UPPER EXTREMITY 1-24-25

MSK TIPS:

- **Ensure extremity of interest is as isocenter as possible**
- **SHIM all Fat sat scans!!**
- **Only use 4ch wrist on RP1 if additional coverage needed**
- **Use Large FOV to find anatomy if you have issues with seeing all planes on your localizer. If you appear to be centered, but don't get any sagittal images on your localizer, you are scanning wrap**
- **OK if slice thickness is slightly thinner than noted on protocols at 3T**
- **When patients go in head first images can be flipped. Please ensure correct orientation in PACS. **Instructions and Images****

Include in Study notes: Date of injury? previous surgery?

If Contrast needed: Vueway 0.05mmol/kg Max 10

Peds under 2yo Multihance 0.1 mmol/kg Max 20 mL

Low eGFR inpatient Dose: No Change

Shoulder protocols on 2nd page

ELBOW OCD/ LOOSE BODY/DISTAL BICEPS & TRICEPS TEAR

MARK PAIN / ARM OVER HEAD

1. 3 Pl loc **Images**
2. Ax T1 (approx. 32 slices) 3/1.5
   - ► GRx on Cor loc Axial to humerus
   - ► Proximal ¼ of humerus thru biceps tendon at radial tuberosity through pathology
3. Ax T2 cl fat
4. Sag T1 (approx. 16 slices) 3/1
   - ► GRx on Ax at distal humerus (see pic)
   - ► Center FOV on Joint
5. Sag T2 cl fat (Propeller)
6. Cor PD cl fat (approx. 24 slices)
   - ► GRx on Ax at distal humerus (see pic)

► Center FOV on Joint

OPT: FABS

15 min should be added to the length of scan (+/-Length button)

1. FABS 3 pl Loc **IMAGES**
2. FABS PD cl fat (along axis of biceps tendon, perpendicular to elbow joint)

Coils: 8Ch knee, 16ch QED Knee, Small 16 ch Flex

PT: prone/swimmers arm over head, hand supine, thumb up

OK to scan with 16ch flex by side if patient cannot tolerate arm above head

ELBOW UCL or RCL tear / Epicondylitis

1. 3 Pl loc **MARK PAIN / ARM OVER HEAD** **Images**
2. Ax PD (approx. 32 slices) 3/1.5 GRx on Cor loc
   - ►Axial to humerus
   - ►Proximal ¼ of humerus thru biceps tendon at radial tuberosity through pathology
3. Ax T2 cl fat
4. Sag T2 cl fat (Propeller) (approx. 16 slices) 3/1.5
   - ►GRx on Ax at distal humerus
5. Cor T1 (approx. 24 slices) 3/0.5
   - ► GRx on Ax at distal humerus
6. Cor PD cl fat

Synovitis Give contrast

Add : 7. Pre Ax T1 FAT 8. +c Ax T1 FAT 9. +c Sag T1 FAT

Coils: 8Ch knee, 16ch QED Knee, Small 16 ch Flex

PT: prone/swimmers arm over head, hand supine, thumb up

OK to scan with 16ch flex by side if patient cannot tolerate arm above head

NEUROGRAM Wrist/Elbow/Humerus/Forearm

****3T ONLY—If patient not 3T compatible ensure ARTIST scanner with DL & Mensa is used**

****unless otherwise specified in protocol, angles are identical to routine angles for each protocol. If more coverage needed, Increase FOV for Sag and Cor scans.** No need to check unless coverage questions

1. 3 Pl loc
2. Ax T1 3/0.5 (humerus/forearm joint to joint)
   - ►Tight FOV decrease if you can ►3/0.2 (elbow/wrist-through joint)
3. Ax T2 Fat – If uneven Fat Sat, please run Ax STIR
4. Sag 3d Mensa **For 750 Scanners (SMC4, EMH2 and HERI) use the CV Type in for each Mensa (instructions below)—other scanners have been updated to MENSA NERVE, which automatically separates Echos and has DL.**
5. Ax 3d Mensa
6. Cor T2 Fat
7. Sag IDEAL 3/1 (humerus/forearm) skin to skin
   - ► 2/0.2 (wrist/elbow) skin to skin

Post Contrast ONLY if concern of tumor/cancer/abscess/infection involvement

8. +c Axial T1 Fat
9. +c Coronal T1 Fat

750scanners use type in for each Mensa sequence:
select carrot by "Scan" button ---> Download
select carrot by "Scan" button ---> Display CV's
type in "rhfiesta" and hit enter

Humerus/ Forearm: Air Coil, 8ch Cardiac or Torso Coil

Elbow: 8ch knee coil, Wrap Coil

Wrist: Dedicated wrist coil or wrap coil

Humerus or Forearm Tumor (Power Injection)

Contrast:POWER INJECTION @2ml/sec Vueway 0.05mmol/kg Max 10

16ch Flex (MR2, MR3, MR6 can use with posterior Gems Coils), Air Coil, Long Bone, Cardiac

**Try to get one slice down middle of Humerus or Radius

**Mark scar, lump, or mass and center FOV on ROI. No need to cover a joint. Only cover area of interest.

**Don't need Skin to Skin on both Cor and Sag.

**Must cover all pathology (OK to increase FOV to cover pathology).

**If there isn't a mass or certain area of interest, just pain "everywhere" then we can increase FOV and cover joint to joint.

Call Rad with questions

****IMAGES****

1. 3 Pl loc
2. Cor STIR Humerus-4/1 Forearm-3/1.5
3. Cor T1
4. Sag STIR Humerus-4/1 Forearm-3/1.5
5. Ax T2 Fat (5/1)
6. Ax T1
7. Ax T1 Lava-Flex Pre (In and Out of Phase to SOURCE)

---After Pre—ensure to Manual prescan and select done, this will ensure subtractions are accurate!

8. Ax T1 Lava-Flex 2 min ►Prep scan inject and start timer, start scan at 2min
9. Cor T1 Lava-Flex
10. Sag T1 Lava-Flex
11. +C Ax T1 Fat

**Subtract Pre Ax Lava-Flex from Post Ax Lava Flex—send to ALI_STORE

►Metal: If Tumor is adjacent to metal implant, send Pre Ax T1 Lava-Flex and call RR to see if they want to do T1 Post without FS instead of 3d Flex with subtraction (T1 post-T1 pre). Ax T2 FAT substitute STIR or T2 No FAT. For T1 FAT substitute T1 Lava-Flex from Tumor protocol

WRIST Pain or Scaphoid Fx Outpatient

MARK PAIN ARM OVER HEAD **Images**

1. 3 Pl loc **10 FOV if dedicated 8/16ch wrist coil/wrap coil**
2. Ax T1 --Distal ¼ of Forearm thru mid metacarp
3. Ax T2 cl fat (Metal: Ax T2 nofat)
4. Cor PD (TR 1500-2000) **Only do 20 slices, Only cover tendon and bone. Adjust TR accordingly** Center FOV on Carpals
5. Cor T2 cl fat (Metal: Cor STIR)
6. Sag T2 cl fat Skin to Skin. Center FOV on Carpals (Metal: Sag STIR)

PAIN: 7. Cor T2 CUBE (do not decrease # of slices)

If CUBE not avail: 7. Obl Ax PD dk fat Scapholunate ligament 8.Obl Ax PD dk fat Lunotriquetral lig (Metal:Ax PD nofat)

Scaphoid Fx Outpatient: Oblq Sag T1 Long axis of scaphoid Cor oZTEO (if available)

CSC/RP:
Dedicated wrist coil SMALL 16 ch flex

8 ch Knee (MR2 if only option and can't move pt)

Large patients/Cast:
16 ch Flex if avail
8 ch Knee
Arm down at side:
4Ch long bone
4ch Cardiac
or 16 ch Flex

WRIST Osteo/Tumor/Abscess

MARK PAIN ARM OVER HEAD **Images**

1. 3 Pl loc **10 FOV if dedicated 8/16ch wrist coil/wrap coil**
2. Ax T1 --Distal ¼ of Forearm thru mid metacarp
3. Ax T2 cl fat (Metal: Ax T2 nofat)
4. Cor T1 **Only do 20 slices, Only cover tendon and bone. Adjust TR accordingly** Center FOV on Carpals
5. Cor T2 cl fat (Metal: Cor STIR)
6. Sag T2 cl fat Skin to Skin. Center FOV on Carpals (Metal: Sag STIR)

TUMOR Protocol ONLY: PRE AX T1 dk fat

Osteo/Tumor/Abscess: Give contrast

7. +C Ax T1dk fat 8. +C Cor T1dk fat

CSC/RP:
Dedicated wrist coil SMALL 16 ch flex

Large patients/Cast:
16 ch Flex if avail
8 ch Knee
Arm down at side:
4Ch long bone
4ch Cardiac
or 16 ch Flex

UCL Thumb (3T Scanner w/DL ONLY until tested on Artist scanners)

**Very Small limited FOV to cover ONLY the Thumb and MCP Joint

**If you see an order that states: "FAST ORTHO UCL protocol (3T ONLY). Ax PD and Cor T2 FAT, 30 min time slot." Only scan those two sequences.

1. 3 pl Loc
2. Ax PD (about 18 slices)
3. Ax T2 Fat
4. Cor T2 Fat Obl to sesamoid bones (about 18 slices posterior thumb through ligament at anterior aspect of MCP joint)
5. Cor PD
6. Sag T2 Fat (cover thumb skin to skin, perpendicular to sesamoid bones

Coil: Use Small Wrap Coil, patient superman position. (no RP1, RP2, 1 S. Park, HERI)

**Images*

Rapid ED Wrist Fracture

1. 3pl Loc
2. Ax T2 FAT --Distal ¼ of Forearm thru mid metacarp
3. Cor T2 FAT--Skin to Skin Center FOV on Carpals
4. Cor T1

CSC/TAC: Dedicated wrist coil or 16ch Flex

WRIST & HAND – Synovitis & Erosions

MARK PAIN ARM OVER HEAD / HAND PRONE

***Include Wrist through MCP Joints**

***If protocoled Hand/Finger Synovitis-Erosions cover MCP joints and fingers**

1. 3 Pl loc
2. Ax T1 3/1 12-16 FOV (as small as possible)
3. Ax T2 cl fat
4. Cor T1 2/0.2 12-16 FOV (as small as possible)
5. Cor STIR
6. Sag T2 cl fat 3/1 12-16 FOV (small as possible)
7. PRE AX T1 dk fat
8. +C AxT1dk fat 8. +C CorT1dk fat 9. +C SagT1dk fat

CSC/RP:
Dedicated wrist/hand coil Small 16ch flex
8 ch Knee if no other option, we would prefer you move patient!! (RP1 if wrist coil won't get signal)
Arm down at side:
4Ch long bone
4ch Cardiac
SMALL 16ch flex

HAND - FINGER - THUMB

MARK PAIN ARM OVER HEAD / HAND PRONE

1. 3 Pl loc **Images**
2. Ax T1
3. Ax T2 dk fat
4. Sag T1-For Finger or Thumb 2/0.2 OBL to ROI
5. Sag T2 dk fat
6. Cor T1-For Finger or Thumb 2/0.2 OBL to ROI
7. Cor FSTIR

FOR TUMOR—PRE AX T1 dk fat

Osteo/Tumor/Abscess Post contrast:

8. **+C** AxT1dk fat 9. **+C** Cor T1dk fat 10.**+C** SagT1dk fat

CSC/RP:
Dedicated wrist/hand
Small 16 ch Flex
8ch Knee (RP1 if wrist coil won't get signal or MR2 if only option and can't move pt)
Arm down at side:
4ch Long bone 4ch Cardiac
Small 16 ch Flex

Elbow Osteo-Abscess or Tumor

1. 3 Pl loc
2.-3. Ax T1 & Ax T2 dk fat 3/1.5 GRx on Cor loc Ax to humerus
4.-5. Sag T1 & Sag T2 dk fat (Propeller) 3/1.5 GRx on Ax Sag to dist humerus
6.-7. Cor T1 & Cor T2 dk fat 3/1.5 GRx on Ax Cor to dist humerus

FOR TUMOR ONLY—PRE AX T1 dk fat

8. **+C** Ax T1 dk fat 9 **+C** Sag T1 dk fat 10. **+C** Cor T1 dk fat

8ch/16ch KNEE or 16 channel Flex coil

►MARKER at point of max pain or markers above and below area of pain

Humerus or Forearm wo or Osteo-Abscess

If there is a small ROI (tumor, mass, or area of pain) decrease FOV after large FOV COR STIR. Ensure to use thinner Axial Slices (5/1) to ensure area of interest is adequately covered. Call radiologist to check if questions

1. 3 Pl loc
2. Cor STIR Humerus-4/2 Forearm-3/1.5
3. Cor T1
4. Sag T1 Humerus-4/2 Forearm-3/1.5
5. Sag STIR
6. Ax T1 Humerus/Forearm- 5/2.5
7. Ax T2 dk fat (upr and lwr)
   8yo or less Tumor ONLY—Ax T1 FAT (1 nex ok if grainy)
8. +C Sag T1 dk fat
9. +C Ax T1 dk fat (upr and lwr)
10. +C Cor T1 dk fat

16ch Flex (MR2, MR3, MR6 can use with posterior Gems Coils, Long Bone, Cardiac

►MARKER at point of max pain or markers above and below area of pain

****Try to get one slice down center of Humerus or Radius**

****Images****

****IMAGES****

Shoulder Protocols 2-11-25

SHOULDER RCT/Labral tear/Instability/Dislocation

****Externally rotate arm (antecubital fossa straight up)**

Adults: **Rigid coil if available.** (1st 8ch Rigid, then try HD rigid)
Only use medium flex if patient is too large for rigid coil or if 8ch or HD Shoulder not available. Sm flex for Peds **NO LARGE FLEX**

1. 3 Pl loc
2. Obl Cor T2 Fat (Metal: STIR)
3. Obl Sag T2 Fat (Metal: STIR)
4. Obl Sag T1
5. **Double** Obl Sag T2 Fat (Metal: STIR)
   ► **GRx on Obl Cor** Perpendicular to RC Tendon 1-2 cm medial to insertion
6. Obl Ax PD Fat (Metal: Ax PD nofat)
   ► **GRx on Obl Sag** 30 deg from horizontal

Synovitis: Omit Double oblique Sag T2 Fat
Add: 6. Pre Ax T1 FAT 7. +C Str Ax T1 Fat 8. +C Obl Cor T1 Fat

For Shoulder Replacements/Lots of Metal Run "Shoulder MAVRIC" protocol in Artist Scanners: Obl Cor MAVRIC Fluid T2, Obl Sag MAVRIC Fluid T2, Straight Axial MAVRIC FluidT2, and Obl Cor MAVRIC PD

Shoulder Osteo-Abscess

Contrast: Vueway 0.05mmol/kg Max 10
**Skin to Skin---Cover Entire ROI
1. 3 Pl loc
2.-3. Straight Ax T1 & Ax T2 dk fat 5/1.5
4.-5. Oblique Cor T1 & Cor T2 dk fat 4/1 Perpendicular to joint
6.-7. Oblique Sag T1 & Sag T2 dk fat 4/1 Parallel to joint through ROI
8yo or lessTumor ONLY—Ax T1 FAT (1nex OK if grainy)
8. +C Ax T1 dk fat
9. +C OBL Cor T1 dk fat
10. +C OBL Sag T1 dk fat

SHOULDER: 8ch Cardiac, 16ch Flex only use 30 small coil if protocol specifies Large FOV. Use dedicated shoulder coil if looking a mass in joint Increase FOV as needed

►MARKER at point of max pain or markers above and below area of pain

Shoulder Tumor (Power Injection)

**Cover Entire ROI
1.3 Pl loc
2. Ax T2 Fat
3. Ax T1
4. Oblique Cor T1 4/1 Perpendicular to joint
5. Oblique Cor T2 Fat
6. Oblique Sag T2 Fat 4/1 Parallel to joint through ROI
7. Ax T1 Lava-Flex Pre (send in-phase and Out of Phase to SOURCE)
---After Pre—ensure to Manual prescan and select done, this will ensure subtractions are accurate!
8. Ax T1 Lava-Flex 2 min
9. Obl Cor T1 Lava-Flex
10. Obl Sag T1 Lava-Flex
11. +C Ax T1 Fat

**Subtract Pre Ax Lava-Flex from Post Ax Lava Flex—send to ALI_STORE
►Metal: If Tumor is adjacent to metal implant, send Pre Ax T1 Lava-Flex and call RR to see if they want 2d metal sequences instead.

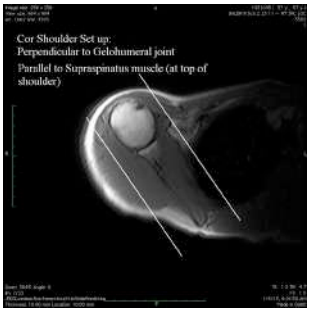
SHOULDER: 8ch Cardiac, 16ch Flex only use 30 small coil if protocol specifies Large FOV.

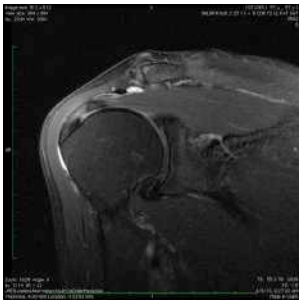
Use dedicated shoulder coil if looking a mass in joint Increase FOV as needed

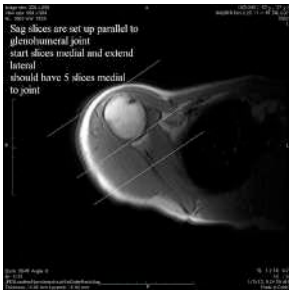
►MARKER at point of max pain or markers above and below area of pain

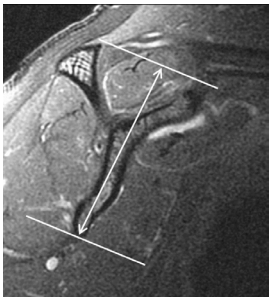
(Some coils [8ch shoulder on RP1] won't allow acceleration—OK to run 2d images in that case)
Contrast:
POWER INJECTION @2ml/sec
Contrast: Vueway 0.05mmol/kg Max 10

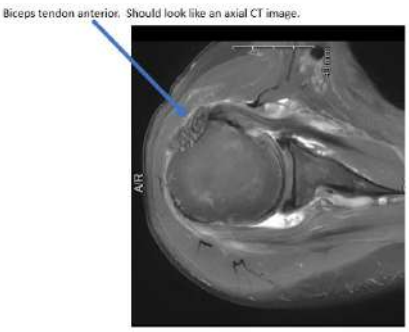
Routine SHOULDER SET UP: Cor Image:







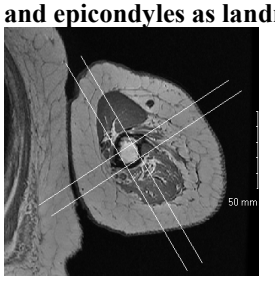


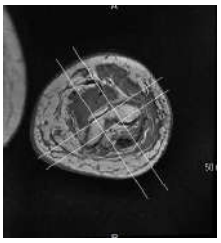


Once the axial is rotated, please double check that the glenoid/scapula is oriented in the same direction on both the Sag and Cor as above.

Humerus Set up

Please keep in mind anatomical position when you scan patients. For humerus protocols you can use the biceps muscle and epicondyles as landmarks. Scan perpendicular or parallel to them for your sagittal or coronal planes.

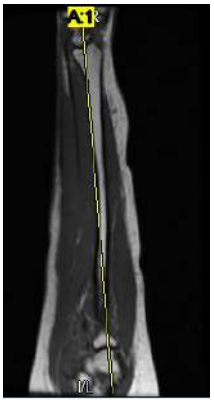




One slice down the center of the humerus

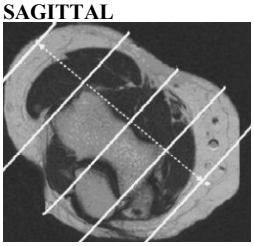
Forearm Set up:

One Slice down the center of the Radius

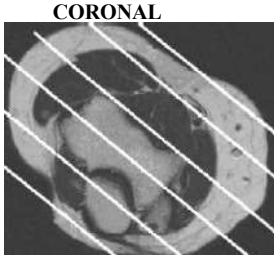


ELBOW SET UP:

SAGITTAL



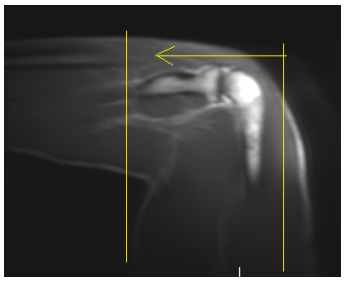
CORONAL

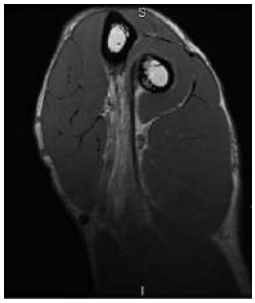


FABS: Flexed Abducted Supinated View

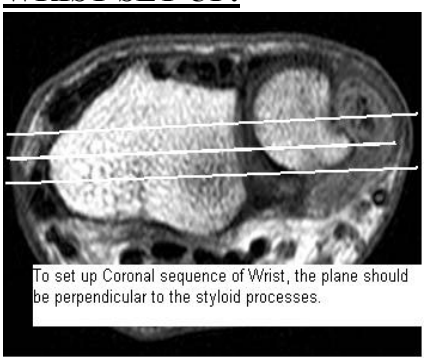
16ch Small Flex or 8ch Shoulder.

Posterior humerus through radial tuberosity

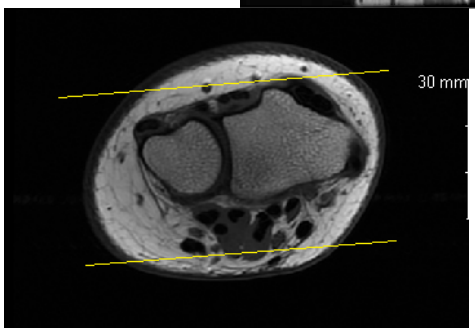




WRIST SET UP:



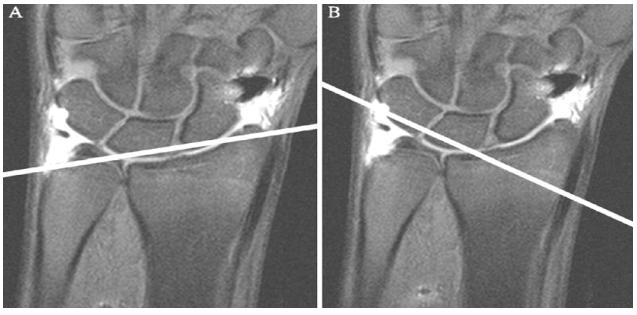
NOTE: Scaphoid is on the Thumb Side.



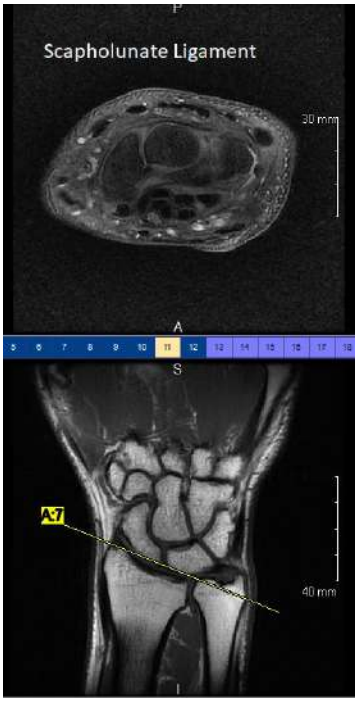
Cor coverage:

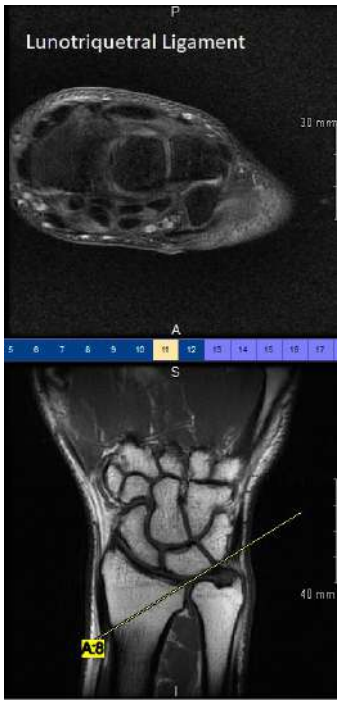
Scapholunate ligament
Parallel to proximal surface of lunate & scaphoid

Lunotriquetral ligament
Parallel to proximal surface of triquetrum & lunate



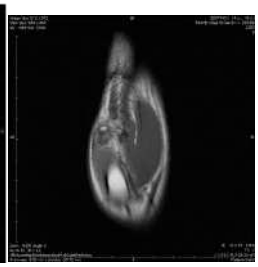
Back to Protocol





Hand/Finger/Thumb set up:

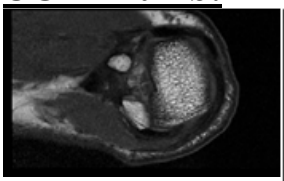
Cor Thumb:



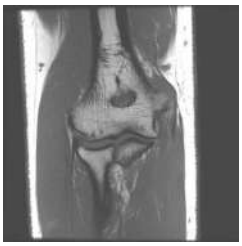
Sag Thumb

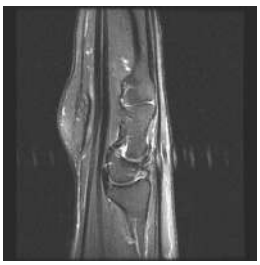
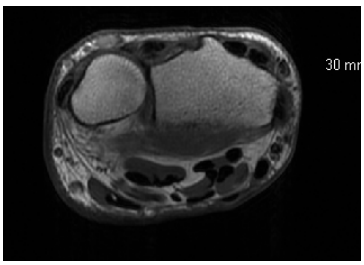
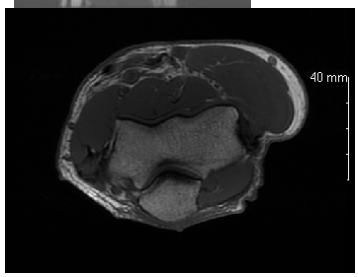
Back to Protocol

UCL Thumb:



- **MSK Rads would like us to start flipping images so they face the right way in PACS for upper extremity patients that are in the Superman position.**
  - **Send images to PACS as usual**
  - **Rt click and select Re-Orient**
  - **For Cor and Sag: Select Counter Clockwise until the Humerus (for elbow) or Hand (for wrist) is at the superior aspect of the image.**
  - **For Ax: Elbows, anterior should be screen top. For wrists, the dorsal part (back of the wrist) should be screen top**
  - **Rt click and select presentation**
  - **Select Save presentation**
  - **Select OK on the window that pops up**
  - **Here are some examples:**






30 mm

40 mm