Low-radiation Coronary CT Angiography without Beta-blockers in an Emergency Department Patient with Reactive Airway Disease

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Clinical History
A 44 year old male smoker with chronic obstructive pulmonary disease (COPD) and hypertension presented to the Emergency Department (ED), primarily because he had recently run out of his home inhalers, but noting recent progressive chest tightness and shortness of breath.

14 months prior, after complaining of similar symptoms, he underwent elective exercise stress nuclear perfusion imaging, achieving excellent exercise capacity (10 METS), normal ECG response, normal myocardial perfusion with gastric uptake artifact adjacent to the inferior wall, and a preserved left ventricular ejection fraction (LVEF) of 58%.

In the emergency department, his vital signs were stable. Initial serum biomarkers and ECG were negative for ischemic changes, but confirmed sinus tachycardia at 125 beats per minute.

Findings
Retrospectively-ECG gated CCTA with functional assessment was performed after the uneventful administration of sublingual nitroglycerine and without intravenous beta-blockade (due to ongoing COPD). Images revealed a 7cm segment total occlusion of the dominant right coronary artery, with distal reconstitution via collaterals. There was mild hypokinesia of the basal to mid inferior wall, with decreased left ventricular ejection fraction of 48%.

He was admitted for observation and serial biomarkers and ECG exams excluded ongoing ischemia. A SPECT myocardial perfusion imaging was performed, confirming a new inferobasal scar, and a decreased LVEF of 50%. He was discharged on maximal medical therapy.

Discussion
In patients with acute chest pain deemed at low to intermediate risk of acute coronary syndrome, CCTA has been shown by several randomized, controlled trials to be efficacious and cost-effective, demonstrating high sensitivity and high negative predictive value. (1) Several important exclusions were applied to most early CCTA studies, chiefly due to the need for strict heart rate and rhythm control when using older-generation CT technology.

The present patient’s tachycardia would previously have been considered a contraindication to CCTA, and was compounded by his relative contraindication to rate control with beta-blockers (i.e. active COPD). However, some modern CT scanners have obviated the need for strict rate control via such technologies as dual-source scanning, and arrhythmia rejection algorithms. (2) Further, these low-radiation dose techniques often allow acquisitions at reasonable radiation exposures over a wide range of heart rates yet obtain sufficient cardiac phases necessary for functional assessment.

In the present case, CCTA enabled rapid diagnosis of coronary artery disease, and showed that the extent of disease was limited to a single vessel not readily amenable to percutaneous intervention. The exam confirmed the presence of ischemic cardiomyopathy via the corresponding territorial resting left ventricular wall motion abnormality, a finding known to complement the sensitivity of anatomic stenosis assessment. (3)
**Figure 1:** Double-oblique long-axis maximum intensity projection (MIP) image of the right coronary artery demonstrates a partially calcified plaque (white arrow) and a long segment, 7-centimeter occlusion of the RCA, with filling of the distal vessel via collaterals. Low tube potential (100 kVp), retrospectively ECG-gated 128-detector-row dual-source CTA resulted in a dose-length product of 224 milliGray-centimeters, corresponding to the equivalent of an effective radiation dose of 3.1 milliSieverts (including the non-contrast calcium scoring exam). The patient’s heart rate during scan acquisition was 89 beats per minute (range 86 to 92 beats per minute).

**Figure 2:** Multiphase assessment of the CTA dataset in the mid-ventricular short axis view of the left ventricle demonstrates regional hypokinesis of the inferior wall. Calculated left ventricular ejection fraction was 48%.

**Figure 3(A,B):** Regadenoson stress (A) and rest (B) perfusion single-photon computed tomography myocardial perfusion imaging (SPECT-MPI) demonstrates a new fixed inferior wall defect with adjacent gastric uptake artifact (white arrows), with calculated left ventricular ejection fraction decreased to 50% currently versus 58% on the prior study 4 months prior (not shown).

**REFERENCES**

