TRA MEDICAL IMAGING

253-761-4200
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tranow.com

CTA Upper Extremity (Thoracic Outlet Syndrome, Subclavian stenosis, Paget-Schroetter for non-emergent cases)

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In accordance with the ALARA principle, TRA policies and protocols promote the utilization of radiation dose reduction techniques for all CT examinations. For scanner/protocol combinations that allow for the use of automated exposure control and/or iterative reconstruction algorithms while maintaining diagnostic image quality, those techniques can be employed when appropriate. For examinations that require manual or fixed mA/kV settings as a result of individual patient or scanner/protocol specific factors, technologists are empowered and encouraged to adjust mA, kV or other scan parameters based on patient size (including such variables as height, weight, body mass index and/or lateral width) with the goals of reducing radiation dose and maintaining diagnostic image quality.

If any patient at a TRA outpatient facility requires CT re-imaging, obtain radiologist advice prior to proceeding with the exam.

The following document is an updated CT protocol for all of the sites at which TRA is responsible for the administration, quality, and interpretation of CT examinations.

Include for ALL exams

- **Scout**: Send all scouts for all cases
- **Reformats**: Made from *thinnest* **source** acquisition
  - Scroll Display
    - Axial recons - Cranial to caudal
    - Coronal recons - Anterior to posterior
    - Sagittal recons - Right to left
  - Chest reformats should be in separate series from Abdomen/Pelvis reformats, where applicable
- **kVp**
  - 100 @ <140lbs
  - 120 @ >140lbs
- **mAs**
  - Prefer: Quality reference mAs for specific exam, scanner and patient size
  - Auto mAs, as necessary

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CTA Upper Extremity (Thoracic Outlet Syndrome, Subclavian stenosis)

Indication: Thoracic Outlet Syndrome, subclavian stenosis, Paget-Schroetter, venous thrombosis, etc
**This protocol is for nonemergent studies in patients with chronic symptoms, intended for the outpatient setting. For ER/In patient/urgent studies, the routine CTA upper extremity protocol should be implemented.

Patient Position: Supine
Stress acquisition: symptomatic arm above head and externally rotated with palm up, have patient turn head toward extremity being imaged with chin up; opposite arm down at side
Neutral acquisition: symptomatic arm down by side, opposite arm above head

Scan Range (CC z-axis): Aortic arch to half-way between shoulder and elbow of the symptomatic arm for each acquisition

IV Contrast Dose, Flush, Rate, and Delay:

- Access: Should be 18 or 20g in arm opposite of arm being evaluated
- Dose: (modify volume if using something other than Isovue 370)
  - < 200 lbs 140 mL Isovue 370 total (70cc each injection)
  - > 200 lbs 160 mL Isovue 370 total (80cc each injection)
- Flush: 50 mL saline
- Rate: 4 cc/sec (18 or 20g IV ideally)

Acquisitions: 4 (arterial and venous at stress and neutral) is default, the clinical history may indicate that venous or arterial is not necessary, please contact Rad with questions.

- **Arterial phase (stress)**
  - Trigger off Aortic Arch (Threshold 100HU)
  - Acquisition helical thickness (slice) 0.6 – 0.75 mm

- **Venous phase (stress)**
  - Delay of 70 sec
  - Acquisition helical thickness (slice) 0.6 – 0.75 mm

- **Arterial phase (neutral, arms switched)**
  - Trigger off Aortic Arch (Threshold 100HU)
  - Acquisition helical thickness (slice) 0.6 – 0.75 mm

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- **Venous phase (neutral, arms switched)**
  - Delay of 70 sec
  - Acquisition helical thickness (slice) 0.6 – 0.75 mm

Series + Reformats:

- **Arterial stress**
  - Axial (thin) 0.6-0.75 mm soft tissue kernel (autoroute to TeraRecon)
  - Axial (not thin) 2-2.5 mm soft tissue kernel (autoroute to TeraRecon)
  - Coronal 2 x 2 mm soft tissue kernel
  - Sagittal 2 x 2 mm soft tissue kernel
  - Coronal MIP 5 x 2 mm soft tissue kernel

- **Venous stress**
  - Axial 0.6-0.75 mm soft tissue kernel

- **Arterial neutral**
  - Axial (thin) 0.6-0.75 mm soft tissue kernel (autoroute to TeraRecon)
  - Axial (not thin) 2-2.5 mm soft tissue kernel (autoroute to TeraRecon)
  - Coronal 2 x 2 mm soft tissue kernel
  - Sagittal 2 x 2 mm soft tissue kernel

- **Venous neutral**
  - Axial 0.6-0.75 mm soft tissue kernel

References:

- PMID 27257767 Imaging of the Patient with Thoracic Outlet Syndrome, Radiographics 2016, Raptis et al.
- PMID 24059363 CTA of the Upper Extremity. .AJR 2013, Bozlar et al.
- Stanford CTA protocols, 2010, RL Hallett et al.

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Machine specific recons (axial ranges given above for machine variability):

* NON-CONTRAST PHASE - Soft tissue (ST) Kernel, machine-specific thickness (axial):

- GE = 1.25 mm
- Siemens = 1.2 mm (or 1.5 mm on older generation)
- Toshiba = 2 mm

*THIN, AXIAL ARTERIAL PHASE - Soft tissue (ST) Kernel, machine-specific thickness (axial):

- GE = 0.625 mm
- Siemens = 0.6 mm
- Toshiba = 0.625 mm

*AXIAL ARTERIAL PHASE (not thin) - Soft tissue (ST) Kernel, machine-specific thickness (axial):

- GE = 2.5 mm
- Siemens = 2 mm
- Toshiba = 2 mm

*AXIAL DELAYED PHASE - Soft tissue (ST) Kernel, machine-specific thickness (axial):

- GE = 1.25 mm
- Siemens = 1.2 mm (or 1.5 mm on older generation)
- Toshiba = 2 mm

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General Comments

NOTE:
Use of IV contrast is preferred for most indications *aside from*: pulmonary nodule follow-up, HRCT, lung cancer screening, and in patients with a contraindication to iodinated contrast (see below).

Contrast *Relative* Contraindications

- **Severe contrast allergy**: anaphylaxis, laryngospasm, severe bronchospasm
  - If there is history of severe contrast allergy to IV contrast, avoid administration of oral contrast
- **Acute kidney injury (AKI)**: Creatinine increase of greater than 30% over baseline
  - Reference hospital protocol (creatinine cut-off may vary)
- **Chronic kidney disease (CKD) *stage 4 or 5*** (eGFR < 30 mL/min per 1.73 m^2) **NOT** on dialysis
  - Reference hospital protocol

Contrast Allergy Protocol

- Per hospital protocol
- Discuss with radiologist as necessary

Hydration Protocol

- For eGFR **30-45 mL/min** per 1.73 m^2: Follow approved hydration protocol

IV Contrast (where indicated)

- Isovue 370 is the default intravenous contrast agent
  - See specific protocols for contrast volume and injection rate
- If Isovue 370 is unavailable:
  - Osmolality 350-370 (i.e., Omnipaque 250): Use same volume as Isovue 370
  - Osmolality 380-320 (i.e., Isovue 300, Visipaque): Use indicated volume **+ 25 mL** (*not to exceed 125 mL total contrast*)

Oral Contrast

- Dilutions to be performed per site/hospital policy (unless otherwise listed)
- Volumes to be given per site/hospital policy (unless otherwise listed)
- TRA-MINW document is available for reference if necessary (see website)

Brief Summary

- Chest only
  - ✓ Chest W, Chest WO
  - ✓ CTPE
  - ✓ HRCT
  - ✓ Low Dose Screening/Nodule
    - None

- Pelvis only
  - ✓ Pelvis W, Pelvis WO
    - Water, full instructions as indicated

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- Routine, excluding chest only and pelvis only
  - ✓ Abd W, Abd WO
  - ✓ Abd/Pel W, Abd/Pel WO
  - ✓ Chest/Abd W, Chest/Abd WO
  - ✓ Chest/Abd/Pel W, Chest/Abd/Pel WO
  - ✓ Neck/Chest/Abd/Pel W, Neck/Chest Abd Pel WO
  - ✓ CTPE + Abd/Pel W
    - TRA-MINW offices: Dilute Isovue-370
    - Hospital sites:
      - ED: Water, if possible
      - Inpatient: prefer Dilute Isovue 370
        - Gastrografin OK if Isovue unavailable
        - Avoid Barium (Readi-Cat)
      - FHS/MHS Outpatient: Gastrografin and/or Barium (Readi-Cat)

- Multiphase abdomen/pelvis
  - ✓ Liver, pancreas
    - Water, full instructions as indicated
  - ✓ Renal, adrenal
    - None

- CTA abdomen/pelvis
  - ✓ Mesenteric ischemia, acute GI bleed, endograft
    - Water, full instructions as indicated

- Enterography
  - Breeza, full instructions as indicated

- Esophogram
  - Dilute Isovue 370, full instructions as indicated

- Cystogram, Urogram
  - None

- Venogram
  - Water, full instructions as indicated