Diagnostic Testing Protocol Recommendations Cardiac CT

1. **Patient Preparation**

   - **Contraindications**
     - **Absolute**
       - Iodinated contrast allergy not amenable to pre-treatment
       - Pregnancy
       - Coronary artery stent(s)
     - **Relative**
       - Renal insufficiency
       - Multiple myeloma/Radioactive iodine therapy
       - Untreated hyperthyroidism
       - Inability to perform breathhold $\geq 15$ seconds
       - Cardiac rhythm: frequent ectopy/arrhythmia
       - Unwillingness to hold metformin 48 hour after the CT examination

   - **Prior to arrival**
     - Discontinue phosphodiesterase inhibitors for 48 hours before the test
     - Consider holding nonsteroidal anti-inflammatory agents
     - Consider 48 hour hold of metformin after the CT examination
     - Continue medications other than PDI/NSAID
     - No solids 4 hours prior to the scan
     - May continue usual intake of liquids and solid foods

   - **In the scanner**
     - Patient positioning - Heart should be centered within the gantry
     - Appropriate placement of ECG leads
     - Perform a test breath hold to monitor heart rate to decide on beta blocker requirement and usage of prospective vs. retrospective gating
     - Use of iv or oral beta blockers if heart is above 60 bpm (e.g. 5 to 20 mg Metoprolol, I.V.; or 50 mg Metoprolol, P.O. with additional I.V. Metoprolol as needed) – exceptions can be made for CT scanners with high temporal resolution such as Dual Source or Flash
     - Use of nitroglycerin for coronary vasodilation (e.g. 400-800 mcg sublingual nitroglycerin – one to two tablets or spray)
Important: If phosphodiesterase inhibitors for 48 hours before the test, no nitrates to be given during CT scan acquisition

2. **CT Imaging Protocol**
   - Iodinated contrast agent with at least 320 mg Iodine per ml
   - Injection rate of contrast agent: Minimum of 5ml/sec - up to 8 ml/sec in obese patients
   - Determination of optimal contrast timing using either a test bolus or a bolus trigger technique
   - **AMOUNT OF CONTRAST: DURATION OF SCAN BUT AT LEAST 10 SECONDS** Injection
   - Minimizing the radiation exposure by choosing an appropriate field of view (at the level of the carina to the dome of the diaphragm)

**Steps**

1. **Scout**
   - Topogram AP and/or lateral

2. **Coronary Calcium Assessment**
   - Prospective ECG gated/triggered, low dose non-contrast CT scan to determine Coronary artery calcification

3. **Assessment of coronary atherosclerotic plaque and stenosis**
   - Prospective ECG triggered or retrospective ECG gated CT imaging using tube modulation technique
     - Using maximal temporal and spatial resolution of the equipment
     - **Candidates for prospective triggering**: regular heart rate <62 bpm during breath hold after beta blockade, no cardiac arrhythmias or extrasystolic beats prior or during test breath hold and <400 AS
     - **Adjusting kvp to BMI**
       - 100 kvp if BMI <30 kg/m$^2$ AND body weight is below 220 pounds
       - 120 kvp if BMI > 30 kg/m$^2$
     - For retrospective gating – use **radiation safety options** according to the manufacturers guidelines (i.e. tube current modulation, width of the full tube current according to heart rate, hybrid techniques such as padding)
     - Image reconstruction
       - perform ECG editing in patients with extrasystolic beats
- reconstruct with approximately 50% overlap (Eg. 0.75 mm slice thickness with 0.4 mm increment or 0.6 slice thickness with 0.3 mm overlap)
- reconstruct the number of series necessary to eliminate motion artifacts, typically two data sets, but more if required (i.e. for the RCA) in mid diastole (65-80%) and end systole (35-45%) if retrospective technique was used.

4. **LV function (required only for retrospectively-gated scans)**
   a. If retrospective ECG gating is performed to assess the coronary arteries LV data on global and regional LV function should be collected and assessed
   b. Typically 1.5mm thick axial images are reconstructed at 10% increments (10 phases) for single source CT scanners or 5% increments (20 phases) for dual source CT scanners throughout the cardiac cycle
   c. USE REDUCED PIXEL MATRIX (256x256)

5. **Full field of view**
   a. If incidental findings are assessed – a data set of 3 mm thick axial images, covering the portions of the thorax acquired during the cardiac CT scan is reconstructed
   b. Reconstruction of a field of view optimized for coverage of the heart

6. **Documentation of Radiation Exposure**
   a. document radiation exposure - this page can usually be stored once the reconstruction is finished

3. **CT Parameters to be reported**
   1. Beta blocker and nitrate administration
   2. Imaging sequences performed
   3. Overall contrast administration including which contrast agent
   4. Overall radiation dose
   5. Coronary evaluation including
      a. Artery distribution (right or left dominant, co-dominant)
      b. Overall image quality as interpretable/uninterpretable optimally specify non-evaluable segments/arteries with reason
      c. Presence and extent of coronary atherosclerotic plaque (none, calcified, non-calcified, both) according to AHA classification per vessel and optionally per 17 coronary segments
d. Presence and severity of a significant coronary stenosis (>70% luminal narrowing) per vessel and optionally per 17 coronary segments and classify severity of stenosis as

Left Main
i. Normal: 0%
ii. Non-significant/Minor Disease: 1-49%
iii. Significant Disease: 50-99%
iv. Occluded: 100%

All others Vessels
i. Normal: 0%
ii. Non-significant/Minor Disease: 1-49%
iii. Moderate Disease: 50-69%
iv. Significant Disease: 70-99%
v. Occluded: 100%

6. Optional: Evaluation of the left ventricle
a. Regional LV dysfunction including wall motion and wall thickening of the myocardium assessed qualitatively based on the AHA/ACC/ASE 17-segment model
b. Whether the location of regional dysfunction matches the stenosis location
c. Regional LV dysfunction has to be present in at least two contiguous myocardial segments or in one segment visualized in two different views to be considered a true positive finding.
d. Each LV segment graded as normal, hypokinetic (impaired contraction), akinetic (absent contraction), dyskinetic (paradoxical outward wall motion during systole without aneurismal formation in diastole) or aneurismal 28.

e. Global LV function as normal, mildly, moderately or severely impaired

7. Non-cardiac finding assessment includes, but is not limited to
a. Aortic dissection
b. Pulmonary embolism
c. Pulmonary nodules
d. Pneumonia
e. Pneumothorax
f. Pericardial effusion
g. Hiatal hernia
h. Rib fractures