- g. Inclusion of T4 to T12.

8. Special Remarks:

Examination with the patient in a laying position.

On both the thoracic and the lumbar images T12 must be included.

Lumbar Spine

Lateral projection

1. Imaging technique (recommendations)

- a. Imaging system - Bucky screen technique
- b. Focus size - ≤ 1.3 mm
- c. Total filtering - ≥ 3.0 mm Al-equivalent value
- d. Scattering grid - $r = 12/40$
- e. Film/foil combination - Sensitivity range 200
- f. Film/focus distance - 40 inches (invariable !!)
- g. Imaging voltage - 80 kVp
- h. Exposure time - < 1000 ms

2. Film size

7 x 17 in. (18 x 43 cm / 20 x 40 cm) lengthwise (normal person)
or
11 x 14 in. (30 x 35 cm), lengthwise (extreme lordosis)

3. Patient position

- a. Place patient on table in lateral position (left lateral if possible) with arms and legs flexed for comfort and support.
- b. Place pillow under patient's head.
- c. Place supports between knees and ankles and under knee next to table (for support and to aid in maintaining lateral position).
- d. Place lead shield over patient to protect gonads

4. Part Position

- a. Place radiolucent support under midlumbar region to place long axis of spine parallel to table.
- b. Adjust body to lateral position (shoulders, hips, knees, and ankles superimposed).
- c. Align midaxillary (coronal) plane of body to midline of table.
- d. To assure lateral position, stand at head of table and look down the patient's back and hips to make certain that there is vertical superimposition of shoulders and hips.
- e. If using 11 x 17 in. (30 x 43 cm) film, center cassette (in Bucky tray) to level of 2nd lumbar vertebra (lower margin of ribs).

5. Central Ray

- a. Direct central ray perpendicular to 3rd lumbar vertebra.
- b. Close collimation and placing lead shield on table behind lumbar spine aid in reducing scattered radiation.

6. Patient Instruction

Have patient suspend respiration for exposure (on expiration to get the lungs out of the scan field of view).

7. Criteria for assessing image quality

- a. Line-shaped visualization of the upper and lower plates in the central ray and demonstration of the intervertebral spaces.
- b. Complete superposition of the posterior edges of the vertebral bodies.
- c. Clear visualization of the oval arch roots.
- d. Demonstration of the vertebral arches and intervertebral foramina.
- e. Clear demonstration of the cortex and trabecula of the spongiosa.
- f. Visualization of adjacent soft tissue.
- g. Inclusion of T12 to L5.

8. Special Remarks

Both the thoracic and the lumbar images T12 must be included.