Austin Radiological Association

MRI MSK Protocols

Adult 3T

Questions?

Last Update: 9/13/2024 8:21 AM

3T MSK Protocols

3T Preferred Exams

General Guidelines

(Updated 9/13/24)

MSK	

General	• NEVER hesitate to reach out to a radiologist for guidance!
	• All PEDI MSK arthritis exams should be performed using the standard adult protocols, unless specifically requested for pediatric radiologist to read
	• MSK Guidelines portal page reference
	  ○ T1 & T2 weighted imaging is needed to accurately differentiate mass and infection (osteomyelitis, cellulitis, abscess)
	  ○ PDs are generally useful for tendons, ligaments, & joint spaces
	  ○ T2s are the most beneficial sequences and should be repeated for motion

Technique	• Use "Weak" FS (Siemens) or "Classic" FS (GE) on all sequences with FS

Protocol	• MSK *known* mass / infection exams (osteomyelitis, cellulitis, abscess) should be performed using is T1 & T2 FS all 3 planes with appropriate T1 FS pre & post. Metastatic concerns do not require contrast
	  ○ Always need
	  ▪ *Known* mass / tumor exams - request prior x-ray study for comparison, if applicable
	  ▪ T1 FS pre – prior to contrast injection for direct comparison with post imaging
	  ▪ Generally short axis to the mass is the best option for pre/post imaging
	  ▪ T1 (generally Coronal) for ALL bone metastasis, infection, or fracture cases
	  ▪ If contrast is contraindicated a T1 FS pre does not need to be performed
	• Metal Protocols
	  ○ Total joint replacements use T1 & IR series (TSE/FSE sequence types)
	  ○ Hardware such as pins, screws, etc. use standard protocols with metal reduction techniques
	  ○ Metal reduction techniques
	  ▪ Bandwidth 400 Hz or more with signal compensation, fast RF mode
	  ▪ E-line (3T & Aera) WARP on, VAT 100%

	• Pelvis vs Hip
	  ○ Hip – evaluation of cartilage & labrum
	  ○ Pelvis – evaluation of fractures, soft tissue & cancer
	  ▪ AVN, Osteonecrosis or history of "steroid use with hip pain"
	  ▪ Cancer (mass, tumor), metastasis, myeloma
	
	• Long Bones
	  ○ Focal symptoms, mass, or bone lesion
	  ▪ Image area of interest only
	  ▪ Do not need to include joint to joint, single joint imaging will suffice to target location of pathology
	  ▪ Center axials on area of interest, no need to include joint. DO NOT split pathology in upper / lower series
	  ○ General pain, myositis, cellulitis, or non-focal history
	  ▪ Image anatomy as indicated
	
	• Inflammatory Arthritis (rheumatoid arthritis, psoriatic arthritis, juvenile rheumatoid arthritis, reactive arthritis, gout, CPPD [calcium pyrophosphate deposition disease], or septic arthritis)
	  ○ The entire hand and entire foot must be scanned for arthritis cases without any other indications such as a tear or mass
	  ▪ Contrast is needed to differentiate joint fluid from synovitis
	  ○ If a hand and wrist exam are ordered with a diagnosis of arthritis without any other indications, the wrist and hand need to be scanned together in the same FOV
	• History of pigmented villonodular synovitis (PVNS)
	  ○ Add T1 Coronal for all joint studies

Contrast	• Delayed contrast required for all exams, perform at least 1 T2 weighted image immediately after injection to allow for sufficient uptake time. • Two planes post contrast are always needed on MSK exams • Not required for marrow disease or lesions (mass/tumor) unless in rare cases it extends into the soft tissues • X-ray / CT abdomen and pelvis imaging must be performed prior to MR contrast exams. • DatScans must be performed prior to MR contrast exams.

1.5T and 3T Preferred Exams

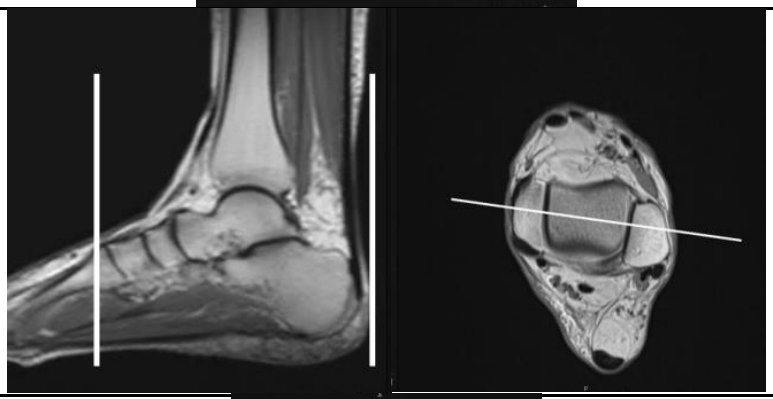
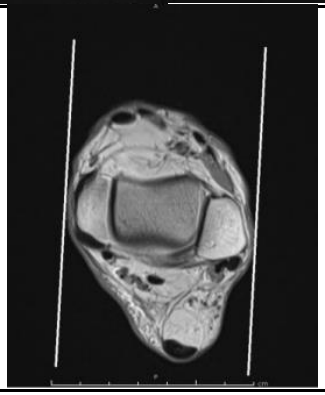
1.5T	3T
•	• Fingers • Pelvis Athletic Pubalgia • Toes
Hand and foot exam codes are closed on 1.5T scanners to avoid incorrect scheduling of finger and toe exams. See 3T MSK Protocols	

Arthrogram

GENERAL GUIDELINES	
Failed Exam	• Perform routine joint protocol for failed exams, i.e., no contrast within the joint space. Radiologist will interpret study or determine if patient needs to return.
Indirect Arthrogram of Any Joint	• Requires Radiologist consultation / approval • Inject IV gadolinium • Instruct patient to move the affected joint for 15 minutes in rotation, abduction, & adduction prior to scanning • Follow the applicable routine Arthrogram protocol
Available Locations	• QRY • SW (MR1, MR2, MR3)

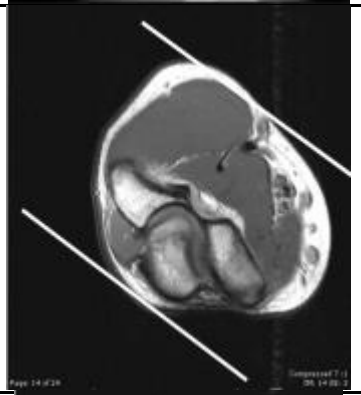
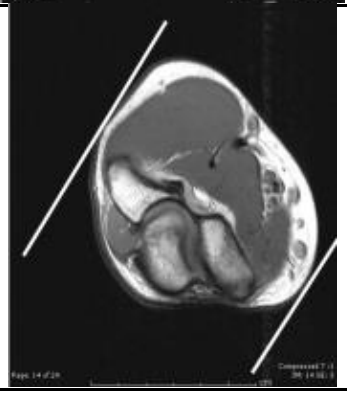
Ankle

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.
- Is the pain the same, improved or worsened since the procedure?

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Dixon Ax	140	2 x 0.5 ~48 slices		
T1 FS Cor T2 FS Dixon Cor	140	2 x 0.5 ~58 slices	Perpendicular to lateral/medial malleoli, see talar dome	
T1 FS Sag T2 FS Sag	140	0 x 0.5 ~31 slices	Parallel to lateral/medial malleoli, see talar dome	

Elbow

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.
- Is the pain the same, improved or worsened since the procedure?

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Dixon Ax	120 (256 x 179)	4 x 1 ~23 slices	Include the radial tuberosity to include the bicep tendon attachment	
T1 FS Cor T2 FS Dixon Cor	100 (256 x 179)	2 x 0 ~39 slices	• Parallel to the humeral epicondyles • Do not use a localizer to set the angle of the coronal series	
T1 FS Sag T2 FS Dixon Sag	100 (256 x 179)	2 x 0 ~39 slices	• Perpendicular to the humeral epicondyles • Do not use a localizer to position the sagittal series	

Hip

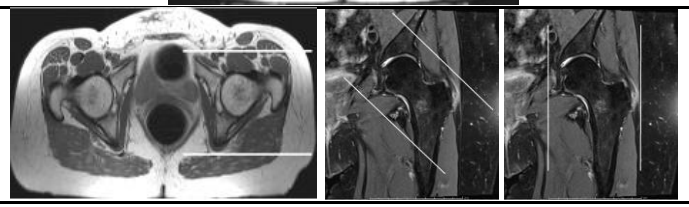
(Updated 5/21/21)

Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation, note patient's inability to do so
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Ax Bilat (STIR Espree or suboptimal FS)	~360	5 x 1 ~40 slices	• Parallel to the superior surfaces of the femoral heads • Include from above sacrum through the hamstring attachment on the ischium	
T1 Cor Bilat	~360	5 x 1	Parallel to the anterior surfaces of the femoral heads	
PD FS Cor (H>F phase) PD FS Obl Ax PD FS Sag	180 200, large PT	2 x 0.5	Cor: optional 200 FOV with R>L phase for flow artifact in hip joint	
Contrast, if needed T1 FS Cor Pre / Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	Copies to T1 Cor
T1 FS Ax Post				Copies to T1 Ax

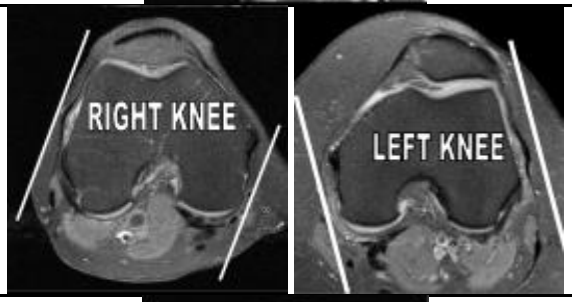
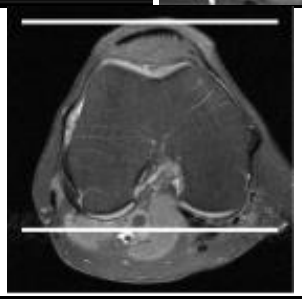
Tech Notes:

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.

- Is the pain the same, improved or worsened since the procedure?

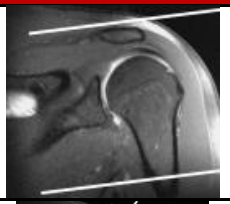
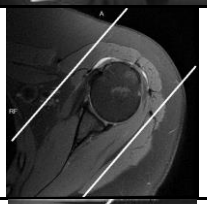
Knee

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.
- Is the pain the same, improved or worsened since the procedure?

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 FS Ax	140	2.5 x 0.5 ~40 slices		
T1 FS Sag PD Sag	140	2 x 0.5 ~40 slices	Parallel to the outer surface of the lateral femoral condyle	
T1 FS Cor T2 FS Cor (TE 36)	140	2 x 0.5 ~36 slices	Parallel to the posterior surfaces of the femoral condyles	

Shoulder

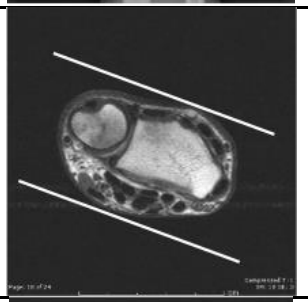
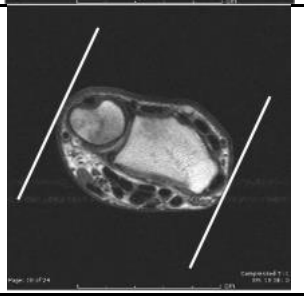
Position
- Supine with affected arm at side in external rotation (palm directed upward)
- Place sandbag on palm if necessary to help the patient maintain this position

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 FS Ax T2 FS Ax	150	2 x 0.5 ~36 slices	Include AC joint	
T1 FS Cor T2 FS Cor	140	2 x 0.2 ~32 slices	Perpendicular to the glenoid fossa	
T1 Sag	140	4 x 0.5 ~32 slices	Parallel to the glenoid fossa	
T2 FS Sag		3 x 0.3 ~32 slices		

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.
- Is the pain the same, improved or worsened since the procedure?

Wrist

Arthrogram protocols must include tech notes regarding the patient's pain post arthrogram "fluoro" procedure.
- Is the pain the same, improved or worsened since the procedure?

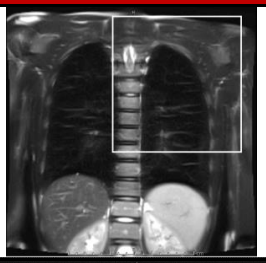
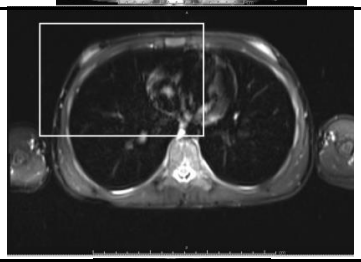
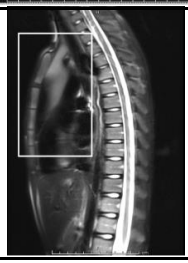
SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Ax	100	3 x 0 ~24 slices		
T1 Cor T1 FS Cor T2 FS Dixon Cor	100	2 x 0.2 ~17 slices		
T1 FS Sag	100	3 x 0 ~24 slices		

Abdominal Wall

(mass, focal pain, fracture of rib, costochondral, costochondritis, specific area of interest)

(Updated 10/15/20)

- Tailor coverage to area of interest
- Run phase direction & position patient supine/prone to best minimize motion artifact.
- Perform as breath-hold as needed to minimize motion artifacts.
- Do no perform at ARA RCP MR1 GE, SM, WLK, WMC

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax STIR Ax	240	4 x 0 ~44 slices		
T1 Cor STIR Cor	240	5 x 0 ~36 slices		
T1 Sag STIR Sag	240	5 x 0 ~36 slices		
Contrast, if needed T1 FS AX Pre / Post Additional plane post		4 x 0 ~44 slices	Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Exam Code:

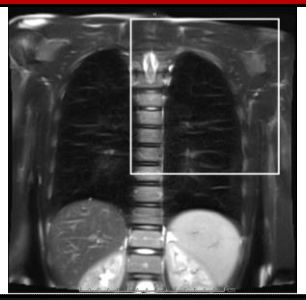
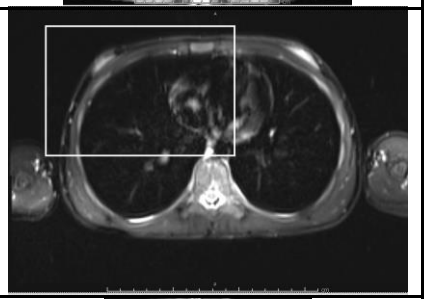
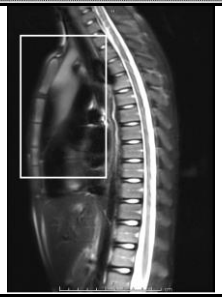
- MRABWCSMSK – MRI Abdominal Wall With and Without Contrast – MSK
- MRABWSMSK – MRI Abdominal Wall Without Contrast - MSK

Chest Wall

(mass, focal pain, fracture of rib, costochondral, costochondritis, specific area of interest)

(Updated 10/15/20)

- Tailor coverage to area of interest
- Run phase direction & position patient supine/prone to best minimize motion artifact.
- Perform as breath-hold as needed to minimize motion artifacts.

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax STIR Ax	240	4 x 0 ~44 slices		
T1 Cor STIR Cor	240	5 x 0 ~36 slices		
T1 Sag STIR Sag	240	5 x 0 ~36 slices		
Contrast, if needed T1 FS AX Pre / Post Additional plane post		4x0 ~44 slices	Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Joint Contrast

(synovitis, rheumatoid arthritis, inflammatory arthritis, or inflammatory arthropathy)

(Updated 5/18/22)

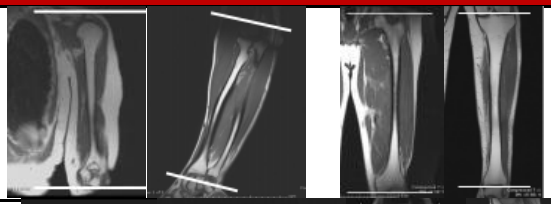
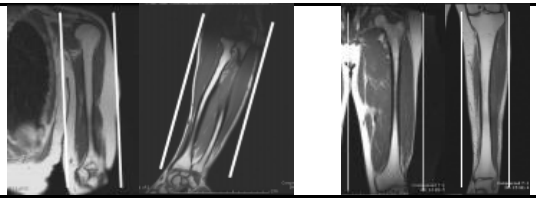
- Tailor FOV to body part
- Perform T2 weighted image immediately after injection to allow for contrast uptake.

ADDITIONAL SEQUENCES	COMMENTS
T1 FS Ax Pre / Post T1 FS Sag Post	Ankle, Foot, Toe
Follow Hip: Unilateral protocol	Hip
T1 FS Cor Pre / Post T1 FS Ax Post	Shoulder, Hand, Fingers, Thumb, Wrist
T1 FS Cor Pre / Post T1 FS Sag Post	Elbow, Knee

Long Bone – Non-specific ROI
(general pain, myositis, cellulitis)

- Full FOV may require upper / lower to include full long bone
- Optional deletion of sagittal plane if upper / lower needed

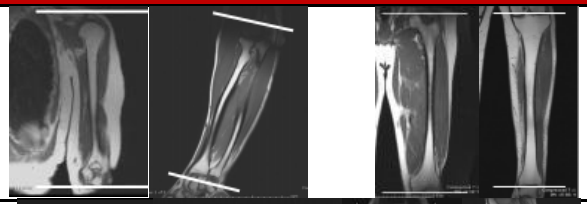
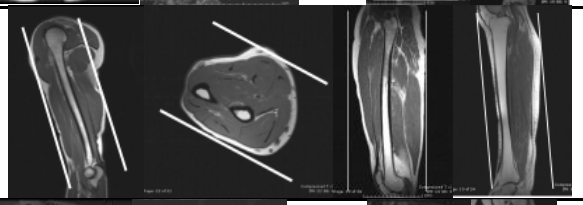
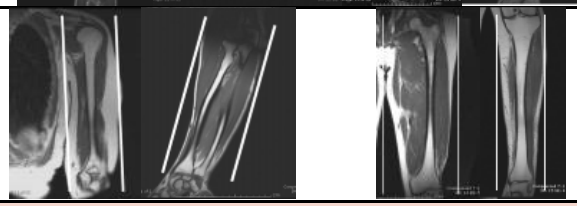
Position
- Humerus: anatomical with palm face up
- Forearm: arm down by side or superman with palm face up
- Femur: anatomical with toes pointing up
- Tib/Fib: anatomical with toes pointing up

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	140 – 200	7 x 1	Humerus: Forearm: parallel to radius / ulna Femur: Tib/Fib:	
T1 Cor T2 FS Dixon Cor	300 – 400	5 x 1	Humerus: Forearm: parallel to radius / ulna Femur: parellel to femur Tib/Fib:	
If long bone can be fully imaged in a single FOV without significant edge of field artifact the 3 plane protocol should be performed, regardless of diagnosis				
T1 Sag T2 FS Dixon Sag	200 – 300	5 x 1		
Send to PACS: FastView localizer				

Long Bone – Specific ROI
(focal pain, mass)

- Full FOV preferred
- Partial FOV acceptable if upper / lowers required to include entire long bone, include joint closest to pathology
- Place skin marker to indicate area of concern
- Perform STIR for suboptimal FS

Position
- Humerus: anatomical with palm face up
- Forearm: arm down by side or superman with palm face up
- Femur: anatomical with toes pointing up
- Tib/Fib: anatomical with toes pointing up

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	140 – 200	5 x 1	Humerus: Forearm: parallel to radius / ulna Femur: Tib/Fib:	
T1 Cor T2 FS Dixon Cor	200 - 380	5 x 1	Humerus: Forearm: parallel to radius / ulna Femur: parellel to femur Tib/Fib:	
T1 Sag T2 FS Dixon Sag	200 – 380	5 x 1		
Contrast: mass, infection or post-op, may consult with radiologist for appropriate planes *Contrast not required for metastatic disease*				
T1 FS Ax Pre T1 FS Ax Post Additional plane post: T1 FS Cor Post T1 FS Sag Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Neurography *

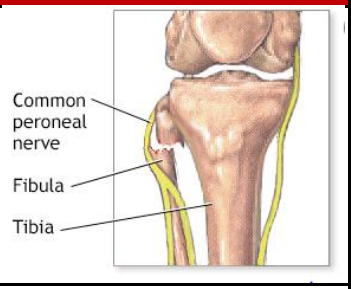
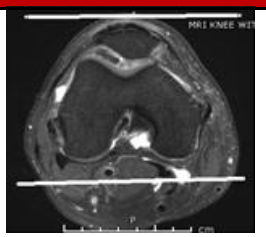
Knee

(drop foot, peroneal or tibial nerve compression at fibular head)

Do not perform at SW MR2

Position

- Torso coil for increased coverage
- Leg secured in anatomical position
- Lateral and posterior coverage are the most important to evaluate the nerves
- More of the tibia needs to be included compared to a routine knee

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Cor	170 256 x 192	5 x 1 ~17 slices	TR 69, TE 9.9 H>F phase, 100% OS BW 235 1 NEX 	
T1 Ax	130 256 x 205	3 x 0.3 ~54 slices	TR 720, TE 11 A>P, 70% OS BW 234 1 NEX	
T2 FS Ax	130 448 x 314	3 x 0.3	TR 6100, TE 63 BW 180 1 NEX	
IR Ax, optional for metal				Copies to T1 Ax
Resolve Diffusion Ax	140 124 x 124	4 x 0 ~86 slices		Copies center to T1 Ax

Other Extremities

Long bone, increase FOV as needed. May need upper / lower FOVs				
SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Cor	170 256 x 192	5 x 1 ~17 slices	TR 69, TE 9.9 H>F phase, 100% OS BW 235 1 NEX	
T1 Ax	130 256 x 205 170 – 180 long bone	3 x 0.3 ~54 slices	TR 720, TE 11 A>P, 70% OS BW 234 1 NEX	
T2 FS Ax	130 448 x 314	3 x 0.3	TR 6100, TE 63 BW 180 1 NEX	
IR Ax, optional for metal				

Upper Extremity

Clavicle

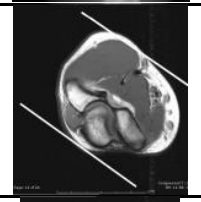
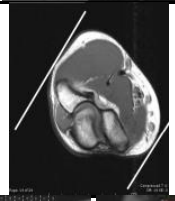
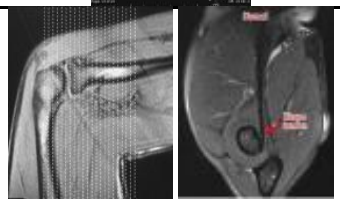
- Position patient Prone
- All planes are orthogonal to body, do not angle with clavicle
- Include opposite SC joint in all series
- Perform STIR for suboptimal FS

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	~200	3 x 0		
T1 Cor T2 FS Cor	~200	3 x 0		
T1 Sag T2 FS Sag	~200	3 x 0		

Elbow

(biceps tendon tear)

(Updated 1/23/23)

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	120 130 Large PT	4 x 1 ~23 slices	• Center to joint, Include radial tuberosity for bicep tendon attachment • Adjust in plane rotation for correct anatomical positioning	
PD Cor T2 FS Cor	100 130 Large PT	2 x 0 ~39 slices	• Position off T1 Ax • Center to joint, parallel to humeral epicondyles	
T2 FS Sag	100 130 Large PT	2 x 0 ~39 slices	• Position off PD FS Ax • Center to joint, perpendicular to humeral epicondyles • Only image through lateral and medial collateral ligaments • Optional bicep or tricep tendon tear: 160 FOV, 3x1mm	
T2 FS Long Axis FABS View, *optional Dr. Daniel Stewart, TX Orthopedics*	~130	3 x 0.5 ~24 slices	• Position elbow within shoulder coil in 90° flexion with forearm and palm in lateral position. • FABS View Positioning – Shoulder Coil 	

100 FOV series do not need to include all soft tissue (fat/muscle)

Finger *

(pain in phalanges or metacarpals, excludes thumb)

- Tailor coverage to area of interest

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax T2 FS Dixon Ax	100	2 x 0 ~22 slices	• Oblique to obtain true axial	
T1 Cor T2 FS Dixon Cor	130	2 x 0 ~21 slices	• Oblique to obtain true coronal	
PD Sag T2 FS Dixon Sag	130	2 x 0 ~21 slices	• Oblique to obtain true sagittal • Include adjacent 2nd – 5th finger for comparison, do not use thumb	

Finger: Mass / Infection *

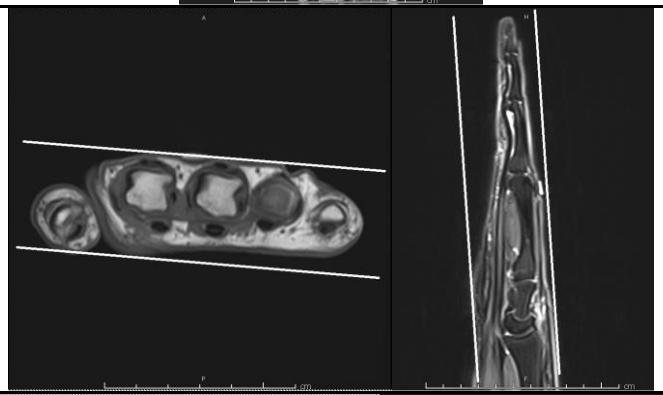
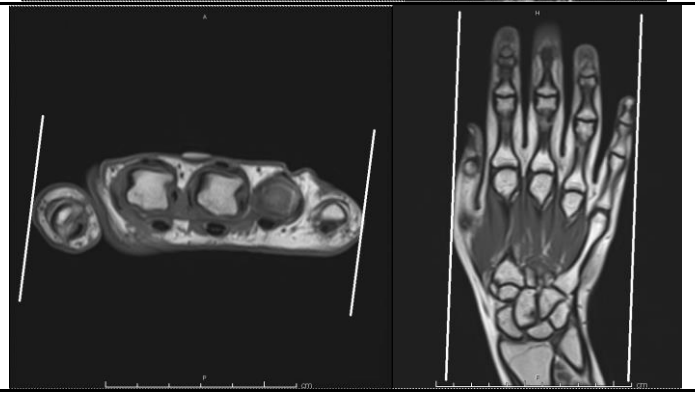
(known mass-tumor, infection / inflammation in phalanges or metacarpals, excludes thumb)

- Tailor coverage to area of interest

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	100	2 x 0 ~22 slices	• Oblique to obtain true axial	
T1 Cor T2 FS Dixon Cor	130	2 x 0 ~21 slices	• Oblique to obtain true coronal	
T1 Sag T2 FS Dixon Sag	130	2 x 0 ~21 slices	• Oblique to obtain true sagittal • Include adjacent 2nd – 5th finger for comparison, do not use thumb	
Contrast: mass, infection *Contrast not required for metastatic disease*				
T1 FS Dixon Ax Pre *Administer contrast* T1 FS Dixon Ax Post Additional plane post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Hand
(pain)

- Tailor coverage to area of interest, 3T often performs as partial hand
- Always place marker to indicate area of interest

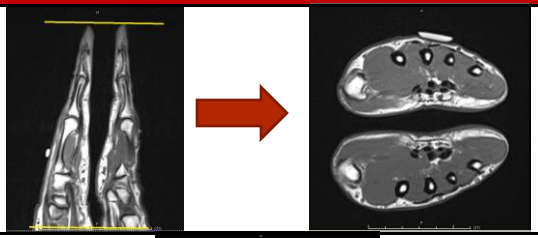
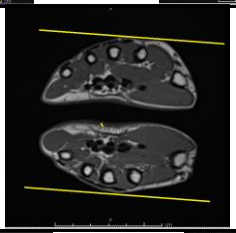
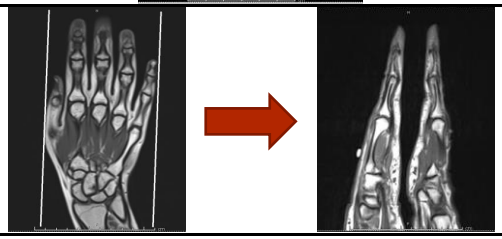
SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	120	4 x 1 ~22 slices	• Oblique to obtain true axial	
T1 Cor T2 FS Dixon Cor	220	2 x 0.5 ~23 slices	• Oblique to obtain true coronal	
PD Sag T2 FS Dixon Sag	220	4 x 1 ~24 slices	• Oblique to obtain true sagittal • Include adjacent 2nd – 5th finger for comparison, do not use thumb	

Hand: Bilateral Praying Hands

(inflammatory arthritis, only if bilateral hands requested)

- Always place marker on RIGHT hand to differentiate RT/LT

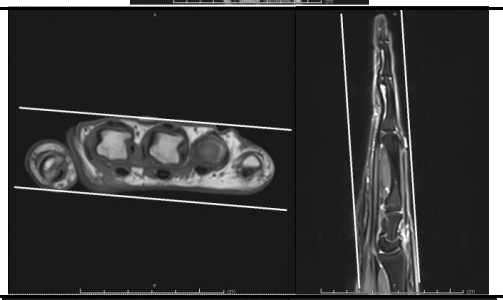
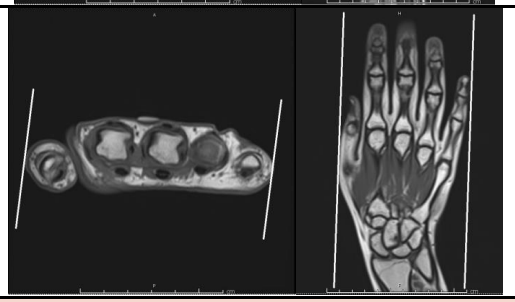
Position
- PT lateral recumbent with hands in fixed praying position
- Fingers straight with cushion in between hands

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	120 – 140	4 x 1 ~22 slices	• Oblique to obtain true axial	
T1 Cor T2 FS Dixon Cor	220	2 x 0.5 ~45 slices		
PD Sag T2 FS Dixon Sag	220	4 x 1 ~24 slices	• Oblique to obtain true sagittal • Include adjacent 2nd – 5th finger for comparison, do not use thumb	
T1 FS Dixon Cor Pre *Administer Contrast* T1 FS Dixon Cor Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	
T1 FS Dixon Ax Post				

Send to PACS: Localizers to 2nd ACC

Hand: Mass / Infection

- Tailor coverage to area of interest
- Always place marker to indicate area of interest

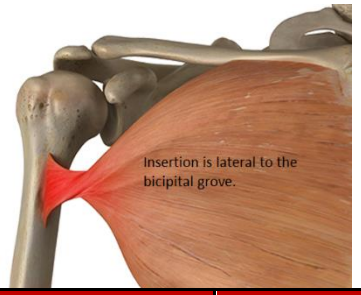
SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	120	4 x 1 ~22 slices	• Oblique to obtain true axial	
T1 Cor T2 FS Dixon Cor	220	2 x 0.5 ~23 slices	• Oblique to obtain true coronal	
T1 Sag T2 FS Dixon Sag	220	4 x 1 ~24 slices	• Oblique to obtain true sagittal	
Contrast: mass, infection				
T1 FS Dixon Ax Pre Administer contrast T1 FS Ax Dixon Post Additional plane post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

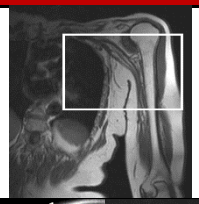
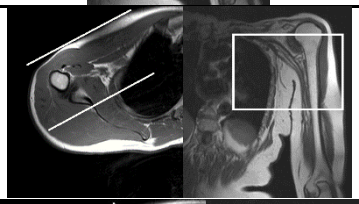
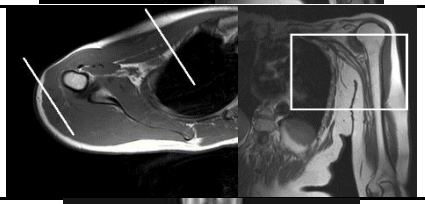
Pectoralis Tendon

(Updated 6/5/23)

Position:

- Patient prone with the affected arm as close to the patient's body as possible to achieve the 20cm FOV
- Affected side as close to isocenter as possible to ensure quality imaging through the humerus laterally

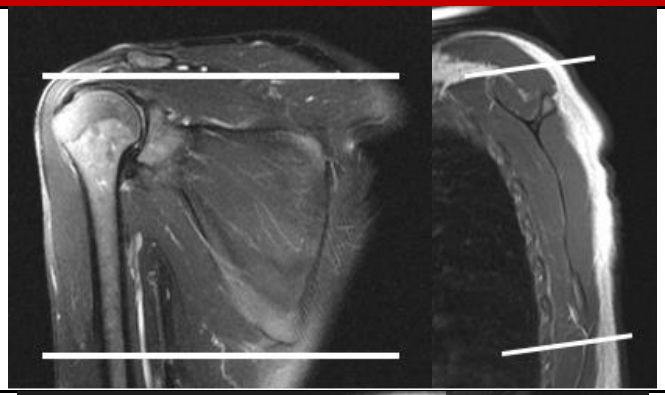
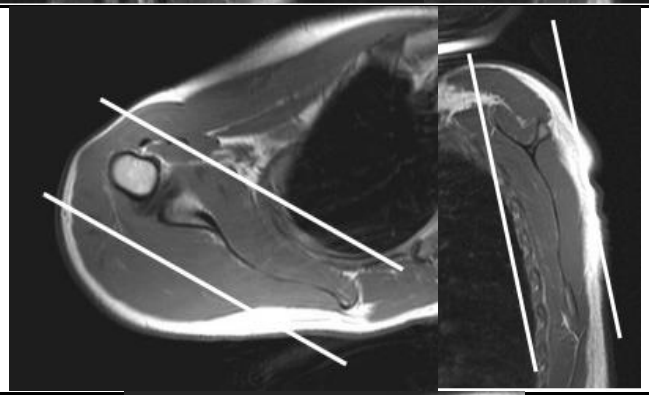


SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax STIR Ax	~200	4 x 0.5 ~40 slices	Scan affected side only	
T1 Cor T2 FS Cor	~200	4 x 0 ~24 slices	Parallel to the pectoral muscle/tendon and through the humeral shaft	
T1 Sag T2 FS Sag	~200	4 x 0.5 ~30 slices	Perpendicular to pectoral muscle/tendon and through humeral shaft	
STIR Ax Bilat	~400	5 x 1 ~32 slices	• Including both sides with arms at the patient's side. • Espree magnets, right / left sides should be scanned separately due to the bore FOV limitations.	

- The small FOVs are designed to show tears of the pectoral tendon at its insertion on the humerus or at the junction of the pectoral muscle and pectoral tendon. A 20cm FOV should be achievable on most patients. Do not need to include the entire pectoral muscle.
  - L>R: mid pectoral muscle through humerus
  - I>S: top of the pectoral muscle through the deltoid tuberosity of the humerus
  - P>A: posterior to the humerus through the pectoral muscle anteriorly
- The large FOV STIR Axial sequence will show muscle tears that aren't seen on the small FOV sequences
  - Position patient prone with both arms down by side

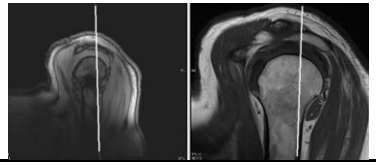
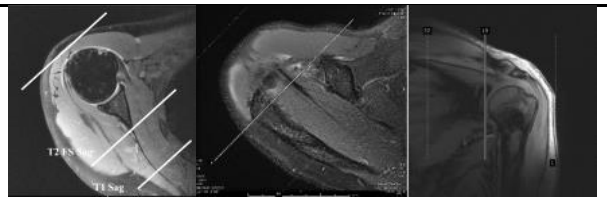
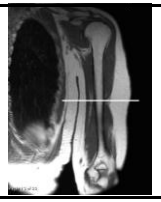
Scapula

(Updated 2/8/07)

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax STIR Ax	220	5 x 1	Oblique to obtain true axial	
T1 Cor T2 FS Cor	240	4 x 1 ~20 slices	Oblique to obtain true coronal	
T1 Sag T2 FS Sag	240	5 x 1	Oblique to obtain true sagittal	

Shoulder

Position:
- Affected arm at side with external rotation, palm facing upward
- Place sandbag on palm if necessary to help the patient maintain this position

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD FS Ax	150	2 x 0.5 ~36 slices	• Scan through the AC joint • Sag loc – slices parallel with the acromion & coracoid • Cor loc – slices perpendicular to the glenoid	
PD Cor T2 FS Cor	140	2 x 0.2 ~32 slices	• Slices need to be perpendicular to the glenoid fossa • Sag loc – position slices perpendicular to scapular spine & coracoid • PD FS Ax – position slices parallel with supraspinatus tendon	
T1 Sag	140	4 x 0.5 ~32 slices	T1 Sag: Include 6cm medial to the glenoid fossa • Slices need to be parallel to the glenoid fossa • PD FS Ax – position slices perpendicular to the supraspinatus tendon • PD Cor – position slices parallel with the glenoid fossa • Verify in plane rotation with sag localizer is orthogonal 	
T2 FS Sag	140	3 x 0.3		
T1 Ax T2 FS Ax *Dr. Douglas, Austin Sports Medicine*	150	5 x 1	• Remove shoulder coil and use torso • Include shoulder joint through mid humerus	

Sternum

Position
- Prone when possible
- Use of breast coil is encourage

- Perform STIR for suboptimal FS
- Orient phase direction that best minimizes artifact

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	180	3 x 0		
T1 Cor T2 FS Cor	180	3 x 0 ~18 slices		
T1 Sag T2 FS Sag	180	3 x 0 ~18 slices		

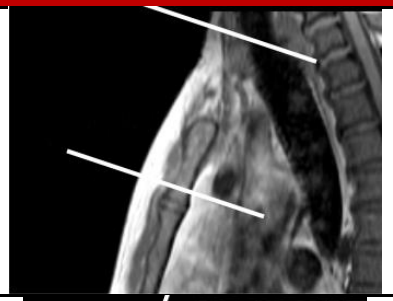
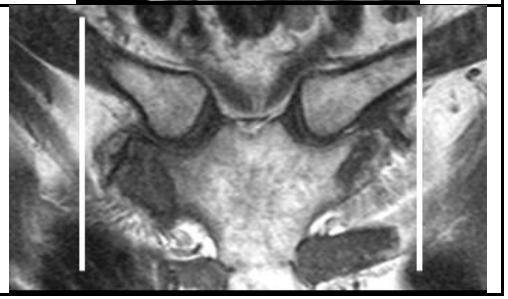
Sternoclavicular Joints

(Updated 5/29/08)

Position

- Prone when possible

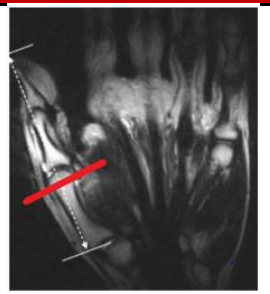
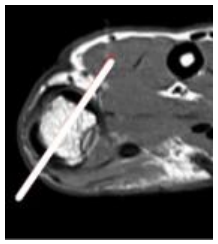
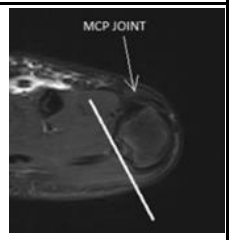
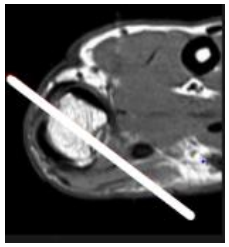
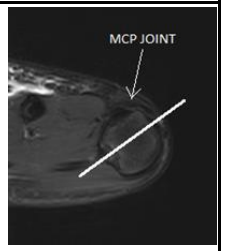
- Perform STIR for suboptimal FS
- Orient phase direction that best minimizes artifact

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	180	3 x 0		
T1 Cor T2 FS Cor	180	3 x 0 ~18 slices		
T1 Sag T2 FS Sag	180	3 x 0		

Thumb *

(pain, excludes 2nd – 5th digits)

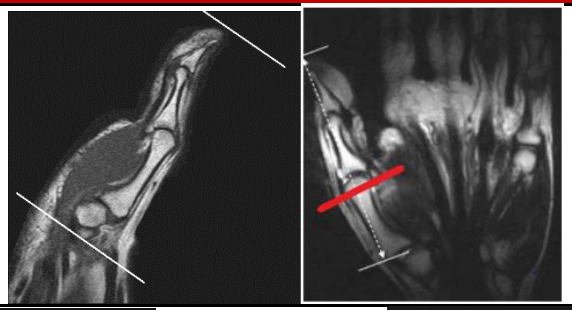
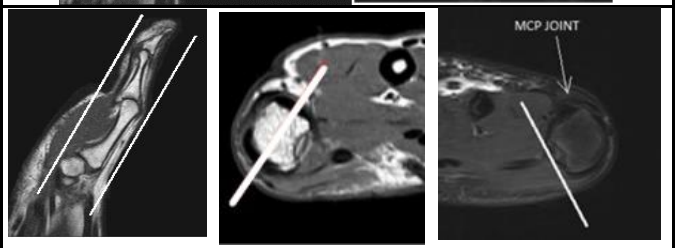
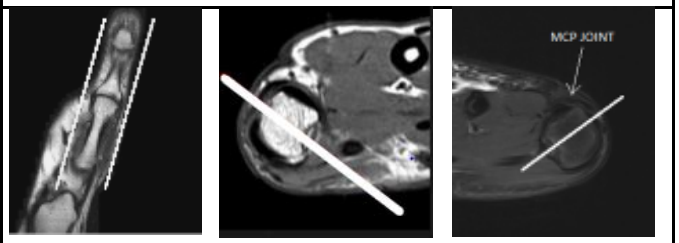
- Tailor coverage to area of interest

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax T2 FS Dixon Ax	100	2 x 0 ~22 slices	• Oblique to obtain true axial • The widest part of the metacarpal head is marked in red	 
PD Cor T2 FS Dixon Cor	130	2 x 0 ~21 slices	• Oblique to obtain true coronal • Set up slices on the axial slice that demonstrates the widest part of the metacarpal head in red	  
PD Sag T2 FS Dixon Sag	130	2 x 0 ~21 slices	• Oblique to obtain true sagittal • Set up slices on the axial slice that demonstrates the widest part of the metacarpal head in red	  

Thumb: Mass / Infection *

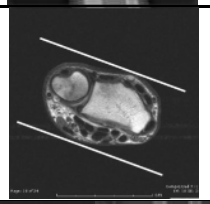
(pain, excludes 2nd – 5th digits)

- Tailor coverage to area of interest

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	100	2 x 0 ~22 slices	• Oblique to obtain true axial • The widest part of the metacarpal head is marked in red	
T1 Cor T2 FS Dixon Cor	130	2 x 0 ~21 slices	• Oblique to obtain true coronal • Set up slices on the axial slice that demonstrates the widest part of the metacarpal head in red	
T1 Sag T2 FS Dixon Sag	130	2 x 0 ~21 slices	• Oblique to obtain true sagittal • Set up slices on the axial slice that demonstrates the widest part of the metacarpal head in red	
Contrast: mass, infection				
T1 FS Dixon Ax Pre *Administer contrast* T1 FS Dixon Ax Post Additional plane post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Wrist

•Perform T2 weighted image immediately after injection to allow for contrast uptake.

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax (TE 14) T2 FS Ax	100 256 x 167	3 x 0 ~24 slices		
PD FS Cor T2 FS Dixon Cor T1 Cor	100 256 x 167	2 x 0.2 ~17 slices		
T2 FS Sag	100	3 x 0		

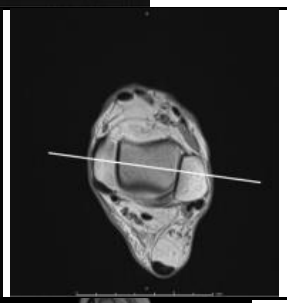
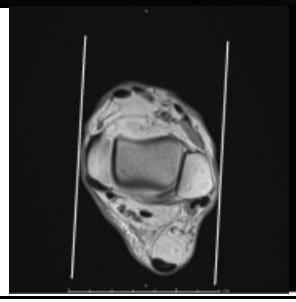
Contrast: pain
T1 FS Cor Pre T1 FS Cor Post T1 FS Ax Post
Contrast: mass protocol (T1, T2 FS protocol)
T1 FS Ax Pre T1 FS Ax Post Additional plane to best demonstrates mass
Contrast: inflammatory process
Follow JOINT CONTRAST protocol
Not performed on WLK MR1 Symphony

Lower Extremity

Achilles Tendon

(Updated 5/30/24)

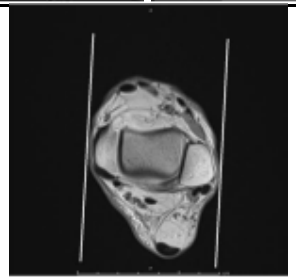
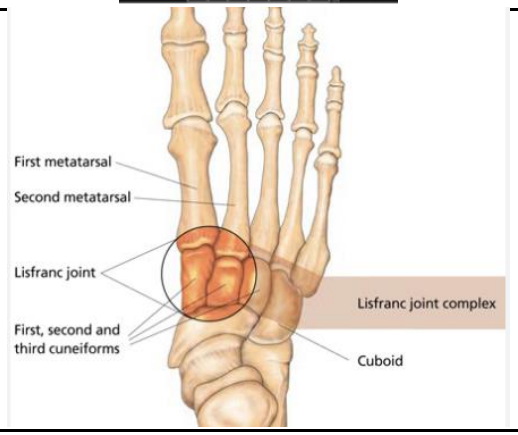
- Include all tarsal bones on all sequences

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax T2 FS Dixon Ax	140	3.5 x 1 ~48 slices		
T1 Cor T2 FS Dixon Cor	140	3.5 x 1 ~35 slices	Perpendicular to lateral/medial malleoli, see talar dome	 
T1 Sag	250	2 x 0.5 ~30 slices	• Parallel to lateral/medial malleoli, see talar dome • Include mid-calf through calcaneus	 
T2 FS Sag	250			

Ankle

(pain, plantar fasciitis, posterior tibial tendon pathology)

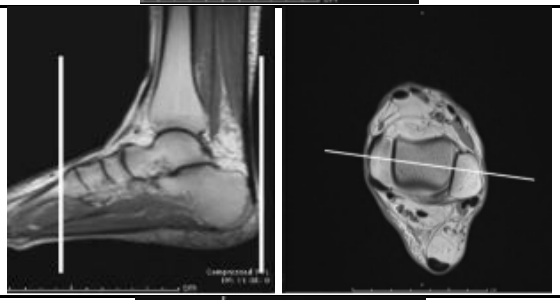
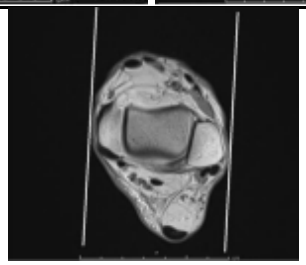
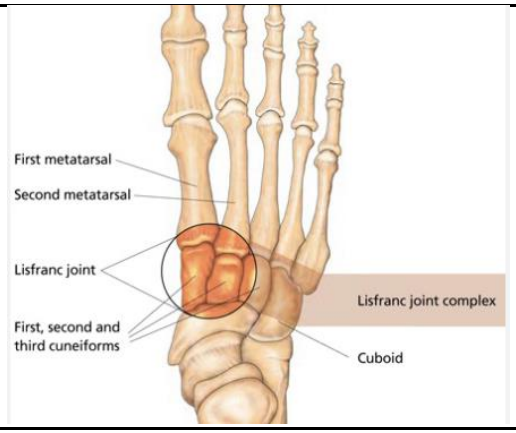
- Include all tarsal bones on all sequences

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax T2 FS Dixon Ax	140	2 x 0.5 ~48 slices		
T1 Cor T2 FS Dixon Cor	140	2 x 0.5 ~58 slices	Perpendicular to lateral/medial malleoli, see talar dome	
T1 Sag STIR Sag	140	0 x 0.5 ~31 slices	Parallel to lateral/medial malleoli, see talar dome	
• Must include Lisfranc joint in all planes				

Foot: Hindfoot

(metatarsal pain, swelling or mass)

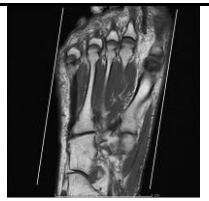
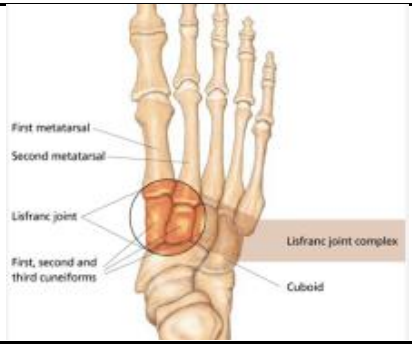
- Include all tarsal bones on all sequences

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD Ax	140	2 x 0.5		
T1 Cor T2 FS Dixon Cor	140	2 x 0.5	Perpendicular to lateral/medial malleoli, see talar dome	
T1 Sag T2 FS Dixon Sag	140	2 x 0.5 ~33 slices	Parallel to lateral/medial malleoli, see talar dome	
Must include Lisfranc joint in all planes				
Whole foot: plantar nerve lesion				

Foot: Mid or Forefoot

(metatarsal pain, swelling or mass)

- Include all tarsal bones on all sequences

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	140	3 x 1 ~24 slice		
T1 Cor T2 FS Dixon Cor	140	3 x 1 ~34 slices	Perpendicular to lateral/medial malleoli, see talar dome	
T1 Sag STIR Sag	140	2 x 0.5 ~33 slices	Angle to specific metatarsal as needed	
Must include Lisfranc joint in all planes				

Forefoot: osteomyelitis
Whole foot: plantar nerve lesion

Foot: Morton's Neuroma or Contrast

(interspace, metatarsal pain, swelling or mass)

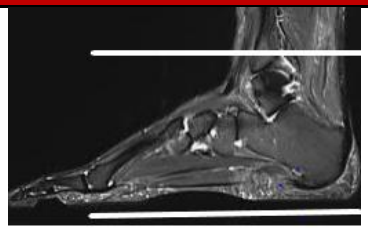
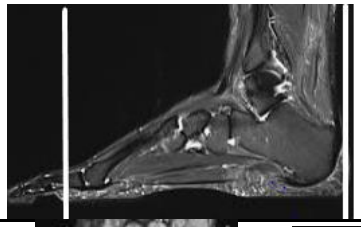
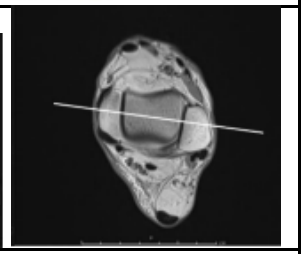
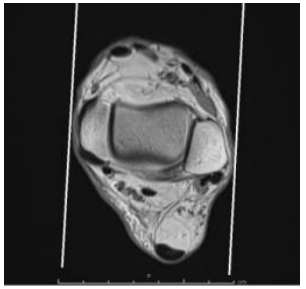
Updated 11/30/21

- Morton's Neuroma – FOV to include mid-foot through end of toes, include all tarsal bones on all sequences
- Contrast – consult radiologist for coverage as needed

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	140	3 x 1 ~24 slice		
T1 Cor T2 FS Dixon Cor	140	3 x 1 ~34 slices	Perpendicular to lateral/medial malleoli, see talar dome	
T1 Sag STIR Sag	140	2 x 0.5 ~33 slices	Angle to specific metatarsal as needed	
T1 FS Dixon Cor Pre *Administer contrast* T1 FS Dixon Cor Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	Copies to T1 Cor
T1 FS Dixon Ax Post				Copies to T1 Ax

Foot: Plantar Fibromatosis

- Include all the foot except the toes

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Dixon Ax	200	3 x 1		
T1 Cor T2 FS Dixon Cor	140	3 x 1 ~50 slices	Perpendicular to lateral/medial malleoli, see talar dome	 
T1 Sag T2 FS Dixon Sag	200	2 x 0.5 ~33 slices	Parallel to lateral/medial malleoli, see talar dome	 

- If the referral states plantar fascia fibromatosis, verify the diagnosis since it is usually plantar fasciitis not fibromatosis
- Fibromatosis is a rare, benign, hyperproliferative fibrous tissue disorder resulting in the formation of nodules along the plantar fascia. It is the thickening of the plantar fascia

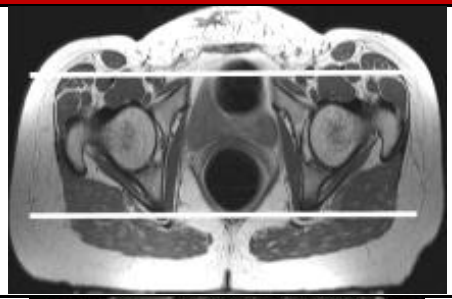
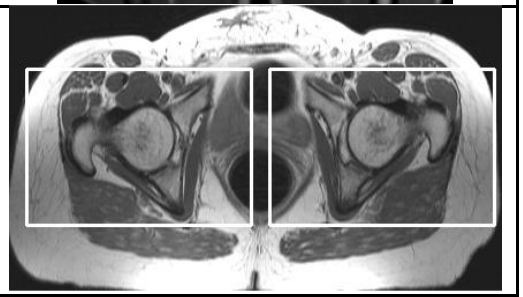
Hip: Bilateral

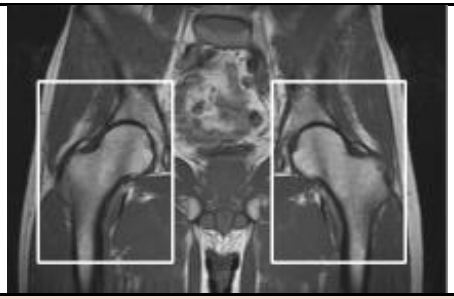
(Updated 11/6/20)

Perform for partial and total hip arthroplasty
Consider MSK Pelvis protocol with history of arthroplasty / total joint replacement, consult with MSK Radiologist.

Prep:
- Empty bladder

Position:
- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Cor Bilat STIR Cor Bilat	~360	5 x 1	Parallel to the anterior surfaces of the femoral heads	
T1 Ax Bilat T2 FS Ax Bilat (STIR suboptimal FS)	~360	5 x 1 ~36 slices	• Parallel to the superior surfaces of the femoral heads • Include from above sacrum through the hamstring attachment on the ischium	
RT PD FS Cor LT PD FS Cor	180 H>F phase	2 x 0.5	Cor: optional 200 FOV with R>L phase for flow artifact in hip joint	
RT PD FS Obl Ax LT PD FS Obl Ax	180	2 x 0.5	Ax: above acetabulum through ischium	

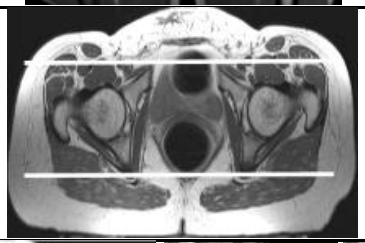
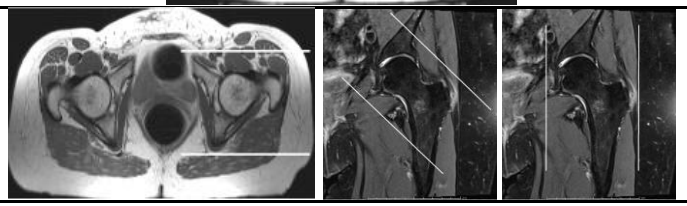
RT PD FS Sag LT PD FS Sag	180	2 x 0.5	Include from greater trochanter through medial edge of femoral heads	
Contrast: osteomyelitis, mass *Contrast not required for metastatic disease*				
T1 FS Cor Pre / Post	~360	4 x 0 28 slices	Perform T2 weighted image immediately after injection to allow for contrast uptake.	Copies to T1 Cor
T1 FS Ax Post	~360	5 x 1 ~36 slices		Copies to T1 Ax
Tech Notes: Document patient's inability to internally rotate Send to PACS: Bilateral sequences to both folders				

Hip: Unilateral

Consider MSK Pelvis protocol with history of arthroplasty / total joint replacement, consult with MSK Radiologist.

Prep:
- Empty bladder

Position:
- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Ax Bilat (STIR Espree or suboptimal FS)	~360	5 x 1 ~40 slices	• Parallel to the superior surfaces of the femoral heads • Include from above sacrum through the hamstring attachment on the ischium	
T1 Cor Bilat	~360	5 x 1	Parallel to the anterior surfaces of the femoral heads	
PD FS Cor (H>F phase) PD FS Obl Ax PD FS Sag	180 200, large PT	2 x 0.5	Cor: optional 200 FOV with R>L phase for flow artifact in hip joint	
Contrast, if needed T1 FS Cor Pre / Post			• Consult radiologist for possible MSK pelvis if ordered for METS, lesion, mass • Perform T2 weighted image immediately after injection to allow for contrast uptake.	Copies to T1 Cor
T1 FS Ax Post				Copies to T1 Ax

Tech Notes:
Document patient's inability to internally rotate

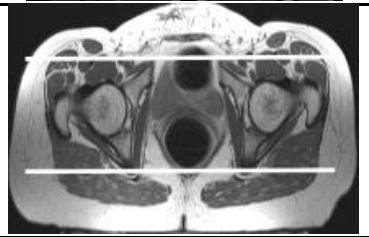
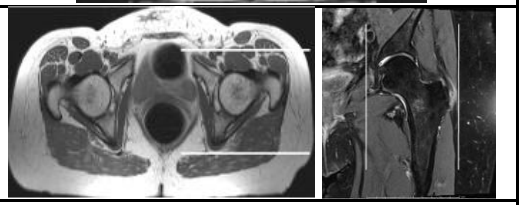
Hip: Unilateral, Geriatric 70+ Y/O

(Updated 9/9/21)

Consider MSK Pelvis protocol with history of arthroplasty / total joint replacement, consult with MSK Radiologist.

Prep:
- Empty bladder

Position:
- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax Bilat T2 FS Ax Bilat (STIR Espree or suboptimal FS)	~360	5 x 1 ~40 slices	• Parallel to the superior surfaces of the femoral heads • Include from above sacrum through the hamstring attachment on the ischium	
T1 Cor Bilat STIR Cor	~360	5 x 1	Parallel to the anterior surfaces of the femoral heads	
PD FS Cor (H>F phase) PD FS Sag	180 200, large PT	2 x 0.5	Cor: optional 200 FOV with R>L phase for flow artifact in hip joint	
Contrast, if needed T1 FS Cor Pre / Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	Copies to T1 Cor
T1 FS Ax Post				Copies to T1 Ax

Tech Notes:
Document patient's inability to internally rotate

Hip: Replacement

(DEPUY hip prosthesis recall)

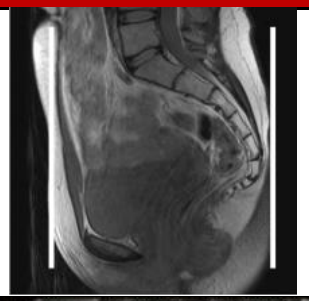
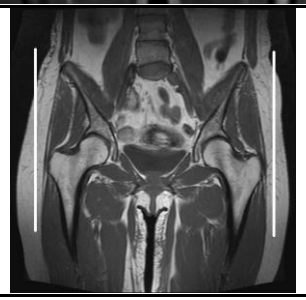
Perform for total hip arthroplasty.

Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 TSE Cor Bilat STIR Cor Bilat	~360	6 x 1	Cover entire boney pelvis	
T1 TSE Ax Bilat STIR Ax	~360	5 x 1 ~36 slices	Cover entire boney pelvis	
T1 TSE Sag	~360	6 x 1	Cover entire boney pelvis Espree – Cover as much as possible without orange lines	

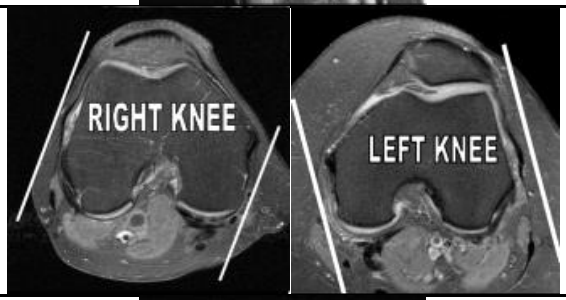
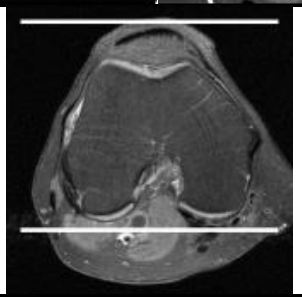
- Use Fast Spin Echo (FSE) sequences & a high bandwidth in order to reduce the artifact from the hip prosthesis
- Siemens up to 400 hz/pixel. GE up to 64khz
- Siemens B-line / E-line: WARP, VAT 100%

Knee

(Updated 10/3/23)

For indications of quad tendon:

- Torso coil
- FOV 17 CM for Sag / Cor – include patellar tendon attachment & above

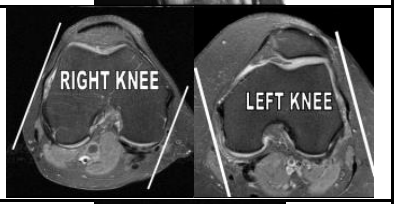
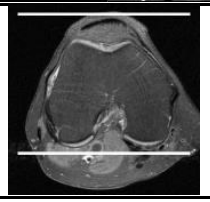
SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
PD FS Ax (TE 33)	140	2.5 x 0.5 ~40 slices		
PD Sag (TE 33) PD FS Sag (TE 36)	140	2 x 0.5 ~24 slices	Parallel to the outer surface of the lateral condyle	
PD Cor (TE 36) T2 FS Cor (TE 62)	140	2 x 0.5 ~36 slices	Parallel to the posterior surfaces of the femoral condyles	
T1 Cor, *optional*			• Add for history of trauma or bright bone on T2 • Add for PVNS (pigmented villonodular synovitis)	Copies to PD Cor

Knee: Metal

(pin / screw vs total replacement)

(Updated 4/27/23)

Select protocol based on hardware, pin/screw vs total joint

PIN / SCREWS		TOTAL JOINT		COMMENTS	IMAGES
SEQUENCE	PARAMETERS	SEQUENCE	PARAMETERS		
PD IR Ax	140 FOV 2.5 x 0.5 ~40 slices	T1 Ax IR Ax	140 FOV 3 x 0.6 ~40 slices		
PS Sag PD IR Sag	140 FOV 2 x 0.5 ~24 slices	T1 Sag IR Sag	140 FOV 3 x 0.8 ~24 slices	Parallel to the outer surface of the lateral condyle	
PD Cor PD IR Cor	140 FOV 2 x 0.5 ~36 slices	T1 Cor IR Cor	140 FOV 3 x 0.8 ~36 slices	Parallel to the posterior surfaces of the femoral condyles	
T1 Cor, *optional*				• Add for history of trauma or bright bone on T2 • Add for PVNS (pigmented villonodular synovitis)	Copies to PD Cor

Knee: MyKnee Surgical Planning*

Available locations: All 3Ts

Position: FFS as ISO as possible. Secure ankle with sandbags/pads in anatomical flexed position & wrap knee with large flex coil. Ensure the arms are not down by the hips.

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
FastView Loc			Landmark to pelvis	
T1 SE Ax (ankle)	260 x 100 256 x 256	4 x 1 ~20 slices	• Straight, no angle • Include both malleoli & at least 5cm of distal tibia	
T1 WE VIBE Sag (knee)	220 x 90% 256 x 256 Interpolated	1 x 0	• Straight, no angle • Include entire boney aspects of tib/fib laterally, approx. 7cm of distal femur & 5cm of proximal tib/fib	
T1 SE Ax (hip)	360 256 x 256	4 x 1 ~20 slices	• Straight, no angle • Include at least 10cm of proximal femur	

NOTE:

- CT may be preferred for PT's with significant metal artifact in ankle or hip regions.
- Protocol link

Knee: Visionaire, smith&nephew

Available locations:
- 1.5T: MPT MR2, Espree
- 3T: Kyle, WP

Exam Codes: MRKNSVR, MRKNSVL

SEQUENCE	REFERENCE
Protocol	Siemens Skyra 3T

Knee: Zimmer

Available locations:
- 3T: Kyle
- 1.5T: MPT MR2, Espree

Exam Codes: MRKNSVR, MRKNSVL

SEQUENCE	REFERENCE
Protocol	Siemens Skyra 3T

Pelvis

(inguinal hernia, coccyx or sacrococcygeal, hip for AVN)

See Pedi protocol for 0-17 y/o or small adults

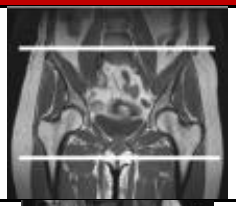
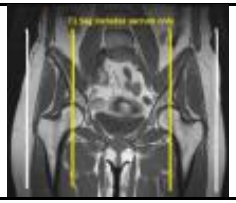
Consider hip protocol if the diagnosis or patient history (particularly when the patient is under the age of 60) indicates possible hip pathology such as labral tear, cartilage abnormality, consult with MSK Radiologist.

Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~40 slices	Parallel to the superior surfaces of the femoral heads	
T1 Cor STIR Cor	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~32 slices		
T2 FS Sag T1 Sag	~300	5 x 1 (include entire boney pelvis)	T2 FS Sag: include entire boney pelvis T1 Sag: only include for sacrum/coccyx fracture	

- Include the hamstring attachment on the ischial tuberosity on all sequences

Tech Notes:

Document patient's inability to internally rotate

Pelvis Contrast

(sacroiliitis, arthritis, mass)

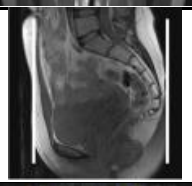
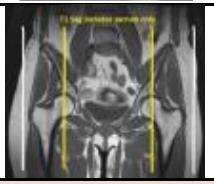
See Pedi protocol for 0-17 y/o or small adults

Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~40 slices	Parallel to the superior surfaces of the femoral heads	
T1 Cor STIR Cor	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~32 slices		
T2 FS Sag T1 Sag	~300	5 x 1 (include entire boney pelvis)	T2 FS Sag: include entire boney pelvis T1 Sag: only include for sacrum/coccyx fracture	
Contrast: sacroiliitis, arthritis				
T1 FS Cor Pre *Administer contrast* T1 FS Cor Post T1 FS Ax Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	
Contrast: mass *Contrast not required for metastatic disease*				
T1 FS Ax Pre *Administer contrast* T1 FS Ax Post T1 FS Cor Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Pelvis: MSK Athletic Pubalgia *

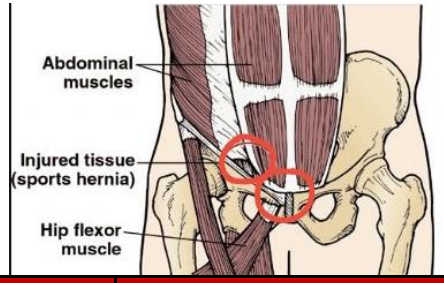
(sports hernia, osteitis pubis, groin pain, adductor muscle/tendon, core muscle injury)

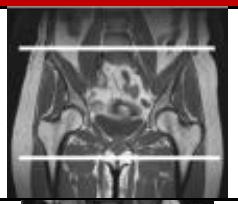
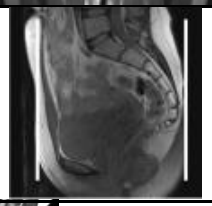
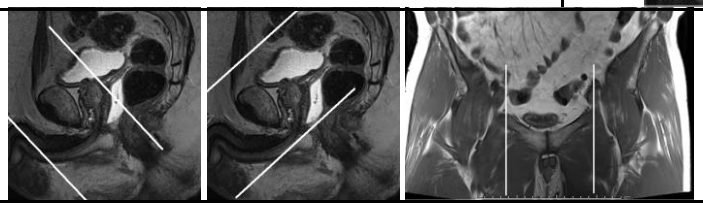
Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation
- Legs need to be as flat as possible



SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Ax	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~40 slices	Parallel to the superior surfaces of the femoral heads	
T1 Cor	~360 (minimum FOV to include entire boney pelvis)	5 x 1 ~32 slices		
T2 FS Obl Ax Hires T2 FS Obl Cor Hires T2 FS Sag Hires	160	4 x 0.5		

Tech Notes:

Document patient's inability to internally rotate

Sacroiliac Joints

(Updated 1/6/23)

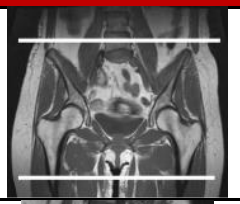
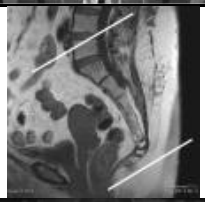
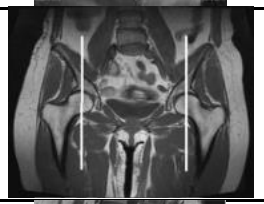
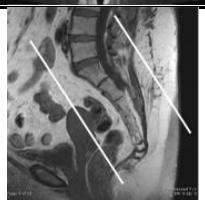
Only perform if exam is specifically ordered as SI Joint protocol.

Prep:

- Empty bladder

Position:

- Tape or strap feet with internal rotation
- Legs need to be as flat as possible

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T2 FS Ax	~360 (minimum FOV to include entire boney pelvis)	5 x 1	Parallel to the superior surfaces of the femoral heads	
T1 Ax Hires T2 FS Ax Hires	240	5 x 1 ~30 slices	Perpendicular to Sacrum	
T1 Sag	~240	5 x 1	Include sacrum only	
T1 Cor STIR Cor *Administer contrast, if needed* T1 FS Cor Pre / Post T1 FS Ax post (copies T1 Ax hires)	~240	4 x 1	• Parallel with Sacrum • Extend coverage to include cyst or posterior soft tissue, as needed • Perform T2 weighted image immediately after injection to allow for contrast uptake.	
Send to PACS: Localizers				

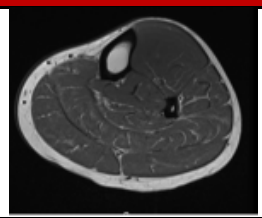
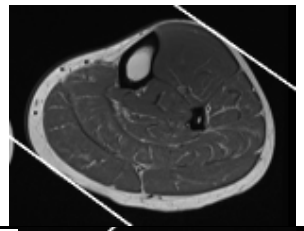
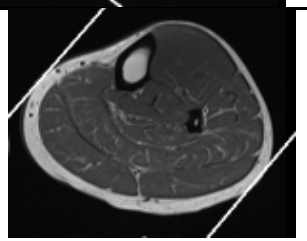
Tibia

(Updated 5/1/24)

- Place skin marker to indicate area of concern
- Partial FOVs – focal pain, mass; must include either the proximal or distal joint
- Full FOVs – general pain, myositis, cellulitis; upper/lower as needed to include full long bone

Position

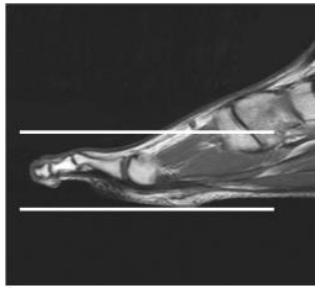
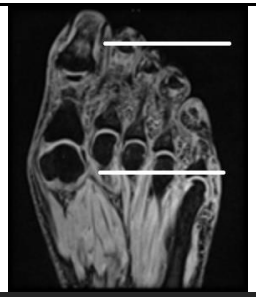
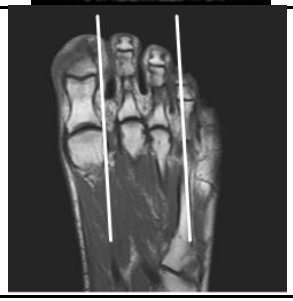
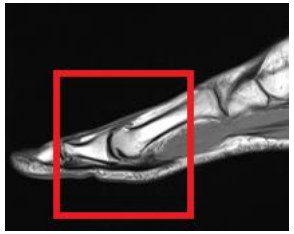
- Tib/Fib: anatomical with toes pointing up

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax STIR Ax	140 – 200	5 x 1		 
T1 Cor STIR Cor	200 - 380	5 x 1	Tib/Fib: perpendicular to the tibiotalar joint	 
T1 Sag STIR Sag	200 – 380	5 x 1	Tib/Fib: parallel to the tibiotalar joint	 
Contrast: mass, infection, or post-op, may consult with radiologist for appropriate planes *Contrast not required for metastatic disease*				
T1 FS Ax Pre T1 FS Ax Post Additional plane post: T1 FS Cor Post T1 FS Sag Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Toe *

(pain, turf toe, plantar plate)

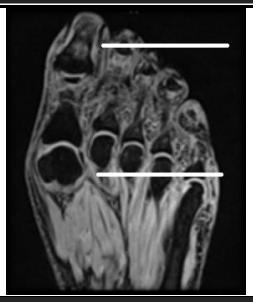
- Place marker on area of interest.
- Include affected toe and adjacent 2nd – 4th toes for comparison

SEQUENCE	FOV (mm)	SLICE (mm)	PAIN	TURF TOE / PLANTAR PLATE
PD FS Dixon Ax	90	2 x 0.5	Include entire toe 	MTPJ is the primary area of interest 
T1 Cor T2 FS Dixon Cor	90	2 x 0.5		
PD Sag T2 FS Dixon Sag	90	2 x 0		

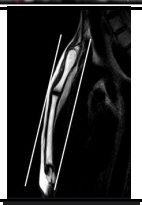
Toe: Mass *

Place marker on area of interest

Perform forefoot for DX of osteomyelitis, ulcer, or infection

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
T1 Ax T2 FS Ax	90	2 x 0.5		
T1 Cor T2 FS Dixon Cor	90	2 x 0.5		
PD Sag T2 FS Dixon Sag	90	2 x 0	Affected toe and adjacent 2nd – 4th toes for comparison	
Contrast: mass				
T1 FS Cor Pre *Administer contrast* T1 FS Cor Post T1 FS Sag Post			Perform T2 weighted image immediately after injection to allow for contrast uptake.	

Whole Body Myeloma *
(monoclonal gammopathy)

SEQUENCE	FOV (mm)	SLICE (mm)	COMMENTS	IMAGES
STIR Cor Skull	250	6 – 7 x 0.5		
STIR Cor Sternum	240	5 x 0.5	Include medial ½ of clavicle	
RT STIR Cor Humerus LT STIR Cor Humerus	450 – 500	6 – 7 x 0.6	Include partial wall and distal clavicle	
STIR Cor Pelvis	500	6 – 7 x 0.6	Include as much as femurs as possible	
T1 Sag Total Spine Loc				
T1 Sag Cervicothoracic STIR Sag Cervicothoracic	~400	5 x 0.5		
T1 Sag Thoracolumbar STIR Sag Thoracolumbar	~400	5 x 0.5	Ensure overlap with cervicothoracic sagittal series	
Referred by hematologist or oncologist, primarily Dr. Matsui and Anna Courtney, PA				