Reading Hospital School of Health Sciences
Medical Imaging Program
MI 238: Clinical Seminar III
2022

Trauma Knee

Routine:	**Trauma:** AP, Medial Oblique, Lateral Oblique & Lateral
Position/Projection:	**Supine (AP)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Place the patient in a supine position- adjust the body so there is no rotation of the pelvis. Flex the joint slightly, locate the apex of the patella and as the patient extends the knee, center the IR ½" inferior to the apex. Internally rotate the leg to place the intermalleolar and the line between the femoral epicondyles parallel to the table. The patella will be slightly off center to the medial side. Place a sandbag at the ankle to immobilize the leg.
Central Ray:	To the knee joint. (½" below apex of patella)
Shielding:	Gonadal shielding not required at RH
Marker Placement:	Appropriate right or left marker should be placed on the image
Breathing Instructions:	N/A
Purpose/Structures:	Shows an AP projection of the knee structures**.**

Evaluation Criteria:

- Knee fully extended if patient's condition permits
- Entire knee without rotation
    - Femoral condyles symmetric and tibia intercondylar eminence centered
    - Slight superimposition of the fibular head if the tibia is normal
    - Patella completely superimposed on the femur
- Open femorotibial joint space, with interspaces of equal width on both sides if the knee is normal

Merrill's Notes:
< 19 cm – 3-5 degree caudad tube angle (thin pelvis)
19-24 cm – 0 degree tube angle
>24 cm – 3-5 degree cephalad tube angle (large pelvis)

RH Note: At RH, if patient has a knee replacement, all hardware must be seen.
Views to perform: Trauma Knee- All views; Non Trauma Knee- AP and Lateral
You do not need to chase a femur rodding for a knee order

Routine:	**Trauma:** AP, Medial Oblique, Lateral Oblique & Lateral
Position/Projection:	**Medial Oblique (AP Oblique)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To area of interest
Patient Position:	Rotate the entire leg medially 45 degrees. Support the elevated hip if necessary. Immobilize with a sandbag on the lateral aspect of the ankle. This is a difficult position for some patients and you may have to tolerate some part receptor distance. CR to the knee joint.
Central Ray:	To the knee joint. (½" below apex of patella)
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right and left marker should be placed on the image.
Purpose/Structures:	Shows an AP oblique projection of the medially rotated femoral condyles, patella, and tibial condyles, proximal tibiofibular joint and head of the fibula

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Tibia and fibula separated at their proximal articulation
- Posterior tibia
- Lateral condyles of the femur and tibia
- Both tibial plateaus
- Margin of the patella projecting slightly beyond the medial side of the femoral condyle
- Open knee joint
- Bony trabecular detail and surrounding soft tissues

Merrill's Notes:
< 19 cm – 3-5 degree caudad tube angle (thin pelvis)
19-24 cm – 0 degree tube angle
>24 cm – 3-5 degree cephalad tube angle (large pelvis)

RH Note: At RH, if patient has a knee replacement, all hardware must be seen.
Views to perform: Trauma Knee- All views; Non Trauma Knee- AP and Lateral
You do not need to chase a femur rodding for a knee order

Routine:	**Trauma:** AP, Medial Oblique, Lateral Oblique & Lateral
Position/Projection:	**Lateral Oblique (AP Oblique)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To area of interest
Patient Position:	Rotate the knee laterally 45 degrees (you must rotate the entire leg). Support the elevated hip if necessary. Immobilize with a sandbag on the lateral aspect of the ankle.
Central Ray:	To the knee joint. (½" below apex of patella)
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right and left marker should be placed on the image.
Purpose/Structures:	Shows an AP oblique projection of the laterally rotated femoral condyles, patella, tibial condyles, and head of the fibula

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Medial femoral and tibial condyles
- Tibial plateaus
- Fibula superimposed over the lateral half of the tibia
- Margin of the patella projected slightly beyond the edge of the lateral femoral condyle
- Open knee joint
- Bony trabecular detail and surrounding soft tissues

Merrill's Notes:
< 19 cm – 3-5 degree caudad tube angle (thin pelvis)
19-24 cm – 0 degree tube angle
>24 cm – 3-5 degree cephalad tube angle (large pelvis)

RH Note: At RH, if patient has a knee replacement, all hardware must be seen.
Views to perform: Trauma Knee- All views; Non Trauma Knee- AP and Lateral
You do not need to chase a femur rodding for a knee order

Routine:	**Trauma:** AP, Medial Oblique, Lateral Oblique & Lateral
Position/Projection:	**Lateral (Mediolateral)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To area of interest
Patient Position:	Turn the patient towards the affected side. Bring the opposite knee forward and support with a sponge to prevent forward rotation of the pelvis. Flex the affected knee 20-30 degrees. Grasp the medial and lateral border of the patella between the thumb and index finger and adjust the patella to be perpendicular to the IR.
Central Ray:	Directed 5° cephalad to the knee joint (the joint is approximately 1" distal to the medial femoral epicondyle) • The joint can easily be located by palpating the depression between the femoral and tibial condyles on the medial side of the knee just below the level of the patellar apex
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right and left marker should be placed on the image.
Purpose/Structures:	Shows a lateral image of the distal end of the femur, patella, and knee joint, proximal ends of the tibia and fibula, and adjacent soft tissue.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Knee flexed 20 to 30 degrees in true lateral position as demonstrated by femoral condyles superimposed (locate the more magnified medial condyle)
    - Anterior surface of medial condyle closer to patella results from over-rotation toward the image receptor (IR).
    - Anterior surface of medial condyle farther from patella results from under-rotation away from the image receptor (IR).

    - Inferior surface of medial condyle caudal to lateral condyle results from insufficient cephalad central ray (CR) angle.
    - Inferior surface of lateral condyle caudal to medial condyle results from too far cephalad CR angle.
- Fibular head and tibia slightly superimposed (over rotation causes less superimposition, and under rotation causes more superimposition)
- Patella in a lateral profile
- Open patellofemoral joint space
- Open joint space between femoral condyles and tibia
- Bony trabecular detail and surrounding soft tissues

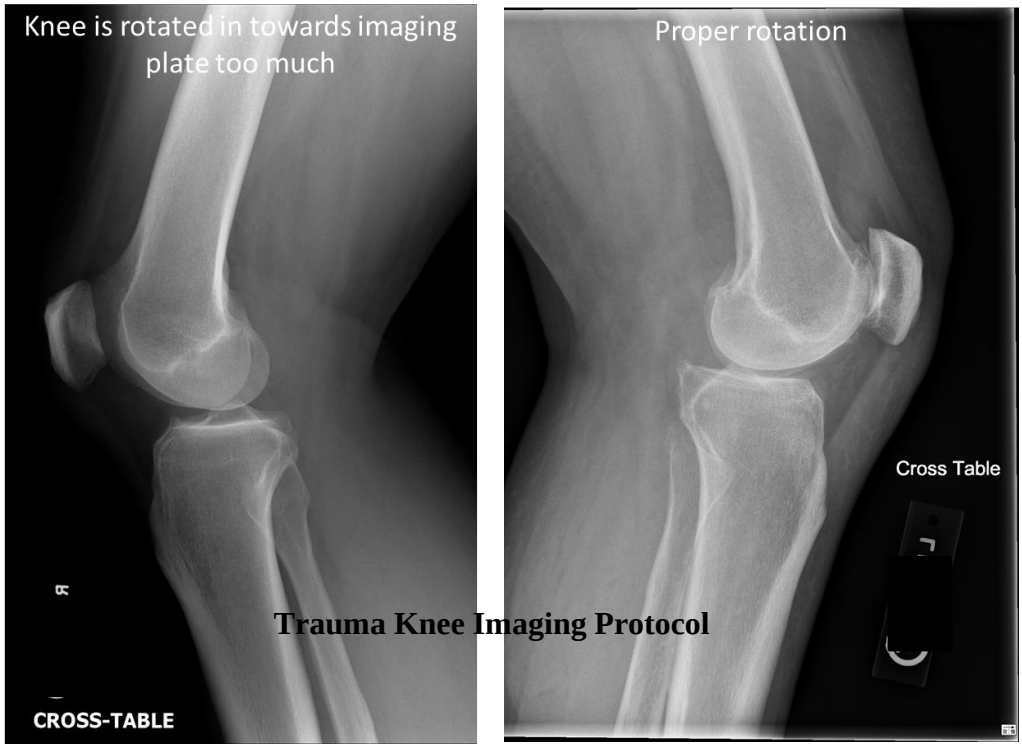
Merrill's Note:

- 20-30-degree knee flexion relaxes the muscles and shows the maximum volume of the joint cavity
- Tube may be angled 5-7 degrees cephalad through the joint space.

RH Note:

- **If the patient is in a cervical collar…**
    - You are not allowed to roll the patient without a nurse or physician holding the neck
    - It is best for the patient if you attempt all views without rolling the patient, if the patient is able to move legs
    - If the patient is unable to move their legs, we will perform an AP and cross table lateral

Cross Table Knee Orientation



Trauma Knee Imaging Protocol

Adult	Pediatric (Under 18)
AP, Medial Oblique, Lateral Oblique, Lateral	8 years and younger: AP and Lateral
	> 8 years old: AP, Medial Oblique, Lateral Oblique, Lateral

RH Additional Note:

- Patients with trauma and hx of knee replacement should have all trauma views obtained.
- As of 11/2019 - In ED if 3 view knee is ordered, must call to clarify what views to perform

Non Trauma Knee

Routine:	**Non-Trauma:** AP, Sunrise (9 years and older), Lateral, and PA erect (40 years and older)
Position/Projection:	**Supine (AP)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Place the patient in a supine position- adjust the body so there is no rotation of the pelvis. Flex the joint slightly, locate the apex of the patella and as the patient extends the knee, center the IR ½" inferior to the apex. Internally rotate the leg to place the intermalleolar and the line between the femoral epicondyles parallel to the table. The patella will be slightly off center to the medial side. Place a sandbag at the ankle to immobilize the leg.
Central Ray:	To the knee joint. (½" below apex of patella)
Shielding:	Gonadal shielding not required at RH
Marker Placement:	Appropriate right or left marker should be placed on the image
Breathing Instructions:	N/A
Purpose/Structures:	Shows an AP projection of the knee structures**.**

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Knee fully extended if patient's condition permits
- Entire knee without rotation
    - Femoral condyles symmetric and tibia intercondylar eminence centered
    - Slight superimposition of the fibular head if the tibia is normal
    - Patella completely superimposed on the femur
- Open femorotibial joint space, with interspaces of equal width on both sides if the knee is normal
- Bony trabecular detail and surrounding soft tissues

Merrill's Notes:
< 19 cm – 3-5 degree caudad tube angle (thin pelvis)
19-24 cm – 0 degree tube angle
>24 cm – 3-5 degree cephalad tube angle (large pelvis)

RH Note: At RH, if patient has a knee replacement, all hardware must be seen.
Views to perform: Trauma Knee- All views; Non Trauma Knee- AP and Lateral
You do not need to chase a femur rodding for a knee order

Routine:	**Non-Trauma:** AP, Sunrise (9 years and older), Lateral, and PA erect (40 years and older)
Position/Projection:	**Sunrise; Settegast method (Tangential)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**70 kVp @ 2.0 mAs (Tabletop)**
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Erect at wall bucky: Angle erect board 35-45 degrees. Have patient flex knee and place lower leg flush with IR. Weight should be on opposite leg. Prone on table: Flex the patient's knee slowly and as much as possible or until patella is perpendicular to the IR. The degree of tube angulation depends on the degree of flexion of the knee. Tube angulation is typically 15 to 20 degrees cephalad. • Avoid imaging patient in supine position to reduce unnecessary exposure to eyes and thyroid Free detector: Place the free detector in mobile holder and angle the detector 35-45 degrees. The patient should sit on the edge of the table. Have the patient flex knee and place lower leg flush with detector.
Central Ray:	Perpendicular to the joint space between the patella and femoral condyles.
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right or left marker should be placed on the image. ***Image should be oriented as an AP, should be mirrored if necessary.***
Purpose/Structures:	Shows vertical fractures of the bone and the articulating surfaces of the patellofemoral articulations.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Patella in profile
- Femoral condyles and intercondylar sulcus
- Open patellofemoral articulation
- Bony trabecular detail and surrounding soft tissues

Merrill's Note: Recommends collimation to a 4x4

RH Additional Notes: If femur overlies joint space, angle the erect board less (more like 35 degrees).

RH and SHS Note:

- What tube angle do you need to measure SID to the cassette/detector?
    - Digital Radiography (DR)
        - If your tube angle is ≥ 20 degrees you must measure your SID. Anything under 20 degrees you will not have to measure as long as your original SID was at 40".

Routine:	**Non-Trauma:** AP, Sunrise (9 years and older), Lateral, and PA erect (40 years and older)
Position/Projection:	**Lateral (Mediolateral)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To area of interest
Patient Position:	Turn the patient towards the affected side. Bring the opposite knee forward and support with a sponge to prevent forward rotation of the pelvis. Flex the affected knee 20-30 degrees. Grasp the medial and lateral border of the patella between the thumb and index finger and adjust the patella to be perpendicular to the IR.
Central Ray:	Directed 5° cephalad to the knee joint (the joint is approximately 1" distal to the medial femoral epicondyle) • The joint can easily be located by palpating the depression between the femoral and tibial condyles on the medial side of the knee just below the level of the patellar apex
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right or left marker should be placed on the image.
Purpose/Structures:	Shows a lateral image of the distal end of the femur, patella, and knee joint, proximal ends of the tibia and fibula, and adjacent soft tissue.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Knee flexed 20 to 30 degrees in true lateral position as demonstrated by femoral condyles superimposed (locate the more magnified medial condyle)
    - Anterior surface of medial condyle closer to patella results from over-rotation toward the image receptor (IR).

    - Anterior surface of medial condyle farther from patella results from under-rotation away from the image receptor (IR).
    - Inferior surface of medial condyle caudal to lateral condyle results from insufficient cephalad central ray (CR) angle.
    - Inferior surface of lateral condyle caudal to medial condyle results from too far cephalad CR angle.
- Fibular head and tibia slightly superimposed (over rotation causes less superimposition, and under rotation causes more superimposition)
- Patella in a lateral profile
- Open patellofemoral joint space
- Open joint space between femoral condyles and tibia
- Bony trabecular detail and surrounding soft tissues

Merrill's Note:

- 20-30-degree knee flexion relaxes the muscles and shows the maximum volume of the joint cavity
- Tube may be angled 5-7 degrees cephalad through the joint space.

Routine: and PA erect (40	**Non-Trauma:** AP, Sunrise (9 years and older), Lateral, years and older)
Position/Projection:	**Erect Knee Weight Bearing Method (PA)** ***RH - 40 years and older**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
Technique:	**85 kVp ○●○; non AEC 2.5 mAs (Bucky)**
SID:	40" SID
Collimation:	To area of interest
Patient Position:	Patient is upright and in PA position. Have patient adjusted so affected knee is centered to the IR. Toes should be straight ahead with weight equally distributed on the feet.. *Merrills demonstrates these can be done in an AP projection too.*
Central Ray:	To the knee joint. (½" below apex of patella)
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Marker Placement:	Appropriate right or left marker should be placed on the image. As well as an "ERECT" marker if erect marker is not used you must annotate "ERECT" on your image. ***Image should be oriented as an AP, should be mirrored if necessary.***
Purpose/Structures:	Shows the joint space of the knee. Varus and valgus deformities can also be evaluated with this procedure.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Both knees without rotation (RH only does the side of interest)
- Knee joint spaces centered to the exposure area (RH only does the side of interest)
- Bony trabecular detail and surrounding soft tissues

Merrill's Note: Performs as AP bilateral weightbearing with a 17x14 collimation

RH Note: At RH, if patient has a knee replacement, all hardware must be seen.
Views to perform: Trauma Knee- All views; Non Trauma Knee- AP and Lateral
You do not need to chase a femur rodding for a knee order

Non Trauma Knee Imaging Protocol

Adult	Pediatric (Under 18)
< 40 years old: AP, Sunrise, Lateral	8 years and younger: AP, Lateral
40 years and older: AP, Sunrise, Lateral, Erect PA	> 8 years old: AP, Sunrise, Lateral

*At RH, if patient has a knee replacement, all hardware must be seen
Views to perform:
Trauma Knee- All views
Non Trauma Knee- AP and Lateral

RH Note: As of 11/2019 - In ED if 3 view knee is ordered, must call to clarify what views to perform

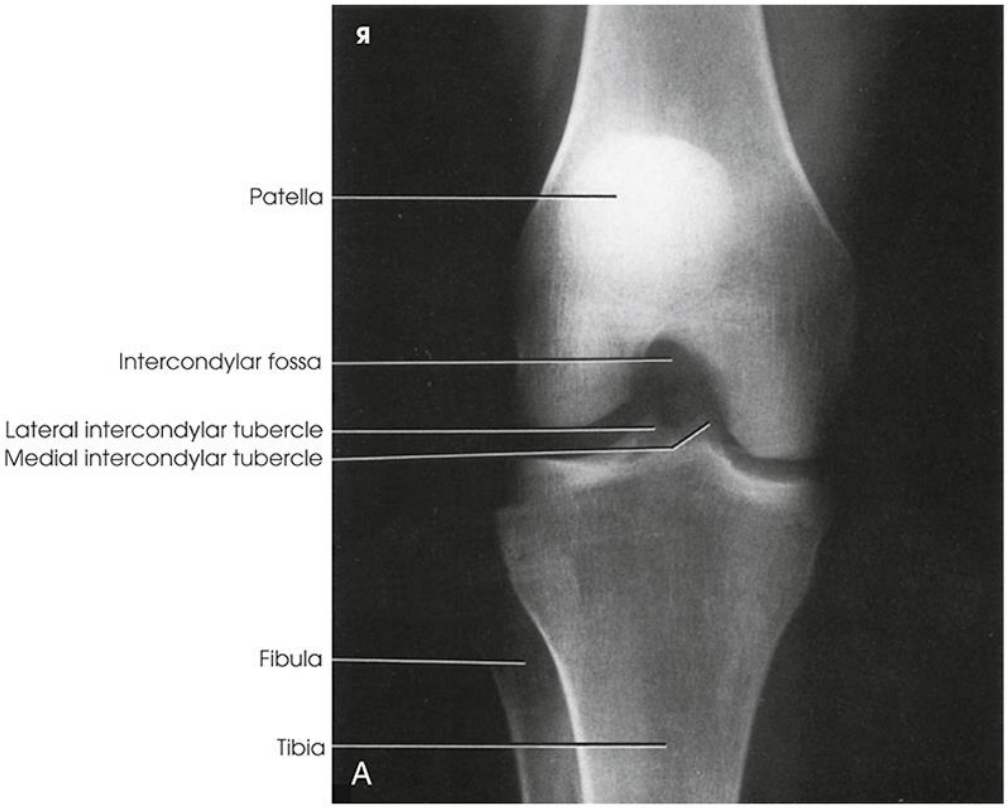
KNEE – SPECIAL VIEW

*14th edition Merrill's Volume I, page 354-355

Position/Projection:	**Camp Coventry Method – PA Axial – intercondylar fossa (Tunnel)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Patient in prone position. Flex patient's knee to a 40- or 50-degree angle, place the femoral portion of the knee on the IR and rest the foot on a suitable support. Center upper half of IR to knee joint.
Central Ray:	Perpendicular to the long axis of the lower leg, entering the popliteal fossa and exiting at the patellar apex. Angled 40 degrees when the knee is flexed 40 degrees and 50 degrees when the knee is flexed 50 degrees
Marker Placement:	Place appropriate right or left marker on the image.
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Purpose/Structures:	The intercondylar fossa and posteroinferior articular surfaces of the condyles of the femur, as well as the medial and lateral intercondylar tubercles of the intercondylar eminence and tibial plateaus in profile.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Open intercondylar fossa
- Posteroinferior surface of the femoral condyles
- Knee joint space open, with one or both tibial plateaus in profile (superimposed anterior and posterior surfaces)
- Apex of the patella not superimposing the fossa
- No rotation, demonstrated by slight tibiofibular overlap and centered intercondylar eminence
- Bony trabecular detail and surrounding soft tissues



KNEE – SPECIAL VIEW

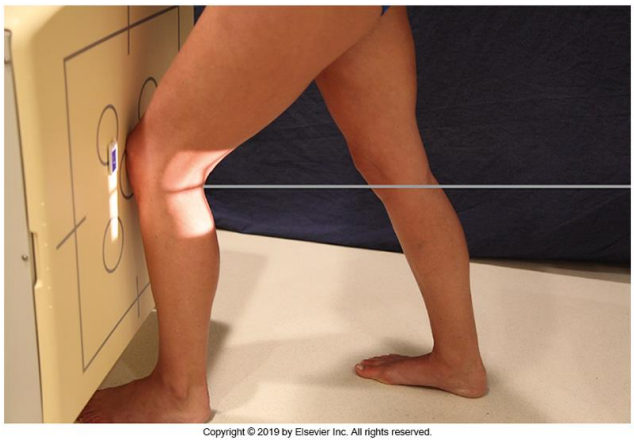
*14th edition Merrill's Volume I, page 352-353

Position/Projection:	**Holmblad Method – PA Axial – intercondylar fossa (Tunnel)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	**(1)**Standing with knee of interest flexed and resting on a stool at the side of the radiographic table **(2)** standing at the side of the radiographic table with the affected knee flexed and placed in contact with the front of the IR **(3)**kneeling on the radiographic table as originally described by Holmblad, with the affected knee over the IR. Tibial portion of the knee is in contact with IR and the patient's upper body is stabilized with appropriate support. Center the IR to apex of the patella. Flex the knee 70 degrees from full extension.
Central Ray:	Perpendicular to the lower leg, entering the superior aspect of the popliteal fossa and exiting at the level of the patellar apex, for all 3 positions
Marker Placement:	Place appropriate right or left marker on the image.
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Purpose/Structures:	The intercondylar fossa and posteroinferior articular surfaces of the condyles of the femur, as well as the medial and lateral intercondylar tubercles of the intercondylar eminence and tibial plateaus in profile. Widens the joint space between the femur and tibia and gives an improved image of the joint and the surfaces of the tibia and femur.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Open intercondylar fossa
- Posteroinferior surface of the femoral condyles

- Knee joint space open, with one or both tibial plateaus in profile (superimposed anterior and posterior surfaces)
- Apex of the patella not superimposing the fossa
- No rotation, demonstrated by slight tibiofibular overlap and centered intercondylar eminence
- Bony trabecular detail and surrounding soft tissues



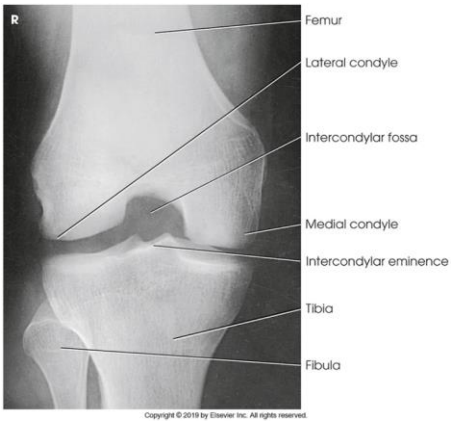
KNEE – SPECIAL VIEW

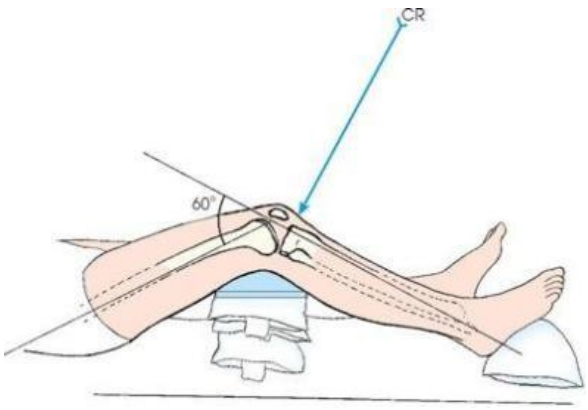
*14th edition Merrill's Volume I, page 356

Position/Projection:	**Beclere Method - AP Axial – Intercondylar Fossa**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Patient is supine. Flex the affected knee enough to place the long axis of the femur at an angle of 60 degrees to the long axis of the tibia. Place IR under the knee. Adjust the leg so that the femoral condyles are equidistant form the IR. Immobilize the foot with a sandbag.
Central Ray:	Perpendicular to the long axis of the lower leg, entering the knee joint 1/2 " below the patellar apex.
Marker Placement:	Place appropriate right or left marker on the image.
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Purpose/Structures:	Intercondylar fossa, intercondylar eminence and the knee joint

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Open intercondylar fossa
- Posteroinferior surface of the femoral condyles
- No superimposition of the fossa by the apex of the patella
- No rotation, as demonstrated by the slight tibiofibular overlap
- Bony trabecular detail and surrounding soft tissues





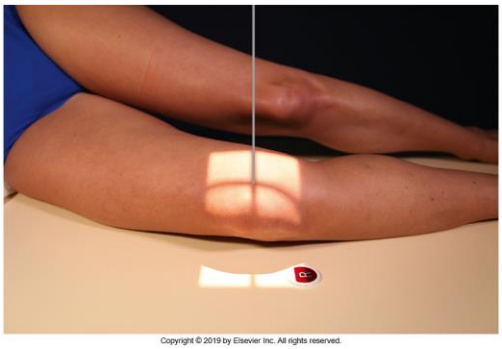
PATELLA – SPECIAL VIEW

*14th edition Merrill's Volume I, page 358

Position/Projection:	**Lateral (Mediolateral)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Patient in lateral recumbent position. Patient turns onto the affected hip. Have patient flex the unaffected knee and hip and place the unaffected foot in front of the affected extremity for stability. Flex the affected knee approximately 5-10 degrees. Increasing flexion reduces the patellofemoral joint space. Adjust knee into true lateral position (epicondyles superimposed and patella perpendicular to IR)
Central Ray:	Perpendicular to the IR, entering the knee at the midpatellofemoral joint.
Marker Placement:	Place appropriate right or left marker on the image.
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	N/A
Purpose/Structures:	Lateral projection of the patella and patellofemoral joint space.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Knee flexed 5 to 10 degrees
- Patella in lateral profile
- Open patellofemoral joint space
- Bony trabecular detail and surrounding soft tissues



PATELLA – SPECIAL VIEW

*14th edition Merrill's Volume I, page 360-361

Position/Projection: **Merchant View - Tangential**

Patient Prep: Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting

SID: 40" SID

Collimation: To anatomy of interest

Patient Position: Place the patient supine with both knees at the end of the table. Support knees and lower legs with an adjustable IR-holding device. Elevate the patient's knees approximately 2 inches to place the femora parallel with the tabletop. Adjust the angle of knee to 40 degrees. Patient's legs must be relaxed for accurate diagnosis.

Central Ray: Perpendicular to the IR. With 40-degree knee flexion, angle the central ray 30 degrees caudad from the horizontal plane. Enters midway between the patellae at the level of the patellofemoral joint.

Marker Placement: Place appropriate right or left marker on the image.

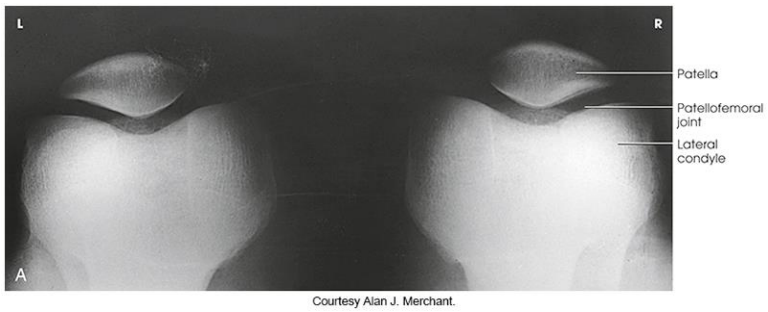
Shielding: Gonadal shielding not required at RH

Breathing Instructions: N/A

Purpose/Structures: Bilateral tangential image shows axial projection of the patellae and patellofemoral joints. Patella are seen as nondistorted, albeit slightly magnified images

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Patellae in profile
- Femoral condyles and intercondylar sulcus
- Open patellofemoral articulation
- Bony trabecular detail and surrounding soft tissues



Courtesy Alan J. Merchant.

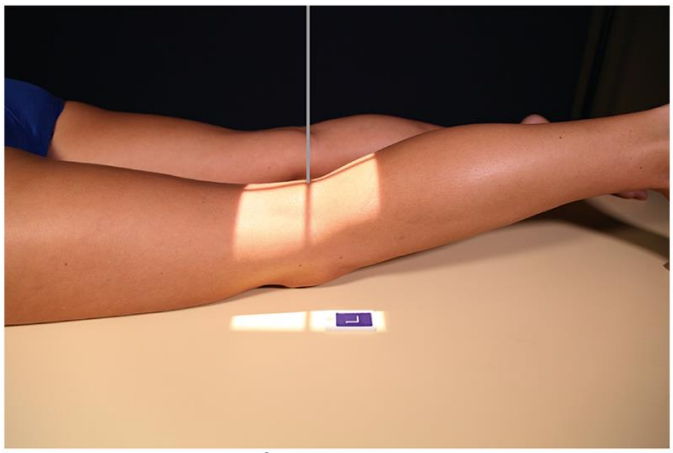
PATELLA – SPECIAL VIEW

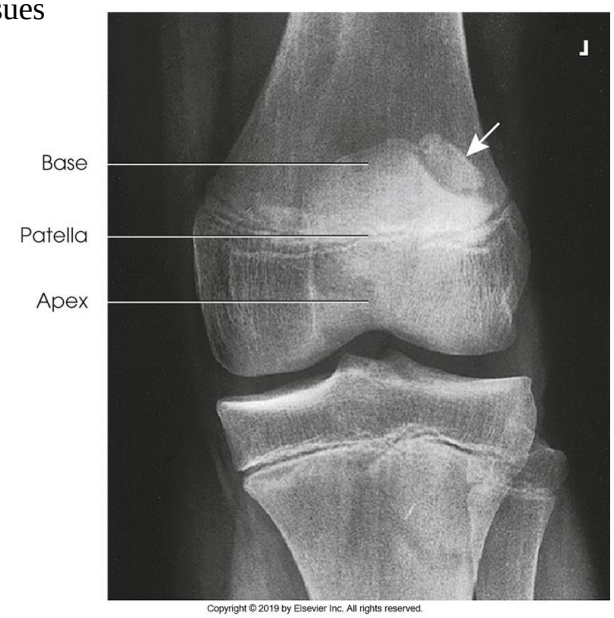
*14th edition Merrill's Volume I, pages 360-361

Position/Projection:	**PA Patella**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting
SID:	40" SID
Collimation:	To anatomy of interest
Patient Position:	Place the patient in the prone position. Adjust the position of the leg to place the patella parallel with the plane of the IR (usually requires the heel be rotated 5-10 degrees laterally).
Central Ray:	Perpendicular to the midpopliteal area exiting the patella
Shielding:	Gonadal shielding not required at RH
Marker Placement:	Place appropriate right or left marker on the image.
Breathing Instructions:	N/A
Purpose/Structures:	PA projection of the patella provides improved spatial resolution over the AP projection because of a closer object-to-IR distance.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Patella completely superimposed by the femur
- No rotation
- Bony trabecular detail and surrounding soft tissues





PATELLA – SPECIAL VIEW

*14th edition Merrill's Volume I, page 359

Position/Projection: **Hughston view (Tangential)**

Patient Prep: Remove pants. Patient should wear shoes and socks if walking. Shorts are allowed if able to roll high enough and be unrestricting

SID: 40" SID

Collimation: To anatomy of interest

Patient Position: Place the patient in the prone position. Place IR under femoral portion of knee. Slowly flex affected knee so that the tibia and fibula form a 50- to 60-degree angle from the table. Adjust patient leg so there is no rotation.

Central Ray: Angle 45 degrees cephalad and directed through the patellofemoral joint

Shielding: Gonadal shielding not required at RH

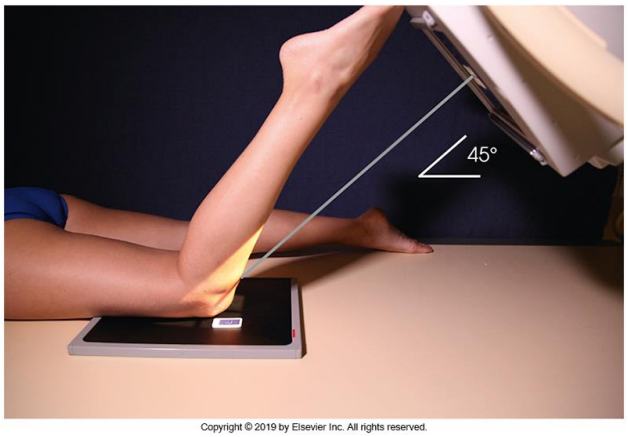
Marker Placement: Place appropriate right or left marker on the image.

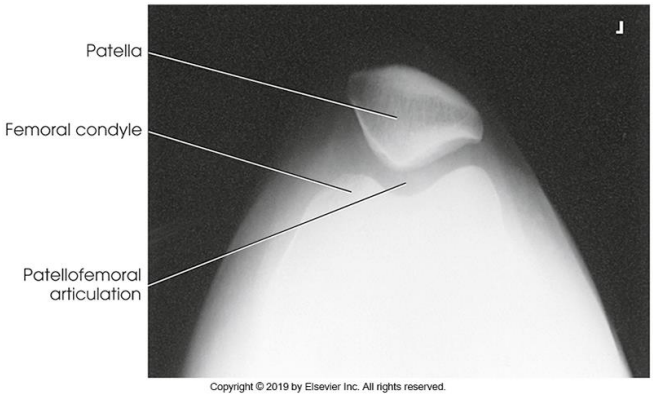
Breathing Instructions: N/A

Purpose/Structures: Shows subluxation of the patella and patellar fractures and allows radiologic assessment of the femoral condyles.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Patella in profile
- Femoral condyles and intercondylar sulcus
- Open patellofemoral articulation
- Bony trabecular detail and surrounding soft tissues





Part:	FEMUR
Routine:	AP & Lateral
Position/Projection:	**AP (2 exposures if needed to ensure overlap)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking.
Technique:	**AP (distal) 87 kVp ○●○ ; non AEC 3.6 mAs (Bucky)** **AP (proximal) 87 kVp ○●○ ; non AEC 7.1 mAs (Bucky)**
SID:	40" SID
Collimation:	10X17 PORTRAIT, 2nd image collimated to ensure overlap (no smaller than 6X6 collimation, in most circumstance collimation should not exceed 10X12 PORTRAIT)
Patient Position:	Patient supine. Adjust the femur to a true AP. Line between the femoral epicondyles must be parallel to the IR. Internally rotate the feet 15 degrees (immobilize with a sandbag) to overcome the anteversion of the femoral necks.
Central Ray:	Central ray perpendicular to IR. Center to include entire femur proximally and distally. ***If 2 images are needed, it is recommended to start proximally and take the second image distally*** ***RH and Merrill's Proximal** - place top of IR at level of ASIS* ***RH Distal** - bottom of light 1-2 fingers below patella apex for distal image* ***Merrill's Distal** – Place bottom of IR 2 inches below the knee joint*
Shielding:	Gonadal shielding not required at RH
Breathing Instructions:	Suspended respiration with proximal image; no breathing instruction required on distal image
Marker Placement:	Appropriate right and left marker should be placed on the image at the bottom of the light field and not moved between images to ensure overlap.
Purpose/Structures:	Shows an AP projection of the femur, including the knee joint or hip or both

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Most of the femur and the joint nearest to the pathologic condition or site of injury (a second projection of the other joint is recommended)
- Femoral neck not foreshortened on the proximal femur
- Lesser trochanter not seen beyond the medial border of the femur or only a very small portion seen on the proximal femur
- No knee rotation on the distal femur
- Gonad shielding when indicated, but without the shield not covering proximal femur
- Any orthopedic appliance in its entirety
- Bony trabecular detail and surrounding soft tissues

****Should not place marker internally on the proximal images***

Remember, patella does not need to be included on the femur images and the medial condyle is the most distal aspect of the femur.

<u>Charges (no need for charge adjustment form)</u>

XR FEMUR LT 1 VIEW

XR FEMUR RT 1 VIEW

XR FEMUR LT 1 VIEW PORTABLE

XR FEMUR RT 1 VIEW PORTABLE

XR FEMUR LT 1 VIEW PORTABLE ND

XR FEMUR RT 1 VIEW PORTABLE ND

Part:	FEMUR
Routine:	AP & Lateral
Position/Projection:	**Lateral (2 exposures if needed to ensure overlap)**
Patient Prep:	Remove pants. Patient should wear shoes and socks if walking.
Technique:	**Lateral (distal) 87 kVp ○●○ ; non AEC 3.6 mAs (Bucky)** **Lateral (proximal) 87 kVp ○●○; non AEC 7.1 mAs (Bucky)**
SID:	40" SID
Collimation:	10X17 PORTRAIT, 2nd image collimated to ensure overlap (no smaller than 6X6 collimation, in most circumstance collimation should not exceed 10X12 PORTRAIT)
Patient Position:	*To image proximal femur:* Have the patient turn towards the affected side. Draw the unaffected side posteriorly (Merrills states 10-15 degrees from the lateral position) and support on a large sponge. Adjust the body rotation to place the patella perpendicular to the table and the long axis of the femur is parallel to the IR. *To image distal femur:* Turn the patient towards the affected side. Bring the unaffected leg forward and bend up as high as possible then support the leg on a sponge to prevent forward rotation. **RH -** slightly 20-30 degrees. **Merrill's -** Flex the affected knee 45 degrees. Place the patella perpendicular to the table.
Central Ray:	**Proximal -** Central ray perpendicular to IR. Center to include entire femur proximally. Place top of IR at level of ASIS **Distal -** Central ray perpendicular to IR. Center to include entire femur distally. ***RH –**Centering recommendation: bottom of light 1-2 fingers below patella apex* ***Merrill's –** Place the bottom of the IR 2 inches below the knee joint*
Shielding:	Gonadal shielding not required at RH

Breathing Instructions: Suspended respiration for the proximal image; no breathing instruction required on distal image

Marker Placement: Appropriate right and left marker should be placed on the image at the bottom of the light field and not moved between images to ensure overlap.

Purpose/Structures: Shows a lateral projection of about ¾ of the femur and adjacent joints. If needed, use two IR's for demonstration of the entire length of the adult femur.

If 2 images are needed, it is recommended to start proximally and take the second image distally

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Most of the femur and the joint nearest to the pathologic condition or site of injury (a second projection of the other joint is recommended)
- Any orthopedic appliance in its entirety
- Bony trabecular detail and surrounding soft tissues

With knee included (distal)

- Superimposed anterior surface of the femoral condyles
- Patella in profile
- Open patellofemoral space
- Inferior surface of the femoral condyles not superimposed because of divergent rays

With the hip included (proximal)

- Opposite thigh not over proximal femur and hip joint
- Greater trochanter superimposed over distal femoral neck
- Lesser trochanter visible on medial aspect of proximal femur

RH ADDITIONAL NOTES:

- **If there is an obvious fracture of the femur, you will obtain a cross table lateral (not roll the patient).**

LONG BONE MEASUREMENT - SPECIAL VIEW

*14th edition Merrill's Volume I, page 368-372

Position/Projection: **Upright Leg Measurement (AP)**

Patient Prep: Remove pants. Patient should wear shoes and socks if walking. Remove shoes when in the room.

SID: 40" SID

Collimation: To anatomy of interest

Patient Position: Place the patient in the erect position. If examining both legs, separate the ankles 5 to 6 inches and place a specialized ruler between the patient and the IR, with the top at the level of the pelvis and extending down between the legs. If examining legs separately, position the patient with the special ruler behind each extremity.

The three-exposure sequence may be made manually, with the radiographer moving the tube and IR for each exposure, or automatically with the equipment programmed by the radiographer adjusting he field to include ASIS at the top of the field and the ankles at the bottom.

Exposure Order: 1) Hip 2) Knee 3) Ankle

Central Ray: Localize each joint and mark the central ray centering point.

- **Hip Joint** – place a mark 1 to 1 1/4 inches laterodistally and at a right angle to the midpoint of an imaginary line extending from the ASIS to the pubic symphysis.
- **Knee Joint** – just below the apex of the patella at the level of the depression between the femoral and tibial condyles.
- **Ankle Joint** – directly below the depression midway between the malleoli.

*****When significant discrepancy in length of the two extremities exists, it will not be possible to place the CR at the level of both joints for a bilateral procedure. In this case, professional judgment to place the CR as close as possible to the center of both joint.

*****For automated exposure, there may be a small cephalad angle for the hip exposure and a small caudad angle for the ankle exposure.

Shielding: Gonadal shielding not required at RH

Marker Placement: Place appropriate right and/or left marker on the image.

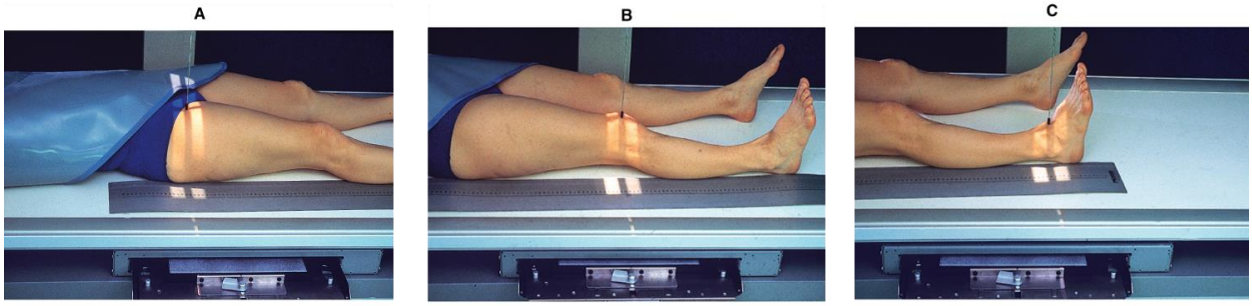
Breathing Instructions: Hips – suspended respiration; Knee and Ankle – no breathing requirements unless automated exposure, then suspended respiration

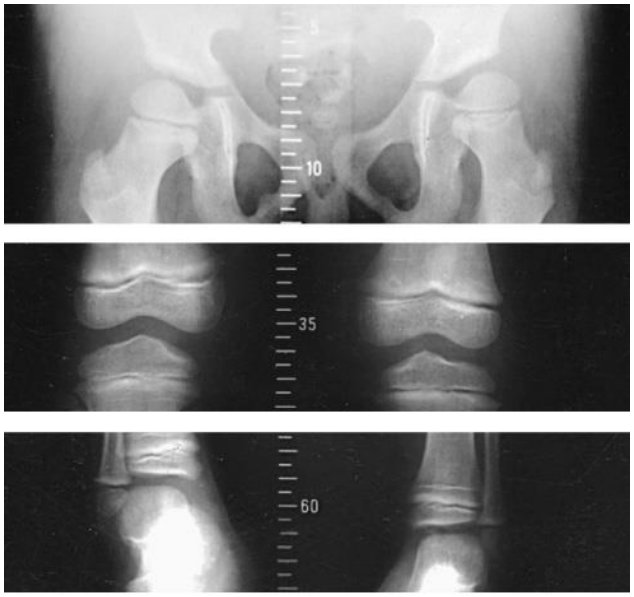
Purpose/Structures: A composite of the three exposures digitally stitched into one image, which includes all anatomy from the hip joints to the ankle joints.

Evaluation Criteria:

- Evidence of proper collimation and the presence of a side marker placed clear of the anatomy of interest
- Image of the special ruler
- All lower extremity anatomy, including the hip joint, the knee joint, and the ankle joint
- Bony trabecular detail and surrounding soft tissues

***If performing Long Bone Measurement Supine on the table, radiographer will manually move tube and IR, there is not an automated program. Same criteria and position.**





RH Protocol - Scanogram

Routine: 3 Exposures of ankle, knee, and hip joints

Projections: **AP Ankle Joints, AP Knee Joints, AP Hip Joints**

Collimation: To anatomy of interest (visualizing both joints on one image)

Patient Position: After taping the special scanogram ruler down the center of the table, center the mid-sagittal plane of the body to the center of the table. The ankle joints should be at the 10 cm lead marker on the ruler. Three exposures are then made, one of the ankle joints, one of the knee joints, one of the hip joints. Be very careful so that the ruler does not move after the first exposure.

Respiration: Suspended for hip images

Marker Placement: Mark side appropriately for each image

Evaluation Criteria:

- Patient may not move during exam
- Ankle joints are on the 10 cm marker on the ruler
- Entire joint spaces seen on each exposure

Additional Note:

- A Scanogram and knee xray (any views) may not be imaged in the same day.

RH Protocol - Scanogram (3 foot film / leg pasting) Room 4 & JC 365

Scanogram is the charge in EPIC for these images for the ortho doctors. (Longenecker or Stapinski) You may see "3 foot film" in comment field. These are images for pre-op or post-op TKR. They may also be listed as Entire Leg Pasting or DR Long Legs.

Set Up:

1. Select patient from worklist.

2. Click Examination.

3. DR Bilat. Long Legs will be the first selection, make sure that is selected.

4. Put L & R marker accordingly on the wall bucky – do not place on patient or scoliosis stand.

5. Make sure 180 cm grid (purple – labeled STITCHING GRID) is in wall stand.

6. Take arm bar out of wall stand *as this can create movement/stitching issues.*

7. Position tube to 102 SID.

8. Move scanogram stand in place in front of wall bucky.
    - Align back 2 wheels into metal grooves on floor.
    - Lock front 2 wheel brakes.
    - Move stitching ruler into the center so it will go down the center between the patients legs
    - Release foot stand using white latch to the left and bring foot stand to floor.

9. Patient should change taking pants off. They should keep their shoes on until they enter the room. ***Shoes should then be removed for images.***

Scanogram Procedure and Positioning:

1. The patient should stand straight in an **AP position** on the platform with their posterior surface close to the barrier stand, weight distributed evenly on both feet. Midsagittal plane centered to the midline of the central ray and stand.

2. Have patient hold onto handle bars on either side of them.

3. Have the patient centered and both legs internally rotated to center the patella, just as we do for an AP knee.

4. Open collimation from top of ASIS to include the mortise joint of ankles (collimation will be open to approximately the top of the foot)

5. Instruct the patient that the tube will move during the exposure

6. You may use the TEST button on the tube as a test run to ensure collimation looks appropriate, *but this step is not required*, but very effective.

7. Inform the patient that there will be 3 exposures from their hips to their ankles.

8. When taking the exposure keep depressing the switch as multiple exposures are being taken. Do not leave go until completed! In the bottom left of the screen you will see "Now generating image 1 of 3" etc. until all 2 or 3 stitched images are taken you will "Stitching run complete". You may now release the exposure button.

9. Computer will display a stitched image and each individual image.

10. You now need to verify everything stitched properly on the stitched image.

    - Using the hand/magnifying glass and the zoom in + button, zoom in to the lines where it is stitched to ensure all anatomy is aligned properly
    - You may now hit reset or the zoom out button to go back to normal image.
    - If it stitched properly, proceed to step 13. If not, you must repeat exposure.

11. On the **stitched** image, you will see 2 sets of dashed lines, the stitching. These lines must be removed. To do so:

    Press the stitching lines button 

    Then press single orange line button to remove lines 

Press the stitching lines button again to save. 

12. Check mark all images to confirm them. If you repeated images, reject them.

13. Hit Review and send individual images, as well as the stitched image to PACS.

14. Hit Complete to complete the study.

    *in your document, number of views: 1, number of images: 4

Scanogram Evaluation Criteria:

- Both femurs in entirety to ankle mortise joints
- Legs internally rotated so patella is in center of knee
- Mortise joints open
- Pelvis in center with ruler down the middle
- Correct identification marker

Additional notes:
-If patient's knees are covered by ruler due to anatomy (knock knees) it is okay.
-If patient's ankles are covered by the ruler due to anatomy (bowed legs) it is okay.
-It is efficient if the ruler is off centered to the left or right by approx. half inch, this sometimes happens if the patient's anatomy is off due to hip or knee anatomy.

FOR JOINT CENTER 365 ONLY:

After the images are sent, Dr. Longenecker wants you to add alignment lines to the stitched image. You will need to draw a line from middle of femoral head to middle of the mortise joint of the ankle.
To do so:
Under the review tab, select the stitched image.
Hit  followed by 
Click on middle of femoral head, then click the middle of the mortise joint of that same leg.
Do the same thing on the opposite leg, you will need to hit  again.

Send this image. In your document, your number of views: 1, number of images: 5

Reading Hospital Radiology- General Imaging Protocols

*Please note: Technologists image at the discretion of the Radiologist. The below are guidelines established by our Radiologists to ensure consistent imaging practices

throughout the department. If a question of appropriate imaging protocol arises, questions should be directed to a Supervisor or Radiologist for clarification.

Protocols included:

- Foreign Bodies, Punctures, Lacerations, Open Wounds and Lumps/Palpable Masses Protocol
- Post Op, Post Rodding, and Post Reduction Protocol
- Weight Bearing Views Protocol
- Trauma Views Protocol
- Image Check Protocol

Foreign Bodies, Punctures, Lacerations, Open Wounds and Lumps/Palpable Masses Protocol

Procedure:

- If the patient arrives with a puncture wound with no history of a foreign body, mark the wound with a BB and document this in the electronic note.
- If the patient arrives with an open, gaping wound with presence of a foreign body, no BB or marker should be placed on the wound, document this in the electronic note.
- If the patient arrives with a laceration and the technologist believes there may be a presence of a foreign body, mark the laceration with a BB and document this in the electronic note (this should occur even if the patient's history states there is no evidence of a foreign body).
- If the patient arrives with a laceration and the patient gives a history of a foreign body, mark the laceration with a BB and document this in the electronic note.
- If the patient arrives with a lump or palpable mass, mark it with a BB and document this in the electronic note.

Post Op, Post Rodding, and Post Reduction Protocol

Procedure:

- 2 views (AP and Lateral) should be taken when imaging a patient either post op, post rodding, or post reduction unless otherwise specified by the ordering physician.
- If imaging a patient post rodding, make sure to include the entire rod or orthopedic appliance on both the AP and Lateral images.

Weight Bearing Views Protocol

Procedure:

- 2 views (AP and Lateral) should be taken when ordering physician indicates weight-bearing images (unless otherwise indicated by the physician order).
- Label all images as weight-bearing.

Trauma Views Protocol

Procedure:

- If patient presents with a history of injury and subsequent pain, **regardless of timeframe**, current trauma imaging protocols should be followed.
- Trauma Views Protocol supersedes Post Op, Post Rodding, and Post Reduction Protocol if patient is reporting for imaging following a new injury.

Image Check Protocol

Procedure:

- If patient presents with an injury within 2 weeks, an Image Check should be requested.
- In addition, an Image Check can be requested at the discretion of the performing technologist if an obvious abnormality is identified (fracture, large effusion, etc.). This is regardless of injury timeframe.