# BODY CT PROTOCOLS

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# MESENTERIC ISCHEMIA-2 phases

**Oral Prep:** Water

**Scanning:**
Injection rate: 4cc/sec
1. CTA abdomen (through aortic bifurcation) arterial phase (~25 seconds)
2. Abdomen & pelvis PV phase (~60-70 seconds)

**Post processing/reformatting/sending:**
Send to PACS:
- 1.25mm axial recons-both phases
- 5mm axial recons-both phases
- 3mm coronal and sag recons-both phases

**3D Reformats:**
- 3D rotation of aorta and kidneys
- 3D rotation of aorta and kidneys with transparent bone
- 2mm MIP sag through celiac and SMA origins
- 2mm MIP sag through IMA origin
- 2mm MIP cor through renal origins

**RENA**L-3 phases. Done to evaluate or follow up renal masses, RFA

**Oral Prep:** None

**Scanning:**
Injection rate: 4cc/sec
1. I- through kidneys only
2. I+ nephrographic phase~90 seconds after injection starts, through kidneys only
3. Delay “excretory” phase, delay of ~5 minutes through kidneys only

**Post processing/reformatting/sending:**
Send to PACS:
1. 1.25mm axial recons-all phases
2. 5mm axial recons-all phases
3. 3mm coronal and sag recons-all phases

**CT UROGRAM 3 PHASE PROTOCOL** done for hematuria

**Oral Prep:** One liter water PO within one hour of scanning

**Scanning:**
1. Unenhanced:
   a. Low dose, above kidney to below bladder
2. Nephrogram phase:
   a. abdomen pelvis (most sensitive for detection of urothelial tumors and bladder masses)
   b. 110ccs at 4cc/sec, scan abdomen pelvis at 100 sec
3. Excretory phase: abdomen pelvis
   a. 10mg IV Lasix 3-5min prior to excretory phase
i. avoid if allergic to sulfa or Lasix

ii. avoid if sBP < 90mm Hg

iii. instead give 250cc NS bolus after nephrographic phase

b. 10-15 min post IV contrast (UCSF usually 12 min)

c. Low dose technique, abdomen and pelvis from above kidneys through bladder

Post processing/reformatting/sending:
Send to PACS: reconstruct at 1.25mm @0.625 intervals
   1.25mm axial recons-all phases
   5mm axial recons-all phases
   3mm coronal and sag recons-all phases
3D reformats (for delays only)
   3D rotation of kidneys, ureters and bladder
   3D rotation of kidneys, ureters and bladder with transparent bone

CT UROGRAM 2 PHASE / split bolus protocol

Hematuria in very low risk patients, < 45 years old

Oral Prep: One liter water PO within one hour of scanning

Scanning:
1. Unenhanced:
   a. Low dose, above kidney to below bladder

2. Nephrographic/delay phase combo:
   a. Inject 10mg IV Lasix and 50 cc contrast, wait 6 min
   b. Inject 100ccs at 4cc/sec
   c. scan abdomen pelvis at 100 sec

Post processing/reformatting/sending:
Send to PACS: reconstruct at 1.25mm @0.625 intervals
   1.25mm axial recons-all phases
   5mm axial recons-all phases
   3mm coronal and sag recons-all phases
3D reformats (post contrast image set)
   3D rotation of kidneys, ureters and bladder
   3D rotation of kidneys, ureters and bladder with transparent bone
**LIVER-2 phases.** Done for evaluation or follow up liver masses, HCC, Cirrhosis

**Oral Prep:** None

**Scanning:**
Injection rate: 4-5cc/sec
1. I+  Late arterial phase-25 sec after start injection
2. I+  PV phase-60-70 sec after start injection

**Post processing/reformatting/sending:**
Send to PACS: (for each phase)
  1. 25mm axial recons
  5mm axial recons
  3mm coronal and sag recons

**LIVER-3 phases.** Done to evaluate for hemangioma

**Oral Prep:** None

**Scanning:**
Injection rate: 4-5cc/sec
1. I+  Late arterial phase – liver only - 25 sec after start injection
2. I+  PV phase – entire abdomen - 60-70 sec after start injection
3. I+  Delay- liver only ~5 minutes after start injection

**Post processing/reformatting/sending:**
Send to PACS: (for each phase)
  1.25mm axial recons
  5mm axial recons
  3mm coronal and sag recons

**LIVER-Post RFA/fatty liver.** Done for “fatty liver protocol” for GI, post RFA

**Oral Prep:** None

**Scanning:**
Injection rate: 4-5cc/sec
1. I-  Liver only
2. I+  Late arterial phase – liver only - 25 sec after start injection
3. I+  PV phase – entire abdomen - 60-70 sec after start injection

**Post processing/reformatting/sending:**
Send to PACS: (for each phase)
  1.25mm axial recons
  5mm axial recons
3mm coronal and sag recons

**PANCREAS**-2 phases. Done to evaluate for mass, pancreatitis (*for s/p Whipple patients, only need to do a regular A/P I+ CT*)

**Oral Prep:** Water: 500-700ml within 30 minutes of the scan

**Scanning:** Injection rate: 4-5cc/sec
1. I+ Pancreatic phase ~35 sec after injection starts, through pancreas only *as thin as possible*
2. I+ PV phase-60-70 sec after start injection. Entire abdomen

**Post processing/reformatting/sending:** Send to PACS: (for each phase)
- 1.25mm axial recons
- 2.5mm axial recons
- 3mm coronal and sag recons

3D reformats available on request:
- Curved reformats of pancreatic duct on late arterial phase

**ADRENAL**-3 phases. To characterize an adrenal lesion; Not always needed for follow up. Once a lesion has been characterized, if f/u is for growth only, you don’t need a 3 phase scan

**Oral Prep:** None

**Scanning:** Injection rate: 4cc/sec
1. I- Through adrenals only
2. I+ Entire abdomen in portal venous (PV) phase
3. Delay 15 minutes through adrenals only

**Post processing/reformatting/sending:** Send to PACS: (for each phase)
- 1.25mm axial recons
- 5mm axial recons
- 3mm coronal and sag recons

**CHEST/ABDOMEN/PELVIS I+**

**Oral Prep:** Select
Scanning:
I+ PV phase~60-70 seconds after injection starts

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons in standard algorithm
  5mm axial recons in standard and lung algorithm
  3mm coronal recons

ABDOMEN/PELVIS I+

Oral prep: Select from list

Scanning:
I+ PV phase~60-70 seconds after injection starts

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons
  5mm axial recons
  3mm coronal and sag recons

ENTEROGRAPHY - in lieu of small bowel follow through – typically GI referral to evaluate small bowel pathology/ Crohns disease

Oral Prep:
1. Volumen 450ml 60 min before scan
2. Volumen 450ml 40 min “
3. Volumen 450 ml 20 min “

Scanning:
1. PV phase-60-70 sec after start injection

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons
  2.5mm axial recons
  3mm coronal and sag recons
  3D reformats
  3D volume rendered images may be coming in the future

RENAL STONE

Oral Prep: None
Scanning:
I- Kidneys through bladder

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons
  5mm axial recons
  3mm coronal and sag recons

CT CYSTOGRAM


IF REQUESTED DURING TRAUMA SCAN:
1. Following the standard CAP CT scan, either:
   Clamp Foley x 10 min
   Retrogradely fill bladder with dilute contrast up to 350cc or patient tolerance.
2. Scan pelvis. Authors do not routinely scan post void.

IF REQUESTED AS UNIQUE STUDY:
Scanning:
1. Unenhanced: CT pelvis, review 2.5mm or thinner, reconstruct at 1.25mm @0.625 intervals
2. Retrograde bladder filling:
   a. Dilute contrast up to 350cc or patient discomfort (gravity drip preferred)
   b. CT pelvis
3. Post void CT pelvis

Post processing/reformatting/sending:
Send to PACS: reconstruct at 1.25mm @0.625 intervals
  1.25mm axial recons-all phases
  5mm axial recons-all phases
  3mm coronal and sag recons-all phases
CTA abdominal aorta +/- pelvis
-abdominal aorta for renals, mesenteric vessels
-Abdominal aorta and pelvis for AAA work-up or follow-up repair

Scanning:
Injection rate: 4cc/sec
I+ Smart prep timed
Delay (Done for s/p endograft repair of AAA, r/o endoleak)

Post processing/reformatting/sending:
Send source images to vitrea 4 & AWW
Send to PACS:
  1.25mm axial recons
  2.5 mm axial recons standard algorithm
  3 mm coronal recons
  3 mm sagittal recons

3D Reformats:
- 3D rotation of aorta and kidneys
- 3D rotation of aorta and kidneys with transparent bone
- curved reformats 0* and 90 * of aorta with right and left iliacs
- centerline 0* and 90* of aorta with right and left iliacs

CTA abdomen, pelvis and lower extremities

Scanning:
Injection rate: 5cc/sec
I+ Timed with ROI on aortic bifurcation AND popliteal artery

Post processing/reformatting/sending:
Send source images to vitrea 4 & AWW
Send to PACS:
  1.25mm axial recons of entire study
  5 mm axial recons of entire study
  2 mm coronal recons in 3 separate series with overlap
    1. Abdomen & pelvis
    2. Thigh
    3. Lower leg
  2 mm sagittal recons in 3 separate series with overlap
    1. Abdomen & pelvis
    2. Thigh
3. Lower leg

3D reconstructions
- 3D rotation of aorta through anterior and posterior tibial arteries (3 separate stations)
- 3D rotation of aorta through anterior and posterior tibial arteries with transparent bone (3 separate stations)
- Curved reformat 0 and 90 deg R/L aortoiliacs including CFAs
- Centerline view of aorta

**CTA upper extremity**

**Scanning:**
Injection rate: 5cc/sec
I+ Timed with ROI on aortic arch

**Post processing/reformatting/sending:**
Send source images to vitrea 1 & AWW
Send to PACS:
1. 2.5mm axial recons of entire study
2. 5 mm axial recons of entire study
2 mm coronal recons in 2 separate series with overlap
  *(Coronal with respect to axis of body)*
  1. Arch and upper arm
  2. Elbow, forearm, hand
2 mm sagittal recons in 2 separate series with overlap
  *(Sagittal with respect to long axis of arm)*
  1. Arch and upper arm
  2. Elbow, forearm, hand

3D reconstructions
- 3D rotation of aortic arch and arm
- 3D rotation of aortic arch with transparent bone
- Curved reformat 0 and 90 deg R/L subclavian and axillary arteries

**CTA Renal Donor** - 3 phases.

**Oral Prep:** None

**Scanning:**
Injection rate: 4cc/sec
1. I+ CTA abdomen and pelvis
2. Delay “excretory” phase, delay of ~5 minutes, kidneys-through bladder

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons-all phases
  5mm axial recons-all phases
  3mm coronal and sag recons-all phases

3D Reformats:
  - 2mm MIP coronal oblique through renal artery origins
  - 3D rotation of aorta and kidneys (arterial images)
  - 3D rotation of aorta and kidneys with transparent bone
  - 3D rotation of kidneys, ureters and bladder (delay images)
  - 3D rotation of kidneys, ureters and bladder with transparent bone (delay)
  - Thick section MIP of collecting systems

CTV abdomen/pelvis veins — Done for? Pelvic or IVC clot

Scanning:
Injection rate: 4cc/sec
I+ Fixed scan delay of 180 seconds

Post processing/reformatting/sending:
Send to PACS:
  1.25mm axial recons
  5 mm axial recons standard algorithm
  3 mm coronal recons
  3 mm coronal recons
CHEST CT PROTOCOLS

CHEST I- Done for grading aortic calcifications, evaluating esoph leak
*Scan at end inspiration after hyperventilation

Post processing/reformatting/sending:
Send to PACS:
  3.75 mm axial in standard algorithm
  3.75 mm axial recons in lung algorithm
  1.25 mm axial recons in standard algorithm
  3mm coronal recons in standard algorithm

CHEST I- Limited/low dose done for eval or follow up pulmonary nodule, r/o bronchiectasis, r/o emphysema, r/o pneumonia

*Scan at end inspiration after hyperventilation
Low dose ~75-100mA
Z-axis coverage may be limited per discretion of protocoling radiologist
  *write this in the comments/special instructions*

Post processing/reformatting/sending:
Send to PACS:
  3.75 mm axial in standard algorithm
  3.75 mm axial recons in lung algorithm
  1.25 mm axial recons in standard algorithm
  3mm coronal recons in standard algorithm

CHEST I+
Scanning:
*Scan at end inspiration after hyperventilation
I+ ~25 seconds after injection starts (smart prep in descending aorta)

Post processing/reformatting/sending:
Send to PACS:
  3.75 mm axial in standard algorithm
  3.75 mm axial recons in lung algorithm
  1.25 mm axial recons in standard algorithm
  3mm coronal recons in standard algorithm
High Resolution Chest CT (HRCT)  Done for initial evaluation of interstitial lung disease per pulmonologist request.  3 scans: supine inspiratory and expiratory and prone inspiratory.

IF it’s an f/u scan, can skip exp and prone. *write this in the comments/special instructions section*

Scanning:
1. **Supine:** Helical mode. Entire chest. End inspiration after hyperventilation
   *****Techs to page Chest resident, Dr Black (2455) or Dr Czum (2218) to check images before proceeding*****
2. **Supine:** Axial mode. End expiration after hyperventilation.
   1.25mm thick @ 10mm intervals.
3. **Prone:** Axial mode. End inspiration after hyperventilation
   1.25mm thick @ 10mm intervals.

Post processing/reformatting/sending:
Send to PACS:
1. (Entire chest)
   3.75 mm axial recons in lung algorithm
   3.75 mm axial in standard algorithm
   1.25 mm axial recons in standard algorithm
   1.25 mm q 10mm in lung algorithm
   3mm coronal recons in standard algorithm

2. & 3. (HRCT images) just the intermittent 1.25 mm sections in lung algorithm

CTA pulmonary angiogram/ PE

Scanning:
FOV-entire Lungs (don’t have to go down to adrenals)

***IF doing CTA in combo with A/P CT, please do entire chest including lung bases during the pulmonary arterial phase. You will then have to go back and overlap some to get entire liver dome on PV phase***

Injection rate: 5cc/sec

I+ MIROI (test dose given, time to peak calculated in pulm arteries)

* Have patient hyperventilate during initial injection and during monitoring, then breath hold at end inspiration for the scan.

Post processing/reformatting/sending:
Send to PACS:
2.5 mm axial recons standard algorithm
2.5mm axial recons lung algorithm
1.25mm axial recons standard algorithm
3 mm coronal recons

**may need 7-8cc/sec if pregnant**
** If pregnant give 1 cup barium PO to attenuate beam in abdomen

**CTA Cardiac**

**Scanning:**
Injection rate: 5cc/sec

1. I- 2.5mm (25cm FOV) ECG gating axial mode standard algorithm, full chest
2. Timing run
3. I+ 0.625mm ECG gating helical mode default 75% phase standard, through heart (*Extend Z-axis coverage for post CABG to full chest)

**Post processing/reformatting/sending:**
Send source images to GE ADW
Send to PACS:
   I- Axial recon full FOV lung algorithm
   I+ Axial recon 0.625mm 40-70% @5% increments standard
   I+ Axial recon 1.25mm 0-90% @10% increments standard

3D reconstructions
   - Calcium scoring
   - Angiographic views
   - Ejection fraction (if requested)
   - Full function (if requested)

**CTA thoracic aorta**

**Scanning:**
Injection rate: 4cc/sec
I+ Smart prep timed

**Post processing/reformatting/sending:**
Send source images to vitrea 4 & AWW
Send to PACS:
   1.25mm axial recons
   2.5 mm axial recons standard algorithm
   5 mm axial recons lung algorithm
   3 mm coronal recons
   3 mm sagittal recons

3D reconstructions
   - 3D rotation of aorta and heart
   - 3D rotation of aorta and heart with transparent bone
   - curved reformat 0* and 90* of aorta
- Lumen view 0* and 90* of aorta
- TAA measurements (if requested)
- Curved reformat Ao/iliacs 0 and 90 degrees (when TAAA scanned)
- Lumen view Ao/iliacs 0 and 90 degrees (when TAAA scanned)

**CTA left atrium/pulmonary veins** - pre-ablation for atrial flutter or atrial fibrillation (a.k.a. pulmonary vein isolation or pulmonary vein mapping)

**Scanning:**
Injection rate: 4cc/sec
I+ Smart prep timed, ROI in left atrium

**Post processing/reformatting/sending:**
Send source images to vitrea 4
Send to PACS:
  - 1.25mm axial
  - 2.5 mm axial recons standard algorithm
  - 5 mm axial recons lung algorithm
  - 3 mm coronal recons
  - 3 mm sagittal recons

* Burn DICOM-formatted source data set onto CD [this is for image fusion with the EP lab electrical maps]

3D reconstructions
  - 3D 12 images, 30 degrees each, rotation along z-axis
  - 3D 12 images, 30 degrees each, rotation along left to right axis (tumble)

**CTV thoracic veins** — Done for? SVC syndrome

**Scanning:**
Injection rate: 4cc/sec
I+ Fixed scan delay of 120 seconds

**Post processing/reformatting/sending:**
Send to PACS:
  - 1.25mm axial recons
  - 5 mm axial recons lung algorithm
  - 5 mm axial recons standard algorithm
  - 3 mm coronal recons
APPENDIX

CHEST CT PROTOCOL MODIFICATIONS

The following protocol modifications may be written in the "Comments/Special Instructions" box of the protocoling form.

Please write out complete instructions, not just a "title".

1. PLEURAL EFFUSION WORK-UP to look for underlying lung pathology in the setting of known moderate/large effusion(s) of unknown etiology
   Prone (preferred) or decubitus (if prone not possible)

2. ESOPHAGEAL MASS WORK-UP oral barium contrast administered on table immediately before scan

3. ESOPH POST-OP LEAK oral water-soluble contrast administered on table immediately before scan

4. SOLITARY PULMONARY NODULE 12 cm FOV reconstruction covering known focal pathology (almost always a nodule or mass)
   1.25 mm thick; 1.25 mm interval; lung algorithm Z-axis coverage limited to target lesion of interest:
   be explicit, e.g. LLL mass, include tracheal carina to dome of left hemidiaphragm, or:
   from 1 cm above to 1 cm below LLL mass (see image x of series y)

Residents/fellows/attending: Drs. Black and Czum are available and happy to discuss these and any other potential Chest CT modifications with you.