Reading Hospital School of Health Sciences
Medical Imaging Program
MI 243 Clinical Seminar IV
2022

Lumbar Spine

Routine:	*AP, RPO, LPO, Lateral Lumbar, Lateral L5/S1*
Projection:	**AP**
Patient Prep:	Remove everything except shoes, socks, and underwear including bra, and any metal overlying abdomen
Technique:	AEC: 90 kVp, center cell, grid Manual: 10 mAs 90 kVp, grid
SID:	40" *
Collimation:	14X17 Portrait *(RH - Do not collimate to spine. Here this view is used as a general survey of the abdomen and kidneys also**)*
Patient Position:	Pt supine***. Adjust the shoulders and hips to lie in the same transverse plane. Pt straight on table. To reduce kyphosis and lumbar lordosis, you can flex the patient's hips and knees enough to place the back in firm contact with the table.
Central Ray:	Central ray is perpendicular to the IR at about the level of the iliac crests (L4) and centered down the MSP.
Marker Placement:	Right or Left marker on corresponding side
Shielding:	Shield all males No shielding for females required
Breathing:	Suspended expiration
Purpose/Structures:	Entire lumbar spine including lower T12 and superior sacrum. Lumbar bodies, intervertebral disk spaces laminae, and spinous and transverse processes. L5/S1 disk space not shown well in AP projection.

Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Bony trabecular detail and surrounding soft tissues.
- Area from lower thoracic vertebrae (T 12) to the sacrum should be included

- Exposure should penetrate all the vertebral structures
- Intervertebral joints should be open and well visualized
- No rotation
    - Sacroiliac joints should be equidistant from the vertebral column
    - Symmetric vertebrae, with the spinous processes centered to the bodies
- No artifact across mid-abdomen from elastic in underclothing

Additional Notes:
* Merrill's recommends 48" to reduce distortion and open intervertebral disk spaces more completely.
** Merrill's recommends 8x14 or 8x17 collimation.
***Merrill's mentions this image can be obtained in the PA position which would place intervertebral disk spaces at an angle more closely parallel to the divergence of the beam. Patient dose is also reduced due to decreased abdominal thickness when prone.

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Routine:	*AP, RPO, LPO, Lateral Lumbar, Lateral L5/S1*
Projection:	**RPO/LPO**
Patient Prep:	Remove everything except shoes, socks, and underwear including bra, and any metal overlying abdomen
Technique:	AEC: 90 kVp, center cell, grid Manual: 18 mAs 90 kVp, grid
SID:	40”
Collimation:	11X14 LW
Patient Position:	Using an oblique sponge, have the patient turn from the supine position approximately 45°.
Central Ray:	Perpendicular to the third lumbar vertebrae (about 1- 1.5” above the iliac crest), entering about 2” medial to the elevated ASIS.
Marker Placement:	Mark the side down (demonstrates articular processes of the side ***closest*** to the IR.)
Shielding:	Shield all males No shielding for females required
Breathing:	Suspended expiration
Purpose/Structures:	Articular processes and zygapophyseal joints of side closest to IR.

Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Bony trabecular detail and surrounding soft tissues.
- Area from the lower thoracic vertebrae to the sacrum should be included. Include down to bottom of SI Joints
- Zygapophyseal joints closest to the film should be well demonstrated
    - When the joint is not well demonstrated and the pedicle is anterior on the vertebral body, the patient is not rotated enough.
    - When the joint is not well demonstrated and the pedicle is posterior on the vertebral body, the patient is rotated too much.

- Vertebral column parallel with the tabletop so that the T12-L1 and L1-L2 joint spaces remain open

Additional Notes:
* Merrills mentions an oblique of 60 degrees may be needed to show the L5-S1 Zygapophyseal joints.

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Routine: *AP, RPO, LPO, Lateral Lumbar, Lateral L5/S1*

Projection: **Lateral**

Patient Prep: Remove everything except shoes, socks, and underwear including bra, and any metal overlying abdomen

Technique: AEC: 96 kVp, center cell, grid
Manual: 28 mAs 96 kVp, grid

SID : 40''*

Collimation: 11x14 Portrait

Patient Position: Place the patient in the left lateral recumbent position, with knees and hips flexed to stabilize the patient. A support may be placed between the knees to help obtain true lateral position. Center the mid-coronal plane of the body to the midline of table keeping the spine in a true lateral. Adjust patient's arms in a position at right angles to the body. **

Central Ray: Perpendicular to the IR at the level of L2/L3 (about 1.5 – 2" above the iliac crest), entering the mid-coronal plane (which is located about 3" anterior to the palpated spinous process of L4).

Marker Placement: Left marker on patient's anterior side

Shielding: Shield all males
No shielding for females required

Breathing: Suspended expiration

Purpose/Structures: Entire lumbar spine including lumbar bodies, spinous processes, and lumbosacral junction. Profile image of L1-4 intervertebral foramina.

Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Bony trabecular detail and surrounding soft tissues.
- Area from the lower thoracic vertebrae to L5/S1 junction should be visualized
- Open intervertebral disk spaces and foramina L1-L4.
- No rotation
    - Posterior margins of each vertebral body should be superimposed
    - The crests of the ilium should nearly superimpose each other

- Vertebrae should be aligned down the middle of the radiograph
- Spinous processes in profile

Additional Notes:

* Merrill's recommends: 48" SID to reduce magnification of the spine (spine has significant OID). Also a piece of lead posteriorly behind the pt on the table will help absorb the significant scatter produced in this projection.

**Merrill's recommends: if the long axis of the vertebral column is not horizontal elevate the lower thoracic region with a radiolucent support. This is the preferred method. If not using a support, tube can be angled an avg of 8° caudad for females and 5° for males.

RH - When a patient arrives for AP and Lateral L-spine imaging, obtain all lumbar spine vertebrae on lateral image. There is no need for an L5-S1 conedown image.

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Routine: *AP, RPO, LPO, Lateral Lumbar, Lateral L5/S1*

Projection: **Lateral L5/S1**

Patient Prep: Remove everything except shoes, socks, and underwear including bra, and any metal overlying abdomen

Technique: AEC: 96 kVp, center cell, grid
Manual: 45 mAs 96 kVp, grid

SID : 40''

Collimation: 10X12 Portrait

Patient Position: Place the patient in the left lateral recumbent position, with knees and hips flexed to stabilize the patient. A support may be placed between the knees to help obtain true lateral position. Center the mid-coronal plane of the body to the midline of table keeping the spine in a true lateral.*

Central Ray: Angled caudally (5° for males and 8° for females). It should pass on a coronal plane 2" posterior to the elevated ASIS and 1.5" inferior to the iliac crest.

Marker Placement: Left marker on patient's anterior side

Shielding: No shielding required on males or females

Breathing Instructions: Suspended expiration

Purpose/Structures: Disc space between L5 and S1 opened

Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Bony trabecular detail and surrounding soft tissues.
- Lumbosacral joint should be clearly seen and open
- All of the fifth lumbar vertebra should be included as well as the upper portion of the sacrum
- Lumbosacral joint should be in the center of image
- Exposure should penetrate both ilia to demonstrate the lumbosacral joint
- Not rotation as evident with crests of ilia nearly superimposing each other when beam if beam is not angled.

Additional Notes:

*Merrill's recommends: if the long axis of the vertebral column is not horizontal elevate the lower thoracic region with a radiolucent support. This is the preferred method. If not using a support, tube can be angled an avg of 8° caudad for females and 5° for males. Alternative method: draw imaginary line between interiliac line and adjust central ray so parallel. A larger waist may require a slightly cephalic tube angle.

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Special Views for Lumbar Spine

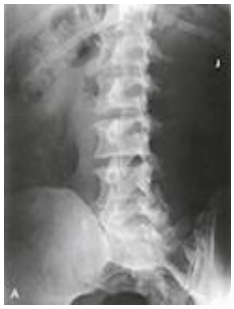
*information from 14th edition Merrill's Volume I, page 477-478

Position/ Projection:	**Anterior Obliques (RAO/LAO)**
Patient Prep:	Remove everything from waist up including bra and necklaces.
Technique:	AEC: 90 kVp, center cell, grid Manual: 18 mAs 90 kVp, grid
SID:	40"
Collimation:	11x14 portrait
Patient Position:	From the prone position, have the patient turn away from the side of interest approx. 45 degrees. Support the body on the forearm and flexed knee. An oblique position of 60 degrees from the plane of the IR may be needed to sho L5/S1 Zygapophyseal joints. Adjust body so long axis of pt is parallel to table. Center the pt's spine to the oblique grid. In this positon the lumbar spine lies in the longitudinal plane that passes 2" lateral to the spinous processes.
Central Ray:	Perpendicular to enter the elevated side approx. 2" latera. To the palpable spinous process and 1-1.5" above the iliac crest
Marker Placement:	Mark side against IR
Shielding:	Shield both males and females
Breathing Instructions:	Suspended expiration
Purpose/ Structures:	In a 45 degree oblique position, the articular process and zygapophyseal joints are shown. When properly position, lumbar spine will have scotty dog appearance.

Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Area from lower thoracic vertebrae to the sacrum
- Zygapopyseal joints farthest from IR
    - When joint is not well seen and pedicle is quite anterior on the body, the pt is not rotated enough

- When the joint is not well seen and the pedicle is quite posterior on the body, the pt is rotated too much.
- Vertebral column parallel with the tabletop so that the T12-L1 and L1-L2 intervertebral joint spaces remain open
- Bony trabecular detail and surrounding soft tissues



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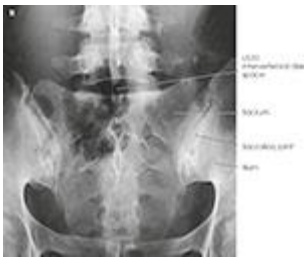
Special Views for Lumbar Spine

*information from 14th edition Merrill's Volume I, page 479-480

Position/ Projection: **L5/S1 AP Axial**

Patient Prep: Remove everything from waist up including bra and necklaces.



Technique: AEC: 90 kVp, center cell, grid
Manual: 10 mAs 90 kVp, grid

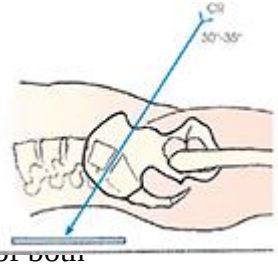
SID: 40"

Collimation: 10x12 portrait

Patient Position: Patient supine and MSP centered to grid, extend pts lower limbs or abduct thighs and adjust in vertical position. Ensure the pelvis is not rotated.

Central Ray: Directed through the lumbosacral joint at an angle of 30 degrees cephalad for male and 35 degrees for female. CR enters the MSP 1.5" superior to the pubic symphysis or 2-2.5" inferior to the ASIS. Center IR to CR.

Marker Placement: Left or right marker on appropriate side

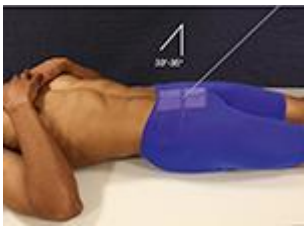


Shielding: Shield both males and females

Breathing Instructions: Suspended respiration

Purpose/ Structures: The lumbosacral joint and a symmetric image of both sacroiliac joints free of superimposition.

Evaluation Criteria:



- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Lumbosacral junction and sacrum
- Open intervertebral disk space between L5/S1\Both sacroiliac joints
- Bony trabecular detail and surrounding soft tissues

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Special Views for Lumbar Spine

*information from 14th edition Merrill's Volume I, page 497-498

Position/ Projection:	**AP RIGHT AND LEFT BENDING**
Patient Prep:	Remove everything from waist up including bra and necklaces.
Technique:	AEC: 90 kVp, center cell, grid Manual: 10 mAs 90 kVp, grid
SID:	40"
Collimation:	14x17 portrait
Patient Position:	Supine or erect with MSP of body to midline of grid. Make the first radiograph with maximum right bending and make the second with maximum left bending. When the patient is supine - to obtain equal bending force throughout the spine cross the patient's leg on the opposite side to be flexed over the other leg. A right bending requires the left leg to be crossed over the right. Move both he patient's heels toward the side that is flexed. Immobilize heels with sandbags. Move shoulders laterally as far as possible without rotating the pelvis.
Central Ray:	Perpendicular to the level of the third lumbar vertebra 1-1.5" above the iliac crest on the MSP. Center the IR to the central ray.
Marker Placement:	Left or right marker on the side the patient is bending towards.
Shielding:	Shield both males and females
Breathing Instructions:	Suspended respiration
Purpose/ Structures:	Used to evaluate the integrity of a spinal fusion and are usually performed 6 months after fusion procedure. Also used for early scoliosis to determine presence of structural change when bending to right and left. May be used to localize a herniated disk as shown by limitation of motion at the site of the lesion.

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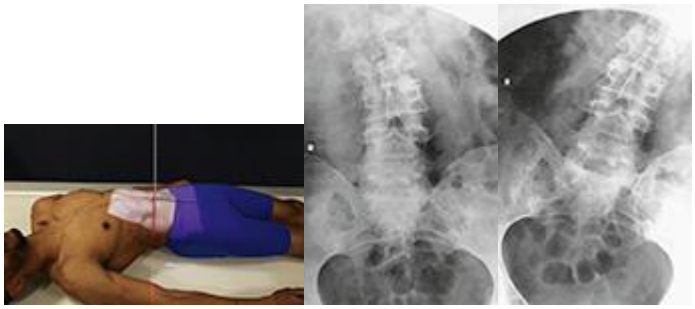
-Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Site of spinal fusion centered and including the superior and inferior vertebrae
- No rotation of the pelvis (symmetric ilia)
- Bending directions correctly identified with appropriate lead markers
- Bony trabecular detail and surrounding soft tissues



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Special Views for Lumbar Spine

*information from 14th edition Merrill's Volume I, page 499-500

Position/ Projection: **LATERAL FLEXION AND EXTENSION**

Patient Prep: Remove everything from waist up including bra and necklaces.

Technique: AEC: 96 kVp, center cell, grid
Manual: 28 mAs 96 kVp, grid

SID: 40"

Collimation: 14x17 portrait

Patient Position: Adjust the patient in the upright or lateral recumbent position. Center midcoronal plane to midline of grid.
Flexion – Ask patient to bend forward, to flex spine as much as possible.
Extension – Ask the patient to bend backward to extend the spine as much as possible. Immobilize the patient to prevent movement if needed. Center the IR at the level of the spinal fusion.

Central Ray: Perpendicular to the spinal fusion area or L3.

Marker Placement: Left marker and Flex or Ext as appropriate

Shielding: Shield both males and females

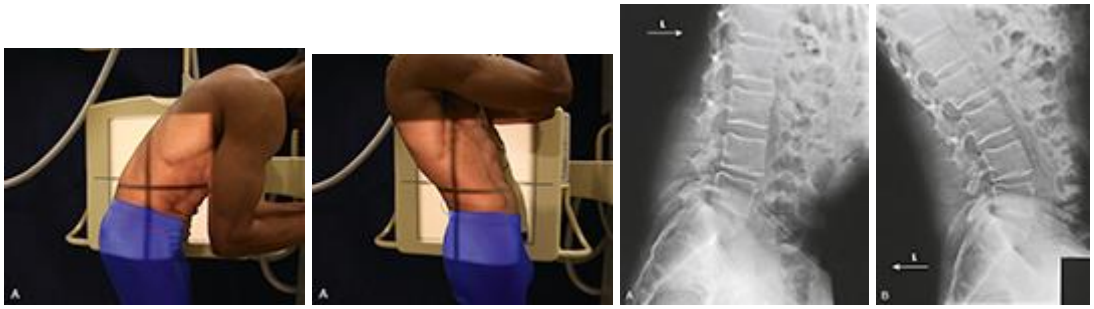
Breathing Instructions: Suspended respiration

Purpose/ Structures: Used to determine whether motion is present in the area of a spinal fusion, indicating nonunion, or to localize a herniated disk as shown by limitation of motion at the site of the lesion.

-Evaluation Criteria:

- Evidence of proper collimation and presence of side marker placed clear of anatomy of interest
- Site of spinal fusion centered
- No rotation of the vertebral column (posterior margins of the vertebral bodies superimposed)

- Hyperflexion and hyperextension identification markers correctly used for each respective projection
- Bony trabecular detail and surrounding soft tissues



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RHS Pediatric Protocols - Lumbar Spine
Lumbar Spine Imaging Protocol

Adult	Pediatric (Under 18)
AP, RPO, LPO, Lateral, L5/S1 Spot	8 years and younger: AP, Lateral
	> 8 years old: AP, RPO, LPO, Lateral, L5/S1 Spot

RHS Department of Radiology Guidelines
Lumbar Spine Charging

Views Obtained	Correct Charge
Any 1 View	XR Lumbar Spine 1 VW
2-3 Views (any combination)	XR Lumbar Spine 2 or 3 VWS
4 or More Views (any combination)	XR Lumbar Spine Routine 4 VWS or More
Full Series with Flex/Ex	XR Lumbar Spine Flexion Extension
Flex/Ex Only	XR Lumbar Spine Flex Ex Only 2 or 3 VWS
1 Bending View Only	XR Lumbar Spine 1 VW