Akron Radiology Inc.
Technique Manual
For
Computed Tomography

Version 2020c

Summa Health System
CCOC
Western Reserve Hospital
Affiliated Imaging Centers: Green, Hudson, White Pond, Medina

CT imaging acquisition parameters, including: slice thickness, table speed, mAs, and kV settings, should be set according to the specific vendor recommendations. These parameters settings along with automatic exposure control techniques should be used to maximize diagnostic yield and minimize patient dose (ALARA). Expected patient dosage for individual CT units should be available on site and actual patient dosage information is available in PACS.

The following protocols refer to reconstruction thickness, interval, windowing and multiplanar reformatting of the images sent to PACS.

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Extremities (with contrast)

STATEMENT ON INTRAVENOUS CONTRAST – Updated 2019

Intravenous contrast can lead to contrast induced nephropathy, although this is controversial. We have been extremely conservative and recent data suggests that prior strategies may been aggressive.

The following patients should be screened for renal insufficiency prior to administration of IV contrast:
If a patient answers yes to any items below then serum creatinine with calculated eGFR within 6 weeks for outpatients and 1 week for inpatients is required (unless life-threatening condition and extremely urgent imaging is required)

1. Age >60
2. Known renal disease, renal failure, transplant or single kidney
3. On immunosuppression for transplant
4. Diabetes
5. Hypertension currently being treated
6. History of heart disease
8. Chemotherapy in the last two weeks
9. Pregnant

In patients with GFR 30 or higher, contrast has been shown in recent studies to not or rarely be nephrotoxic. When GFR <30, *contrast should not be administered* unless the patient is on dialysis and auric, or if contrast is considered diagnostically imperative and the benefits of contrast outweigh the risk of post-contrast acute kidney injury. In these patients, hydration may be a useful strategy to potentially diminish contrast induced nephropathy.

GFR <30:
If contrast is required, then recommended hydration protocol:

- Inpatients – 0.9% normal saline at 100 mL/hr IV beginning 6-12 hours prior to contrast administration and continuing 4-12 hours afterwards
- Outpatients – 0.9% normal saline 500 mL IV bolus prior to contrast administration. Additionally, post-exposure oral hydration (1 cup of water per hour for 8 hours) should be considered provided the patient is not under fluid restriction for medical reasons

Notes on Intravenous Contrast:

- **Standard injection for most studies: 75 ml 370mg% or 100 ml of 300mg%**
- **Standard injection rate: 2-4 ml/sec unless stated otherwise**
- **Quantity should be increased to 100 ml 370mg% in patients approximately > 250lb.**
- **Repeat injection may be performed for total of 150 ml when more than two areas of interest requested**
- **Pediatric patients: 1 ml per pound up to adult dosing (approx. 2ml/kg)**

Statement on Metformin:

- **There is no need to discontinue Metformin in patients receiving IV contrast in the setting of normal to borderline renal function (eGFR > 30**
- **In the rare setting when a patient receiving IV contrast with renal failure (eGFR<30) then Metformin should be withheld for 48 hours after the contrast and not restarted until renal function is reevaluated.**

Recommended Premedication for Contrast Allergy:

- **Routine prep (13hour):**
  Prednisone 50mg po at 13h, 7h and 1hr prior to contrast
  Benadryl 50mg po or IM 1hr before contrast

  Note: Hydrocortisone 200mg IV (at 13h, 7h and 1hr) can be substituted for Prednisone if patient cannot take po meds

- **Emergency prep (4 hour):**
  SoluMedrol 40mg IV or SoluCortef 200mg IV 4 hours prior
  Benadryl 50mg IV, IM or po 1hr prior

  Note: Decadron 7.5mg or Betamethasone 6mg can be substituted in patients with allergy to SoluMedrol or NSAIDS, especially if asthmatic

  Reference: ACR Manual on Contrast Media v10.2

Head/Neck

HEAD WITHOUT

Scan Range: 1cm below skull base to above vertex. Parallel to line intersecting supraorbital ridge and posterior aspect of foramen magnum OR lateral edge of eye and external auditory canal, excluding orbits as much as possible.
Contrast: None
W/L: Brain
Thickness: 3 mm
Interval: 3 mm
W/L: Bone
Thickness: 3 mm
Interval: 3 mm
MPR: Coronal and Sagittal – Brain W/L 3 mm x 3 mm

HEAD WITHOUT/WITH CONTRAST

Scan Range: 1cm below skull base to above vertex. Parallel to line intersecting supraorbital ridge and posterior aspect of foramen magnum OR lateral edge of eye and external auditory canal, excluding orbits as much as possible.
Contrast: 75 ml 370 mg%. Wait 3-5 minutes after injection before imaging.
W/L: Brain precontrast and postcontrast
Thickness: 3 mm
Interval: 3 mm
W/L: Bone precontrast
Thickness: 3 mm
Interval: 3 mm
MPR: Coronal and Sagittal - post contrast – Brain W/L 3 mm x 3 mm

IAC/TEMPORAL BONES

Scan Range: Below mastoid tip to above superior mastoid air cells. Stay parallel to OM baseline.
W/L: Bone high resolution
Thickness: 1 mm
Interval: 1 mm
MPR: Coronal 1 mm x 1 mm

SINUSES - AXIAL ACQUISITION

Scan Range: Top of frontals through maxillary with FOV 130cm
Contast: none
W/L: Bone high resolution
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and Coronal 2 mm x 2 mm

SINUSES - CORONAL ACQUISITION

Scan Range: Nose through sphenoid sinuses with FOV 130cm
Contrast: none
W/L Bone high resolution
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and Axial 2 mm x 2 mm

SINUSES - IMAGE GUIDED SURGICAL PROTOCOL (MEDTRONIC – WRH)

Scan Range: Transaxial vertex through maxillary sinuses with FOV up to 250cm
W/L 1: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR - Coronal magnified for sinuses only with bone W/L

SINUSES - IMAGE GUIDED SURGICAL PROTOCOL (BRAINLAB ENT - SUMMA)

Scan Range: Transaxial sinuses – include forehead, eyes, all of nose
W/L 1: Soft tissue
Thickness: 1 mm
Interval: 0.5 mm
W/L 2: Bone
Thickness: 1 mm
Interval: 1 mm
MPR: Sag and Cor 2mm x 2 mm

NECK WITH IV CONTRAST

Scan Range: Above pituitary fossa to aortic arch. Straight gantry. No contrast as well when concern for salivary gland calculus
Contrast: 75 ml 370 mg%
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and Coronal 3 mm x 3 mm

NECK WITHOUT IV CONTRAST

Scan Range: Above pituitary fossa to aortic arch. Straight Gantry
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and Coronal 3 mm x 3 mm

NECK – PARATHYROID

Indication: Suspected or known parathyroid tumor
Scan Range: Mandible through carina
Scan phase 1: Non-contrast
Scan phase 2: Arterial – 25 second delay after contrast initiation
Scan phase 3: Delayed – 80 second delay after contrast initiation
Contast: 75 ml 370 mg%
W/L: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and Coronal 2 mm x 2 mm of phase 2 and 3

MAXILLOFACIAL CT WITH IV CONTRAST

Indication: Mass or inflammation
Contrast: 75 ml 370mg%. Scan after 2 minute delay
W/L: Soft tissue
Thickness: 2 mm
Interval: 2 mm
MPR: Sagittal and Coronal 2 mm x 2 mm

MAXILLOFACIAL CT WITHOUT CONTRAST

Indication: Trauma
Scan Range: Above frontal sinuses through bottom of chin.
Contrast: none
W/L: Bone
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and Coronal 2 mm x 2 mm

ORBITS WITH IV CONTRAST

Scan Range: Bottom of hard palate through top of frontal sinuses
Contrast: 75 ml 370mg%. Scan after 2 minute delay
W/L: Soft tissue
Thickness: 2 mm
Interval: 2 mm
MPR: Coronal 1 mm x 1 mm

ORBITS WITHOUT IV CONTRAST

Indication: Trauma
Scan Range: Bottom of hard palate through top of frontal sinuses
Contast: none
W/L: Bone
Thickness: 2 mm
Interval: 2 mm
MPR: Coronal 1 mm x 1 mm

SELLA TURCICA

Indication: Patient with contraindication to MRI
Scan Range: Coronal through entire sella turcica
Contrast: precontrast and postcontrast 75 ml 370 mg%
W/L: Brain
Thickness: 1 mm
Interval: 1 mm
MPR: Coronal and Sagittal 1 mm x 1 mm

CTA HEAD

Scan Range: Vertex through C1
Perform noncontrast CT Head first if no exam in 24hrs.
Contrast: 75 ml 370 mg %. Scan after 10 sec delay (Toshiba - Surestart timed to Common Carotid) Rate of injection: 3.5-4.5 ml/sec
W/L 1: Brain
Thickness: 0.5 mm
Interval: 0.3 mm
W/L 2: Brain
Thickness: 2 mm
Interval: 2 mm
MPR- Sagittal and Coronal 1 mm x 1 mm

CTA HEAD/NECK

Scan Range: Aortic arch through vertex
Contrast: 75 ml 370 mg% Scan after 10 sec delay (Toshiba - Surestart timed to Common Carotid) Rate of injection: 3.5-4.5 ml/sec
W/L 1: Soft tissue
Thickness: 0.5 mm
Interval: 0.3 mm
W/L 2: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR- Sagittal and Coronal 1 mm x 1 mm

CTA NECK

Scan Range: Aortic arch through skull base
Contrast: 75 ml 370 mg% Scan after 10 sec delay (Toshiba - Surestart timed to Common Carotid) Rate of injection: 3.5-4.5 ml/sec
W/L 1: Soft tissue
Thickness: 0.5 mm
Interval: 0.3 mm
W/L 2: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR- Sagittal and Coronal 1 mm x 1 mm

CT VENOGRAM HEAD

Scan Range: Vertex through C1

Contrast: 75 ml 370 mg%. Scan after 45 sec delay (Toshiba – Surestart timed to Common Carotid) Rate of injection: 3.5-4.5 ml/sec

W/L 1: Brain

Thickness: 0.5 mm

Interval: 0.3 mm

W/L 2: Brain

Thickness: 2 mm

Interval: 2 mm

MPR- Sagittal and Coronal 1 mm x 1 mm

Chest

CHEST WITH CONTRAST

Scan Range: Apices through top of kidneys
Contrast: 75 ml 370 mg% at 2-3cc/sec
W/L 1: Mediastinum_
Thickness: 3 mm
Interval: 3 mm
W/L 2: Lung (for Toshiba use FC51)
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal 3 mm x 3 mm mediastinum window

CHEST WITHOUT CONTRAST

Scan Range: Apices through top of kidneys
Contrast: None
W/L 1: Mediastinum
Thickness: 3 mm
Interval: 3 mm
W/L 2: Lung: (for Toshiba use FC51)
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal 3 mm x 3mm mediastinum window

CHEST ENB (electromagnetic navigation bronchoscopy) PROTOCOL

Scan Range: Apices through top of kidneys
If requested, Contrast: 75 ml 370 mg% at 2-3cc/sec
W/L 1: Mediastinum (for Toshiba use FC05)
Thickness: 1 mm
Interval: 0.8 mm
W/L 2: Lung (for Toshiba use FC51)
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal 3 mm x 3 mm mediastinum window

HIGH RESOLUTION CHEST

Indication: Pulmonary fibrosis
Scan 1: Apices through top of kidneys in **inspiration**
W/L 1: Mediastinum
Thickness: 3 mm
Interval: 3 mm
W/L 2: Lung (for Toshiba use FC51 or Super High Res FC53 or F80)
Thickness: 1 mm
Interval: 1 mm
MRP: Sagittal and coronal 3 mm x 3 mm mediastinum window

Scan 2: Apices through the top of the kidneys in **expiration**
W/L: Lung
Thickness: 1 mm
Interval: 20 mm

Scan 3: If patient is able, may include prone representative 1mm images through upper, mid and lower chest
W/L Prone: Lung (as above)
Thickness: 1 mm
Interval: 10 mm or more. Minimum of one image upper, mid and lower.

HIGH RESOLUTION CHEST – ENDOBRONCHIAL VALVE

Indication: Endobronchial valve placement for emphysema
Scan: Apices through bases of lungs only.
FOV: Narrow to include only the lungs
W/L: Lung (for Toshiba/Canon use FC51)
Thickness: 1mm
Interval: 1mm

CHEST LOW DOSE SCREENING

Indication: Screening only

Patients should be excluded from screening if:

-They have had chest CT within 12 months

-Have an active lung cancer

-Have current active chest disease process other than smoking related COPD

-Have a known nodule being followed at less than 1 yr intervals

Scan: Apices through lung bases

Acquisition thickness will vary based on scanner

mAs: vary based on exposure (in order to achieve CTDI < 3 mGy)

Contrast: None

W/L 1: Mediastinum

Thickness: 3 mm

Interval: 3 mm

W/L 2: Lung

Thickness: 1 mm

Interval: 1 mm

MPR: Sagittal and coronal 3 mm x 3 mm

Additional recon: Axial 10 mm x 10 mm (thick slab MIP for nodules) in Lung Window

Note: Reporting requires use of Lung-Rads assessment category

CHEST LOW DOSE DIAGNOSTIC

Indication: Follow up of nodules

Scan: Apices through lung bases

Acquisition thickness will vary based on scanner

mAs: vary based on exposure (in order to achieve CTDI < 3 mGy)

Contrast: None

W/L 1: Mediastinum

Thickness: 3 mm

Interval: 3 mm

W/L 2: Lung

Thickness: 1 mm

Interval: 1 mm

MPR: Sagittal and coronal 3 mm x 3 mm

Additional recon: Axial 10 mm x 10 mm (thick slab MIP for nodules) in Lung Window

CTA CHEST

Indication: Pulmonary embolus or non-specific chest pain
Note: **Perform with small amount of inspiration and breathhold, prefer right arm injections**
Scan Range: Apices through top of kidneys
Contrast: 75 ml 370 mg% at 4-5 cc/sec
W/L: Mediastinum
Thickness: c 1 mm
Interval: 1 mm
MPR: Coronal 1 mm x 1 mm, Coronal thick slab (MIP) 10mm x 10mm,
Sagittal 3 mm x 3 mm

CTA CHEST – ATTENTION AORTA

Indication: Aortic dissection or other aortic injury
Contrast: 75 ml 370 mg% at 4-5 cc/sec
Scan phase 1: Non-contrast Low dose technique apices through top of kidneys
W/L: Mediastinum
Thickness: 3 mm
Interval: 3 mm
Scan phase 2: Arterial phase contrast attention to the aorta - apices through top of kidneys
W/L: Mediastinum
Thickness: 1 mm
Interval: 1 mm
MPR of phase 2: Coronal 1 mm x 1 mm, Coronal thick slab (MIP) 10mm x 10mm,
Sagittal 3 mm x 3 mm

CTA CHEST - EKG GATED

Indication: Coronary arteries, Triple Rule-Out, Aortic Dissection, Aortic Aneuysm followup
Scan Range: Apices through top of kidneys (may be tailored by indication)
EKG Gating: Retrospective
Contrast: 75 ml 370 mg% at 4-5 cc/sec (may be tailored by indication)
Coronary: W/L: Mediastinum
Thickness: 0.5 mm
Interval: 0.3 mm
Other: W/L: Mediastinum
Thickness: 1 mm
Interval: 1 mm
MPR: To be done with independent workstation software

CT ESOPHAGOGRAPHY

Indication: Esophageal perforation (not indicated for obstruction)

Scan Range: Apices through top of kidneys

Oral contrast: 50 ml oral Isovue or Omnipaque mixed in solution with fizzies (effervescent granules) ingested just prior to imaging

Note: patient should not be at risk for aspiration

Timing: No delay required

W/L 1: Mediastinum

Thickness: 3 mm

Interval: 3 mm

W/L 2: Lung

Thickness: 1 mm

Interval: 1 mm

MPR: Sagittal and coronal 3 mm x 3 mm mediastinum window

References:

1. Singh, S., et al. Pointers for Optimizing Radiation Dose in Chest CT Protocols. JACR 2011, 663-665.
2. Bankier AA. et al. Dose Reduction Strategies for Thoracic Multidetector CT: background, current issues and recommendations. J Thoracic Imaging 2010; 25: 278-288.
3. http://www.nccn.org/professionals/physician_gls/pdf/lung_screening.pdf

Abdomen/Pelvis

Oral contrast for Abdomen/Pelvis:

Outpatients (one of the following):

1. **Redicat 2:**
   If AM appointment: 1 bottle 450 ml at 11PM at night before, 1 bottle of 450 ml 1 hour before exam
   If PM appointment: 1 bottle 450ml six hours prior to exam, 1 bottle of 450 ml 1 hour before exam
2. **Omnipaque 240 mg%: 50 ml mixed in 32 oz water 1 hour before**
3. **Isovue 300%: 15-30 ml mixed in 32 oz of water - drink over 15-30 min and scan 45-60 min later**

Inpatients (one of the following):

1. **Gastroview: 30 ml mixed in 32 oz water - half at 2 hours before half and 1 hour before exam**
2. **Omnipaque 240: 50 ml mixed in 32 oz water - half at 2 hours before and half at 1 hour before exam**
3. **Isovue 300%: 15-30 ml mixed in 32 oz of water - half at 2 hours before and half at 1 hour before exam**

Emergency patients (one of the following):

1. **Gastroview - 30 ml mixed in 32 oz water 1 hour before**
2. **Omnipaque 240 - 50 ml mixed in 32 oz of water 1 hour before**
3. **Isovue 300%: 15-30 ml mixed in 32 oz of water - drink over 15-30 min and scan 45-60 min later**

Post-Bariatric surgery (within days of surgery to evaluate for leak):

1. **Gastroview: 15 ml mixed in 16 oz water - half at 2 hours before half and on table just before exam begins**

ABDOMEN/PELVIS WITH CONTRAST ORAL & IV

Indication: Abdominal pain, Follow up of neoplasm, Other
Scan: approx. 70 sec delay for portal venous phase from lung base to pubis symphysis. If known pelvic pathology or trauma or at tech or rad discretion: 5 minute delay through pelvis for bladder contrast (iliac crests to pubic symphysis)
Contrast: 75 ml 370mg%, Increase to 100cc if patient estimated over 250lb.
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and Coronal - 3 mm x 3 mm

ABDOMEN/PELVIS WITHOUT IV OR ORAL CONTAST

Indication: Renal colic, flank pain, Other
Scan: From lung bases through pubis symphysis
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and coronal 3 mm x 3 mm

ABDOMEN/PELVIS WITHOUT IV OR ORAL CONTAST – LOW DOSE

Indication: Known renal calculi or on referring physician request
Exposure: DLP <650)
Scan: From lung bases through pubis symphysis
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and coronal 3 mm x 3 mm

ABDOMEN/PELVIS WITH CONTRAST ORAL & IV (DUAL PHASE)

Indication: Suspected hypervascular liver lesion
Scan phase 1: approx. 25 second delay of the abdomen
Scan phase 2: approx. 70 – 90 second delay abdomen for portal venous phase - lung bases to pubis symphysis.
If known pelvic pathology or at tech or rad discretion: 5 minute delay of pelvis for bladder contrast (iliac crests to pubic symphysis)
Contrast: 75 ml 370mg%
W/L: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal of phase 2 at 3 mm x 3 mm

ABDOMEN/PELVIS WITH CONTRAST ORAL & IV (TRIPHASIC)

Indication: Suspected hypervascular liver lesion (when requested as "triphasic")
Scan phase 1: approx. 25 second delay of the abdomen
Scan phase 2: approx. 70 – 90 second delay abdomen for portal venous phase - lung bases to pubis symphysis.
Scan phase 3: approx. 5 min delay of abdomen and if known pelvic pathology or at tech or rad discretion can continue through the pelvis
Contrast: 75 ml 370mg%
W/L: Soft tissue – all phases
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal of phase 2 at 3 mm x 3 mm

ABDOMEN/PELVIS WITH CONTRAST ORAL & IV (PANCREAS PROTOCOL)

Indication: Suspected or known pancreas mass
Scan phase 1: approx. 40 second delay of the abdomen
Scan phase 2: approx. 70 – 90 second delay abdomen for portal venous phase - lung bases to pubis symphysis. If known pelvic pathology or at tech or rad discretion: 5 minute delay of pelvis for bladder contrast (iliac crests to pubic symphysis)
Contrast: 75 ml 370mg%
W/L: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal of phase 2 at 3 mm x 3 mm

ABDOMEN WITHOUT AND WITH IV CONTRAST (HEMANGIOMA PROTOCOL)

Indication: Known Liver lesion, hemangioma protocol
Scan phase 1: Lung bases to iliac crests without IV contrast at low dose (mAs) setting
Scan phase 2: Approx. 70 sec delay (portal venous phase) lung bases to iliac crest
Scan phase 3: 5 minute through liver
Scan phase 4: 10 minute through liver
Scan phase 5: 15 minute through liver
Contrast: 75 ml 370 mg%
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm

ABDOMEN WITHOUT AND WITH IV CONTRAST (ADRENAL WASHOUT)

Indication: Known Adrenal lesion
Scan phase 1: Non-contrast lung bases to iliac crests at low dose (mAs) setting
Scan phase 2: 70 second delay post contrast from lung bases to iliac crests
Scan phase 3: 15 minute delayed post contrast of adrenals
W/L: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: none

ABDOMEN/PELVIS WITH & WITHOUT IV CONTRAST (SPLIT BOLUS)

Indication: Hematuria, Renal mass
(Results in nephrographic and urographic phases in one scan).
Scan Range: Lung bases through pubis, except exclude pelvis if ordered as CT abdomen only
Scan phase 1: Non-contrast lung bases through pubis at low dose (mAs) setting
Injection: ½ of bolus injected and wait 3 minutes
Scan phase 2: Following injection of second ½ of bolus, 70 second delay scan from lung bases through pubis symphysis
Scan phase 3: 5 minute delay through pelvis for bladder contrast (iliac crests to pubic symphysis)
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR: Sagittal and coronal of phase 2 at 3mm x 3mm

CT UROGRAM

Indication: Hematuria, Renal mass
Contrast: 75 ml 370mg% plus oral hydration with water
Scan phase 1: Without contrast from lung bases through pubis symphysis at low dose (mAs) setting
Scan phase 2: 3 minute delay lung bases through pubis symphysis
Scan phase 3: 15 min delay top of kidneys through entire bladder
W/L: Soft tissue
Thickness: 3mm
Interval: 3mm
MPR:
Sagittal and coronal of phase 2 at 3 mm x 3 mm
Sagittal and coronal of phase 3 at 10 mm x 10 mm

CT CYSTOGRAM - (bladder contrast only, no IV or oral)

Indication: Bladder mass, Hematuria, other
Contrast: Conray 5 parts water one part contrast OR
Isovue 20-30ml mixed in 500ml saline bag
Scan phase 1: CT Pelvis 3mm x 3mm without contrast
Scan phase 2: Fill bladder with contrast through Foley catheter and scan again
Scan phase 3: Open catheter and drain. Rescan pelvis
W/L: Soft tissue
Thickness: 3mm
Interval: 3mm
MPR: Sagittal and Coronal of phase 2 at 3mm x 3mm

CT COLONOGRAPHY

Prep 1 (when following failed colonoscopy) - Air insufflation per rectum - as much as patient can tolerate
Prep 2 (24 hour) – On day before exam:
11AM – Bisacodyl (Ducolax) 5mg tablets x2 with 8oz clear liquid
2PM – Mag citrate 10oz bottle with 4-6 cups clear liquid
5PM – Barium sulfate 250ml and 2nd bottle Mag citrate 10oz
7PM – Gastrografin 60ml mixed in 8oz clear liquid

Scan 1 – Supine position - Lung bases through pubis symphysis
Scan 2 – Prone position - Lung bases through pubis symphysis
Contrast: No intravenous contrast
W/L:
Thickness: 1 mm

Interval: 1 mm
MPR: Coronal 2 mm

CT SMALL BOWEL ENTEROGRAPHY

Prep: NPO 6-8 hours prior. Volumen oral contrast - 3 full bottles (prep time of approx 30-60 min), then drink two cups of water just prior to scan.
Scan Range: Lung bases through pubis symphysis
Contrast: 75cc 370mg%
W/L:
Thickness: 2 mm
Interval: 2 mm
MPR: Coronal 2 mm x 2 mm

CTA GI BLEED

Scan Range: Lung bases through pubis
Contrast: 75 ml 370mg% , Injection rate: 4-4.5cc/sec
Scan phase 1: Without oral or IV contrast at low dose (mAs) setting
Scan phase 2: Without oral contrast, With IV contrast timed to distal aorta and add 25 seconds
Scan phase 3: Delayed – add approximately 80 seconds
W/L: Soft tissue
Thickness: 3 mm
Interval: 3 mm
MPR - Coronal 5 mm x 5 mm all three phases

CTA ABDOMINAL AORTA

Indication: AAA, Renal or Mesenteric arteries
Scan Range: Lung bases through midpelvis
Contrast: 75 ml 370 mg% Inject 3.5-4.5cc/sec timed to aorta at the renal arteries
Note: In setting of suspected ruptured AAA add Non-contrast sequence
W/L: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR - Sagittal and Coronal of post-contrast phase 2 mm x 2 mm

CTA ABDOMINAL AORTA - POST STENT GRAFT

Indication: Followup for aortic stent graft (if requested as such with delays)
Contrast: 75 ml 370 mg% Inject 3.5-4.5 cc/sec timed to aorta at the renal arteries
W/L: Soft tissue
Scan phase 1: Without IV contrast - Lung bases through pubis at low dose (mAs)
Thickness: 3 mm
Interval: 3 mm
Scan phase 2: Dynamic contrast enhanced- Kidneys through pubis
Thickness: 1 mm
Interval: 1 mm
MPR: 2 mm x 2 mm
Scan phase 3: 5 min delay post IV contrast - Kidneys through pubis
Thickness: 3 mm
Interval: 3 mm

CTA ABDOMINAL AORTA WITH BILATERAL RUN-OFF

Scan Range: depending upon request, may include arch through feet or just above renals through feet
Contrast: 75 ml 370 mg% Injection rate: 4-4.5 cc/sec timed to distal aorta
W/L - Soft tissue
Thickness: 1 mm
Interval: 0.8 mm
MPR: Coronal and Sagittal 3 mm x 3 mm

CTA DIEP (DEEP INFERIOR EPIGASTRIC PERFORATORS) aka ADOMINAL WALL

Indication: Pre-operative planning for breast reconstruction surgery
Note: Avoid constrictive clothing on abdomen and pelvis
Scan Range: Lung bases through pubis
Contrast: 75 ml 370 mg% Inject 3.5-4.5cc/sec timed to aorta at the lower aorta
W/L: Soft tissue
Thickness: 1 mm
Interval: 0.75 mm
MPR- Coronal 50 mm x 50 mm
Axial 10 mm x 10 mm

Spine

CERVICAL SPINE

Scan Range: External auditory meatus through T2
W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal in bone window 2 mm

THORACIC SPINE

Scan Range: Above T1 through the body of L1
W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal in bone window 2 mm

LUMBAR SPINE

Scan Range: Body of T11 through S1
W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Sagittal and coronal in bone window 2 mm

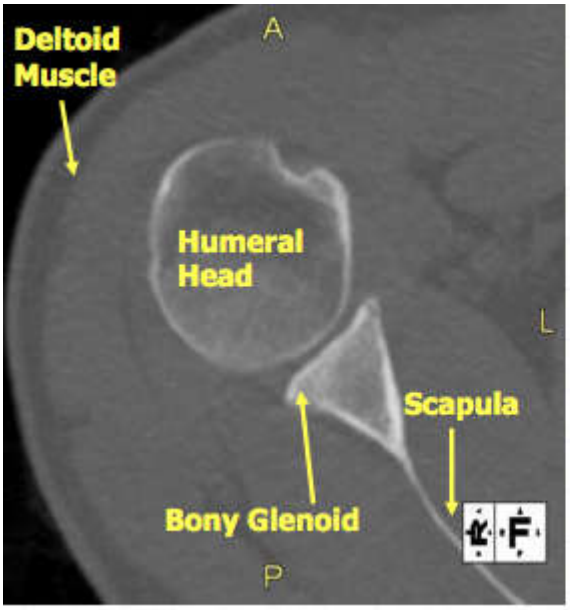
Extremities (without contrast)

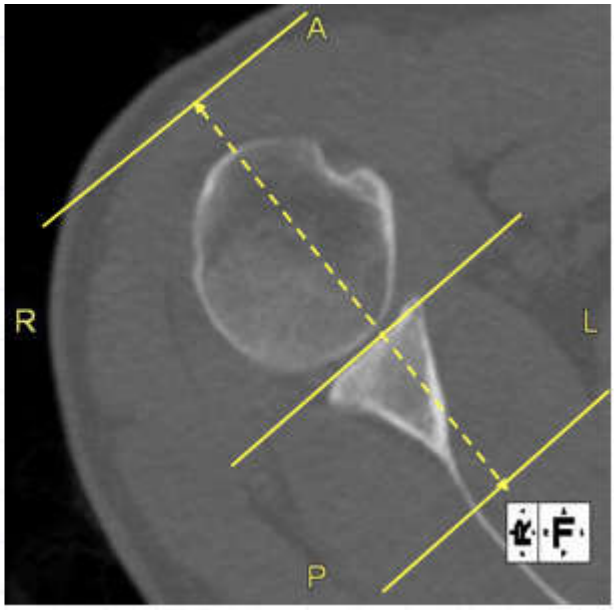
SHOULDER

Positioning: Position patient with unaffected arm above head and affected arm down by side with the palm up. Off center patient on table, so that affected shoulder is centered (do not let unaffected side touch gantry).

Range: Spiral scan to cover acromiocavicular joint through proximal humeral shaft.

W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft tissue
Thickness: 1 mm
Interval: 1 mm
MPR: in bone windows -
Sagittal - Prescribe sagittal plane from axial images with line parallel to bony glenoid





Coronal - Prescribe coronal plane perpendicular to sagittal plane.

ELBOW

Positioning: Position patient prone with affect arm extended out in front. Hand supinated. Elbow joint as straight as possible. If patient cannot tolerate this position - have them supine off center, arm by their side, hand supinated with the elbow as centered as possible.

Range: Spiral scan from distal humeral shaft (just above humeral condyles) through radial tuberosity. FOV to be coned in as small as possible.

W/L 1: Bone

Thickness: 1 mm

Interval: 1 mm

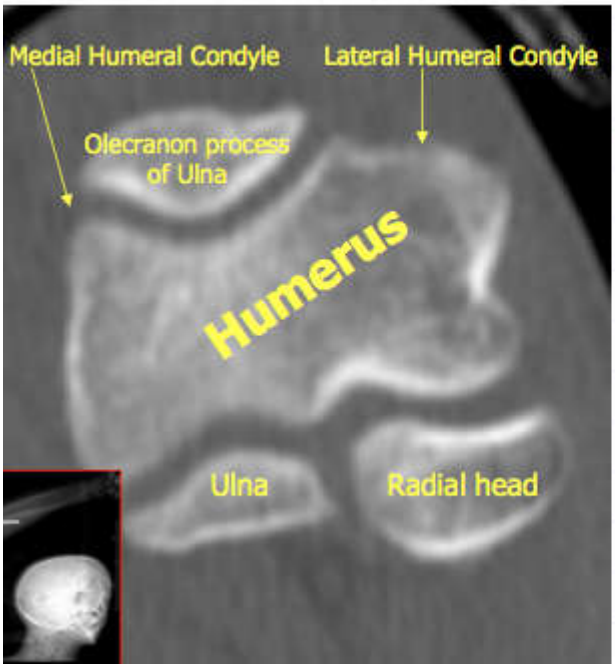
W/L 2: Soft tissue

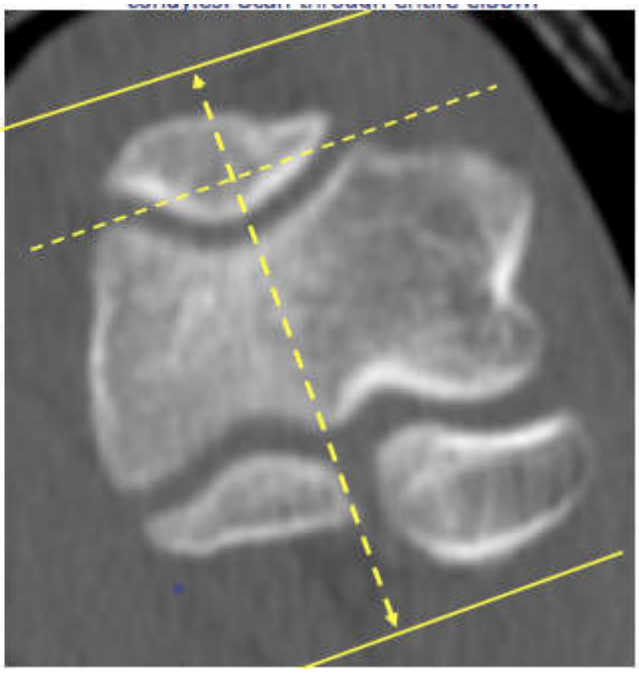
Thickness: 1 mm

Interval: 1 mm

MPR: in bone window

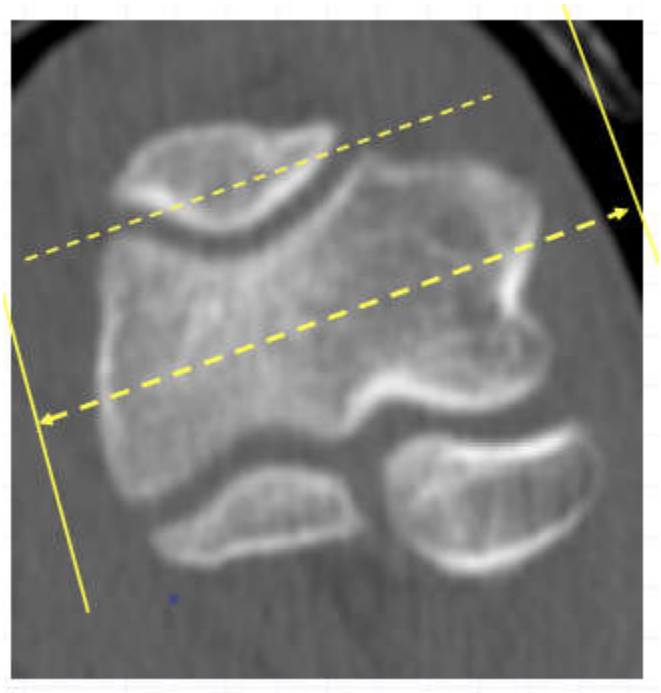
Coronal - Prescribed plane parallel to humerus at condyles





ELBOW continued:

Sagittal - Prescribe plane perpendicular to coronal plane



WRIST

Positioning: Patient prone with affected arm extended out in front. Hand pronated. Wrist as straight as possible.

*** If for SCAPHOID FRACTURE - Patient prone with affected arm extended out in front. Hand pronated, wrist in MAXIMUM ULNAR DEVIATION.

Range: Scan from distal radioulnar joint (DRUJ) through mid metacarpals. FOV to be coned in as small as possible.

<u>64 MDCT Scanner (ACH)</u>

W/L 1: Bone

Thickness: 0.5 mm

Interval: 0.2 mm

W/L 2: Soft tissue

Thickness: 1 mm

Interval: 1 mm

MPR: Coronal and sagittal in bone

WRIST continued:

16 MDCT Scanner

W/L 1: Bone
Thickness: 0.8 mm
Interval: 0.4 mm

W/L 2: Soft tissue
Thickness: 1 mm
Interval 1 mm

MPR: Coronal and sagittal in bone

HAND

Positioning: Patient prone with affected arm extended out in front. Hand pronated. Hand/wrist as straight as possible.

Range: Larger FOV than for CT wrist - scan from distal radioulnar joint (DRUJ) through the thumb and fingers

64 MDCT Scanner (ACH)

W/L 1: Bone
Thickness: 0.5 mm
Interval: 0.2 mm

W/L 2: Soft tissue
Thickness: 1 mm
Interval: 1 mm

MPR: Coronal and sagittal in bone

16 MDCT Scanner

W/L 1: Bone
Thickness: 0.8 mm
Interval: 0.4 mm

W/L 2: Soft tissue
Thickness: 1 mm
Interval 1 mm

MPR: Coronal and sagittal in bone

PELVIS

Range: Iliac crests through the lesser trochanters.
W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft Tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Coronal and sagittal in bone

HIP

Range: Acetabular roof through the lesser trochanter of affected hip
W/L 1: Bone
Thickness: 1 mm
Interval: 1 mm
W/L 2: Soft Tissue
Thickness: 1 mm
Interval: 1 mm
MPR: Coronal and sagittal in bone

KNEE

Positioning:
1. Patient supine with feet first into the scanner
2. Keep knees extended side-by-side
3. Tape feet together with toes pointing up to help keep knees from moving
4. Slide patient so that the knee being scanned is in the center of the table

KNEE CONTINUED:

Range: Spiral scan from suprapatellar region through the tibial tuberosity of proximal tibia

W/L 1: Bone

Thickness: 1 mm

Interval: 1 mm

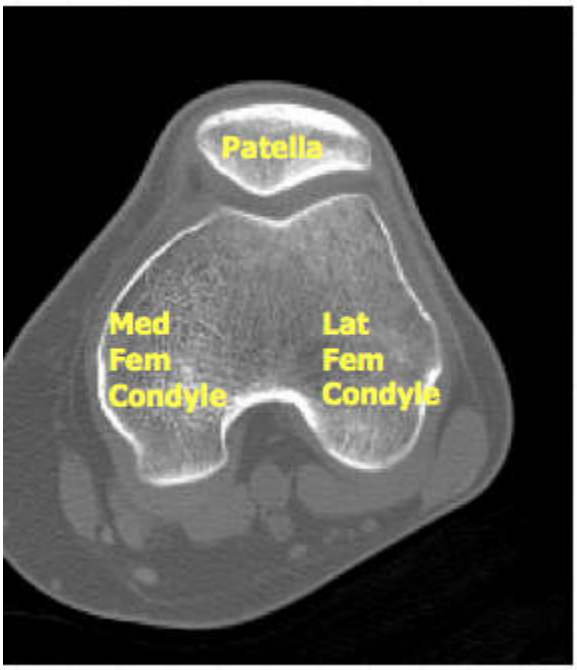
W/L 2: Soft tissue

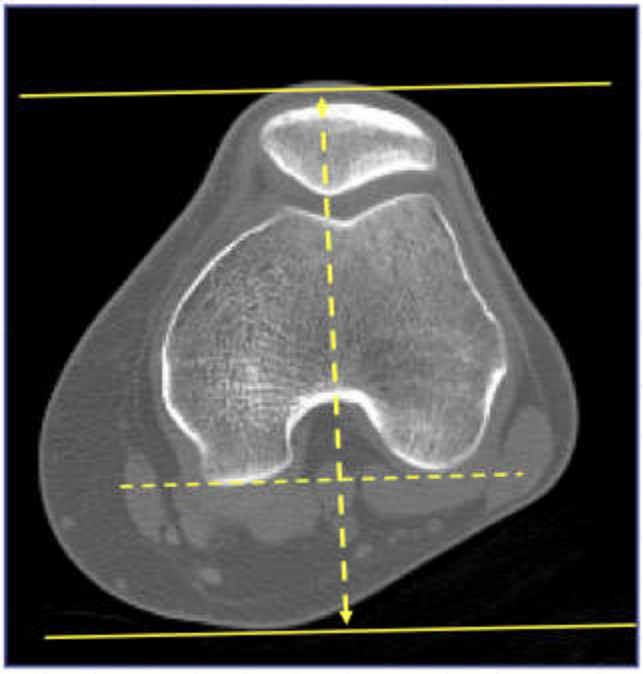
Thickness: 1 mm

Interval: 1 mm

MPR: in bone windows

Coronal - prescribe plane with line parallel to the femoral condyles





Sagittal - prescribe plane perpendicular to coronal plane

ANKLE

Positioning:

1. Supine feet first - foot of interest centered. Use foot holder if available
2. Toes pointing straight up

Range: Spiral scan from the distal tibia to beyond the inferior calcaneus. FOV to include tarsal bones and bases of the metatarsals.

<u>64 MDCT Scanner (ACH)</u>

W/L 1: Bone

Thickness: 0.5 mm

Interval: 0.2 mm

W/L 2: Soft tissue (axial only)

Thickness: 1 mm

Interval: 1 mm

MPR: As below

<u>16 MDCT Scanner</u>

W/L 1: Bone

Thickness: 0.8 mm

Interval: 0.4 mm

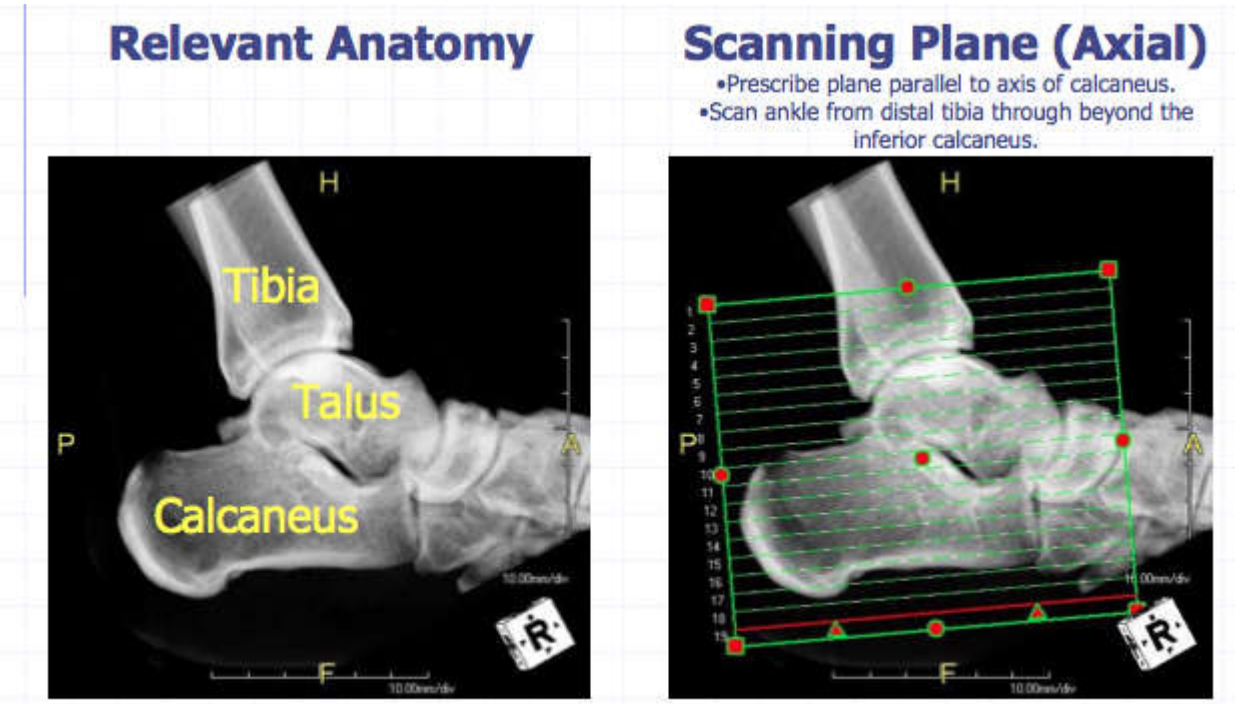
W/L 2: Soft tissue (axial only)

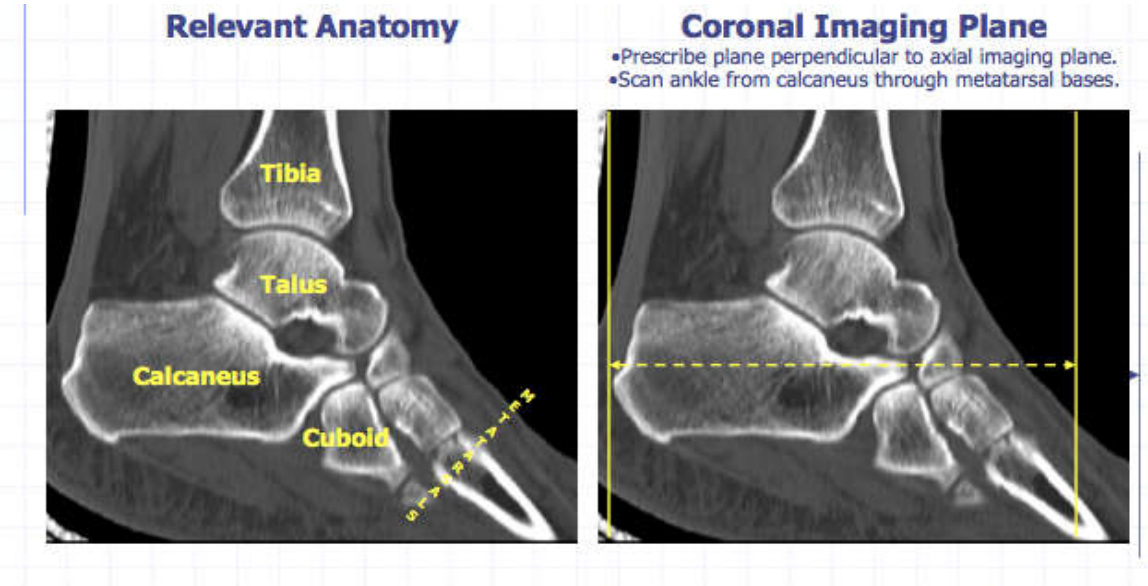
Thickness: 1 mm

Interval 1 mm

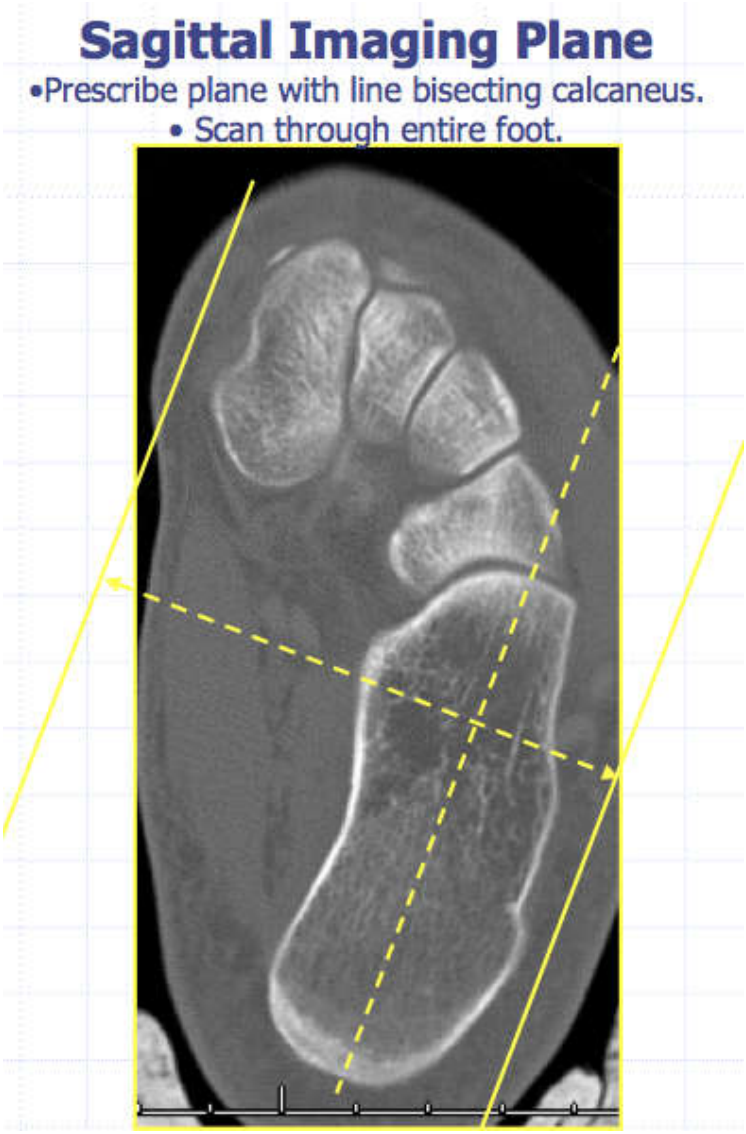
ANKLE continued:

MPR:





ANKLE continued:



FOOT

Positioning:

1. Patient supine feet first into scanner - foot of interest centered. Use foot holder if available
2. Toes pointing straight up

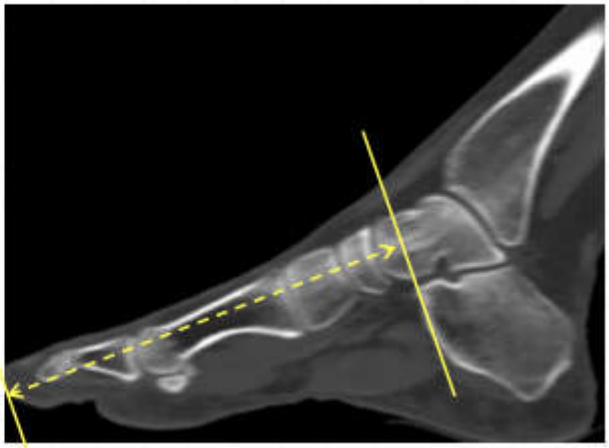
Range and Planes of Imaging:

FOOT continued

Relevant Anatomy

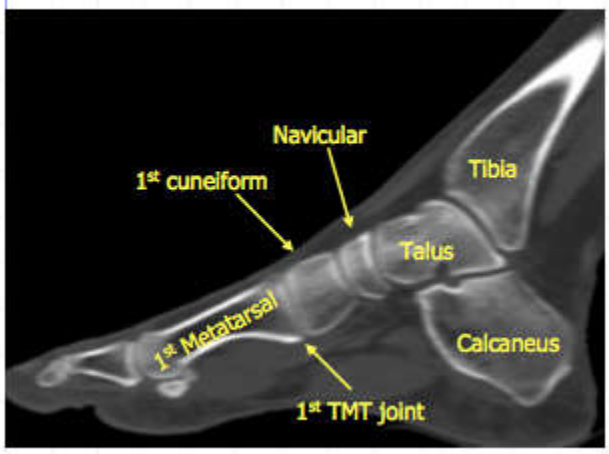
Scanning Plane (Coronal)

- Prescribe plane parallel to 1st Metatarsal.
- Scan through entire mid/forefoot.



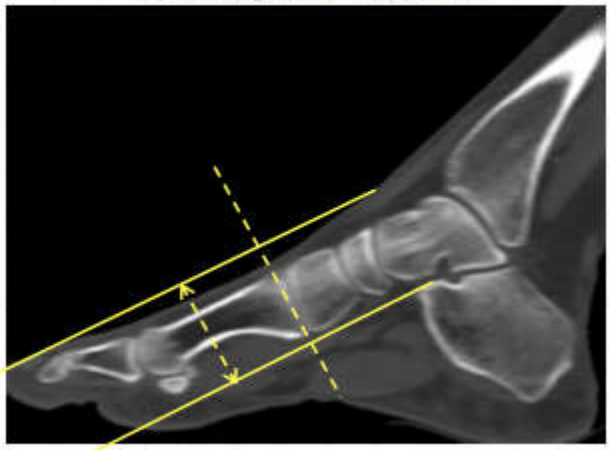
Relevant Anatomy

Lisfranc joint = tarsometatarsal (TMT) articulations, particularly in area between 1st and 2nd TMTs

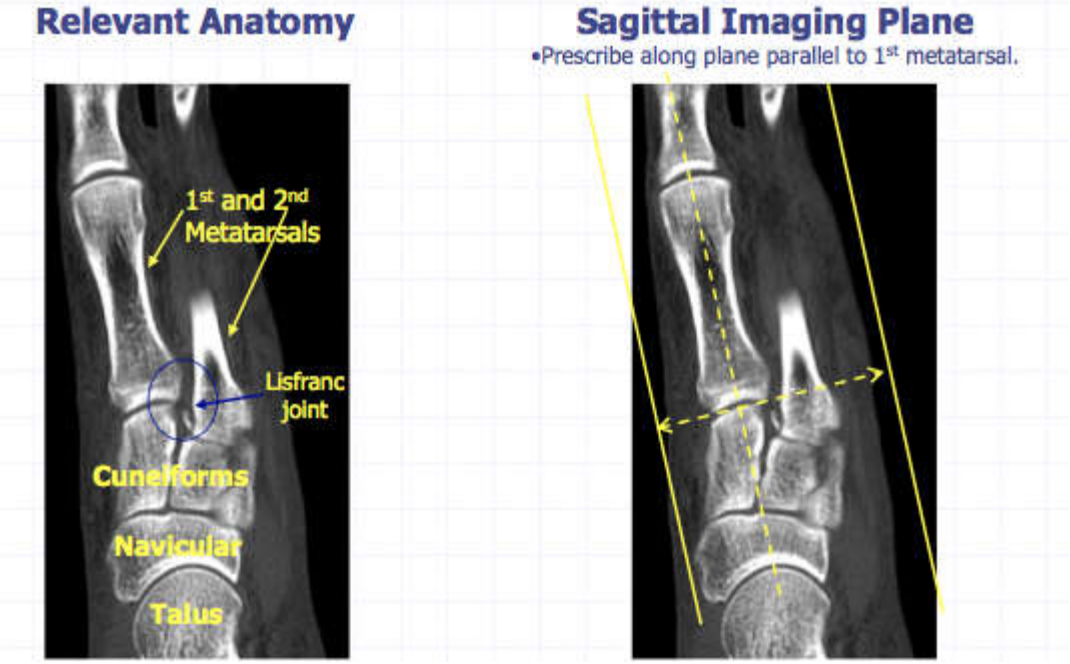


Axial Imaging Plane

- Prescribe plane perpendicular to coronal plane.
- This will be parallel to 1st TMT joint
- Scan through entire mid/forefoot.



FOOT continued



64 MDCT Scanner (ACH)

W/L 1: Bone

Thickness: 0.5 mm

Interval: 0.2 mm

W/L 2: Soft tissue [axial only (long axis)]

Thickness: 1 mm

Interval: 1 mm

MPR: As illustrated above

16 MDCT Scanner

W/L 1: Bone

Thickness: 0.8 mm

Interval: 0.4 mm

W/L 2: Soft tissue [axial only (long axis)]

Thickness: 1 mm

Interval: 1 mm

MPR: As illustrated above

STERNUM

Positioning and range: Patient supine with arms at their sides (if possible given the patient's size). FOV to be coned in on the sternum, including both sternoclavicular joints. Scan from sternoclavicular joints through xiphoid process.

W/L 1: Bone

Thickness: 1 mm

Interval: 1 mm

W/L 2: Soft tissue

Thickness 1 mm

Interval 1 mm

MPR: Coronal and sagittal

STERNOCLAVICULAR JOINTS

Positioning and range: Patient supine with arms down at their sides (if possible given the patient's size). FOV coned in on both sternoclavicular joints. Scan through sternoclavicular and sternomanubrial joints.

W/L 1: Bone

Thickness: 1 mm

Interval: 1 mm

W/L 2: Soft tissue

Thickness 1 mm

Interval 1 mm

MPR: Coronal and sagittal

Extremities (with contrast)

AREA OF CLINICAL INTEREST AS SPECIFIED

Indication - infection, abscess or mass

Scan range: extend through clinical region of interest or as detailed for non-contrast as noted above. Scan at 70 sec delay after contrast

Contrast: 75 ml 370mg%

W/L: Soft tissue

Thickness 3mm

Interval: 3mm

MPR: Sagittal and coronal 3mm x 3mm

UPDATES:

Version 2013 Revisions – June 2013

1. IV contrast changed from 350mg% to 370mg%
2. Added Isovue as oral contrast option
3. Head CT – exclude orbits as much as possible from field of view
4. Deleted Sinus Screening CT protocol
5. Chest CT followup nodules performed with routine Chest CT rather than low dose
6. Chest ENB protocol added (as of 2/2012)
7. Multiphase Abdomen CT – initial non-constrast phase can be performed at low dose setting (decrease mAs)
8. New Abdomen/Pelvis without and with contrast split bolus technique
9. Deleted Abdomen/Pelvis without and with contrast for workup of known renal mass

Version 2013b Revisions – September 2013

1. Added MPR for high resolution chest CT
2. Sinus CT – removed term "Full"
3. Added Pancreas CT
4. CT enterography – Add NPO 6-8 hrs. prior
5. Changed CT Colonography prep options and added prone scan
6. Adjusted outpatient Redicat oral barium instructions due to change in bottle size from supplier

Version 2014 – January 2014

1. Changed Head CT to 3mm x 3mm with Cor and Sag recons
2. Detailed Head CT angle more clearly to avoid orbits
3. CT Chest studies performed – through top of kidneys
4. Oral Isovue can be mixed with 15 or 20 ml contrast since bottles come in 30 ml
5. IV contrast injected at 2-4 ml/sec unless stated otherwise

Version 2014b – 10/2014

1. Added CT Venogram Head
2. Added CT Abdomen/Pelvis – Triphasic

Version 2015 – January 2015

1. Added recons to CT sinuses
2. Added optional 5 min delay pelvis sequence to split bolus Abd/Pelv CT
3. Correction made Feb 2015 – Update CT Lung Screening protocol
4. Add Extremities with contrast

Version 2015b – May 2015

1. Maxillofacial CT without contrast changed from 0.5 mm x 0.5 mm to 1 mm x 1 mm.
2. Maxillofacial CT exams add Sagittal recons. Recons are done at 2 mm x 2 mm.
3. Added CT Cystogram

Version 2015c – August 2015

1. Add CT Neck – Parathyroid
2. CT GI Bleed – add delayed phase
3. Isovue oral contrast for CT – change to 15-**30** ml since contrast most often comes in 30 ml bottle

Version 2015d – December 2015

1. Chest High Resolution – add expiration phase at 20 mm intervals

Version 2016a – April 2016

1. CT Chest screening – send 10x10 axial sequence in lung windows

Version 2016b – August 2016

1. Add - CTA Chest attention aorta – performed without and with contrast
2. Add – CT Esophagography for perforation

Version 2017a - February 2017

1. Add – Low dose chest CT (non-screening) for nodule follow up
2. CT Chest screening –add suggested exclusion criteria for screening chest CT

Version 2017b – June 2017

1. Add statement on Metformin
2. Add statement on Recommended premedication for contrast allergy

Version 2017c – Sept 2017

1. Change names of low dose chest CT exams for consistency

Version 2018 – Feb 2018

1. Add CTA DIEP

Version 2018b – May 2018

1. Correction – emergency premedication prep is 200mg SoluCortef
2. Changed CT sinus surgery protocol to make two protocols (Medtronic and BrainLab)
3. Change CTA chest to be performed with small amount of inspiration and breathhold

Version 2018c – Aug 2018

1. Can use Isovue for CT cystogram

Version 2019

1. Add Abd/Pelv noncontrast Low Dose

Version 2019b:

1. Change CT Abd/Pelv split bolus to required phase 3 5min delay through pelvis

Version 2019c:

1. Add non-contrast phase CTA Abdominal Aorta in setting of suspected aortic rupture

Version 2020:

1. Add HRCT Chest for Endobronchial valve placement for emphysema

Version 2020b:

1. Spine CT soft tissue changed to 1mm x 1mm
2. CT Urogram – include phase 2 recon at 3 mm x 3 mm
3. Add Post-bariatric surgery (within days to evaluate for leak) oral contrast administration

Version 2020c:

Added Statement on IV contrast