General Guidelines

- NEVER hesitate to reach out to a radiologist for guidance!
- Two planes post contrast are always needed for MSK exams

- ALL MSK mass / infection exams, the most common protocol you should be using is T1 & T2 FS all 3 planes with appropriate T1 FS pre & post. This especially applies to adult (non-pedi) patients.
  - Always need
    - 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%

- Metal Protocols
  - 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.
  - PD’s are generally useful for tendons, ligaments, & joint spaces.

- 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
    - IV contrast

- 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 axial series
  - General pain, myositis, cellulitis or non-focal history
    - Image anatomy as indicated
    - Do not perform sagittal series, (3T only)
    - Send FastView Loc to PACS (3T only)
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
ACHILLES TENDON
PD Axial (140 FOV, 3.5x1, ~48 slices)
T2 FS Dixon Axial
T2 FS Dixon Cor (140 FOV, 3.5x1, ~35 slices, perpendicular to lateral/medial malleoli)
T1 Sag (250 FOV, 2x0.5, ~30 slices, mid-calf through calcaneus, parallel to lateral/medial malleoli)
T2 FS Sag

ANKLE (plantar fasciitis, posterior tibial tendon pathology)
PD Axial (140 FOV, 2x.5, 48 slices)
T2 FS Dixon Axial
T1 Cor *ALL 3Ts
T2 FS Dixon Cor (140 FOV, 2x.5, 58 slices, perpendicular to lateral/medial malleoli)
T1 Sag (140 FOV, 2x.5, 31 slices, parallel to lateral/medial malleoli)
T2 FS Dixon Sag (140 FOV, 2x.5, 31 slices)

NOTE: The following 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?

ARTHROGRAM ANKLE
T2 FS Dixon Axial
T1 FS Cor
T2 FS Dixon Cor
T1 FS Sag
T2 FS Dixon Sag

ARTHROGRAM ELBOW
T2 FS Axial
T1 FS Cor
T2 FS Cor
T1 FS Sag
T2 FS Sag

ARTHROGRAM HIP
T2 FS Axial (full pelvis)
T1 FS Cor (full pelvis)
T1 FS Cor
T1 FS Obl Axial
T1 FS Sag

ARTHROGRAM KNEE
T1 FS Axial
T1 FS Sag
PD Sag
T1 FS Cor
T2 FS Cor
ARTHROGRAM SHOULDER
T1 FS Axial
T2 FS Axial
T1 FS Cor
T2 FS Cor
T1 FS Sag
T2 FS Sag

ARTHROGRAM WRIST
T2 FS Axial
T1 FS Cor
T2 FS Dixon Cor
T1 FS Sag

CHEST WALL MASS Run phase direction to best minimize motion artifact.
T1 Cor
T2 FS Cor
T1 Axial
T2 FS Axial
T1 Sag
T2 FS Sag
T1 FS Axial pre
T1 FS Axial post

CLAVICLE
T1 Axial (~200 FOV, 3x0)
T2 FS Axial
T1 Cor (~200 FOV, 3x0)
T2 FS Cor
T1 Sag (~200 FOV, 3x0)
T2 FS Sag

NOTE: All planes are orthogonal to body, do not angle with clavicle. Include opposite SC joint in all series.

ELBOW (FABS view)
T1 Axial (120 FOV, 4x1, 23 slices, 304x320 matrix)
T2 FS Axial (179x256 matrix)
PD Cor (100 FOV, 2x0, 39 slices, 179x256 matrix)
T2 FS Cor (179x256 matrix)
T2 FS Sag (100 FOV, 2x0, 39 slices, 179x256 matrix)

NOTE: 100 FOV series do not need to include all soft tissue fat/muscle.

- Axial: Center to joint, image distally through the radial tuberosity to include the bicep tendon attachment.
- Cor: Center to joint, parallel to the humeral epicondyles. Do not position off localizer.
- Sag: Center to joint, perpendicular to the humeral epicondyles. Only image through the lateral and medial collateral ligaments.

- Additional FABS view, requests per Dr. Daniel Stewart – T2 FS long axis (130, 3.x5, ~24 slices)
- FABS View Positioning – Shoulder Coil
EXTREMITY / LONG BONES FOCAL (specific region of interest, mass, bone lesion) Tailor FOV to size of anatomy or area of interest.
T1 Cor
STIR Cor or T2 FS Dixon Cor
T1 Sag
STIR Sag or T2 FS Dixon Sag
T1 Axial (include full area of interest in 1 series)
STIR Axial or T2 FS Dixon Axial

Contrast: mass, infection or post-op tumor, consult radiologist for appropriate planes.
T1 FS Axial pre
T1 FS Axial post

NOTE: Hands, fingers, feet & toes
• Always place marker to indicate area of concern!
• If scanning an entire hand, you must include the distal radius/ulna through the fingertips on all sequences.
• Limit FOV to the area of interest when there is specific indication. Any questions should be addressed to the radiologist. Evening shifts will need to be preemptive. Late add on exams should be directed to the radiologists on shift in the evening.

EXTREMITY / LONG BONES NON-FOCAL WITHOUT CONTRAST (general pain, myositis, cellulitis) Tailor FOV to size of anatomy or area of interest.
T1 Cor
STIR Cor or T2 FS Dixon Cor
T1 Axial
STIR Axial or T2 FS Dixon Axial

NOTE: Send FastView localizer to PACS.

MID OR FOREFOOT (metatarsal pain, swelling or mass)
T1 Axial (140 FOV, 3x1, 24 slices)
T2 FS Dixon Axial
T1 Cor (140 FOX 3x1, 34 slices)
T2 FS Dixon Cor
T1 Sag (140 FOV, 2x.5, 33 slices)
T2 FS Dixon Sag

NOTE: Perform for toe with diagnosis of osteomyelitis, ulcer or infection.

HIND FOOT (metatarsal pain, swelling)
PD Axial (140 FOV, 2x.5)
T2 FS Dixon Axial
T1 Cor
T2 FS Dixon Cor (140 FOV, 2x.5, perpendicular to lateral/medial malleoli)
T1 Sag (140 FOV, 2x.5, parallel to lateral/medial malleoli)
T2 FS Dixon Sag (140 FOV, 2x.5)
FOOT FOR PLANTAR FIBROMATOSIS
T1 Axial (~200 FOV, 3x1)
T2 FS Dixon Axial
T1 Cor (~140 FOV, 3x1, ~50 slices)
T2 FS Dixon Cor
T1 Sag (~200 FOV, 2x.5)
T2 FS Dixon Sag

NOTE: Include from hind foot through metatarsal heads.

FOOT FOR MORTON’S NEUROMA OR CONTRAST EXAMS
Morton’s Neuroma: Limit FOV from mid-foot through end of toes.
Contrast exams: Consult with Rad regarding FOV & anatomical coverage.
T1 Axial (140 FOV, 3x1, 24 slices)
T2 FS Dixon Axial
T1 Cor (140 FOV 3x1, 34 slices)
T2 FS Dixon Cor
T1 Sag (140 FOV, 3x1, 19 slices)
T2 FS Dixon Sag
T1 FS Dixon Cor pre
T1 FS Dixon Cor post
T1 FS Dixon Axial post

FINGERS (not for thumb)
PD Axial (100 FOV, 2x0, 22 slices)
T2 FS Dixon Axial
PD Cor (130 FOV, 2x0)
T2 FS Dixon Cor
PD Sag (130 FOV, 2x0, affected & adjacent finger for comparison)
T2 FS Dixon Sag

FINGERS MASS / INFECTION (not for thumb)
• Tailor FOV to area of interest, if applicable.
• Always place marker to indicate area of concern, must include distal ulnar/radius through finger tips.

T1 Axial (100 FOV, 2x0, 22 slices)
T2 FS Dixon Axial
T1 Cor (130 FOV, 2x0)
T2 FS Dixon Cor
T1 Sag (130 FOV, 2x0, affected & adjacent finger for comparison)
T2 FS Dixon Sag

Contrast:
• Mass: T1 FS Axial pre & post, with additional plane which best demonstrates mass.
• Inflammation: T1 FS Dixon Cor pre & post
HAND
- Tailor FOV to area of interest, if applicable.
- Always place marker to indicate area of concern, must include distal ulnar/radius through finger tips.

T1 Axial (120 FOV, 4x1, 22 slices)
T2 FS Dixon Axial
T1 Cor (220 FOV, 2x.5, 23 slices)
T2 FS Dixon Cor
PD Sag (220 FOV, 4x1, 24 slices, affected & adjacent finger for comparison)
T2 FS Dixon Sag

HAND MASS / INFECTION (not for thumb)
- Tailor FOV to area of interest, if applicable.
- Always place marker to indicate area of concern, must include distal ulnar/radius through finger tips.

T1 Axial (120 FOV, 4x1, 22 slices)
T2 FS Dixon Axial
T1 Cor (140-220 FOV, 2x.5, 23 slices)
T2 FS Dixon Cor
T1 Sag (140-220 FOV, 4x1, 24 slices, affected & adjacent finger for comparison)
T2 FS Dixon Sag

Contrast:
- Mass: T1 FS Axial pre & post, with additional plane which best demonstrates mass.
- Inflammation: T1 FS Dixon Cor pre/post & T1 FS Axial post

HIPS BILATERAL FOR AVN
STIR Cor (~360 FOV, 4x0, 28 slices)
T1 Cor (~360 FOV, 4x0, 28 slices)
T1 Axial (~360 FOV, 5x1, TE 35, above sacrum through ischium)
T2 FS Axial
Left T1 Sag (220 FOV, 4x1, 22 slices)
Right T1 Sag (220 FOV, 4x1, 22 slices)

HIPS BILATERAL
T1 Axial (360 FOV, 5x1)
T2 FS Axial
T1 Cor (360 FOV, 5x1)
STIR Cor
LT PD FS Cor (RT / LT, 180 FOV, H>F phase) *optional 200 FOV, R>L for flow artifact through hip joint
LT PD FS obl Axial (RT / LT, 180 FOV)
LT PD FS Sag (RT / LT, 180 FOV, include from greater trochanter through medial edge of femoral head)
RT PD FS Cor (RT / LT, 180 FOV, H>F phase) *optional 200 FOV, R>L for flow artifact through hip joint
RT PD FS obl Axial (RT / LT, 180 FOV)
RT PD FS Sag (RT / LT, 180 FOV, include from greater trochanter through medial edge of femoral head)

Note:
- Send bilateral sequences to both folders in Synapse.
- Consider MSK Pelvis with history of arthroplasty / joint replacement.
- Bilateral hips can be performed on a patient at any age, it is not necessary to change to a MSK pelvis exam.
HIPS UNILATERAL
T2 FS Axial (~360 FOV, 5x1, ~40 slices, full pelvis)
T1 Cor (full pelvis)
PD FS Cor (RT / LT, 180 FOV, H>F phase) *optional 200 FOV, R>L for flow artifact through hip joint
PD FS Obl Axial (RT / LT, 180 FOV)
PD FS Sag (RT / LT, 180 FOV, include from greater trochanter through medial edge of femoral head)

CONTRAST, if needed:
• T1 FS Cor pre & post (full pelvis)
• T1 FS Axial post (full pelvis), additional optional post plane.
• If bilateral send full pelvis sequences to both exams in PACS.

HIPS UNILATERAL (large patient)
T2 FS Axial (~360 FOV, 5x1, ~40 slices, full pelvis)
T1 Cor (full pelvis)
PD FS Cor (RT / LT, 200 FOV, H>F phase)
PD FS Obl Axial (RT / LT, 200 FOV)
PD FS Sag (RT / LT, 200 FOV, include from greater trochanter through medial edge of femoral head)

CONTRAST, if needed:
• T1 FS Cor pre & post (full pelvis)
• T1 FS Axial post (full pelvis), additional optional post plane.
• If bilateral send full pelvis sequences to both exams in PACS.

HIPS UNILATERAL, 70+ Y/O
T1 Axial (360 FOV, 5x1)
T2 FS Axial
T1 Cor (360, 5x1)
STIR Cor
PD FS Obl Ax
PD FS Cor (H>F phase)

HIP REPLACEMENT (DEPUY HIP PROSTHESIS RECALL) Include entire bony pelvis
T1 tse Axial (5x1)
STIR Axial
T1 tse Cor (4x0)
STIR Cor
T1 FSE Sag (include entire bony pelvis 6x1)

NOTE:
• Perform on partial and total hip replacements
• Use a Fast RF pulse & a high bandwidth in order to reduce the artifact from the hip prosthesis. Siemens up to 400Hz with WARP & 100% VAT.
JOINT (synovitis, RA, inflammatory arthritis or inflammatory arthroplasty)
Hand: Include the distal radius/ulna through the fingertips on all sequences.
Hip: Follow unilateral hip with contrast protocol.

All joints in addition to routine protocol (except for feet, ankles, hips)
T1 FS Dixon Cor pre & post
Shoulder – add T1 FS Ax post
Elbow – add T1 FS Sag post
Wrist – add T1 FS Ax post
Hand – add T1 FS Ax post
Knee – add T1 FS Sag post

Foot in addition to routine protocol
T1 FS Dixon Axial pre
T1 FS Dixon Axial post
T1 FS Dixon Sag post

Ankle in addition to routine protocol
T1 FS Dixon Axial pre
T1 FS Dixon Axial post
T1 FS Dixon Sag post

KNEE
PD FS Axial (140 FOV, 2.5x.5, 40 slices, TE 33)
PD Sag (140 FOV, 2x.5, 40 slices, TE 33)
PD FS Sag (140 FOV, 2x.5, 40 slices, TE 36)
PD Cor (140 FOV, 2x.5, 36 slices TE 36)
T2 FS Cor (TE 62)

NOTE:
- Add T1 Cor
  - Bright bone marrow on T2 for possible fracture / trauma / soft tissue pathology (mass)
  - History of PVNS (pigmented villonodular synovitis)

PECTORAL MUSCLE/TENDON TEAR
PD Axial
STIR Axial
T1 Cor
T2 FS Cor
T1 Sag
T2 FS Sag
STIR Axial (bilateral)

NOTE:
- Patient prone & orient phase direction to best minimize motion artifact, see picture protocol for detailed instructions.
- Must include pectoralis attachment on humeral shaft.
PELVIS MSK (inguinal hernia, coccyx or sacrococcygeal)
T1 Axial (360 FOV, 5x1)
T2 FS Axial
T1 Cor (360 FOV, 5x1)
STIR Cor
T2 FS Sag (360 FOV, 5x1)
T1 Sag (through sacrum only, add for fracture of sacrum or coccyx and sacrococcygeal disorders)

NOTE:
- 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, etc., consult with an MSK Radiologist to see if a hip protocol should be performed instead.

PELVIS MSK WITH CONTRAST (sacroilitis / arthritis)
T1 Axial (360 FOV, 5x1)
T2 FS Axial
T1 Cor (360 FOV, 5x1)
STIR Cor
T2 FS Sag (360 FOV, 5x1)
T1 Sag (through sacrum only, add for fracture of sacrum or coccyx and sacrococcygeal disorders)
T1 FS Cor pre / post
T1 FS Axial post

NOTE:
- 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, etc., consult with an MSK Radiologist to see if a hip protocol should be performed instead.
- Attempts should be made to perform with & without contrast, however, an exam does not need to be rescheduled if unable to obtain a new order/authorization.

PELVIS MSK WITH CONTRAST (mass)
T1 Axial (360 FOV, 5x1)
T2 FS Axial
T1 Cor (360 FOV, 5x1)
STIR Cor
T2 FS Sag (360 FOV, 5x1)
T1 Sag (through sacrum only, add for fracture of sacrum or coccyx and sacrococcygeal disorders)
T1 FS Axial pre / post
T1 FS Cor post

PELVIS MSK ATHLETIC PUBALGIA (sports hernia, athletic pubalgia, osteitis pubis, groin pain, adductor muscle/tendon)
First/last slice must be completely out of the bony pelvis for full FOV series.

T2 FS Axial (360, 5x1)
T1 Cor (360 5x1)
STIR Cor
T2 FS hr Obl Ax (160, 4x.5)
T2 FS hr Obl Cor (160, 4x.5)
T2 FS hr Sag (160, 4x.5)
PEDI PELVIS MSK FOR SLIPPED CAPITAL EPIPHYSIS Include entire bony pelvis.
T1 Axial (4x1)
T2 FS Axial
T1 Cor (3x1)
STIR Cor
T1 Sag (4x1)

SCAPULA Oblique as needed to obtain true plane images.
T1 Axial (220 FOV, 5x1)
STIR Axial
T1 Cor (240 FOV, 4x1)
T2 FS Cor
T1 Sag (240 FOV, 5x1)
T2 FS Sag

SHOULDER
PD FS Axial (150 FOV, 2x.5, 36 slices)
PD FS Cor (140 FOV, 2x.2, 32 slices)
T2 FS Cor
T1 Sag (140 FOV, 4x.5, 32 slices, must include approx. 6cm of medial anatomy from glenoid fossa)
T2 FS Sag (140 FOV, 3x.3, 32 slices)

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

SHOULDER, Austin Sports Medicine, Dr. Elenz
PD FS Axial (150 FOV, 2x.5, 36 slices)
PD FS Cor (140 FOV, 2x.2, 32 slices)
T2 FS Cor
T1 Sag (140 FOV, 4x.5, 32 slices, must include approx. 6cm of medial anatomy from glenoid fossa)
T2 FS Sag (140 FOV, 3x.3, 32 slices)
T1 Axial (5x1, shoulder joint through mid-humerus)
T2 FS Axial

NOTE:
- Affected arm at side with external rotation, palm facing upward. Place sandbag on palm if necessary to help the patient maintain this position.
- Use shoulder & torso coils for upper arm series.

SI JOINTS
T1 Axial (360 FOV, 5x1, perpendicular to sacrum)
T2 FS Axial
T2 FS Axial (360, 5x1, full pelvis)
T1 Cor (240 FOV, 4x1, parallel to sacrum)
STIR Cor
T1 Sag
T1 FS Cor pre
T1 FS Cor post

NOTE:
- Only perform if exam is specifically ordered as SI Joint protocol.
- Send localizers to PACS.
- If not administering contrast, do not perform T1 FS Cor pre.
STERNUM  Patient prone whenever possible.
T1 Axial
T2 FS Axial
T1 Cor
T2 FS Cor
T1 Sag
T2 FS Sag

STERNOCLAVICULAR JOINTS  Patient prone & orient phase direction to best minimize motion artifact.
T1 Axial (240 FOV, 4x1)
T2 FS Axial
T1 Cor (240 FOV, 3x0)
T2 FS Cor
T1 Sag (200 FOV, 4x0)
T2 FS Sag

NOTE:  Hands, fingers, feet & toes
• Always place marker to indicate area of concern!
• If scanning an entire hand, you must include the distal radius/ulna through the fingertips on all sequences.
• Limit FOV to the area of interest when there is specific indication. Any questions should be addressed to the radiologist. Evening shifts will need to be preemptive. Late add on exams should be directed to the radiologists on shift in the evening.

THUMB
PD Axial (100 FOV, 2x0)
T2 FS Dixon Axial
PD Cor (100 FOV, 2x0)
T2 FS Dixon Cor
PD Sag (100 FOV, 2x0)
T2 FS Dixon Sag

THUMB MASS / INFECTION
T1 Axial (100 FOV, 2x0)
T2 FS Dixon Axial
T1 Cor (100 FOV, 2x0)
T2 FS Dixon Cor
T1 Sag (100 FOV, 2x0)
T2 FS Dixon Sag
T1 FS Dixon Axial pre/post (100 FOV, 2x0)
NOTE:  Additional post plane is NEEDED, consult radiologist for appropriate plane.

THUMB (ARTHRITIS / INFLAMMATION)
PD Axial (100 FOV, 2x0)
T2 FS Dixon Axial
PD Cor (100 FOV, 2x0)
T2 FS Dixon Cor
PD Sag (100 FOV, 2x0)
T2 FS Dixon Sag
T1 FS Dixon Cor pre (100 FOV, 2x0)
T1 FS Dixon Cor post
T1 FS Dixon Axial post
TOE ROUTINE / TURF TOE / PLANTAR PLATE (not Morton’s Neuroma)

* Place marker on area of interest.
PD FS Dixon Axial (90 FOV, 2x.5)
T1 Cor (90 FOV, 2x.5)
T2 FS Dixon Cor
PD Sag (90 FOV, 2x0, affected toe & adjacent for comparison)
T2 FS Dixon Sag

Contrast, if needed:
- T1 FS Dixon Cor pre / post
- Additional post plane is beneficial, consult radiologist for appropriate plane.

TOE MASS
T1 Axial
T2 FS Axial
T1 Cor
T2 FS Cor
T1 Sag
T2 FS Sag
T1 FS Cor pre / post
T1 FS Sag post

NOTE:
- Perform forefoot protocol with diagnosis of osteomyelitis, ulcer or infection.
- Place marker on area of interest.

WHOLE BODY MULTIPLE MYELOMA (monoclonal gammopathy) – 3T Preferred
IR Cor Skull (6-7x.5 mm slice thickness)
IR Cor Sternum (5x.5mm, include medial half of clavicles)
RT IR Cor Humerus (6-7x.6mm, include partial wall and distal clavicle)
LT IR Cor Humerus
IR Cor Pelvis (500 FOV, 6-7x.6mm, include as much as femurs as possible)

T1 Sag Total Spine Localizer (3T auto-composing)
T1 Sag Cervicothoracic (~400 FOV, 5x.5mm)
IR Sag Cervicothoracic
T1 Sag Thoracolumbar (~400 FOV, 5x.5mm)
IR Sag Thoracolumbar

NOTE: Referred by hematologist or oncologist, primarily Dr. Matsui & Anna Courtney, PA.

WRIST
PD Axial (100 FOV, 3x0, 24 slices, TE 14)
T2 FS Axial
PD FS Cor (100 FOV, 2x.2, 17 slices)
T2 FS Dixon Cor
T1 Cor
T2 FS Sag (100 FOV, 3x0)
Contrast:
- Pain: T1 FS Cor pre / post with additional T1 FS Axial post
- Mass: Perform T1 & T2 FS protocol with T1 FS Axial pre & post, with additional plane which best demonstrates mass.
- Follow JOINT CONTRAST protocol for other inflammatory/arthritis/etc. diagnosis.