11.1 Musculoskeletal Imaging

Musculoskeletal Sectional Anatomy & Clinical Imaging

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Outline

11.1 Musculoskeletal Imaging

Part I
• Planes of the Musculoskeletal system
• Sectional Anatomy of the upper extremity
• Sectional Anatomy of the lower extremity

Patient Preparation for MSK Imaging
• Patient Screening
  – Check for contraindications
  – Remove ALL metal
  – Change into gown
• Coil Selection
  – For routine
  – For vascular
  – For Arthrography
• Patient set-up & Positioning
  – Supine
  – Coil on joint
  – Hearing Protection
  – Patient intercom
• Landmark
  – Per joint
  – Other
• Isocenter

Anatomy Musculoskeletal System

Overview musculoskeletal Anatomy - TMJ

Imaging Planes - TMJ

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**Shoulder radiograph**

"There's a sea (C) between two Nations"

**Patient Preparation for TMJ MRI**

- **Patient Screening**
  - Check for contraindications
  - Remove ALL metal
  - Change into gown
- **Coil Selection**
  - For routine TMJ
    - Transmit/receive
    - Receive only
- **Patient set-up & Positioning**
  - Supine - COIL ON TMJ
  - Pad under knees - elbows
  - Hearing Protection
  - Patient Intercom
- **Landmark**
  - CENTER EAM
- **Isocenter**

**Basic “Vanilla” TMJ Protocol**

- **Locater** T1 – plane loc
- **Sagittal Oblique** 12 & PD – CLOSED
  - Generally TSE (aka FSE or RARE)
  - 12 ish to fit anatomy
  - 3 or 4 mm / 1
  - TR = 500-700 ms
  - TE = min
- **Coronal oblique** 12 ish to fit anatomy
  - TR = 4000 ms
  - TE = 30 ms
  - ETL = 8
- **Sagittal oblique** T1 closed/open
  - Generally TSE (aka FSE)
  - 12 ish to fit anatomy
  - 3 or 4 mm / 1
  - TR = 500-700 ms
  - TE = min

**Sag T1**

Sagittal oblique – T1…closed
Generally TSE (aka FSE)
12 ish to fit anatomy
3 or 4 mm / 1
192 x 256
TR = 500-700ms
TE = min

**Sag T1 “open”**

Sagittal oblique – T1…open
Generally TSE (aka FSE)
12 ish to fit anatomy
3 or 4 mm / 1
192 x 256
TR = 500-700ms
TE = min

**Sag T2**

Sagittal Oblique T2
Generally TSE (aka FSE)
12 ish to fit anatomy
3 or 4 mm / 1
192 x 256
TR = 4000 ms
TE = 100 ms
ETL = 8
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Open vs. Closed

- Sagittal oblique - T1 closed/open
- Generally TSE (aka FSE)
- 12 ish to fit anatomy
- 3 or 4 mm / 1
- 192 x 256
- TR = 500-700ms
- TE = min

To evaluate meniscus

Anatomy Musculoskeletal System

- Shoulder
  - Scapula
  - Spine of the scapula
  - Coracoid process
  - Acromion process
  - Clavicle
  - Humerus
  - Head of the humerus
  - Greater tubercle
  - Lesser tubercle

The lumps and bumps of the shoulder

- Shoulder

Surgical Fixation

- AC Joint
- Clavicle
- Ribs

Overview musculoskeletal Anatomy - Shoulder

- The sagittal oblique plane is acquired along this dotted red line, parallel to the glenoid fossa
- The coronal oblique plane is acquired along this dotted red line on the axial shoulder image. Parallel to the supraspinatus muscle & tendon or perpendicular to the glenoid fossa

Structures of the rotator cuff ...(SITS)

- Supraspinatus
- Infraspinatus
- Teres Minor
- Subscapularis
- SITS (S.I.T.S.)

Median Line
Frontal or Coronal Plane
Axial
Sagittal
Coronal oblique
Reformatted CT Image

Trapezius
Deltoid
Axial Shoulder CT
Axial MR Image
Reformatted CT Image

Spine of the scapula
Axial MRI Image
Coronal oblique MR Image
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**Shoulder Structures**
- Deltoid
- Supraspinatus tendon
- Infraspinatus tendon
- Teres minor tendon
- Subscapularis tendon
- Biceps muscle
- Spine of the scapula

**Bony Structures of the shoulder**
- Acromion
- A/C joint (acromio-clavicular joint)
- Clavicle
- Humeral Head
- Humerus
- Corocoid process
- Glenoid fossa
- Glenoid rim
- Scapula
- Humerus

**Anatomy Musculoskeletal System**
- Elbow

**Bones of the Elbow Joint**
- Humerus
- Olecranon fossa
- Capetellum
- Humero-radial joint
- Capetellum
- Trochlea
- Humero-ulnar joint
- Radio-ulnar joint

**Muscles, Tendons & Ligaments of the Elbow Joint**
- Triceps muscles
- Ulnar collateral ligament
- Brachiodialis muscle

**Corocoid vs coronoid**
There's a sea (C) between two Nations...
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**Anatomy Musculoskeletal System**

- Hip
- Acetabulim
- Ilium
- Pubis
- Obturator foramen

**Bony anatomy of the HIP**

- Femoral Head
- Femoral Neck
- Greater Trocanter
- Lesser Trocanter
- Femoral Shaft

**BONE METS**

- Compressed vertebral body
- Met to the pelvic bone

**Hips & Pelvis**

- Coronal MRI of the Hips
- Axial MRI of the Hips

**Structures of the HIP**

- Femoral Head
- Femoral Neck
- Greater Trocanter
- Lesser Trocanter
- Femoral Shaft

**NAVEL**

- Nerve, Artery, Vein, Empty space, Lymph node

- Psoas Muscle
- Sacus Muscle
- Gluteus Maximus
- Gluteus Minimus
- Quadriceps Muscle
- Hamstrings
- Bladder
- Nerve
- Artery
- Vein
- Empty space
- Lymph nodes
- Gluteus Maximus
- Rectum
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Muscular Abcess

Anatomy Musculoskeletal System

Muscular Abscess

Pelvic area

Muscular Abscess

Shoulder area

Bones of the Knee

Knee

Coronal knee MRI

Axial knee

Femur

Patella

Patello-femoral joint

Knee Joint

Tibia

Fibula

Coronal reformatted CT

Lower Extremity Anatomy

Anterior cruciate ligament (ACL)

Posterior cruciate ligament (PCL)

Quadriceps muscles

Femur

Hamstrings muscles

Quadiceps tendon

Mid sagittal slice (MRI)

Patello- Femoral Joint

Patellar ligament

Locations of the lateral collateral ligaments

Femoral condyles

Meniscus (posterior horn, lateral meniscus)

Patella

Tibia

Fibula

Mid sagittal slice (MRI)

Axial femur CT

Muscles of the Knee

Hamstring muscles

Quadriceps Tendon

Attaches the quadriceps muscles

Gastrocnemius muscles

Meniscus and other structures of the knee

Lateral aspect of the patello-femoral joint

Lateral retinaculum

Anterior horn of the meniscus

Posterior horn of the meniscus

Axial knee MRI

Lateral collateral ligament

Lateral meniscus

Medial collateral ligament

Medial meniscus

Coronal knee MRI
Patient Preparation for Lone Bone MRI

- Patient Screening
  - Check for contraindications
  - Remove ALL metal
  - Change into gown

- Coil Selection
  - For routine LONG BONES
  - **Body Coil**

- Patient Set-up & Positioning
  - Supine
  - COIL AROUND AREA?
  - Hearing Protection
  - Patient Intercom

- Landmark
  - MID SH AFT

- Isocenter

Long Bone Pathology & Views

- Mets
- Scan only the bone
- Scan all the bones

Lower Leg Fracture

- AP Scout
- Lat Scout

Foot & ankle bones - Come To Cuba Next Christmas

- Tibia
- Fibula
- Come... (calcaneus)
- To... (talus)
- Cuba (cuboid)
- Next... (navicular)
- Christmas... (3 cuneals)

Anatomy Musculoskeletal System

- Foot and ankle

Ankle Ligaments and Tendons

- Tibia
- Fibula
- Tibio-talar joint
- Mortise joint
- Posterior longitudinal ligament
- Medial collateral ligaments
- Lateral collateral ligaments
- Achilles tendon
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**Ankle Arthrogram**
- Scar or hypertrophied synovium

**Review, Peripheral Vascular Anatomy**
- Abdominal Aorta (AAA - abdominal aortic aneurysm)
- Iliac Arteries
- Femoral Arteries
- Popliteal Arteries
- Trifurcation (anterior tibial, posterior tibial, Peroneus Brevis)

**Patient Preparation for Foot MRI**
- **Patient Screening**
  - Check for contraindications
  - Remove ALL metal
  - Change into gown
- **Coil Selection**
  - For routine FOOT
  - Transmit/receive
  - Receive only

**Basic “Vanilla” Foot Protocol**
- **Localizer (3-plane)**
- Axial T2 & PD
  - FOV = 20 ish to fit anatomy
  - 3 or 4 mm / 1
- Coronal Oblique T2 & PD
  - FOV = 16 ish to fit anatomy
  - 3 or 4 mm / 1
- Sagittal oblique PD & T2
  - FOV = 16 ish to fit anatomy
  - 3 or 4 mm / 1
  - 192 x 256
- STIR plane of interest

**Bone marrow Adema**
- 5th metatarsal

**Bone Tumor**
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Epidermal Cyst

Osteomyelitis

Foot Pathology & Views
- Tarsal Tunnel - axial
- Plantar Fasciitis - axial & sagittal
- Diabetic foot - MRA

Thank you for your attention!

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