Coronary CT Angiography
Hiren R. Patel, M.D.
CCTA

- **What is it?**
  - Non-invasive method of imaging the coronary arteries using computed tomography (CT)

- **What is it used for?**
  - Diagnosis of coronary artery disease (CAD)***
  - Diagnosis of in-stent restenosis
  - Evaluation of coronary bypass graft patency
CCTA

- Clinical application in CAD
- Nine specialty societies agreed
    - American College of Cardiology Foundation Appropriate Use Criteria Task Force
    - Society of Cardiovascular Computed Tomography
    - American College of Radiology
    - American Heart Association
    - American Society of Echocardiography
    - American Society of Nuclear Cardiology
    - North American Society for Cardiovascular Imaging
    - Society for Cardiovascular Angiography and Interventions
    - Society for Cardiovascular Magnetic Resonance
CCTA

Categories appropriate for CCTA:

- Detection of CAD in symptomatic patients without known heart disease, either nonacute or acute presentations
- Detection of CAD in patients with new-onset or newly diagnosed clinical heart failure and no prior CAD
- Preoperative coronary assessment prior to noncoronary cardiac surgery
- Patients with prior electrocardiographic exercise testing - Normal test with continued symptoms or intermediate risk Duke treadmill score
- Patients with prior stress imaging procedures - Discordant electrocardiographic exercise and imaging results or equivocal stress imaging results
CCTA

- Categories appropriate for CCTA:
  - Evaluation of new or worsening symptoms in the setting of a past normal stress imaging study
  - Risk assessment post-revascularization - Symptomatic if post-coronary artery bypass grafting or asymptomatic with prior left main coronary stent of 3 mm or greater
  - Evaluation of cardiac structure and function in adult congenital heart disease
  - Evaluation of cardiac structure and function - Ventricular morphology and systolic function
  - Evaluation of cardiac structure and function - Intracardiac and extracardiac structures
CCTA clinical application in CAD

Advantages

- Quick, accurate & proven
- Highly sensitive & specific
- High negative predictive value
- Readily available in our communities
  - >10,000 cases since 2001
  - Galloway, CMCH and Wall
  - GE 64-Slice CT with ACiR technology
  - Dedicated CCTA staff of techs & nurses
- **CCTA clinical application in CAD**
- **Disadvantages**
  - Requires optimization of HR and breath hold
    - <60 BPM and 5-10 second breath hold
  - Ionizing radiation and iodine contrast
  - Limited by artifacts of CT scanning
  - Contraindicated in arrhythmias, pacemaker, renal insufficiency and contrast allergy
  - Special equipment and staff
    - Minimum 64-slice CT and dedicated CT techs and nurses
  - Limited by large amount of calcified plaque
  - May not be covered by insurance
- Requires optimization of HR and breath hold
- **Patient Preparation**
  - HR < 60 (oral beta blockade)
  - Coaching of patients for breath hold
  - Coronary dilation (sub-lingual nitro)
  - IV access
Ionizing radiation and iodine contrast
  - Necessary and unavoidable
Typical* radiation effective dose (mSv)
  - CXR (PA / LAT): 0.05
  - Mammogram (4 views): 0.70
  - CT head: 2
  - Yearly background exposure in US: 3
  - CT chest / abdomen / pelvis: 8 / 10 / 10
  - Conventional coronary angiogram: 5 - 15
  - SPECT Sestamibi: 5 - 15
  - Retrospective CCTA: 10 - 25
  - SPECT Thallium: 25 - 35
  - Coronary angioplasty: 8 – 57
Recent technology to lower radiation dose

- Selective scanning - Prospective ECG triggering

PROSPECTIVE gated CCTA technique

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- Recent technology to lower radiation dose
- Scan faster = less radiation
  - Dual-Source and Dual-Energy CT

- 128-Slice, 256-Slice, 320-Slice…
- Artifacts:
  - Stair-step – phase misregistration, HR variability
- **Artifacts:**
  - Motion – blurry images
Artifacts:

- Increased BMI – grainy images
Artifacts:
- **Streak** – beam hardening from metal or dense contrast

![CT Scan Image](image_url)
Artifacts:

- Blooming – high contrast structures (stent, calcified plaque) appear larger than they are
Normal
- **Stenosis Grading**
  - Visual assessment (like conventional coronary angiography)
  - Mild = <50% stenosis
  - Moderate = 50 – 75% stenosis
  - Severe = > 75% stenosis
  - Occluded
Mild CAD

3.3 mm (3D)

2.0 mm (3D)
Severe CAD
Structured reporting

- History / Indication
- Technique, including type and amount of contrast, and image acquisition (retrospective or prospective)
- Coronary dominance
- Major vessels and branches
- Visualized lungs, upper abdomen, etc.
- Impression, including recommendation and follow-up
Summary

Coronary CTA:

- Non-invasive, contrast-enhanced, relatively low-dose angiogram for direct coronary evaluation, precise characterization of plaque burden and stent and CABG evaluation.
- Quick, reliable, proven, affordable and readily available for patients in Monmouth, Ocean, Atlantic and Cape May counties.
Margerie Glacier
Glacier Bay, AK
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