

MSK MRI PROTOCOLS



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MSK CHEST



MR MSK Chest Indications:

▶ Pectoralis Major

- Indications:

- ▶ Pec tear

▶ Sternum / SC joints

- Indications:

- ▶ Tumor, infection, arthritis, trauma

▶ Chest wall

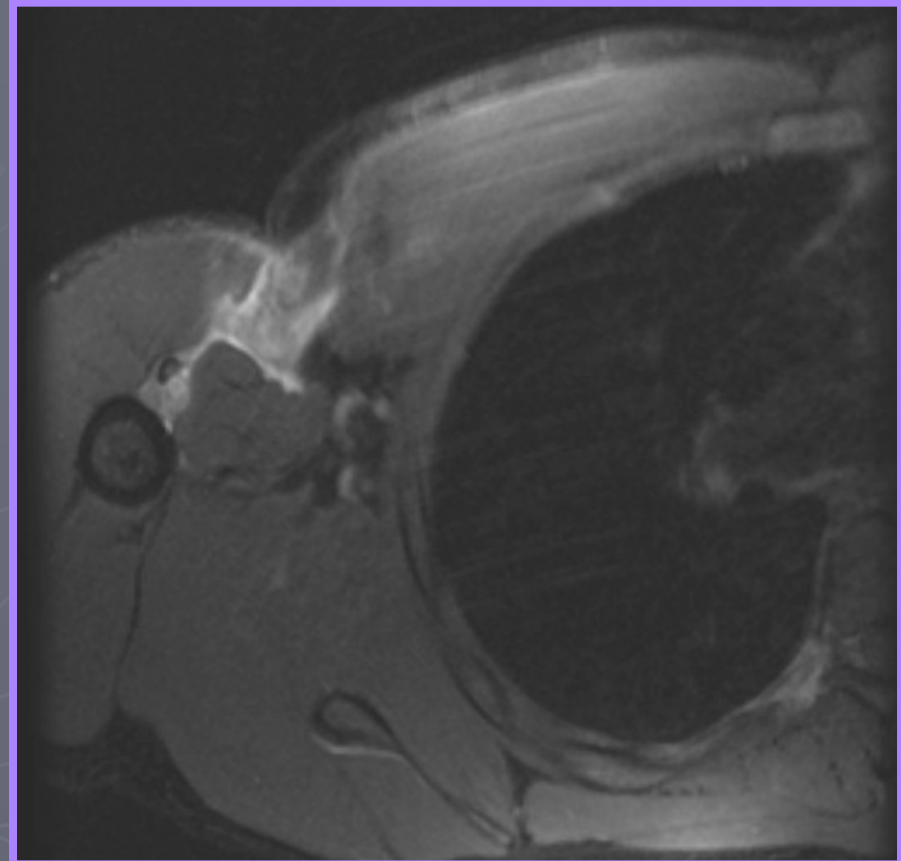
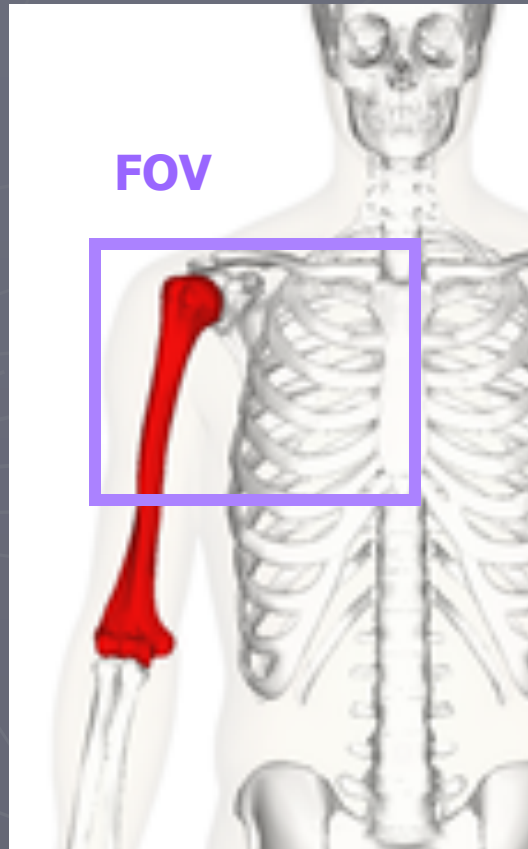
- Indications:

- ▶ Trauma, tumor

Pectoralis Major

► Use large FOV

- Medial-lateral: cover to midline chest
- Superior-inferior: cover down to mid-humeral shaft



Pectoralis Major

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial T1	30-36	256 x 256 1	4/0.5	400-800	min	-	-	-	16
Axial FSTIR	30-36	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Axial T2 FSE	30-36	256 x 256 2	4/0.5	>2000	80-100	-	-	8	16
Cor Obl FSTIR	36-48	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Sag Oblique T2 FSE Fat Sat	30-36	256 x 192 2	4/1	>2000	40-60	-	-	8	16

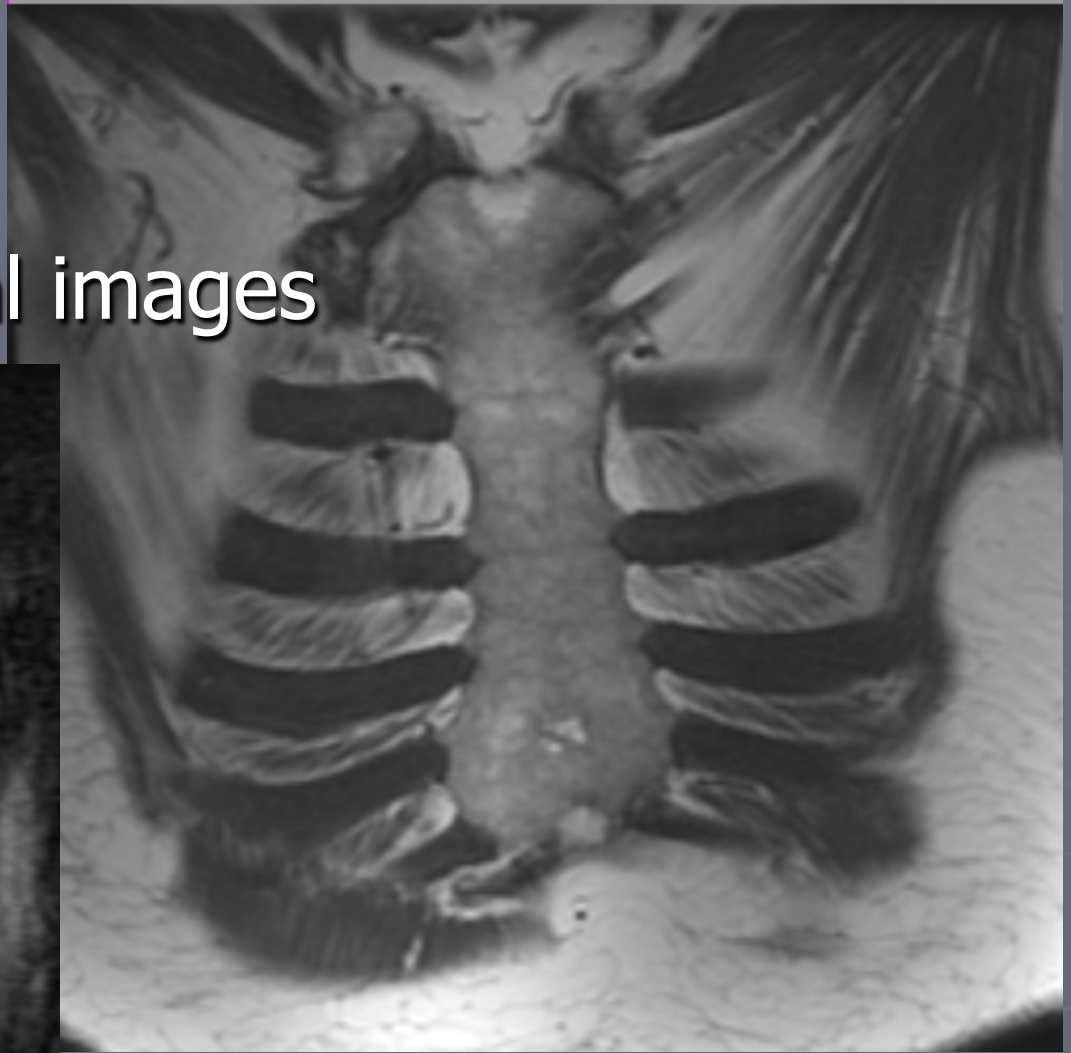
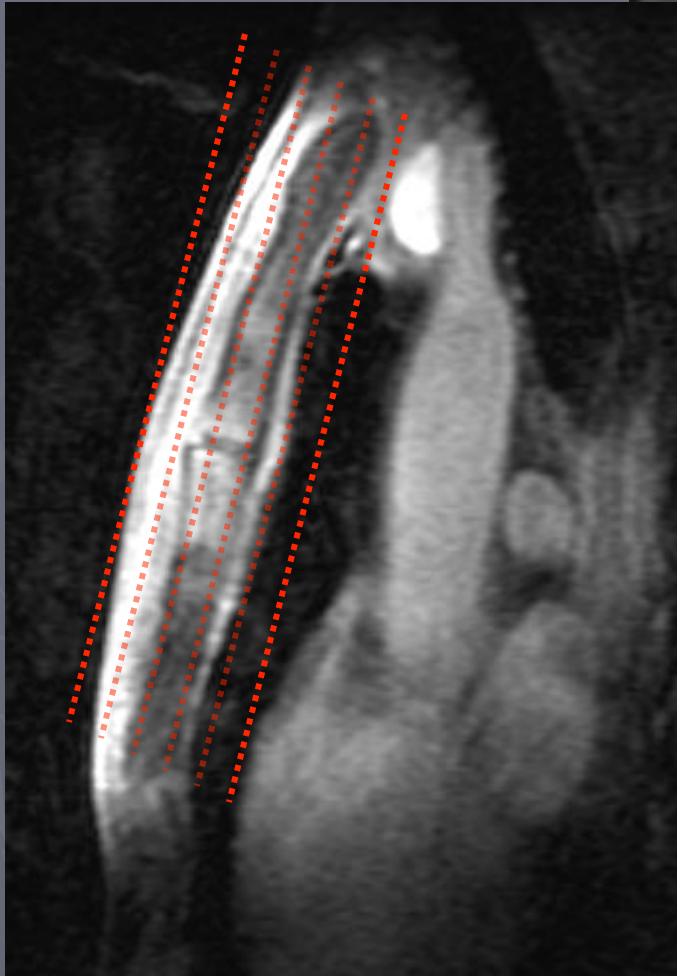
Sternum

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial T1	20-24	256 x 256 1	4/0.5	400-800	min	-	-	-	16
Axial FSTIR	24	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Sag T1	20-30	256 x 256 2	4/0.5	400-800	min	-	-	-	16
Sag FSTIR	20-30	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Cor oblique T2 FSE	20-24	256 x 192 2	4/1	>2000	40-60	-	-	8	16

► Coronal: oblique
along sternum

Planned from sagittal images

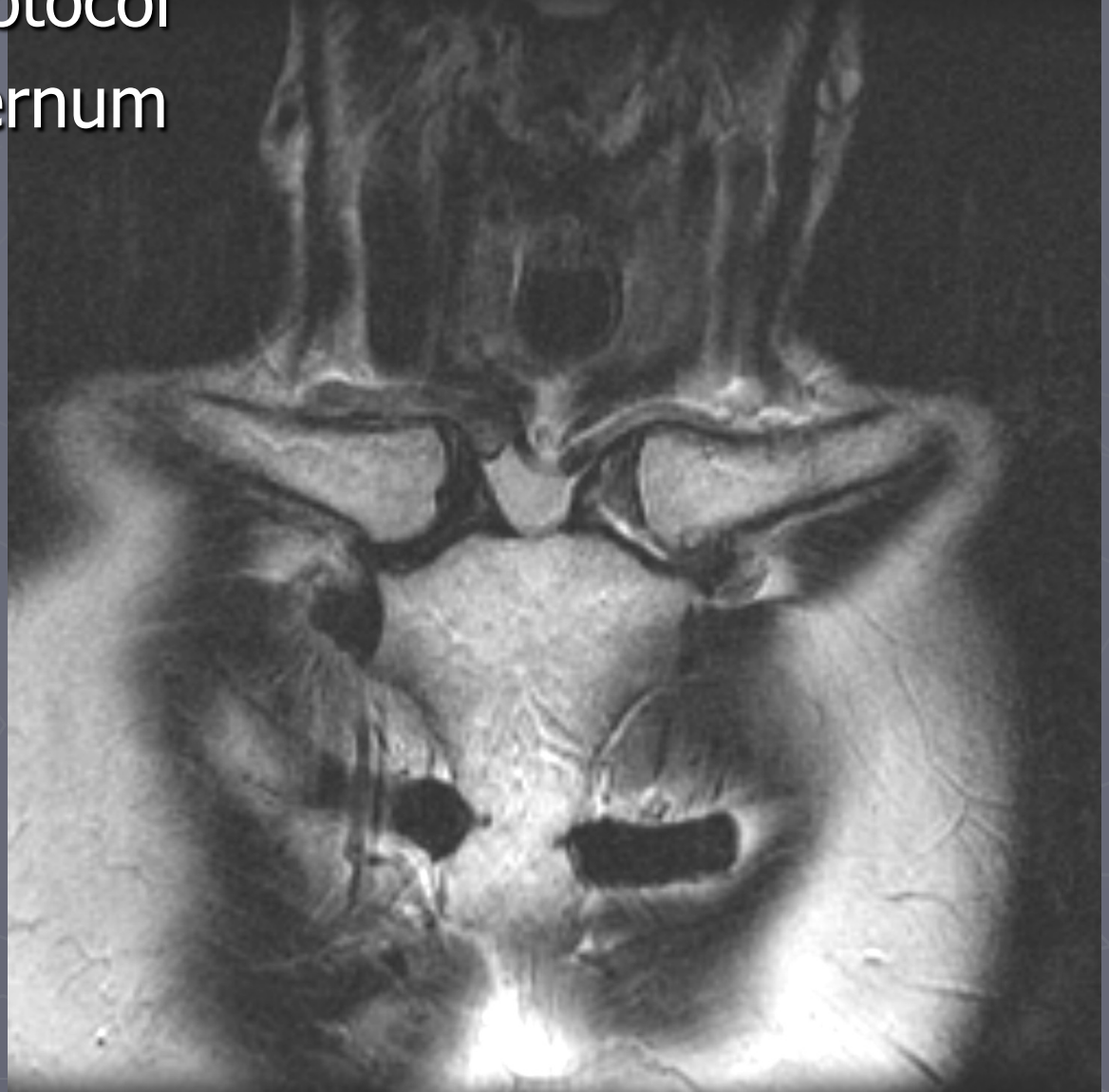


Sternoclavicular joints

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Axial T1	14-20	256 x 256 1	4/0.5	400-800	min	-	-	-	16
Axial FSTIR	14-20	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Sag T1	20-24	256 x 256 2	4/0.5	400-800	min	-	-	-	16
Sag FSTIR	20-24	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Cor T2 FSE	14-20	256 x 192 2	4/1	>2000	40-60	-	-	8	16

► Smaller FOV for SC joints

- Otherwise protocol is similar to Sternum



MSK - Chest Wall



UPPER EXTREMITY



MR Shoulder Indications:

▶ Routine Shoulder

- Indications:

- ▶ Rotator Cuff Pathology/Evaluation

▶ MR Arthrogram

- Indications:

- ▶ Labrum Pathology/Tear

▶ Post Gadolinium Shoulder (Indirect MR Arthrogram)

- Indications:

- ▶ Labral Pathology/Instability without ability to do a direct arthrogram

Shoulder-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Axial PD FSE FatSat	12-14	512 x 256 2	4/0.5	2000-3000	20-40	-	-	8	16
Cor Oblique FSTIR	16-18	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16
Cor Oblique T1 SE Non FatSat	16-18	256 x 256 1	4/0.5	400-800	minimum	-	-		16
Sag Oblique T2 FSE Non Fat Sat	14-16	256 x 192 1	4/1	>2000	90-110	-	-	8	16

MR Arthrogram Shoulder

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial T1 SE FatSat	12-14	256 x 192 2	3/0.5	400-800	minimum				16
Cor Oblique T1 SE FatSat	14-16	256 x 192 2	3/0.5	400-800	minimum				16
Cor Oblique PD FSE FatSat	14-16	256 x 192 2	3/0.5	>1500	30-50			8	16
Sag Oblique T1 SE Non FatSat	14	256 x 192 1	4/1	400-800	minimum				16
ABER T1 SE Fat Sat	14	256 x 192 2	3/0.5	400-800	minimum				16

Shoulder-Post Gadolinium (Indirect MR Arthrogram)

****Inject standard dose of IV contrast and wait 20 minutes before scanning****

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

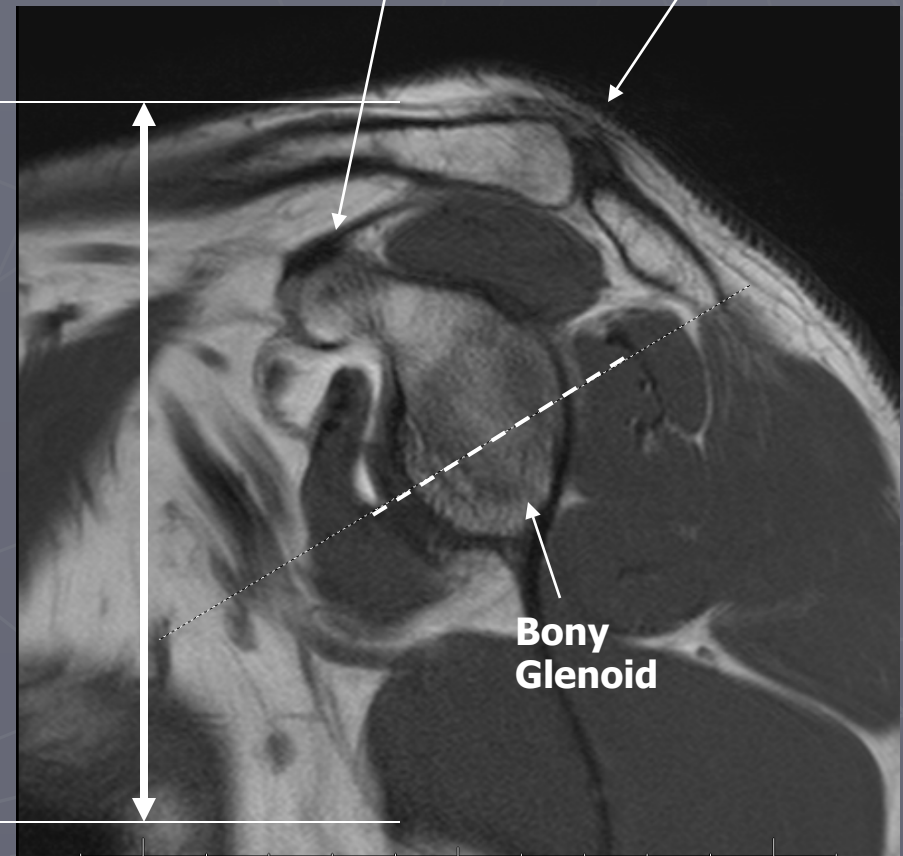
Axial T1 SE FatSat	12-14	256 x 192 2	3/0.5	400-800	minimum				16
Axial PD FSE FatSat	12-14	256 x 192 2	3/0.5	2000-400 0	30-50			8	
Cor Oblique T1 SE FatSat	14-16	256 x 192 2	3/0.5	400-800	minimum				16
Sagittal PD FSE FatSat	14-16	256 x 192 2	4/1	2000-400 0	30-50			8	
Cor Oblique FSTIR	16-18	256 x 192 2	4/0.5	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70	-	8	16

Shoulder – Axial Imaging Plane

The Axial imaging plane is slightly oblique (30 degrees): please prescribe off the sagittal plane and angle approximately 30 degrees to horizontal line as shown here (dashed line):

coracoid

AC Joint

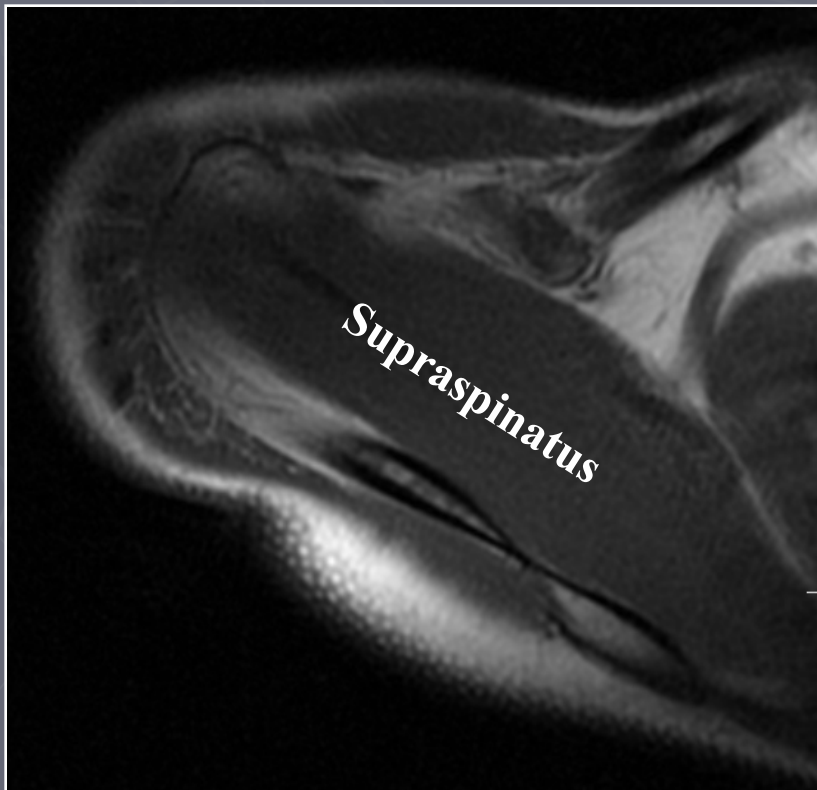


Bony
Glenoid

Cover
from top of AC joint through
proximal humeral diaphysis.

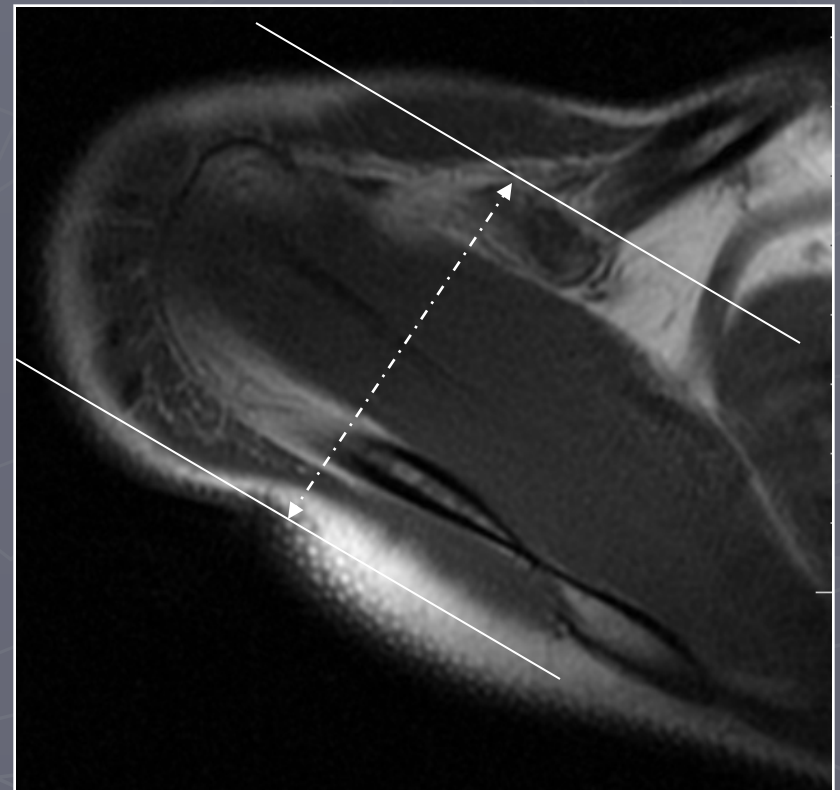
Shoulder-Coronal Imaging Plane

Relevant Anatomy



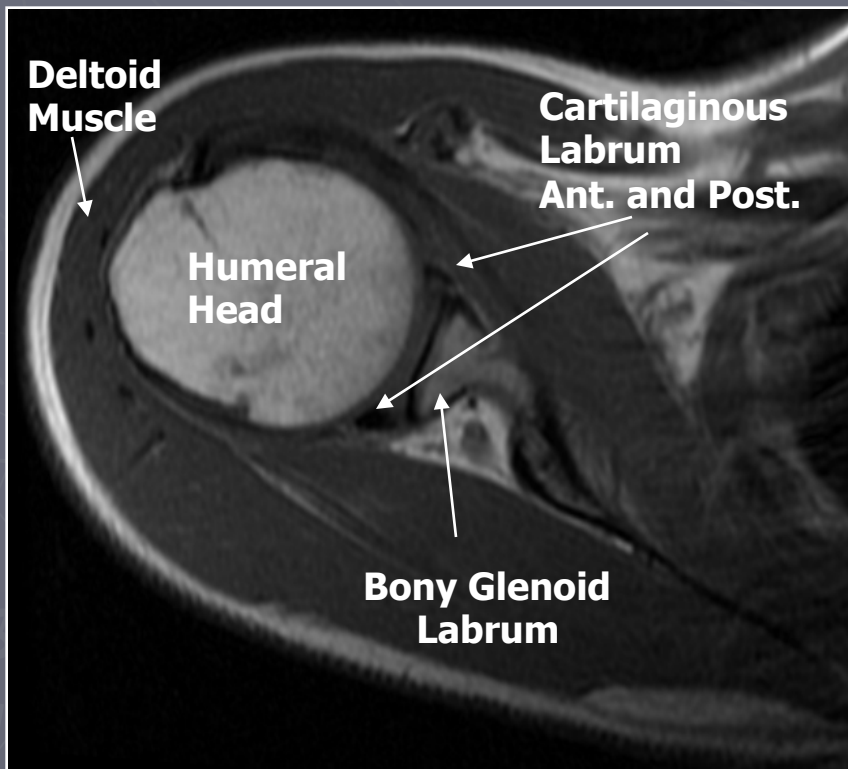
Coronal Imaging Plane

Prescribe coronal plane off of axial images parallel to supraspinatus muscle



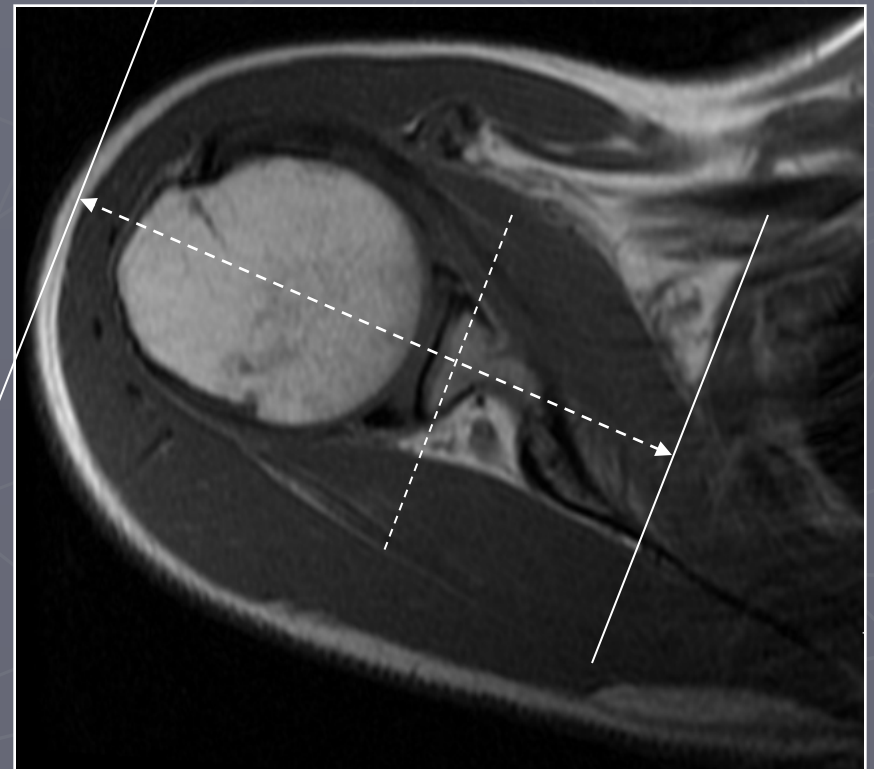
Shoulder-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

Prescribe sagittal plane off axial images with line parallel to bony glenoid. Image from mid-scapula through deltoid muscle.



MR Elbow Indications:

▶ Routine Elbow

■ Indications:

- ▶ Biceps/Triceps tear
- ▶ Medial/Lateral collateral ligament tear
- ▶ Common Flexor/Common extensor tendon pathology

▶ MR Arthrogram Elbow

■ Indications:

- ▶ Intra articular body evaluation
- ▶ Medial/Lateral Collateral Ligament Evaluation
- ▶ Osteochondral defect (OCD)

▶ Post Gadolinium Elbow (Indirect MR arthrogram)

■ Indications:

- ▶ IA body
- ▶ OCD

Elbow-Routine*

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Axial T1	12-14	256 x 256 1	4/1	400-800	minimum				16
Axial FSTIR	14-16	256 x 192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16
Coronal T1	14-16	256 x 256 1	3/0.5	400-800	minimum				16
Coronal PD FSE FatSat	14-16	256 x 256 2	3/0.5	> 1500	20-40			8	16
Sag PD FSE FatSat	12-14	256 x 256 2	3/0.5	1500-300 0	20-40			8	16

*for Biceps pathology perform FABS sequence; follow this [link](#).

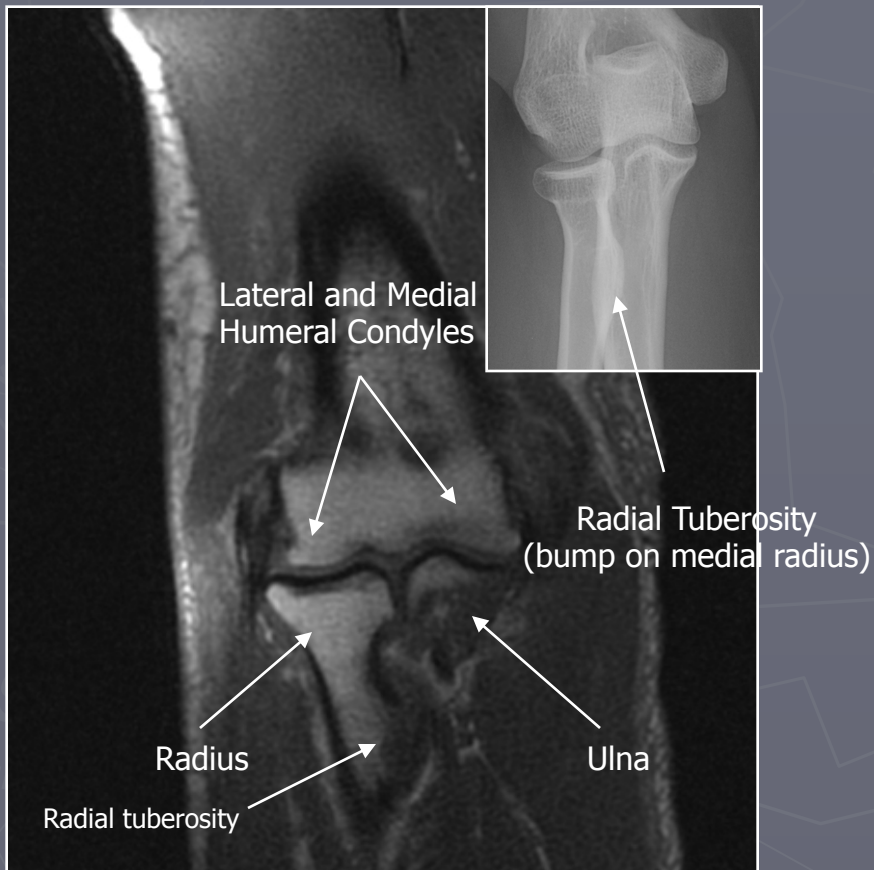
MR Arthrogram Elbow

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial T1 Non FatSat	12-14	256 x 256 1	4/1	400-800	minimum				16
Axial PD FSE FatSat	12-14	256 x 256 2	4/1	>1500	30-50			8	16
Coronal T1 FatSat	12-14	256 x 256 2	3/0.5	400-800	minimum				16
Coronal PD FSE FatSat	12-14	256 x 256 2	3/0.5	>1500	30-50			8	16
Sag T1 SE FatSat	12-14	256 x 256 2	3/0.5	400-800	minimum				16

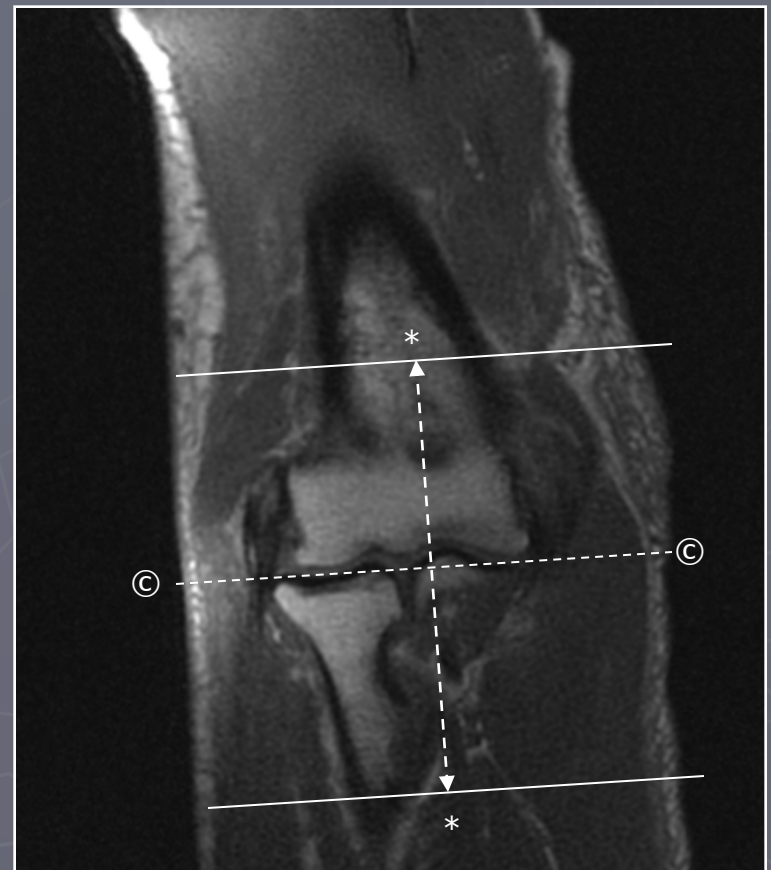
Elbow-Axial Imaging Plane

Relevant Anatomy



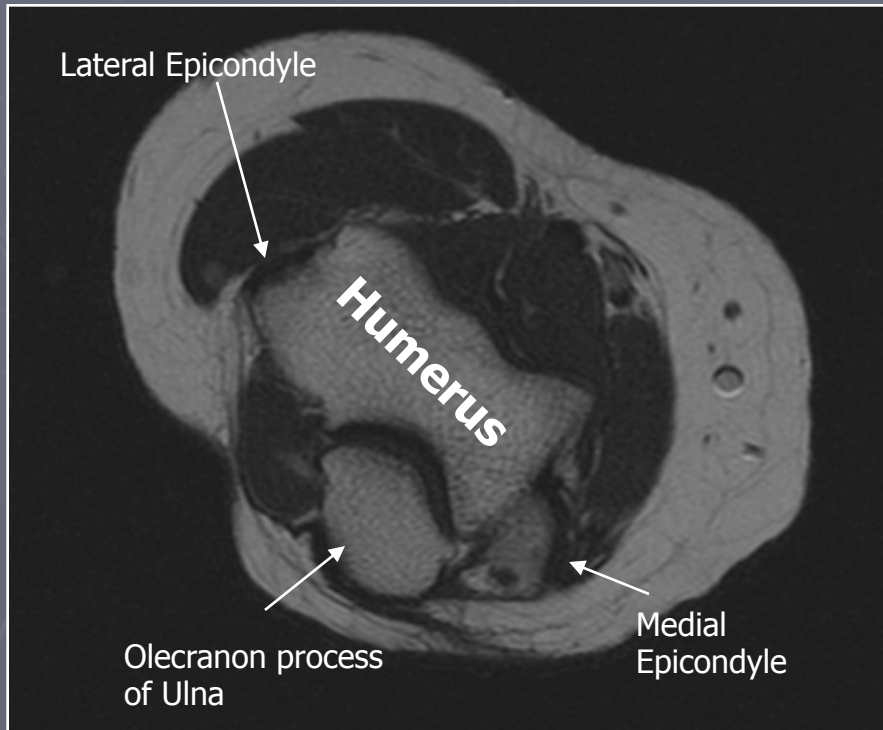
Axial Imaging Plane

*Prescribe plane perpendicular to coronal plane (©). Scan from humeral metaphysis through radial tuberosity.



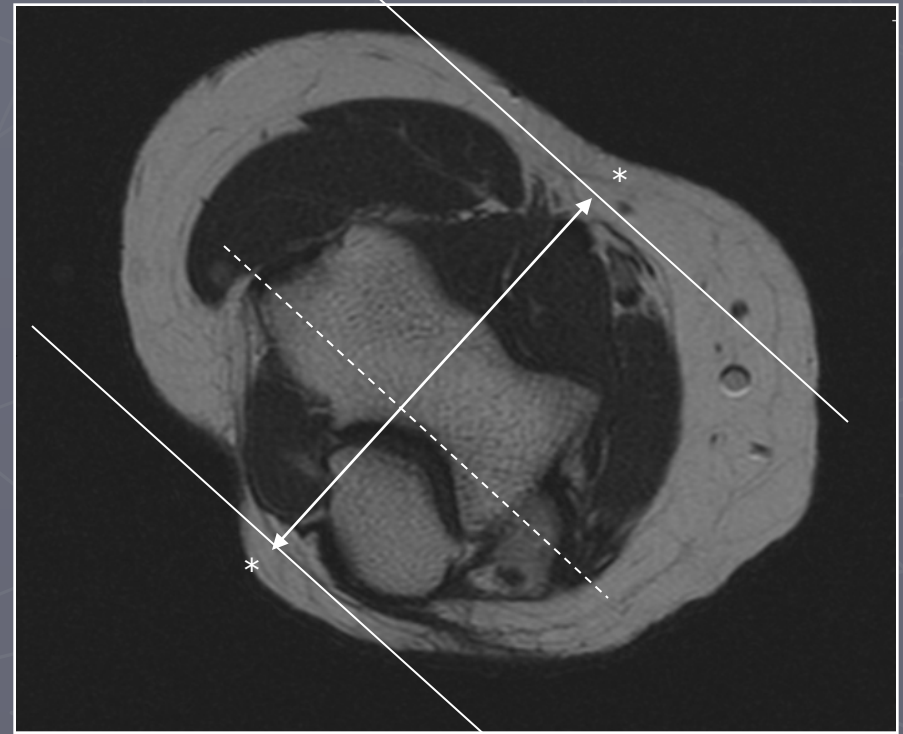
Elbow-Coronal Imaging Plane

Relevant Anatomy



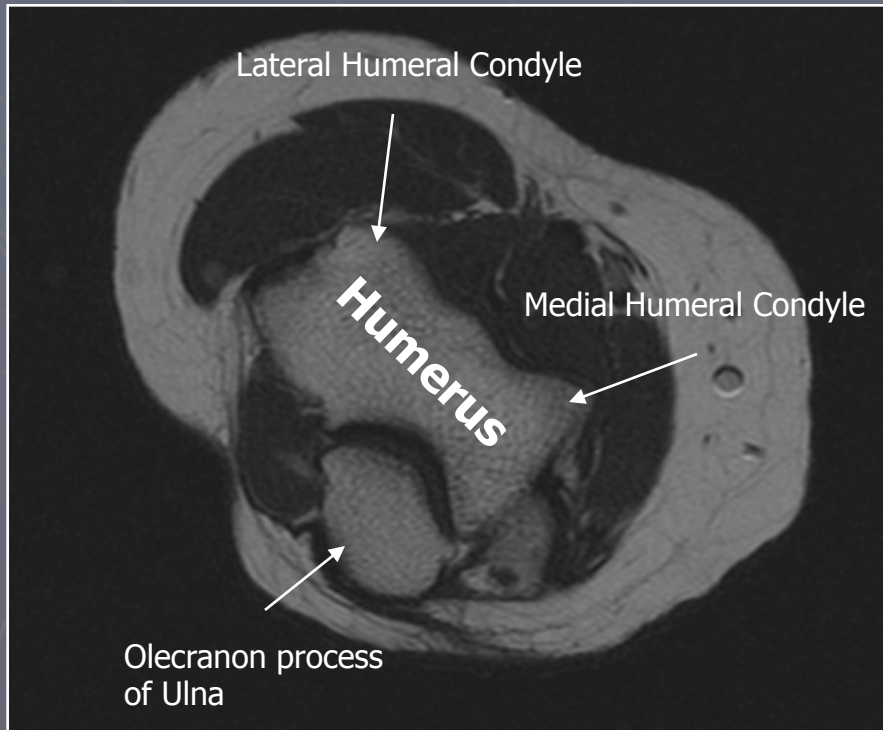
Coronal Imaging Plane

*Prescribe plane parallel to medial and lateral epicondyles.



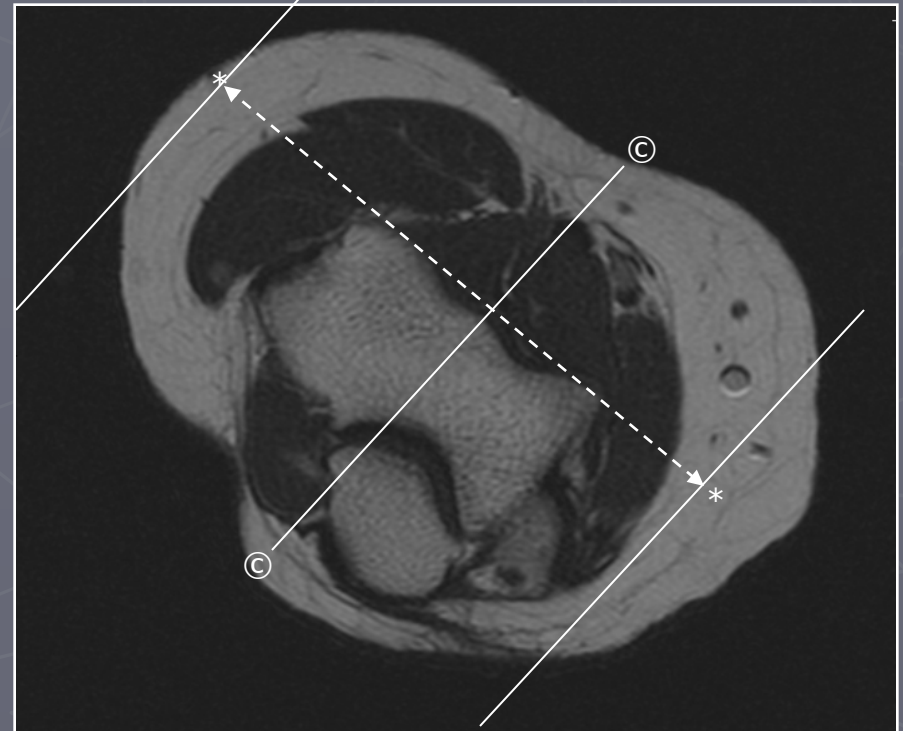
Elbow-Sagittal Imaging Plane

Relevant Anatomy



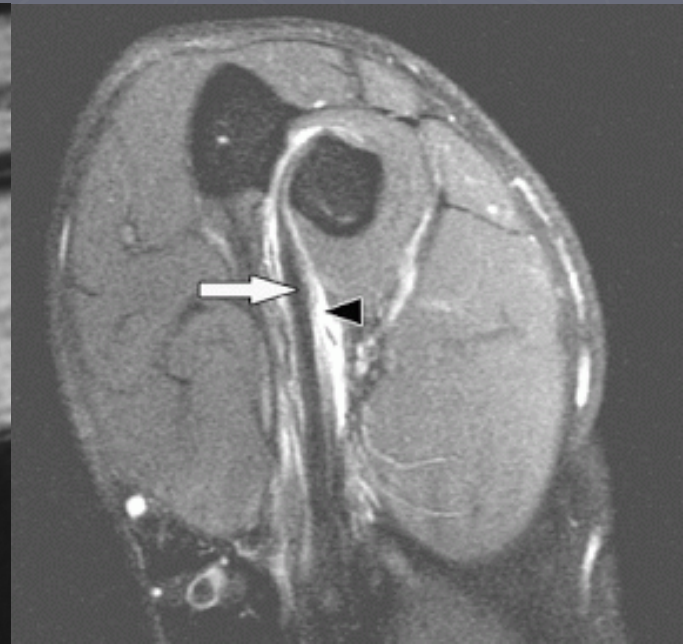
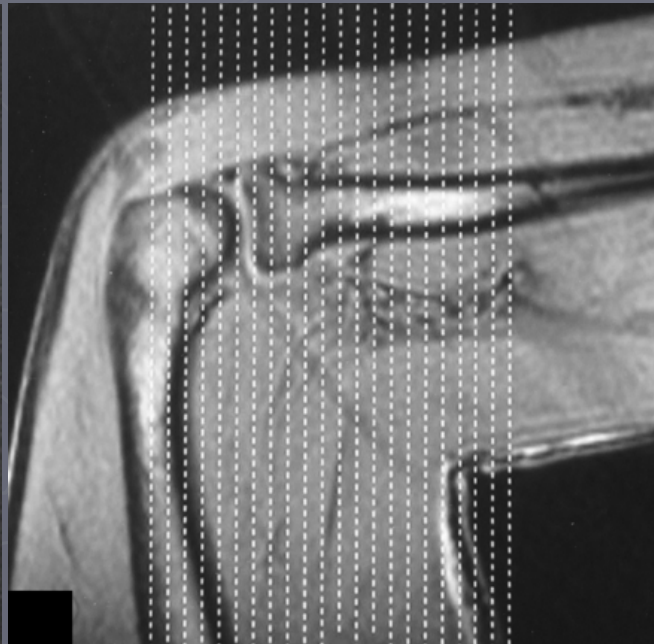
Sagittal Imaging Plane

*Prescribe plane perpendicular to coronal plane (©). Scan through entire elbow.



FABS Sequence

- ▶ For Biceps pathology
 - Acquire T1 and T2 FS



Wrist Indications:

▶ Routine Wrist

■ Indications:

- ▶ TFCC, Lunotriquetral, Scapholunate tear
- ▶ Flexor Tendon/Carpal Tunnel/ Extensor Tendon Pathology
- ▶ Evaluation for Occult fracture

▶ MR Wrist Arthrogram

■ Indications:

- ▶ TFCC/LT/SL ligament tears

▶ Dynamic Enhanced Wrist (Post Gad Images)

■ Indications:

- ▶ Evaluation of Scaphoid Nonunion/Avascular Necrosis Exam:

- **IMPORTANT: **Perform routine wrist PLUS Pre/Post Gadolinium images through carpal bones in coronal plane****

Wrist-Routine

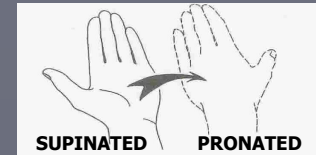
Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal T1	8-12	256 x 256 1	3/0.5	400-800	minimum				16
Coronal PD FSE FatSat	8-12	256 x 256 2	3/0.5	>1500	30-50			8	16
Coronal 2D or 3D GRE FatSat	10-12	256 x 192 2	1/0	60	minimum		20-40		16
Axial PD FSE Fat Sat	8-12	256 x 256 2	3/1	2000-300 0	30-50			8	16
Sag FSTIR	12-14	256 x 192 2	3/1	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16

MR Arthrogram Wrist (direct or indirect)

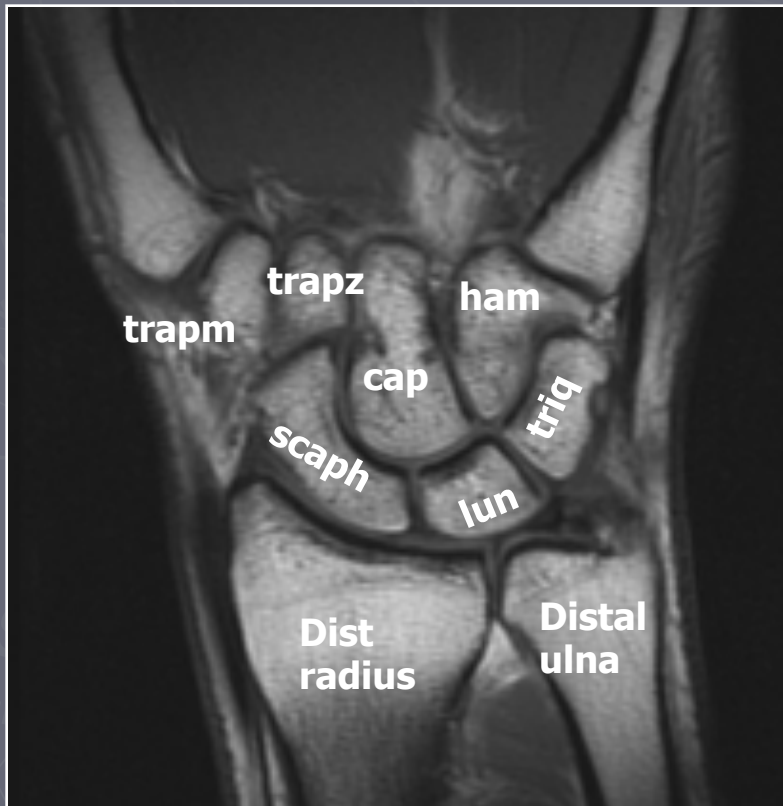
Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal T1 SE FatSat	8-10	256 x 256 2	3/0.5	400-800	minimum				16
Coronal PD FSE FatSat	8-12	256 x 256 2	3/0.5	>1500	30-50			8	16
Coronal 2D or 3D GRE FatSat	10-12	256 x 192 2	1/0	60	minimum		45-60		16
Axial PD FSE FatSat	8-12	256 x 256 2	3/1	>1500	30-50			8	16
Axial T1 Non- FatSat	8-12	256 x 192 1	3/1	400-800	minimum				16
Sag PD FSE FatSat	10-12		3/1	>1500	30-50			8	16

Wrist-Axial Imaging Plane

*****IMAGE WRIST IN PRONATED POSITION!**

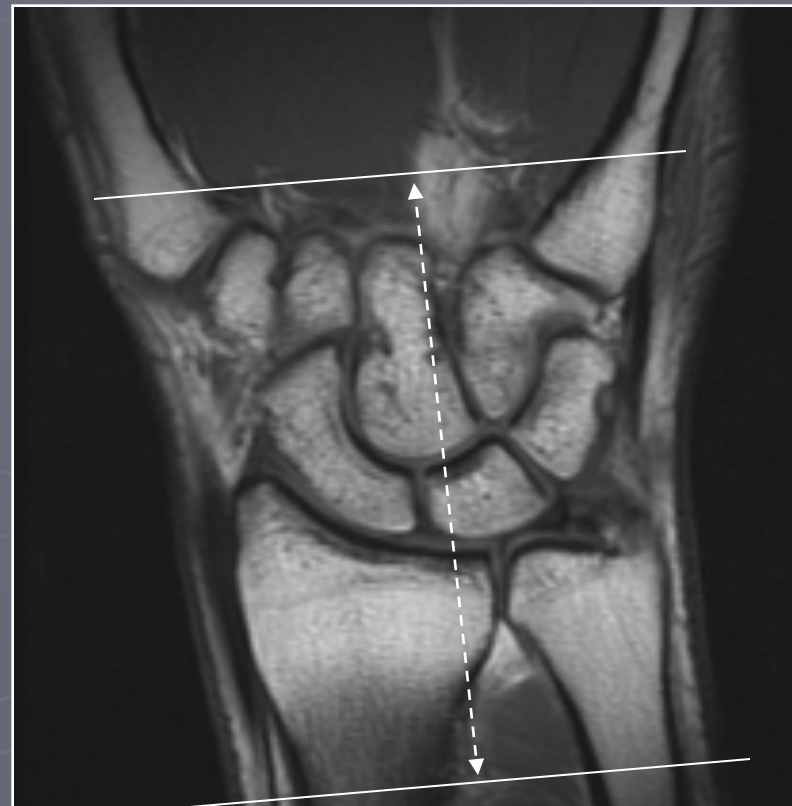


Relevant Anatomy



Axial Imaging Plane

Prescribe plane parallel to distal radius. Scan from proximal metacarpals through distal radial/ulnar metaphysis.

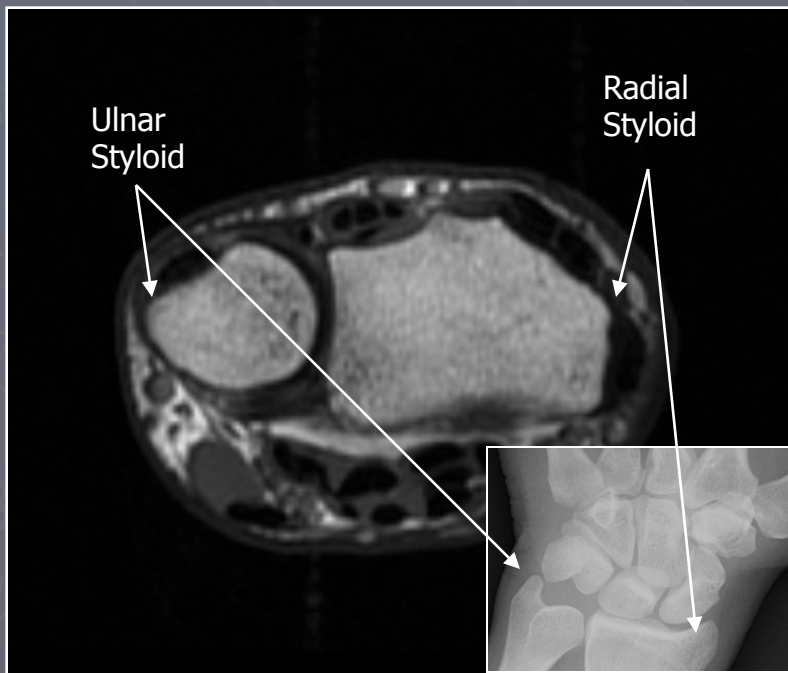


Wrist-Coronal Imaging Plane



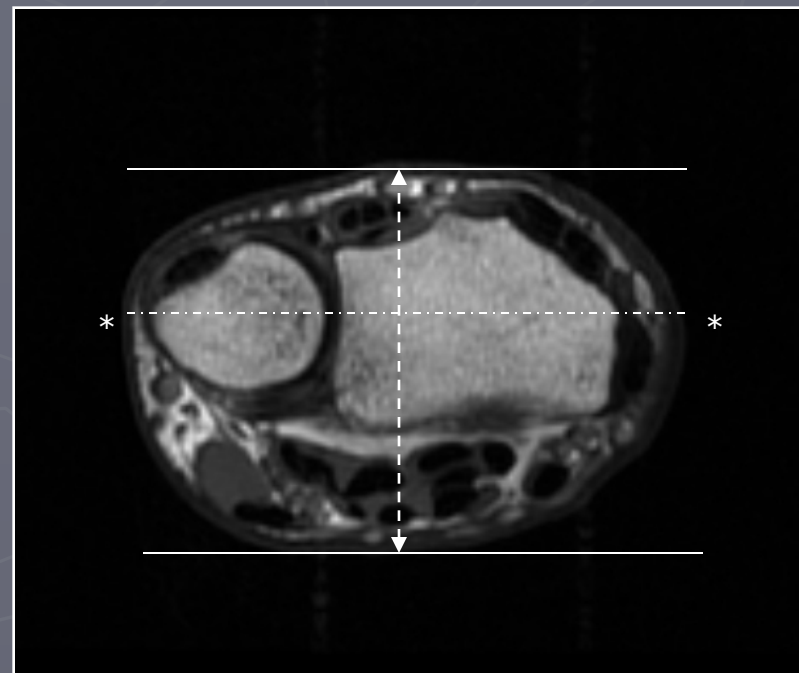
**Remember to
pronate the wrist!**

Relevant Anatomy

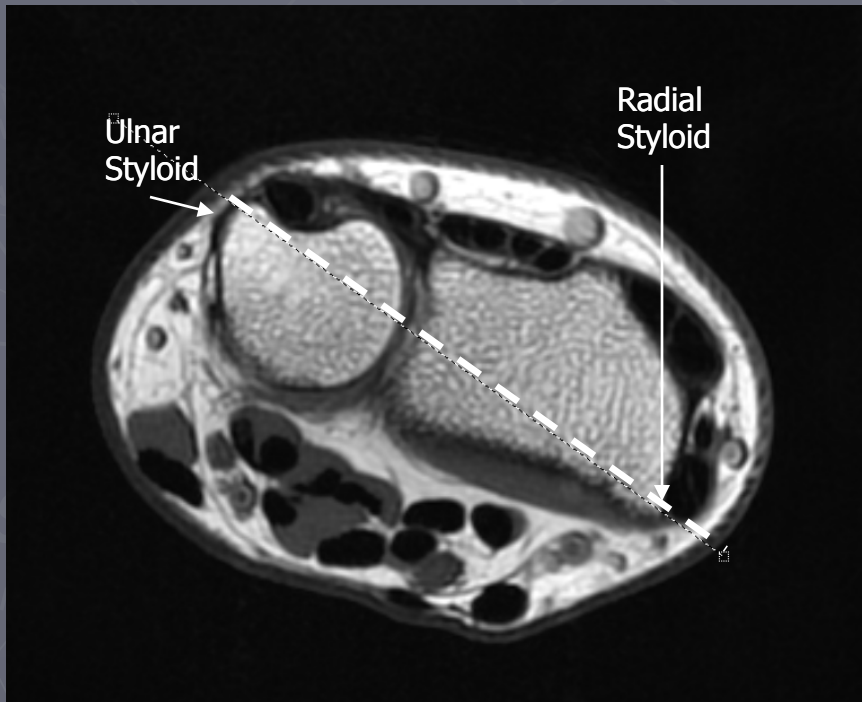


Coronal Imaging Plane

*Prescribe plane along line drawn from ulnar styloid through radial styloid. Scan through entire wrist.



Wrist-Coronal Imaging Plane

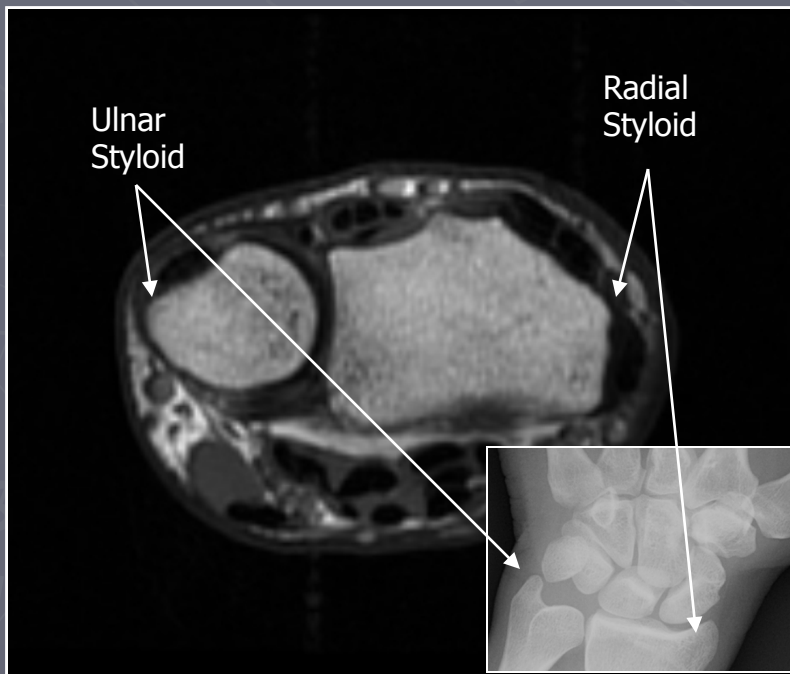


Relevant Anatomy:

See on the left, another example for the correct plane for coronal images with the plane prescribed off the axials and through both the ulnar and radial styloid

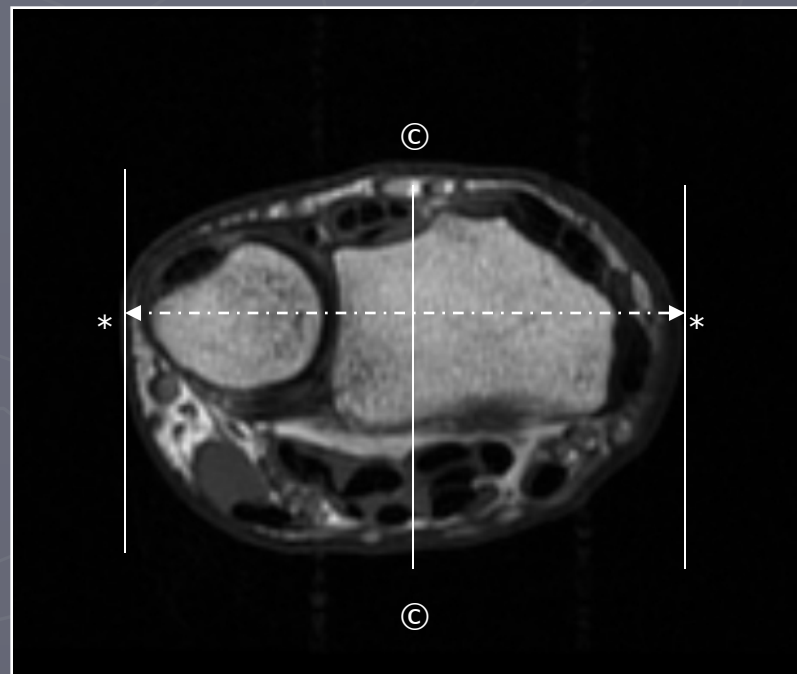
Wrist-Sagittal Imaging Plane

Relevant Anatomy

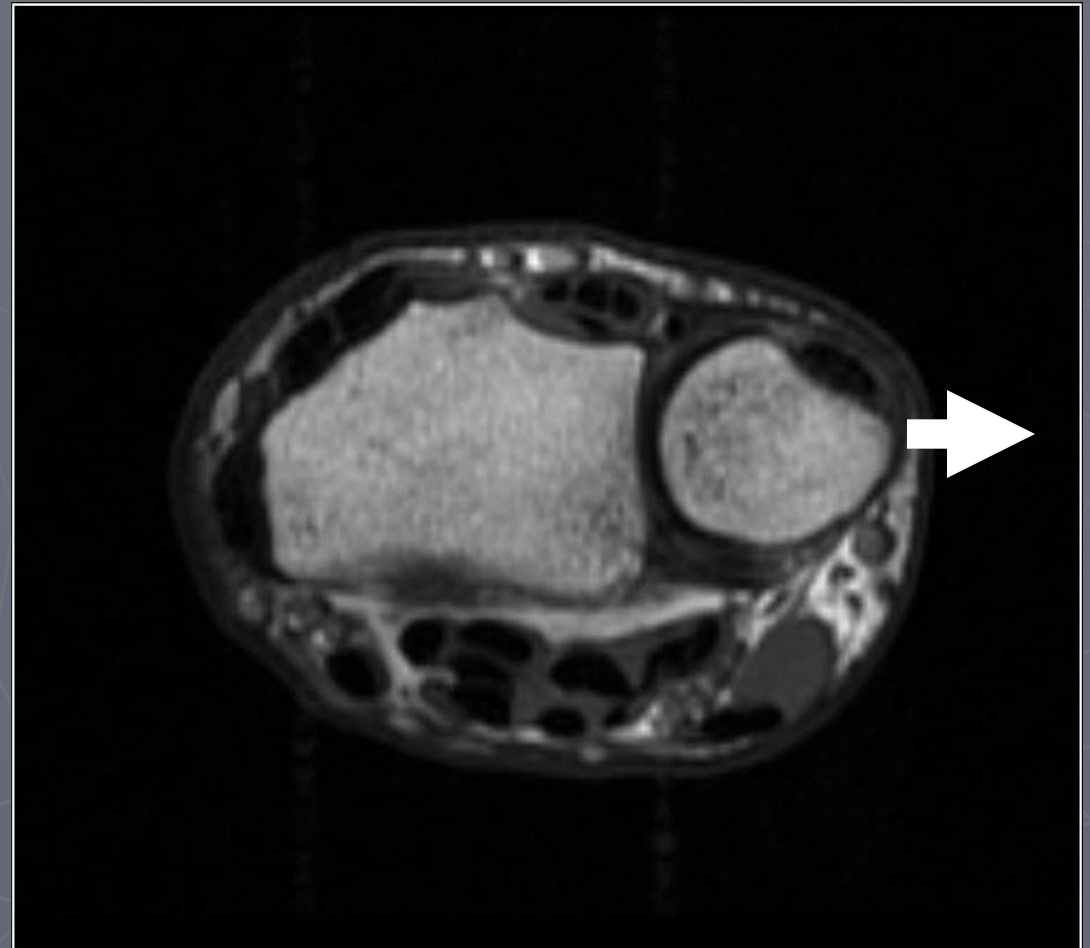
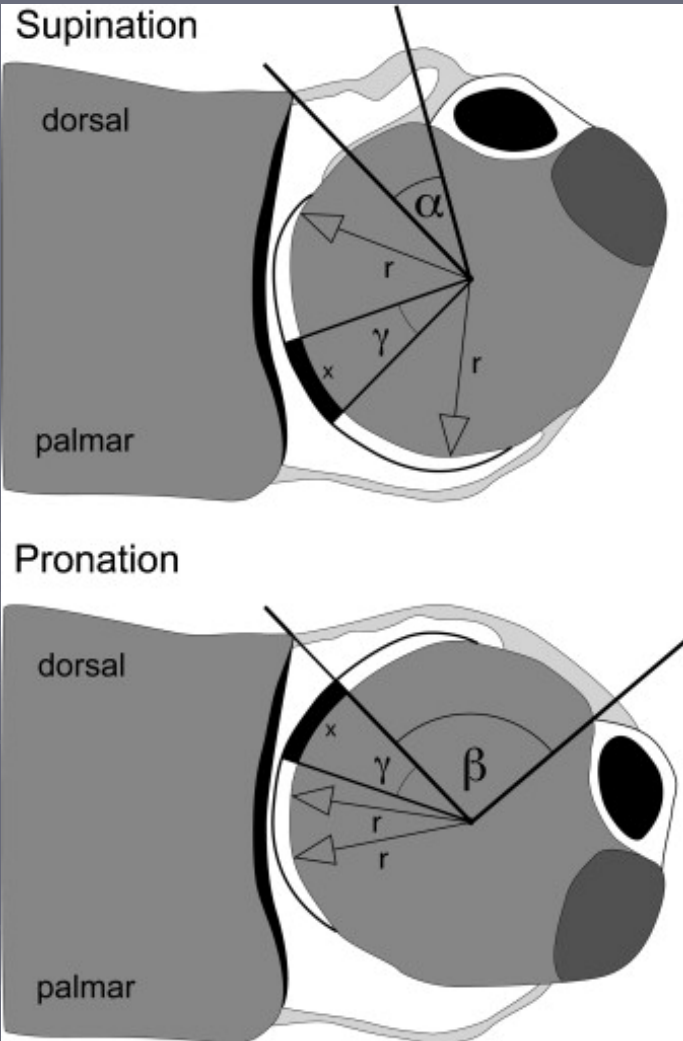


Sagittal Imaging Plane

*Prescribe plane perpendicular to coronal plane (©).
Scan through entire wrist.



Hint: if the ulnar styloid is poking out to the side, the wrist is in pronated position



Thumb Indications:

▶ Routine Thumb

■ Indications:

- ▶ Gamekeeper's thumb (Ulnar Collateral Ligament tear)
- ▶ Flexor/Extensor Tendon Tear
- ▶ R/O Occult Fracture

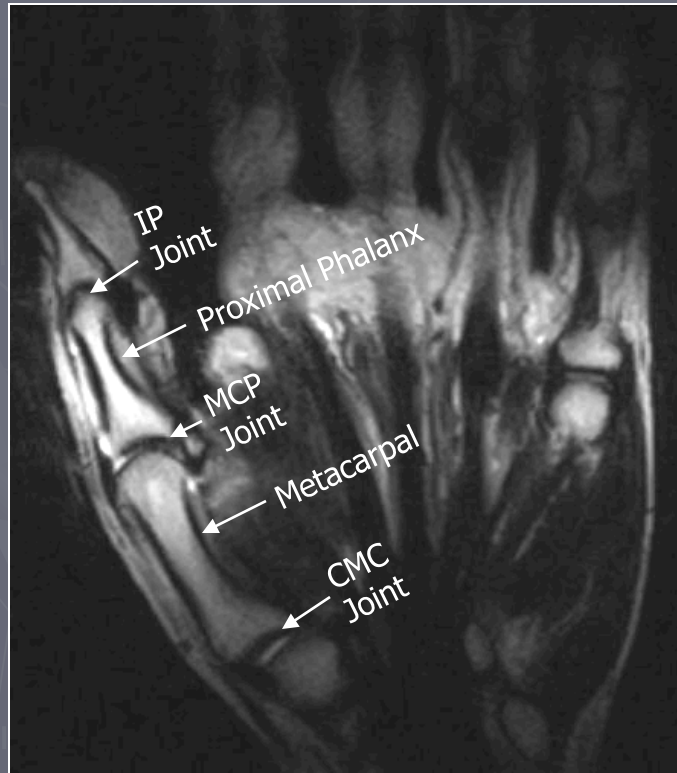
Thumb

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Coronal PD FSE	10	256 x 256 2	3/0.3	>1500	30-50			4	
Coronal T2 FSE Fat Sat	10	256 x 192 2	3/0.3	2000-600 0	50-70			8	16
Sag FSE STIR	10-14	256 x 192 2	3/0.3	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16
Axial T1 SE	10	256 x 192 1	3/0.3	400-800	minimal				
Axial T2 FSE Fat Sat	10	256 x 192 2	3/0.3	2000-600 0	50-70			8	16

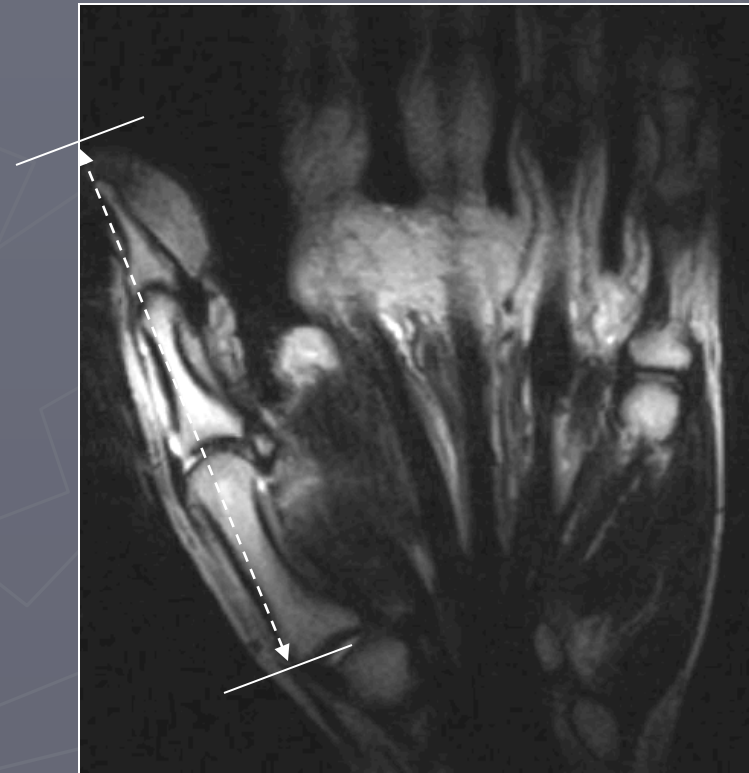
Thumb-Axial Imaging Plane

Relevant Anatomy



Axial Imaging Plane

Prescribe plane perpendicular to midshaft of proximal 1st phalanx. Scan from CMC joint through thumb.

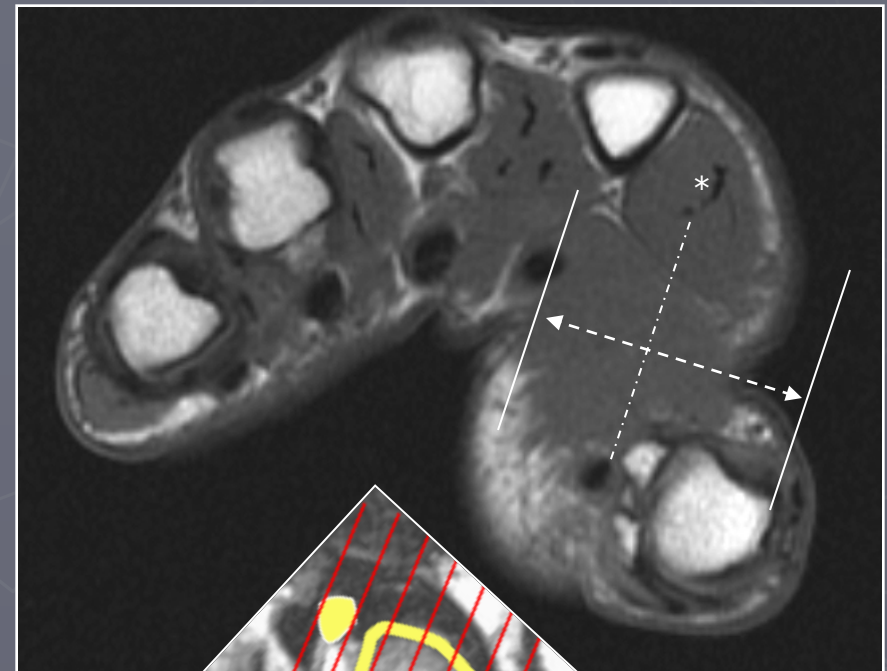
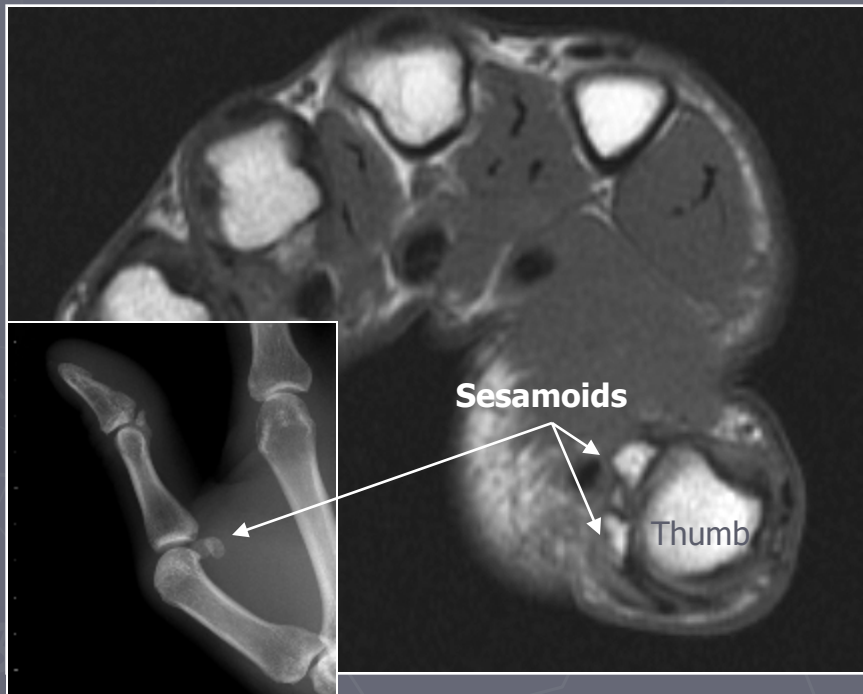


Thumb-Coronal Imaging Plane

Coronal Imaging Plane

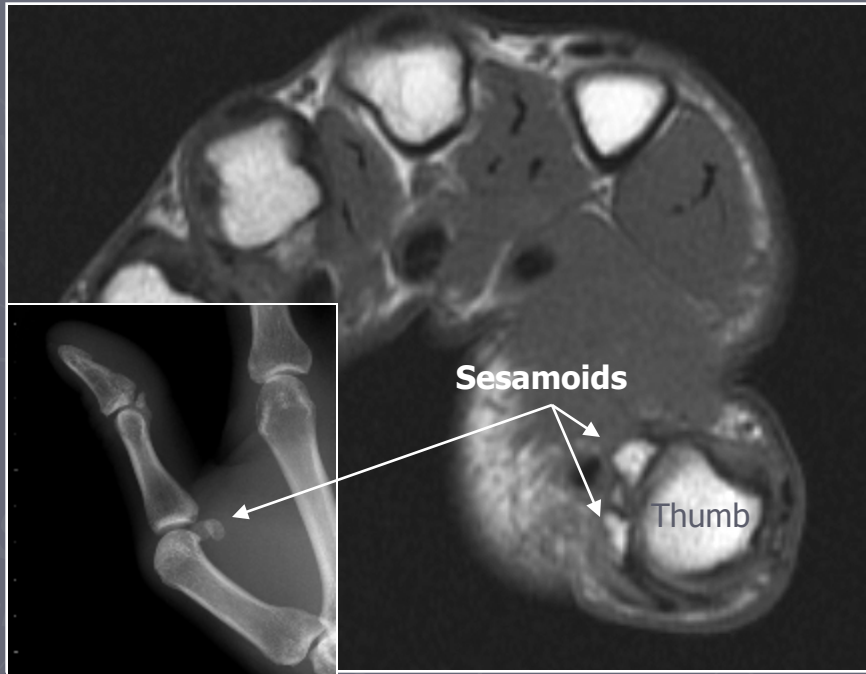
*Prescribe plane along line bisecting sesamoid bones or if sesamoids are not well seen along line bisecting the 1st metatarsal head (red lines through the yellow square shown below). Scan through entire thumb.

Relevant Anatomy



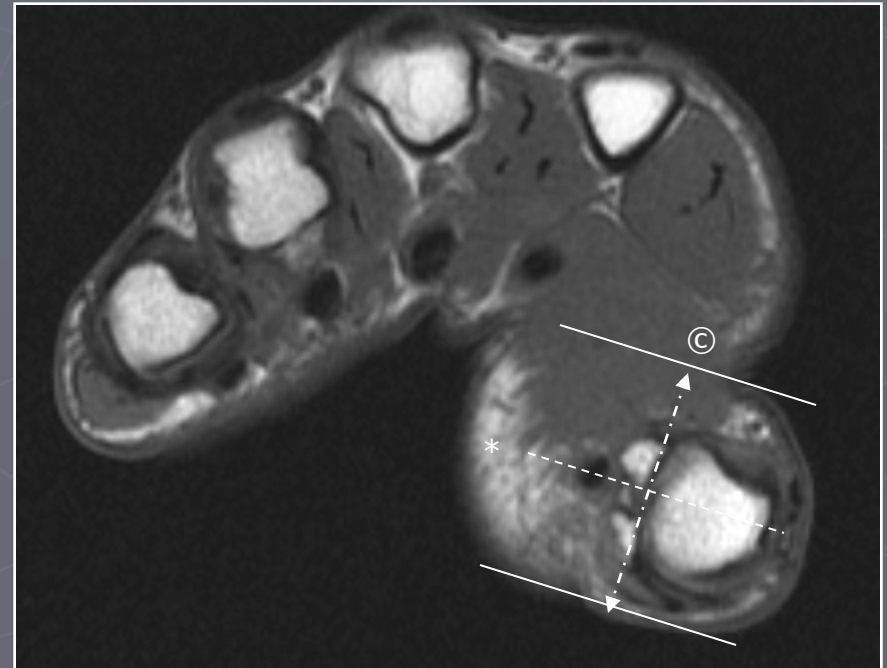
Thumb-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

*Prescribe plane perpendicular to coronal imaging plane (©). Scan through entire thumb.



Finger Indications:

▶ Routine Finger

- Indications:

- ▶ Pulley rupture/Flexor or Extensor Tendon Injury

▶ Post Gadolinium Finger

- Indications:

- ▶ Mass

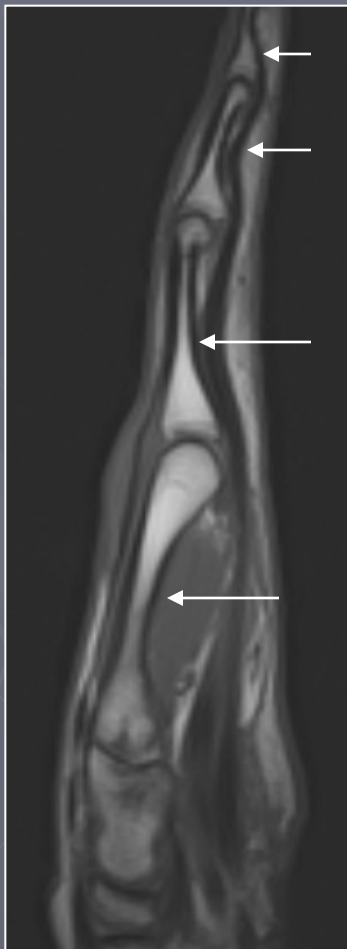
- ▶ **Perform routine finger plus Axial and either Coronal or Sagittal (whichever plane mass best seen) pre/post gadolinium FatSat fast GRE or T1 SE images. See “mass” protocol and adjust FOV and other parameters as needed.

Finger-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Sag T1 SE	10	256 x 192 1	3/0.3	400-800	minimum				16
Sag T2 FSE FatSat	10	256 x 192 2	3/0.3	2000-600 0	50-70			8	16
Axial T1 SE	10	256 x 192 2	3/0.3	400-800	minimum				16
Axial PD FSE FatSat	10	256 x256 2	3/0.3	2000-600 0	30-50			4	16
Coronal STIR	10-14	256 x256 2	3/0.3	>1500	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16

Finger-Axial Imaging Plane

Relevant Anatomy

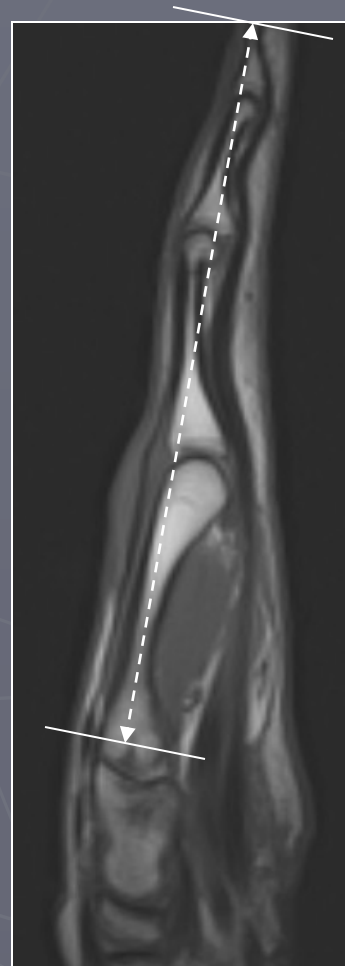


Distal Phalanx

Mid Phalanx

Proximal Phalanx

Metacarpal

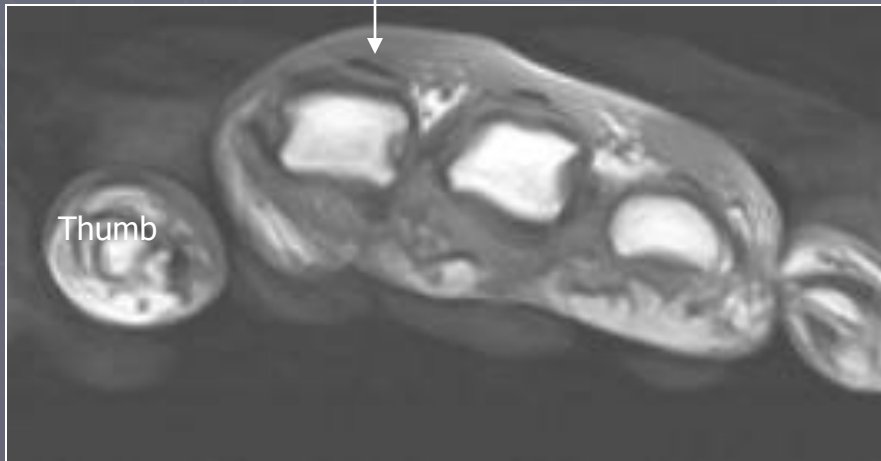


Axial Imaging Plane
Prescribe best fit line. Scan from proximal metacarpal through entire finger.

Finger-Coronal Imaging Plane

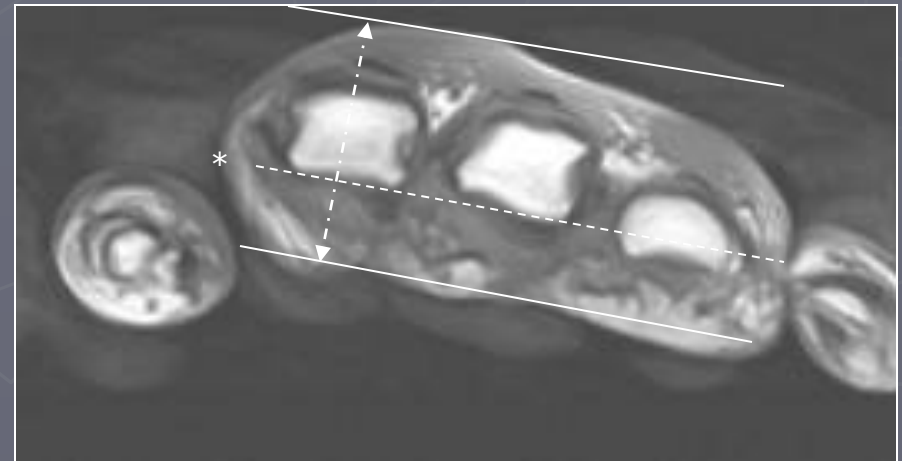
Relevant Anatomy

Extensor Tendon



Coronal Imaging Plane

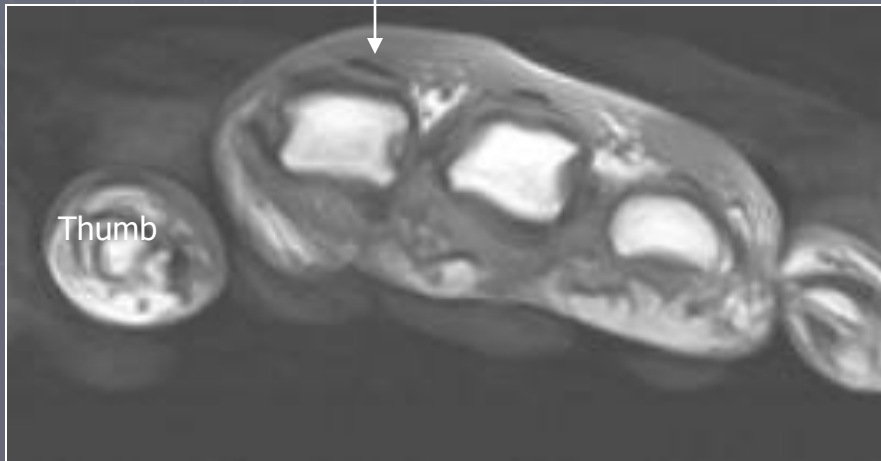
*Prescribe plane parallel to anterior metacarpal head. Scan through entire finger. Include 2 adjacent fingers.



Finger-Sagittal Imaging Plane

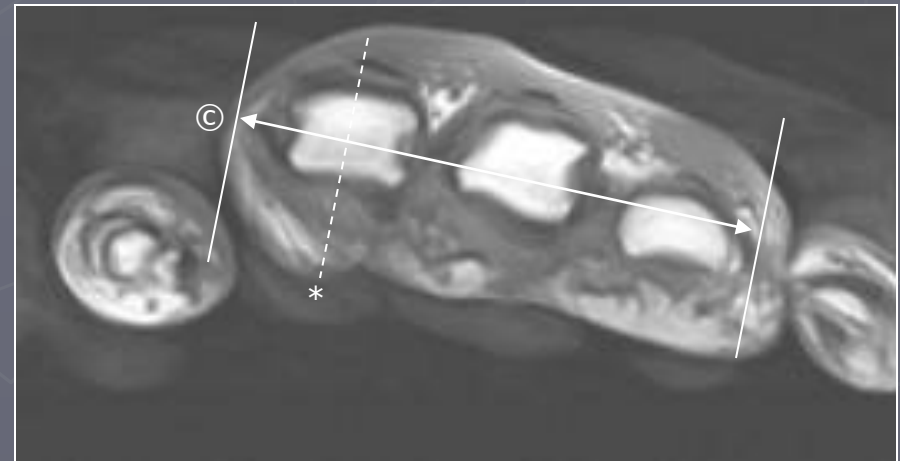
Relevant Anatomy

Extensor Tendon



Sagittal Imaging Plane

*Prescribe plane perpendicular to coronal plane (©). Scan through entire finger. Include 2 adjacent fingers.



LOWER EXTREMITY



ER Hip

(Hip fracture screening)

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal FSE-STIR	36-40	256x192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16
Coronal T1 SE Non FatSat	36-40	256 x 256 1	4/1	400-800	Minimum				16
Axial T2 FSE FatSat	36-40	256 x 256 2	4/1	>2000	80-110			8	16

Direct arthrogram hip

- Indication: hip labrum tear, FAI or dysplasia, hip pain under age 50
- PA Torso coil is 1st choice
- Prescribe obliques along femoral neck from coronal localizer

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal (PELVIS) T1 SE Non FatSat	36-40	256 x 256 1	4/1	400-800	Minimum				16
Coronal (PELVIS) FSE-STIR	36-40	256x192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16
Axial (PELVIS) T2 FSE FatSat	36-40	256 x 256 2	4/1	>2000	40-50			8	16
Ax oblique (HIP) T1 FatSat	14-20	384 x 256 2	4/0.5	400-800	Minimum				16
Coronal (HIP) T1 FatSat	14-20	384 x 256 2	4/0.5	400-800	Minimum				16
Sag (HIP) T1 FatSat	14-16	384 x 256 2	4/0.5	400-800	Minimum				16

Noncontrast hip

- Indication: Unilateral hip pain
- PA Torso coil is 1st choice
- Prescribe ax obliques along femoral neck from coronal localizer

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal (PELVIS) T1 SE Non FatSat	36-40	256 x 256 1	4/1	400-800	Minimum				16
Coronal (PELVIS) FSE-STIR	36-40	256x192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	16
Axial (PELVIS) T2 FSE FatSat	36-40	256 x 256 2	4/1	>2000	40-50			8	16
Ax oblique (HIP) PD FSE FatSat	14-20	384 x 256 2	4/1	>2000	30-40			8	16
Coronal (HIP) PD FSE FatSat	14-20	384 x 256 2	4/1	>2000	40-50			8	16
Sag (HIP) PD FSE FatSat	14-16	384 x 256 2	4/1	>2000	40-50			8	16

Metal Protocol – general recommendations

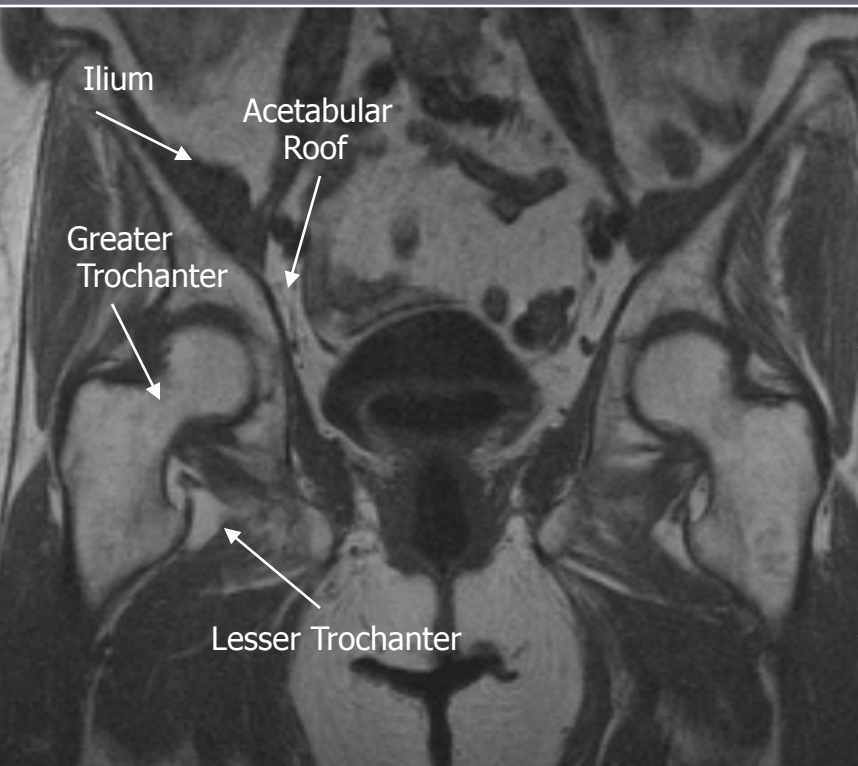
- ▶ Use FSE instead of conventional SE
- ▶ Maximize BW (bandwidth)
- ▶ Lower TE for T2 and STIR
- ▶ Remove fat suppression
- ▶ Avoid GRE
- ▶ Use STIR instead of T2w fat sat

MARS (Metal Artifact Reduction Sequences) – Hip Exam

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal FSE-STIR	36-40	256x192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150 0.7T 100 0.3T: 70		8	64
Coronal T1 SE Non FatSat	36-40	256 x 256 1	4/1	400-800	Minimum				64
Axial T2 FSE	36-40	256 x 256 2	4/1	>2000	50-70			8	64
Axial (HIP) PD FSE	14-20	384 x 256 2	4/1	>2000	30-40			8	max
Coronal (HIP) PD FSE Non FatSat	14-20	384 x 256 2	4/1	>2000	40-50			8	max
Sag (HIP) PD FSE Non FatSat	14-16	384 x 256 2	4/1	>2000	40-50			8	max

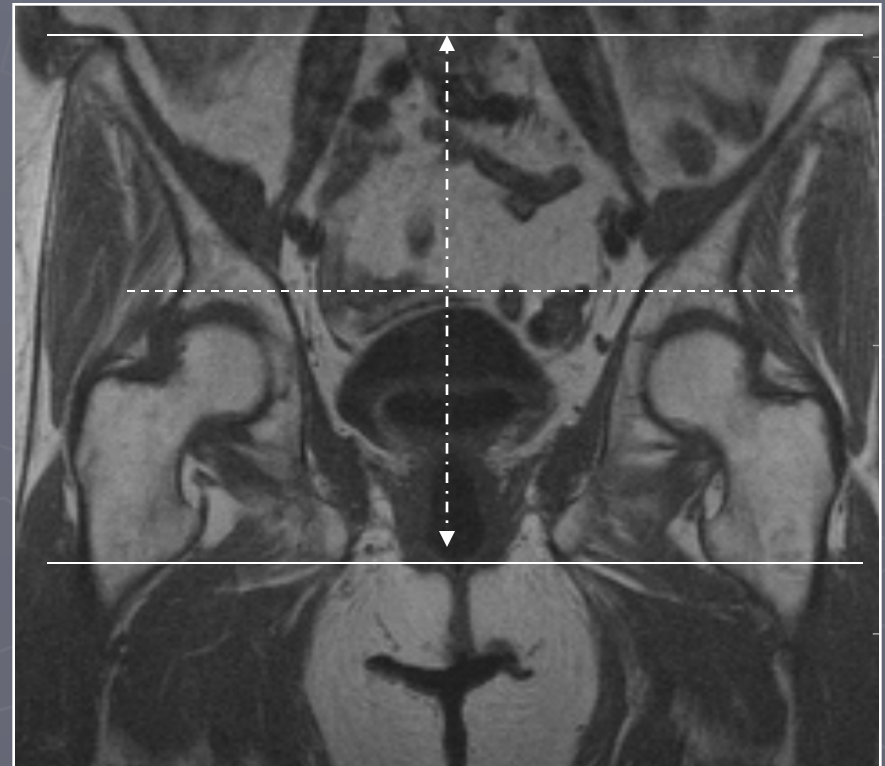
Hip-Axial Imaging Plane

Relevant Anatomy



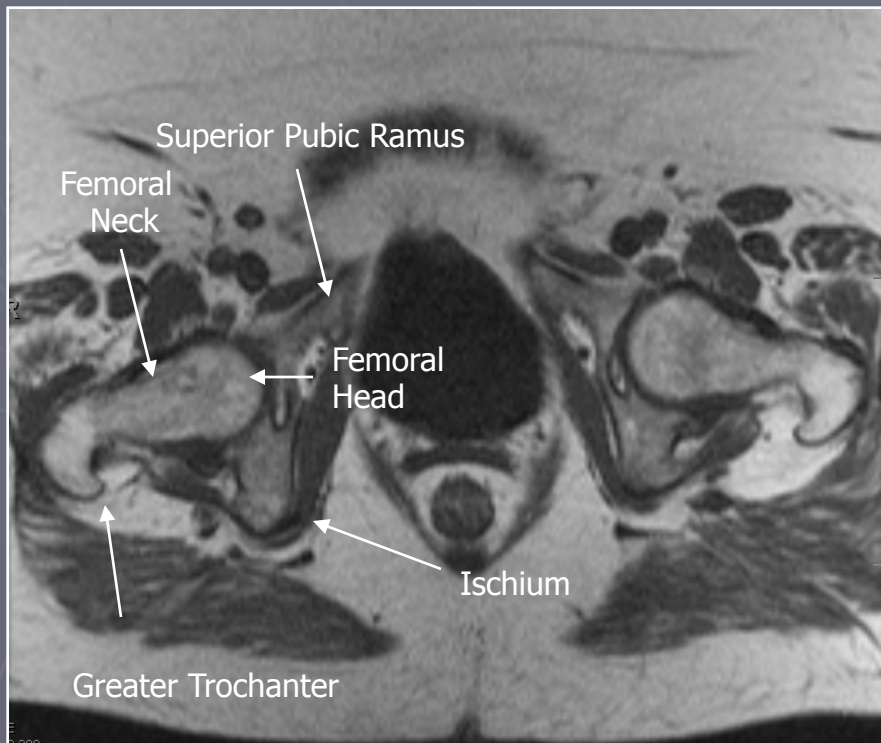
Axial Imaging Plane

Prescribe plane parallel line bisecting lesser trochanters and/or acetabular roofs. Scan from iliac crests through lesser trochanter.



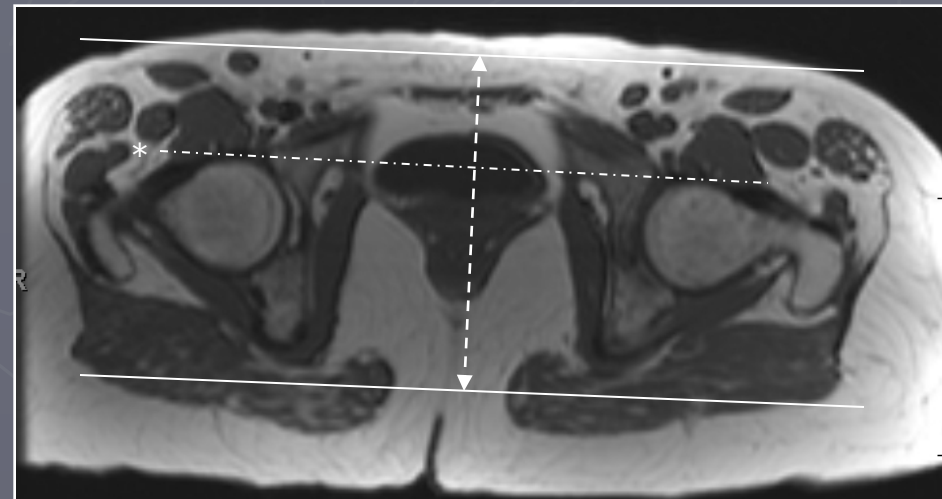
Hip-Coronal Imaging Plane

Relevant Anatomy



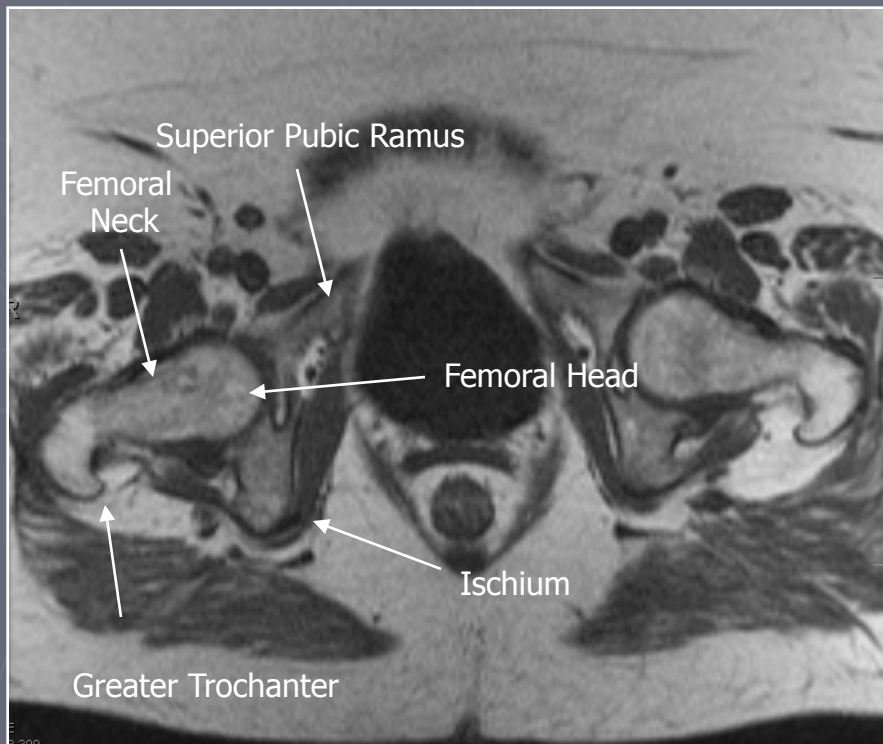
Coronal Imaging Plane

*Prescribe plane parallel femoral heads.
Scan from ischium through pubic symphyses.



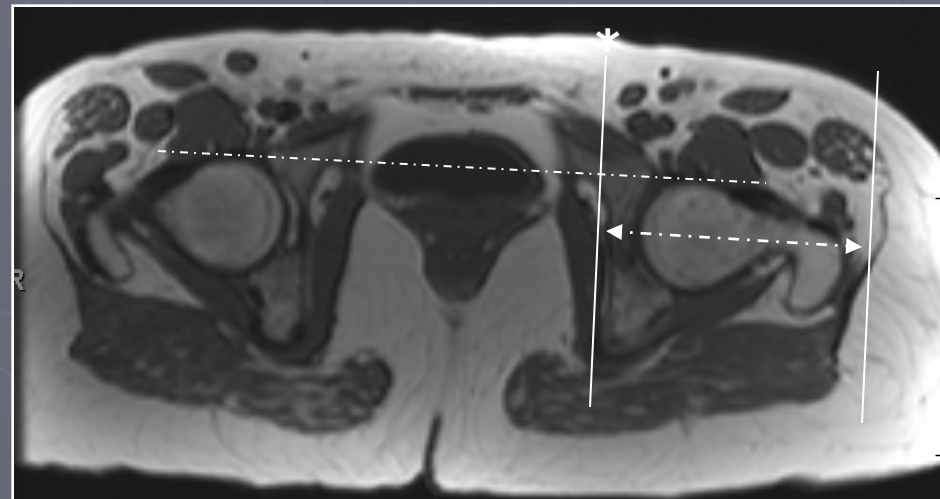
Hip-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

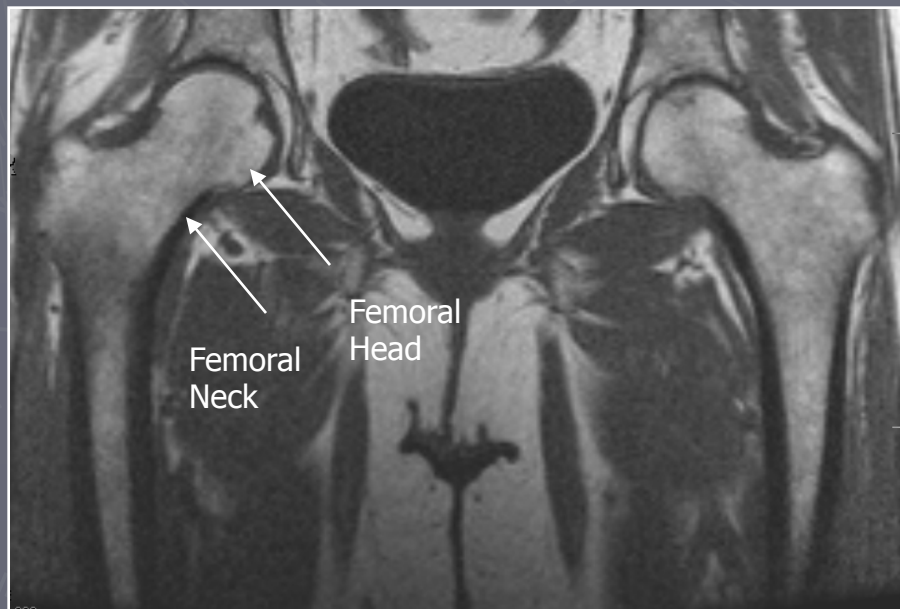
*Prescribe plane perpendicular to coronal plane.
Scan from acetabulum through greater trochanter.



Axial Oblique Imaging Plane

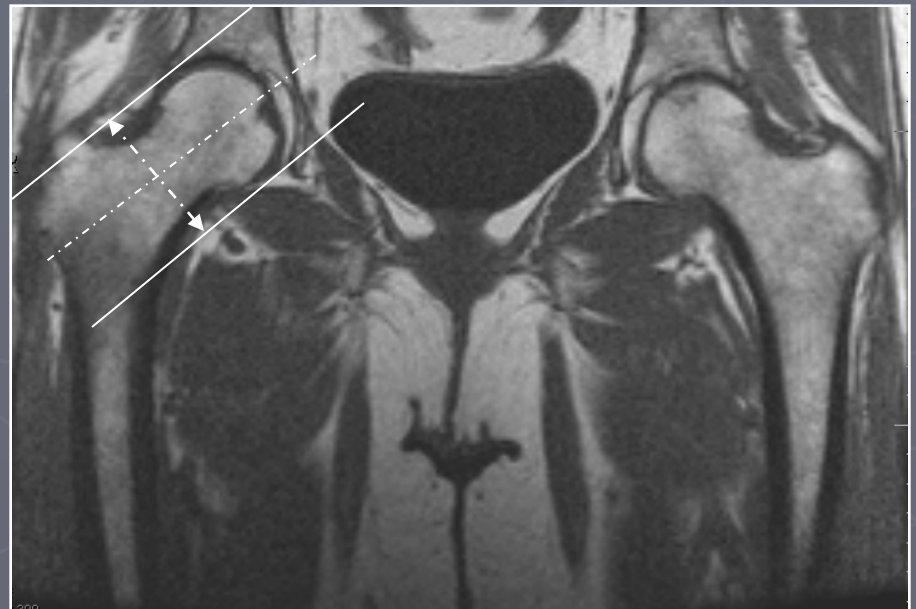
(For Femoracetabular Impingement Patients Only)

Relevant Anatomy



Axial Oblique Plane

Prescribe plane parallel to femoral neck. Scan through entire femoral neck.



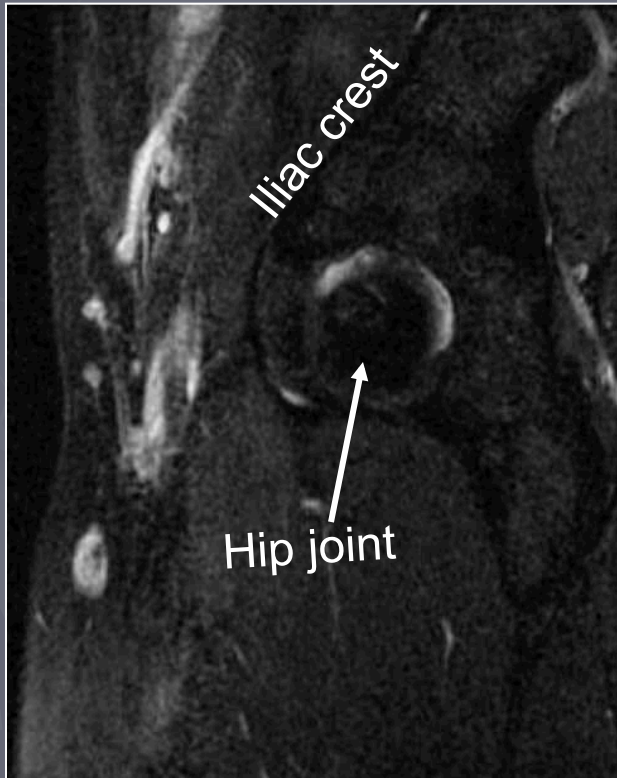
TJUH Athletic Pubalgia MR Protocol

- Indication: Athletic Pubalgia, Sports Hernia, Sportsman's Hernia, Adductor tear/strain, Rectus Abdominis Injury
- PA Torso coil is 1st choice
- Prescribe obliques along anterior iliac crest from sagittal localizer

Seq.	FOV	Matrix/NEX	Slice	TR	TE	TI	ETL	BW
Coronal STIR	28-36 (Both hips)	256x192 2-3	4/1	>2000	20-40	150	8	16
Coronal T1 SE	28 (Both hips)	256x256 1-2	4/1	400-800	minimum			16
Axial T2 FSE Fat Sat	28 (Both hips)	256x256 2-3	5/1	>2000	50-60		8	16
Axial Obl PD FSE Nonfatsat	20	256x192 1-2	4/.5	3000 (max)	25-30		4	16
Axial Obl T2 FSE Fat Sat	20	256x192 2-3	4/.5	>2000	50-60		8	16
Sag T2 FSE Fat Sat	20-22	256x192 2-3	4/.5	>2000	50-60		8	16
Sag PD FSE Nonfatsat (optional)	20-22	256x256 2-3	4/.5	>2000	20-30		8	16

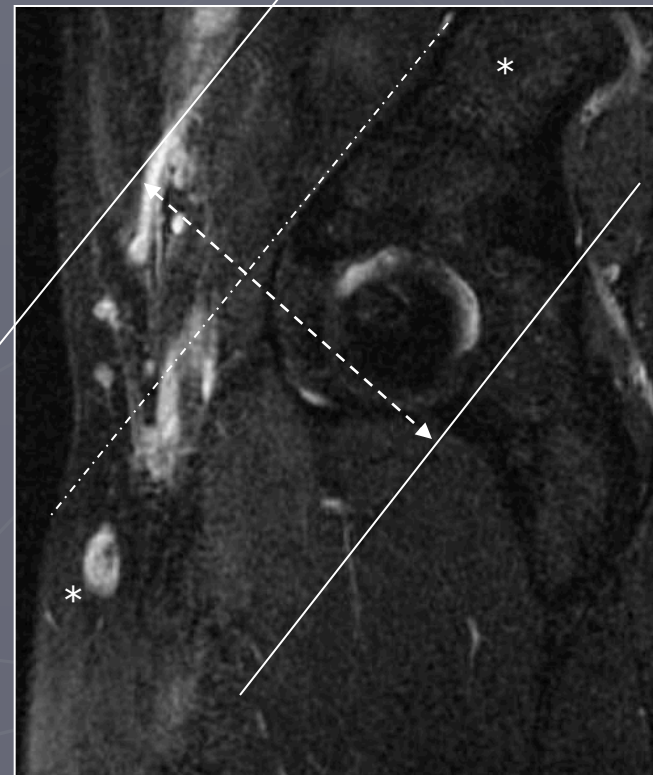
Axial Oblique Imaging Plane (Adductor unfolding plane)

Relevant Anatomy

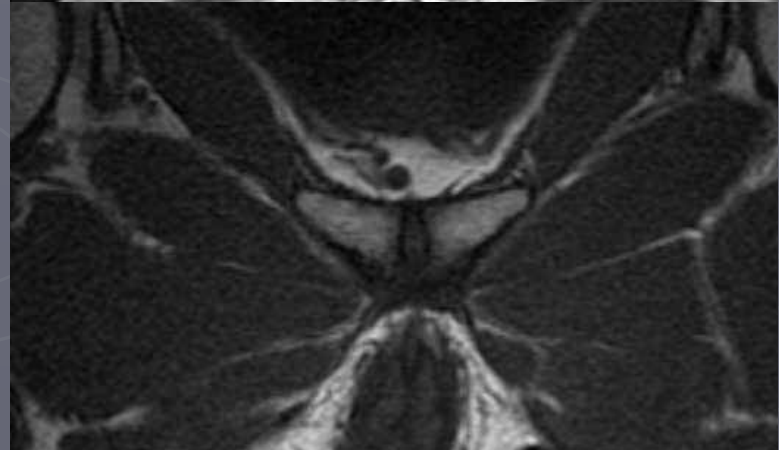
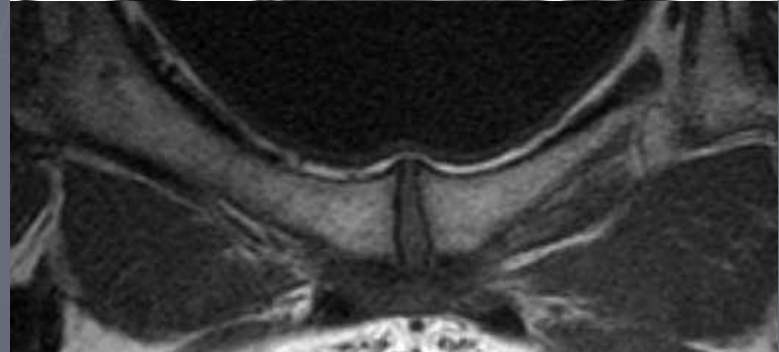
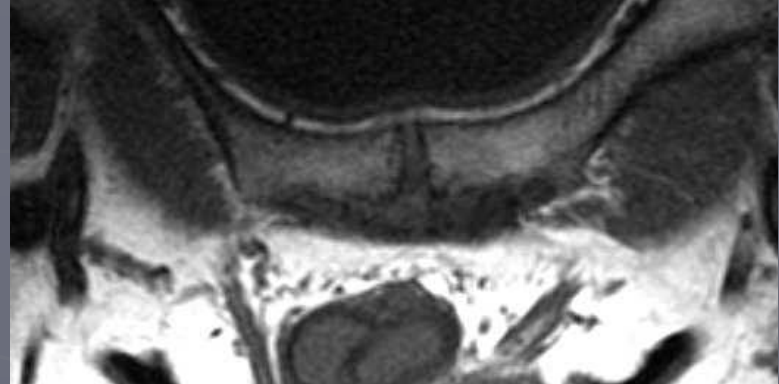
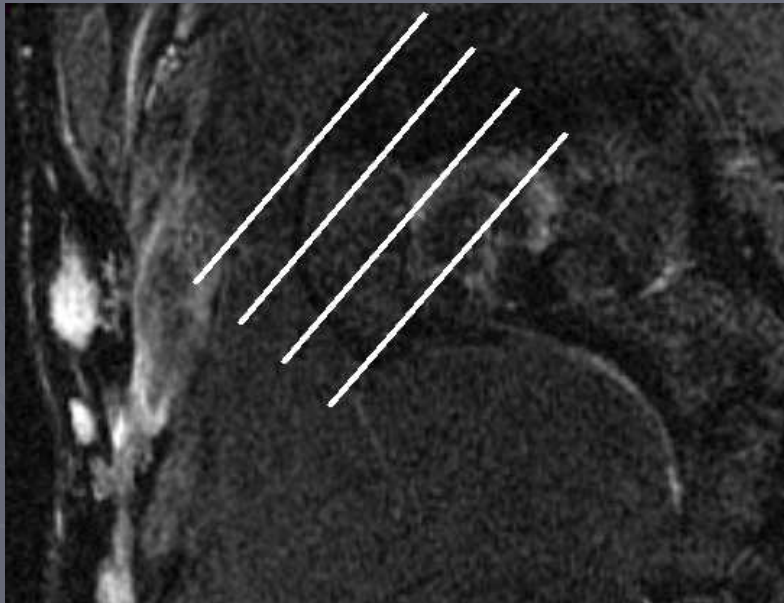


Axial Oblique Imaging Plane

Prescribe plane to line paralleling anterior Iliac crest. Be sure to scan across pubic symphysis at midline



Axial Oblique Imaging Plane (Adductor unfolding plane)



Bony Pelvis (Special Cases) *Follow Hip Planes*

▶ Post Gadolinium Pelvis

- Indications:
 - ▶ Osteomyelitis
- **IMPORTANT:**
 - ▶ Same as Routine Hip Protocol but perform axial and coronal images on both sides.
 - ▶ In addition, perform FMPSPGR fat saturated images pre/post in both axial and coronal planes.

▶ In/Out of Phase Pelvis

- Indications:
 - ▶ Possible Bony Metastases
- **IMPORTANT:**
 - ▶ Perform In/Out of Phase images in Coronal Plane

Bony Pelvis Osteo – pre/post option

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal T1 Non FatSat	30-45	256 x 192	4/1	400-800	minimal				16
Coronal STIR	30-45	256 x 192	4/1	>2000	20-40		8		16
Axial T1 Non FatSat	30-45	256 x 192	4/1	400-800	minimal				16
Axial T2 FSE FatSat	30-45	256 x 256	4/1	2000-600 0	60-70			8	16
Sag T2 FSE FatSat	20	256 x 256	4/1	2000-600 0	50? (60-70)			8	16
Axial/Cor FMPSPGR FatSat Pre/Post	12	256 x 192	3/.5	50	5		30-40	8	16

Sacrum – Sacroiliac joints

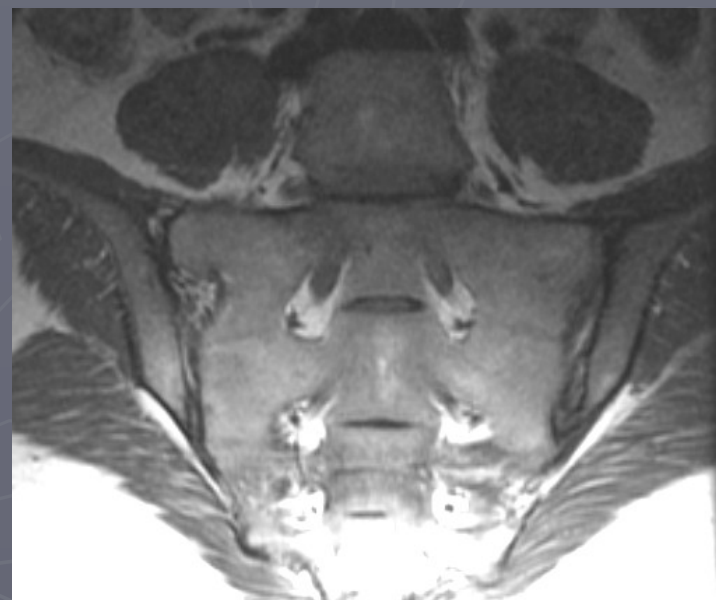
Indications:

Possible Sacroileitis (Septic/Rheumatoid or Rheumatoid Variant Arthritis)

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal STIR	30-45	256 x 192	4/1	>2000	20-40			8	16
Axial T2 FSE FatSat	30-45	256 x 256	4/1	>1500	70-80			8	16
Cor Oblique T1 SE Non FatSat	18-22	256 x 256	3/.5	400-800	minimal				
Cor Oblique T2 FSE FatSat	18-22	256 x 256	3/.5	>1500	70-80			8	16
Sag T2 FSE FatSat	18-22	256 x 256	3/.5	>1500	70-80			8	16
Axial T1 SE Non FatSat	18-22	256 x 256	3/.5	400-800	minimal				

Sacrum – Sacroiliac joints

➤ Prescribing the coronal oblique plane: parallel the sacrum on a sagittal localizer



Routine Thigh (Follow Hip Imaging Planes)

▶ Routine Thigh

- Indications:

- ▶ Polymyositis/Diabetic Myonecrosis

Thigh-Routine

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Coronal T1 SE Non FatSat	40	256 x 192	4/1	400-800	minimal				16
Coronal T2 FSE FatSat	40	256 x 256	4/1	>1500	70-80			8	16
Sag STIR	26	256 x 192	4/1	>2000	20-40	150		8	16
Axial SE T1 Non FatSat	26	256 x 192	4/1	400-800	minimal				16
Axial T2 FSE FatSat	26	256 x 256	4/1	>1500	70-80			8	16

Knee Indications

▶ Routine Knee

- Indications:

- ▶ Meniscal Tear/Medial or Lateral Ligament Tear/ACL/PCL

▶ Direct Arthrogram

- Indications:

- ▶ Meniscal Re-tear
- ▶ Intra articular Body

▶ Post Gadolinium Knee

- Indications

- ▶ Meniscal Re-tear
- **IMPORTANT:** Image 20 minutes post gadolinium

Knee-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Sag PD FSE NonFatSat	14-16	512 x 256 2	4/0.5	3000	15-20			8	16
Sag T2 FSE FatSat	14-16	256 x 256 2	4/0.5	2000	70-80			8	16
Cor T1 SE Non FatSat	16-18	256 x 192 1	3/0.5	400-800	Minimal				16
Coronal T2 FSE Fat Sat	16-18	256 x 256 2	3/0.5	>2000	70-80			8	16
Axial T2 FSE FatSat	14-16	256 x 256 2	3/0.5	>2000	70-80			8	16

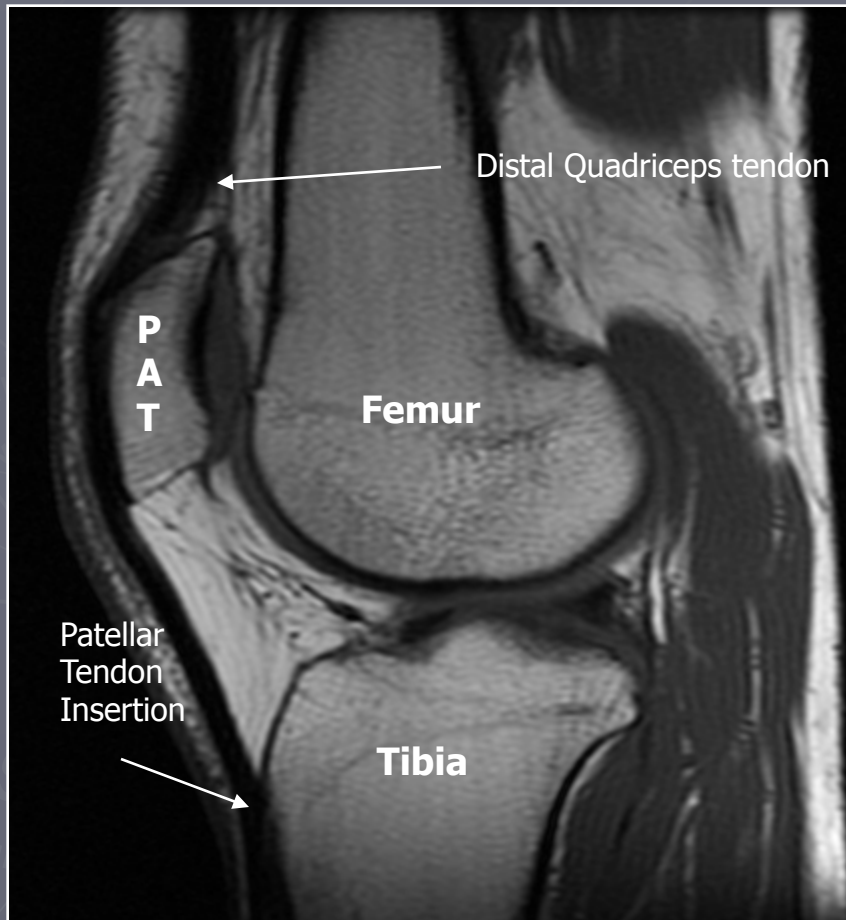
MR Arthrogram Knee (dir or ind)

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Sag T1 Se FatSat	14-16	256 x 192	4/1	400-800	Minimal				16
Sag PD FSE NonFatSat	14-16	512 x 256 2	4/0.5	3000	15-20			8	16
Coronal T2 FSE FatSat	16-18	256 x 256 2	4/1	>1500	70-80			8	16
Coronal T1 SE FatSat	16-18	256 x 192 1	4/1	400-800	Minimal				16
Axial T2 FSE FatSat	14-16	256 x 256	4/1	>1500	70-80			8	16
Axial T1 SE FatSat	14-16	256 x 192	4/1	400-800	Minimal				16

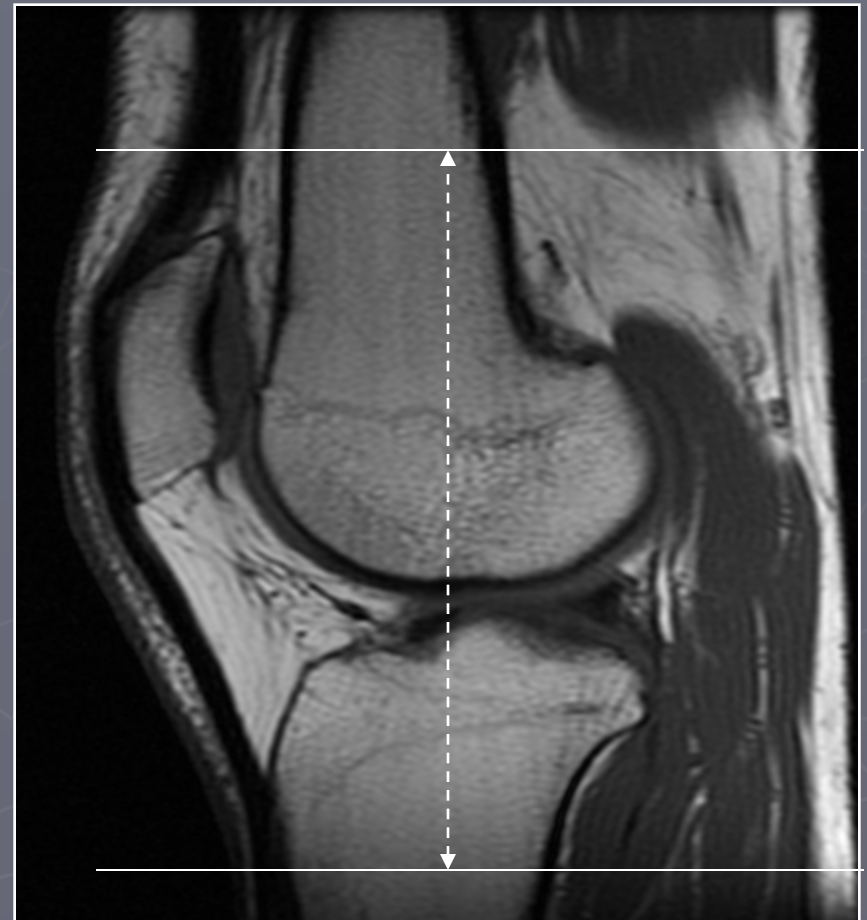
Knee-Axial Imaging Plane

Relevant Anatomy



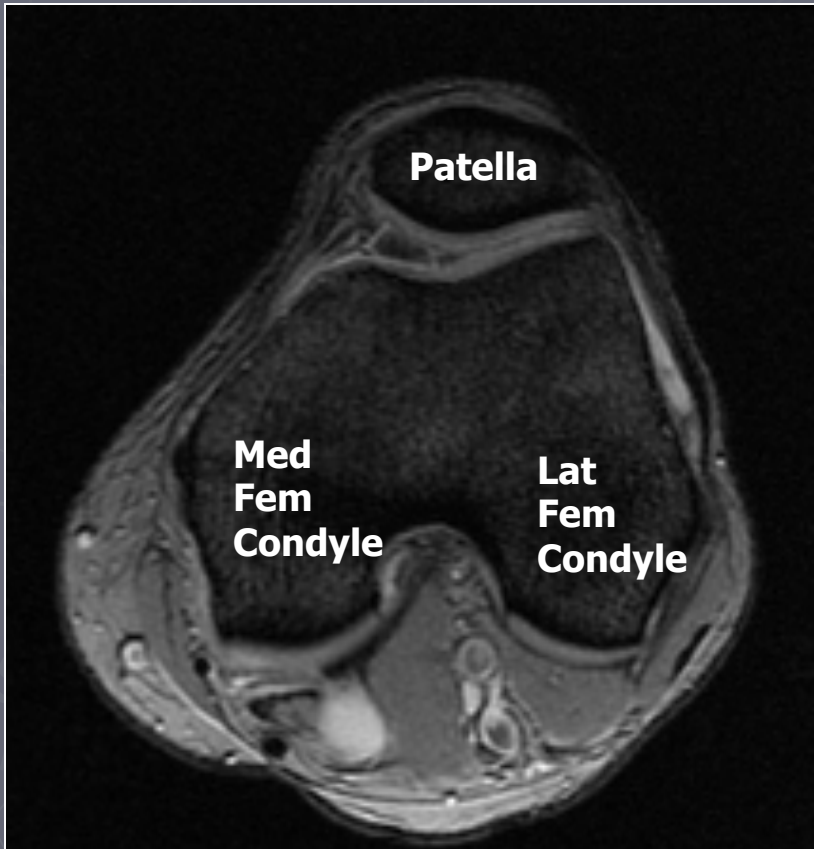
Axial Imaging Plane

Image from distal quad tendon through patellar tendon insertion



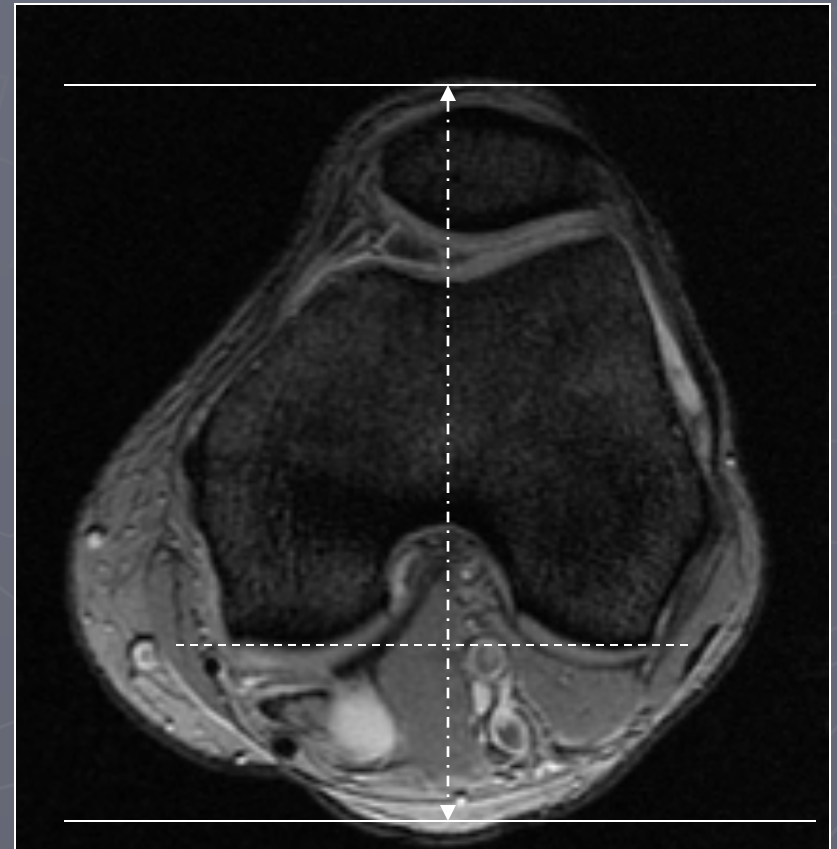
Knee-Coronal Imaging

Relevant Anatomy



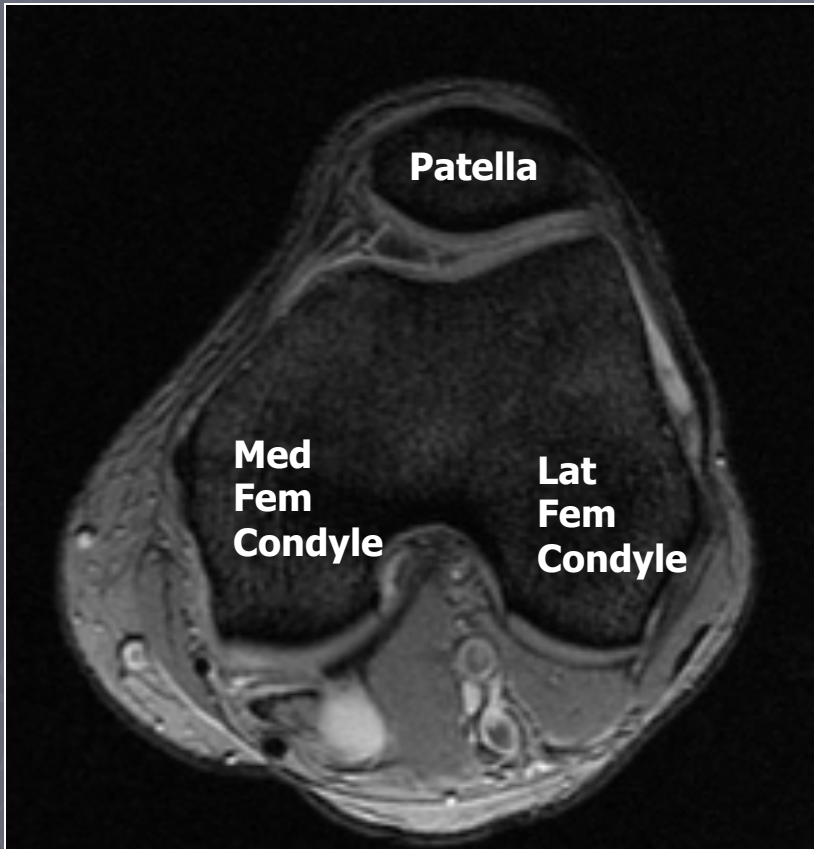
Coronal Imaging Plane

Prescribe plane with line parallel to femoral condyles. Image entire knee.



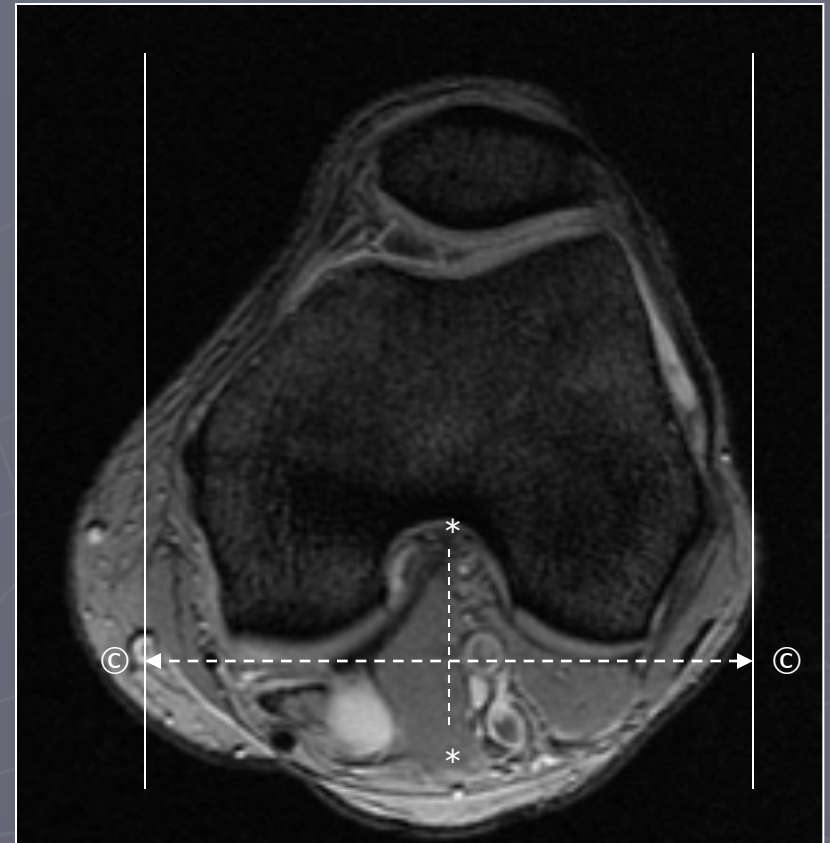
Knee-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

*Prescribe plane perpendicular to coronal plane (©).
Scan from the medial to the lateral femoral condyle.



Lower Extremity/Shin

▶ Indication:

- Shin Splints

▶ IMPORTANT:

- Acquire coronal and axial (STIR) sequences covering both shins, but sagittal and axial (t2 FatSat only of side in question
- Place a marker on pain / tenderness

Lower Extremity/Shin Area

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Coronal T1 SE Non FatSat	35-40	256 x 256	4/1	400-800	minimal				16
Coronal STIR	35-40	256 x 192	4/1	>2000	20-40	150		8	16
Axial STIR	35-40	256 x 192	4/1	>2000	20-40	150		8	16
Axial T2 FSE FatSat (through marker region)	14-16	256 x 256	4/1	>1500	70-80			8	16
Sag T2 FSE FatSat		256 x 256	4/1	>1500	70-80			8	16

Ankle Indications

▶ Routine Ankle

- Ligament Sprain/Tendon pathology/Tarsal Tunnel/Sinus Tarsi/Occult fracture, PTT, Plantar fasciitis

▶ Ankle Arthrogram

- Indications:
 - ▶ Intra-articular Body

▶ Post Gadolinium Ankle

Ankle-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Sag T1 SE Non FatSat	16-18	256 x 256 1	3/1	400-800	Minimal				16
Sag STIR	16-18	256 x 192 3	3/1	>1500	40	120	90	8	16
Axial PD FSE Non FatSat	14-16	384 x 256 2	4/1	3000	40			8	16
Axial T2 FSE FatSat	14-16	256 x 256 2	4/1	>2000	70-80			8	16
Coronal T2 FSE FatSat	14	256 x 256 3	3/1	>2000	40-55			8	16

MR Arthrogram Ankle (dir or ind)

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Sag T1 SE FatSat	16	256 x 192	4/1	400-800	minimal				16
Sag STIR	18	256 x 192	4/1	>2000	20-40	150		8	16
Axial T1 SE FatSat	14	256 x 256	4/1	800	min				16
Axial PD FSE Non FatSat	14-16	513 x 256 2	4/1	3000	40			8	16
Coronal T1 SE FatSat	14	256 x 192	4/1	400-800	minimal				16
Coronal T2 FSE FatSat	14	256 x 256	4/1	>1500	70-80			8	16

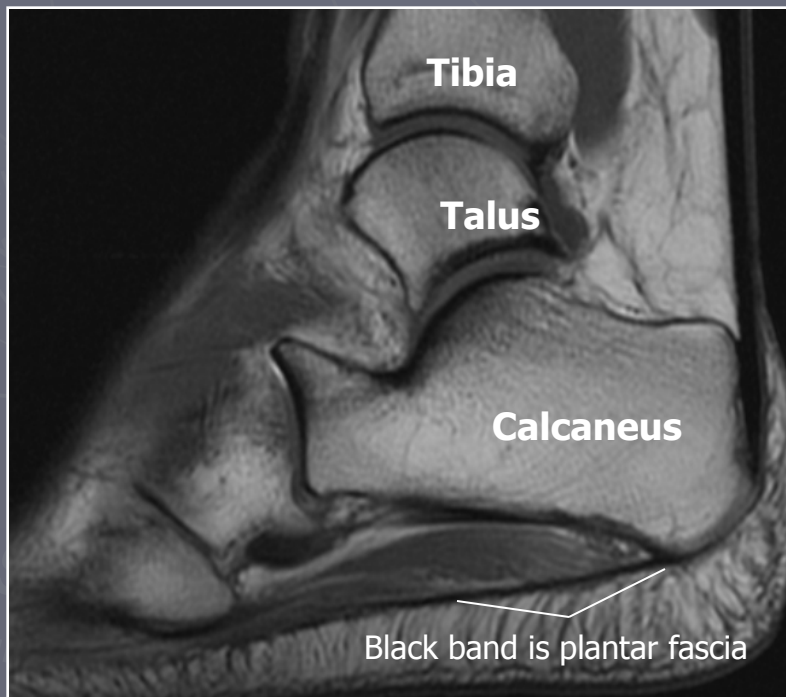
Ankle-Post Contrast

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial FMPSPGR FatSat Pre/Post	14	256 x XX		200 ?	4 ?				16
Sag T1 SE Non FatSat	16	256 x 192	4/1	400-800	minimal				16
Axial T1 SE FatSat	12	256 x 256	4/1	?800	Minimal				16
Axial PD FSE FatSat	14	256 x 256	4/1	>2000	40-50			4	16
Cor T1 SE FatSat	14	256 x 256	4/1	400-800	minimal				16

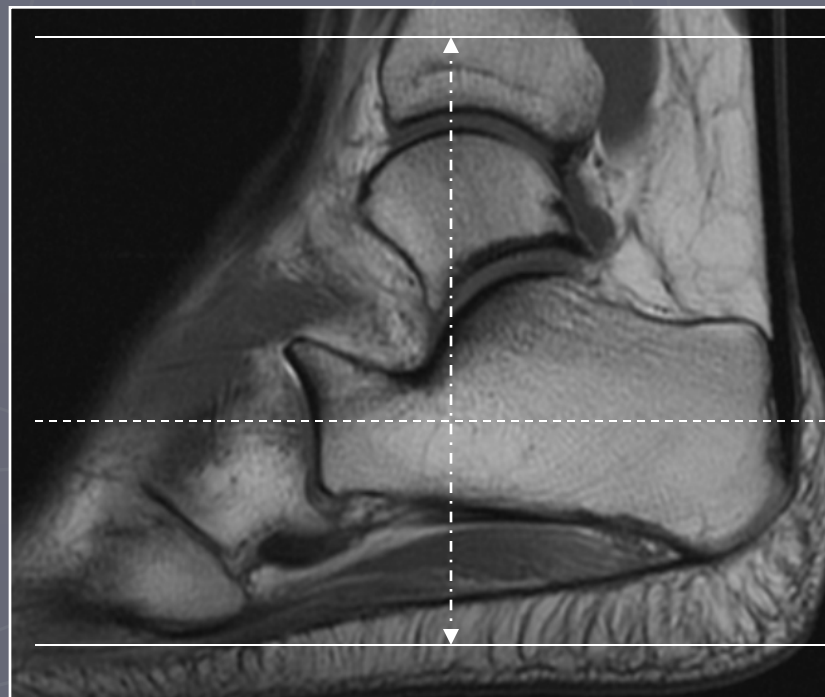
Ankle-Axial Imaging Plane

Relevant Anatomy



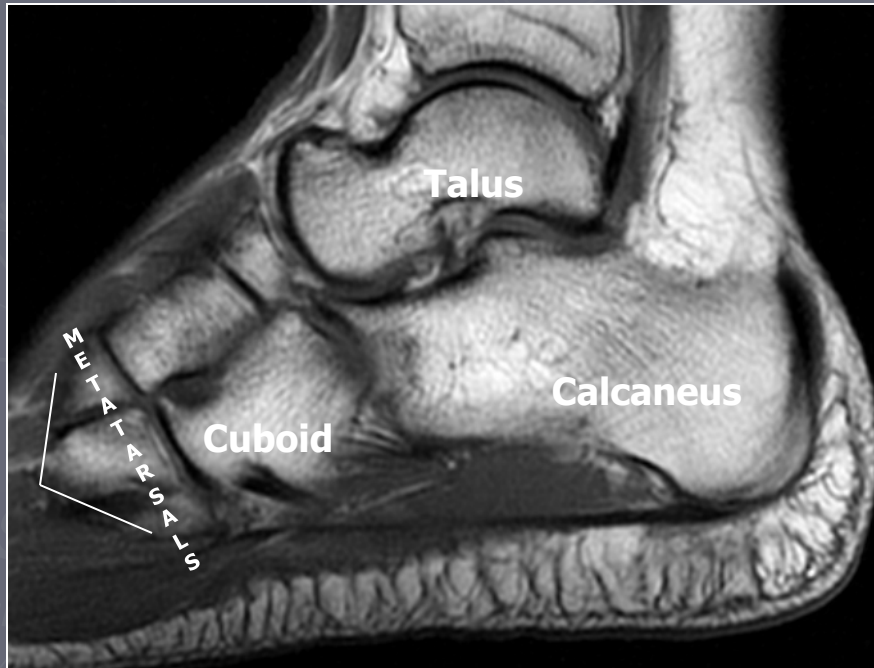
Axial Imaging Plane

Prescribe plane parallel to axis of calcaneus.
Scan ankle from distal tibia through subcutaneous soft tissues (include plantar fascia).



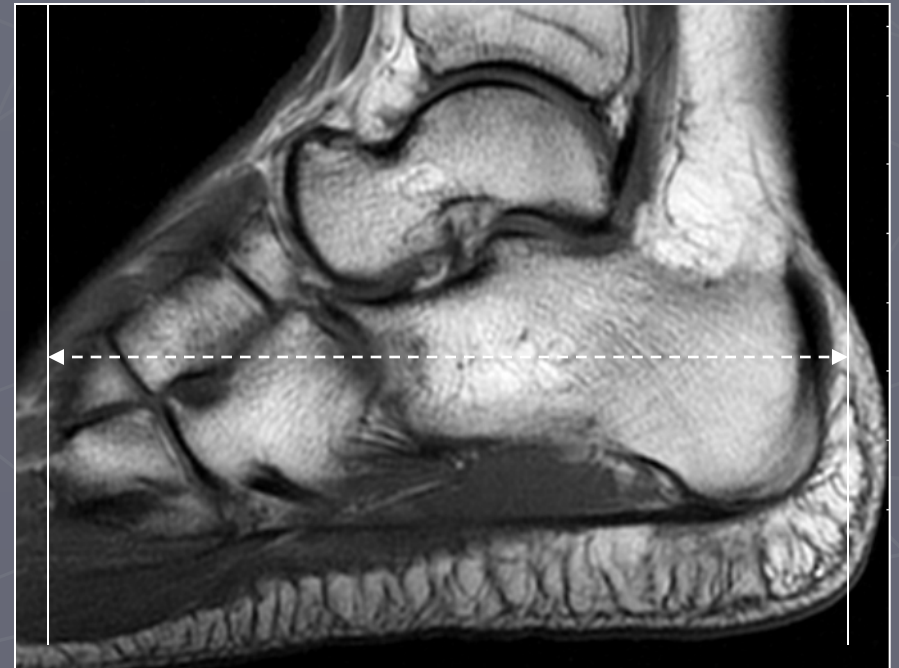
Ankle-Coronal Imaging Plane

Relevant Anatomy



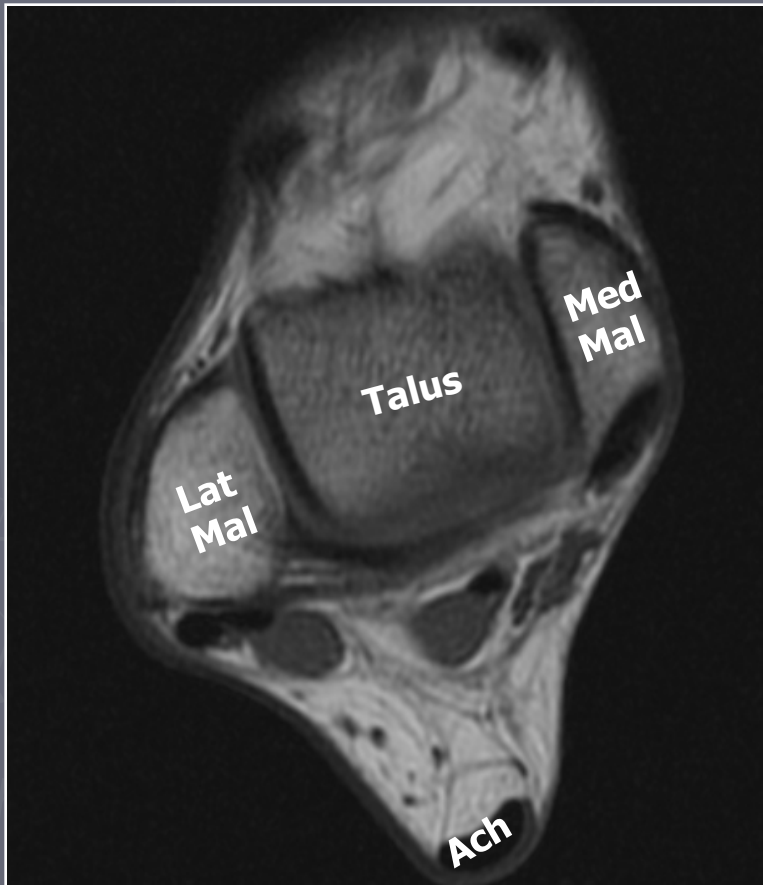
Coronal Imaging Plane

Prescribe plane perpendicular to axial imaging plane. Scan ankle from calcaneus through metatarsal bases.



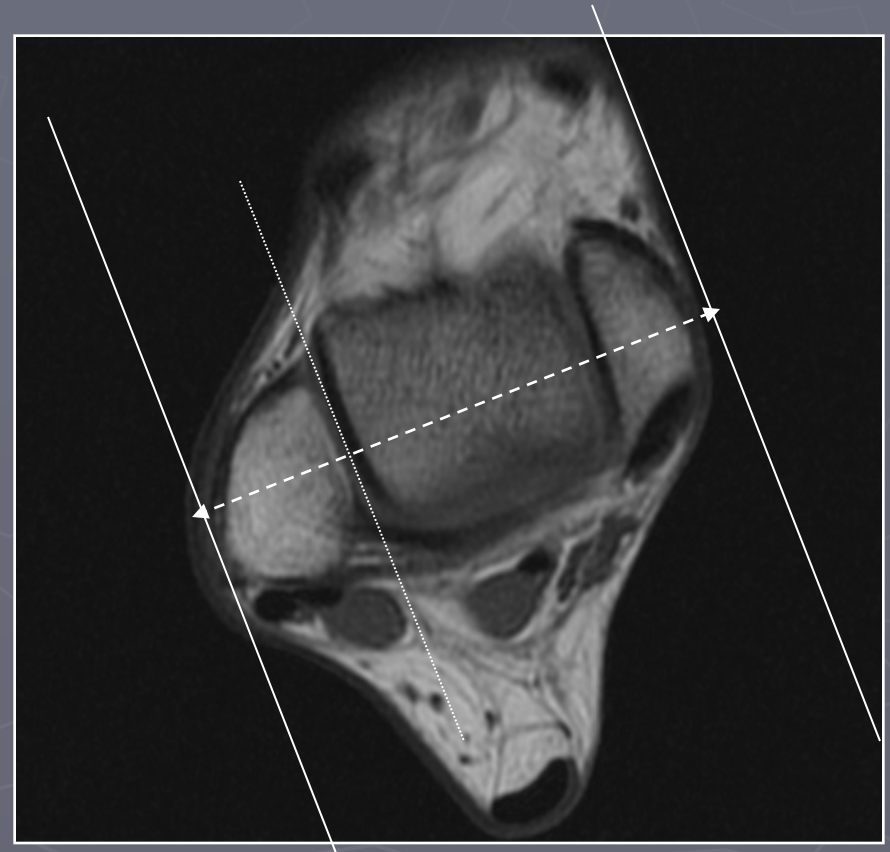
Ankle-Sagittal Imaging Plane

Relevant Anatomy



Sagittal Imaging Plane

Prescribe plane with line parallel to talus. Cover ankle from medial through lateral malleolus.



Midfoot



Forefoot



Foot-Indications

▶ Routine Foot

- Indications

- ▶ Plantar Plate Injury, R/O fracture, Lisfranc injury, tarsal/metatarsal fracture

▶ Post Gadolinium Foot

- Indications:

- ▶ Morton's Neuroma
- ▶ Osteomyelitis

- **IMPORTANT:** Perform routine foot plus coronal FMPSPGR fat saturated pre and post gad images and axial POST gad FMPSPGR fat saturated images.

Foot-Routine

Seq.	FOV	Matrix/ Nex	Slice	TR	TE	TI	Flip	ETL	BW
Coronal (short axis) T1 Non FatSat	10	256 x 256 1	3/0.5	400-800	minimal				16
Coronal (short axis) T2 FSE FatSat	10	256 x 256 2	3/0.5	>2000	70-80			8	16
Sag STIR	12-14	256 x 192 3	3/0.5	>1500	40	120	90	8	16
Sag T1 Non FatSat	12-14	256 x 256 1	3/0.5	400-800	minimal				16
Axial (long axis) PD FSE Non FatSat	12-14	256 x 256 2	3/0.5	>2000	30			8	16
Axial (long axis) T2 FSE FatSat	12-14	256 x 256 2	3/0.5	>2000	90			8	16

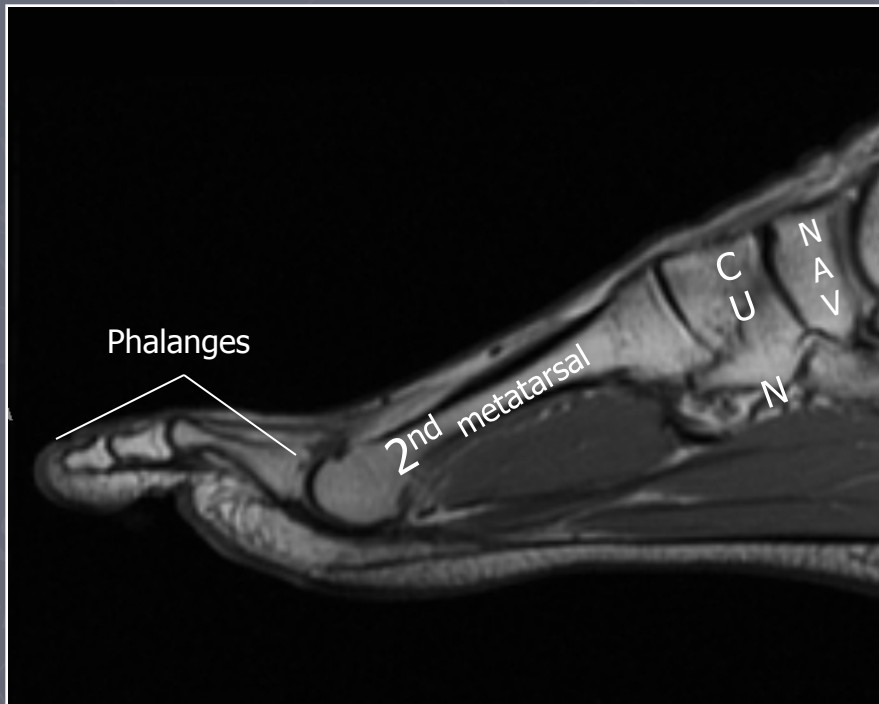
Foot-Mass/Osteomyelitis

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Coronal T1 SE Non FatSat	10-12	256 x 256 1	3/0.5	400-800	minimal				16
Coronal T2 FSE FatSat	10-12	256 x 192 2	3/0.5	>2000	70-80			8	16
Sag STIR	12-14	256 x 192 2	3/0.5	>1500	40	120	90	8	16
Sag T1 Non FatSat	12-14	256 x 256 1	3/0.5	400-800	minimal				16
Coronal FMPSPGR FatSat Pre/Post	10-12	256 x 192 2	3/.5	60	5		30-40	8	16
Axial FMPSPGR FatSat Post	10-12	256 x 192 2	3/.5	60	5		30-40	8	16

Foot-Axial Imaging Plane

Relevant Anatomy



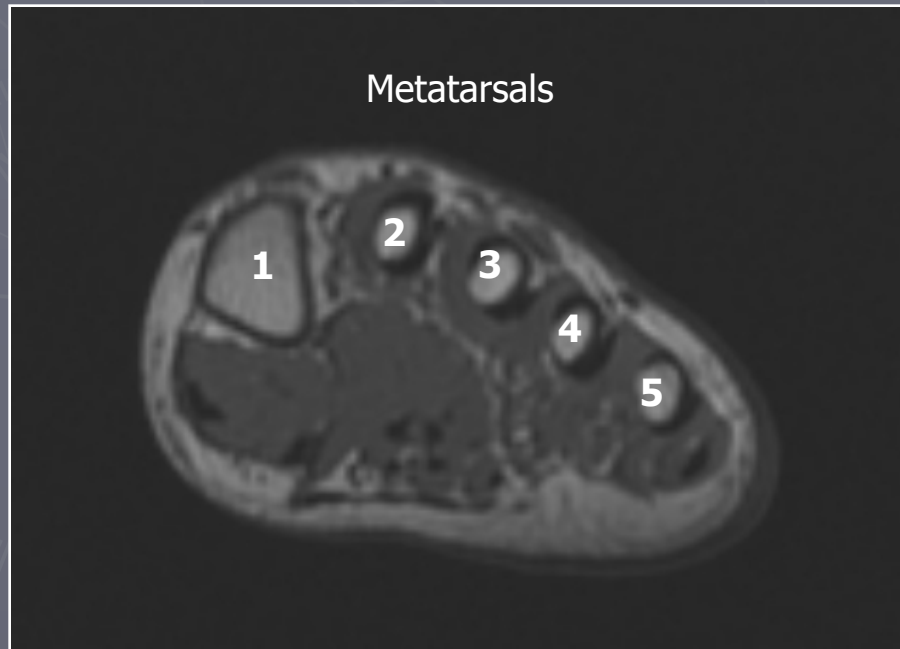
Axial Imaging Plane

Prescribe plane parallel to 2nd or 3rd metatarsal. Scan foot from navicular through phalanges.



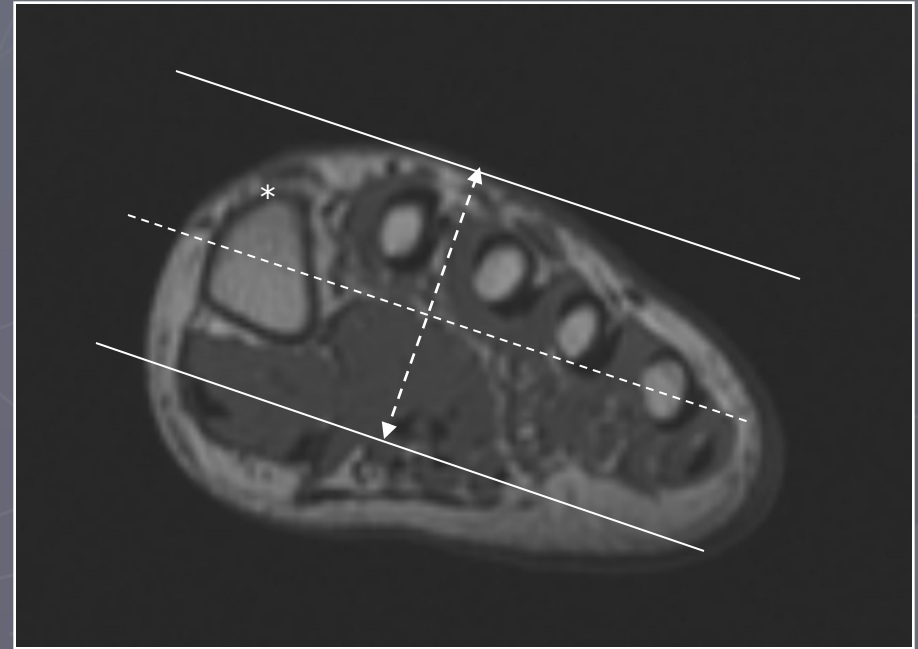
Foot-Coronal Imaging Plane

Relevant Anatomy



Coronal Plane

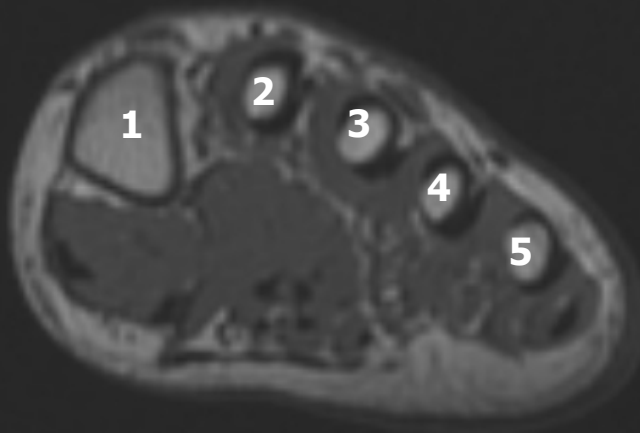
*Prescribe plane parallel to 1st and 5th metatarsal Shafts. Scan through entire foot.



Foot-Sagittal Imaging Plane

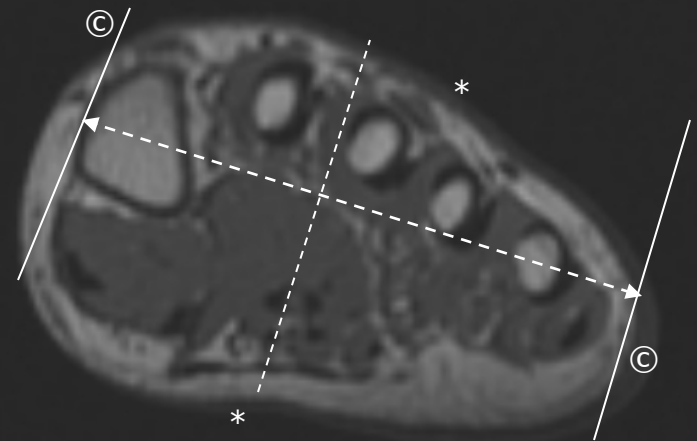
Relevant Anatomy

Metatarsals



Sagittal Plane

*Prescribe plane perpendicular to coronal Plane (©). Scan through entire foot.



Soft Tissue Mass Protocol

General Recommendations

- ▶ Place Vitamin E capsule LIGHTLY on skin (do not depress skin with capsule)
 - If post-operative: place markers at each end of surgical scar
- ▶ FOV determined by mass size / location
- ▶ Try to include adjacent joint for reference
- ▶ Axial always; Sag or Cor depending on location of mass (speak with radiologist)

Soft Tissue Mass

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Axial T1 SE Non FatSat		256 x 192	5/1	400-800	minimum				16
Axial T2 FSE FatSat		256 x 192	5/1	>2000	40-60			8	16
Sag or Cor T1 SE Non FatSat		256 x 192	5/1	400-800	minimum				16
Sag or Cor STIR		256 x 192	5/1	>2000	30-40	150		8	16
Axial T1 GRE or SE FatSat Pre/Post Gd		256 x 192	5/1	60 400-800	5 minimum		30-40 -	8	16
Sag or Cor T1 GRE or SE FatSat Pre/Post Gd		256 x 192	5/1	60 400-800	5 minimum		30-40 -	8	16

MR Neurography Pelvis

Seq. FOV Matrix/
Nex Slice TR TE TI Flip ETL BW

Coronal (PELVIS) T1 SE Non FatSat	36-40	256 x 256 1	4/1	400-800	Minimum				16
Coronal (PELVIS) FSE-STIR	36-40	256x192 2	4/1	>2000	20-40	3.0T: 180 1.5T: 150		8	16
Axial (PELVIS) T2 FSE FatSat	24 (hip to hip)	256 x 256 2	3.5/1	>2000	70-80			>8	16
Coronal T2 vista (or equivalent)	30-34	232x345 1	2/1	2800	288		90	150	
Axial T1 3D FFE	24	276 x276 1	3/1.5	28	2.3		30	1	
Axial M FFE	24	240x160 1	3/0	3570	4		45	4	
Sagittal PD SPAIR	24-28	282x282 1	3.5/1	Max	45		90	>8	

Marrow Survey



ER / Inpatient Protocols

- ▶ Hip / pelvis fracture
- ▶ Joint: survey exam
- ▶ Non-contrast “R/O osteomyelitis”
- ▶ Chest wall / Abdominal wall
- ▶ Spine survey