

CT Coronary
Angiography: Defining a
High-Risk Asymptomatic
Population Through
Noninvasive Testing

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Introduction

- Cardiovascular disease was serious in the modern societies.
- **Secondary prevention** with more benefit than **primary prevention**.
- The current problem: identification of high-risk patients without devastating clinical events.

Functional Testing

- Stress echocardiography and nuclear perfusion
- Tests (+): sufficient coronary blockage
- Tests (-): nonobstructive coronary disease
- Significant coronary atherosclerosis:
maybe no symptoms or negative result of functional tests

Structural Testing

- Invasive coronary angiography:
 - 1.<1% risk of major complication
 - 2.limitation in diagnosing mild diseases

Structural Testing

- Intravascular ultrasound(IVUS):
 - 1.overcome the limitation of coronary angiography.
 - 2.Drawbacks:
 - time consuming,
 - only one artery,
 - anticoagulation therapy,
 - directly instrumented in coronary arteries

New Modalities and Tests

- CT scanning
- Calcium scoring
- CT angiography

CT scanning

- Increased resolution
- Previous problem:
significant motion artifact for beating heart
- Multislice CT (MSCT or spiral CT)

Calcium scoring

- Marker for atherosclerosis
- Gated CT scans
- High calcium scores:
 - ↑ coronary plaque burden, stenosis
- False negative



● LAD

● LMA

CT angiography

- CT coronary angiography (CTA)
- Intravenous bolus of contrast material
- Differentiation between coronary lumen, soft plaque, and calcified plaque
- “Curved reformat” views
- 3D reconstruction

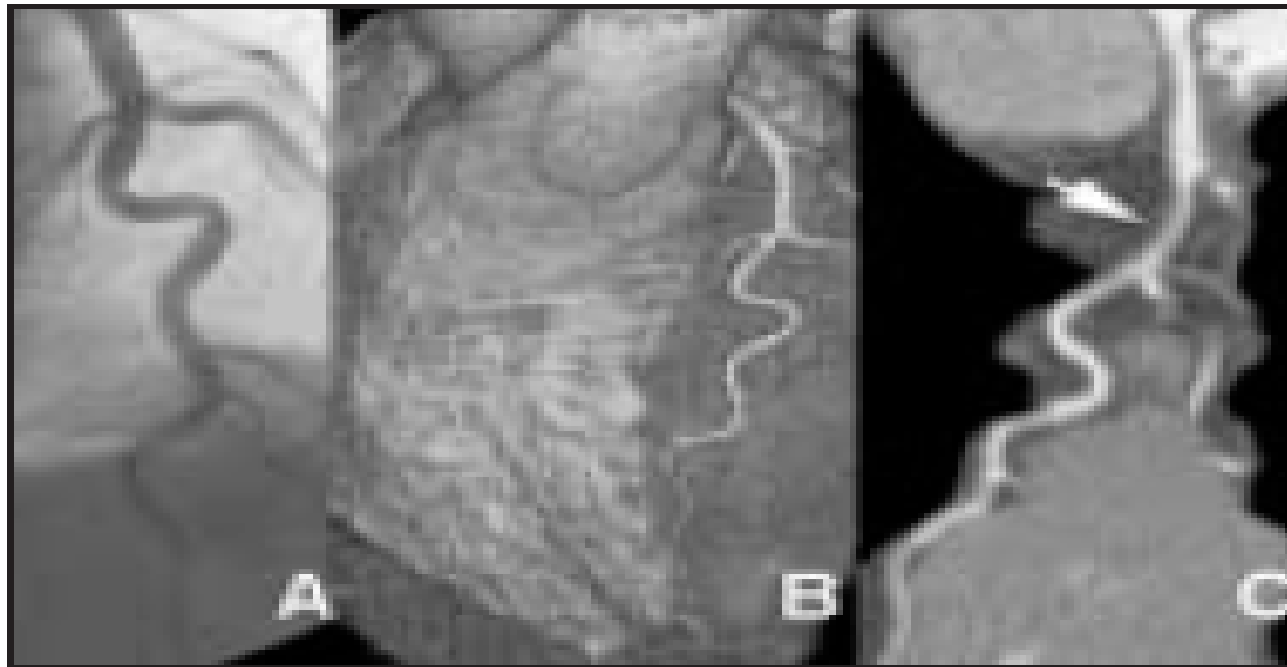


Figure 2. A: Coronary angiogram of a left anterior descending artery. B: 3D reconstruction allows visualization of the same artery in relation to the surrounding structures of the heart. C: Curved reformat reconstruction images allow evaluation of the lumen of the artery as well as atherosclerotic plaque formation (arrow).

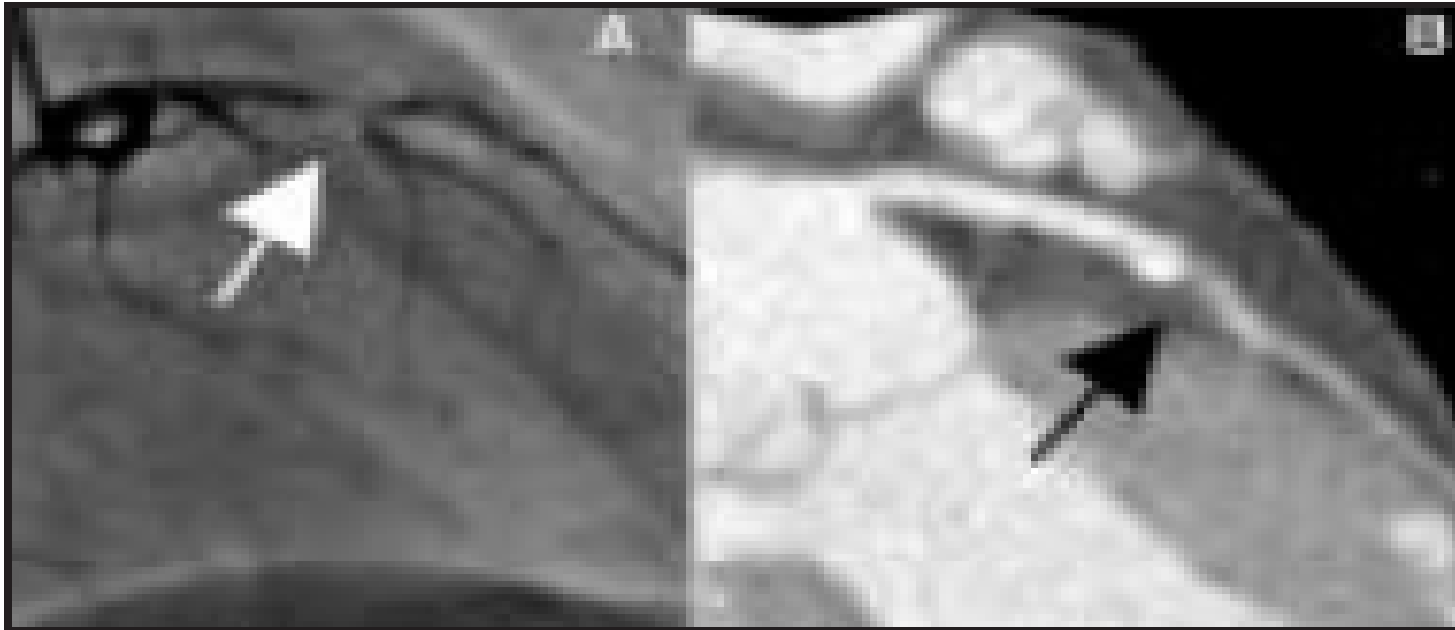


Figure 3. High-grade stenosis of the left anterior descending artery (arrows) visualized by invasive coronary angiography (A) and CTA (B).

Case 1#

- 40 y/o, male
- HTN(-), DM(-), CAD(-)
- Smoking: 1 PPD
- Family history: DM and CAD
- S/S: angina pectoris(-), unremarkable stress test within the last 5 years

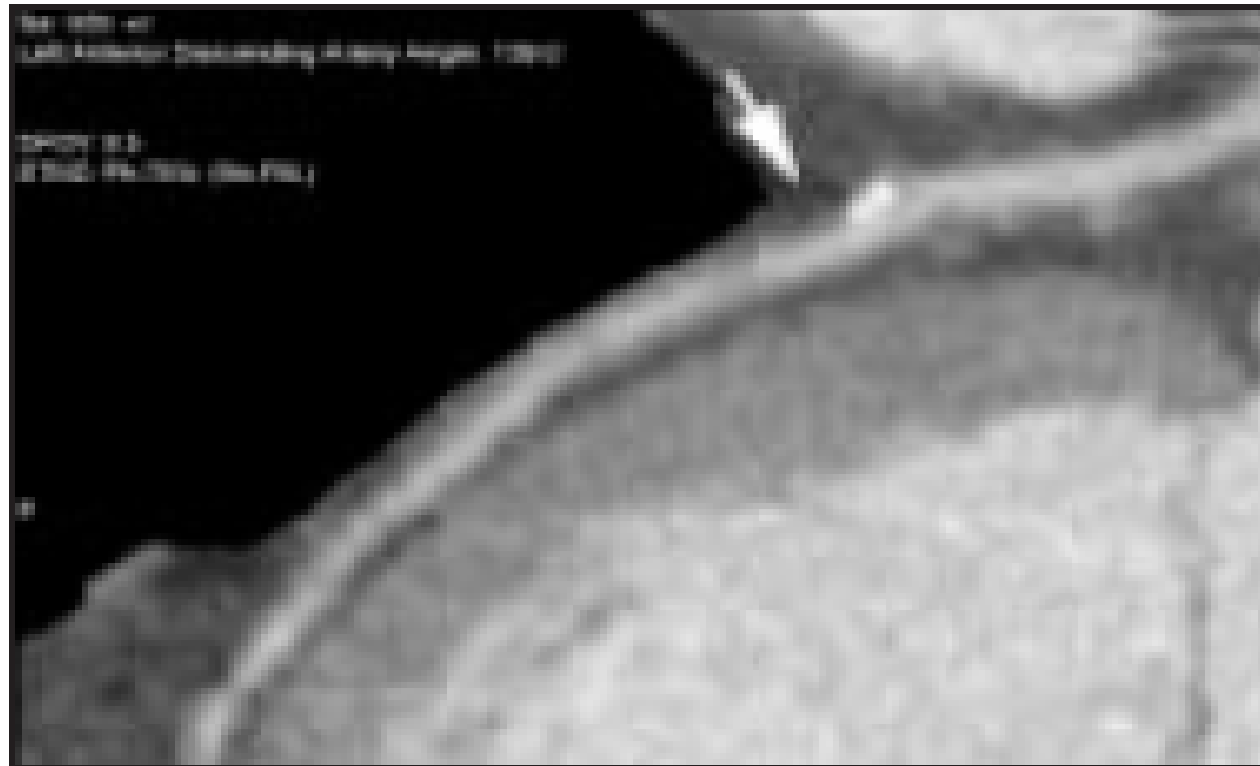


Figure 4. Stenosis (arrow) visualized in the left anterior descending artery by CTA. It consists of both calcified (bright white) and noncalcified (gray) plaque. The patient was asymptomatic and unaware that he had coronary artery disease.

Case 2#

- 52 y/o, male
- Mild HTN(+)
- Mild hypercholesterolemia
- Medication on and off
- Smoking: (-)
- S/S: angina pectoris(-)

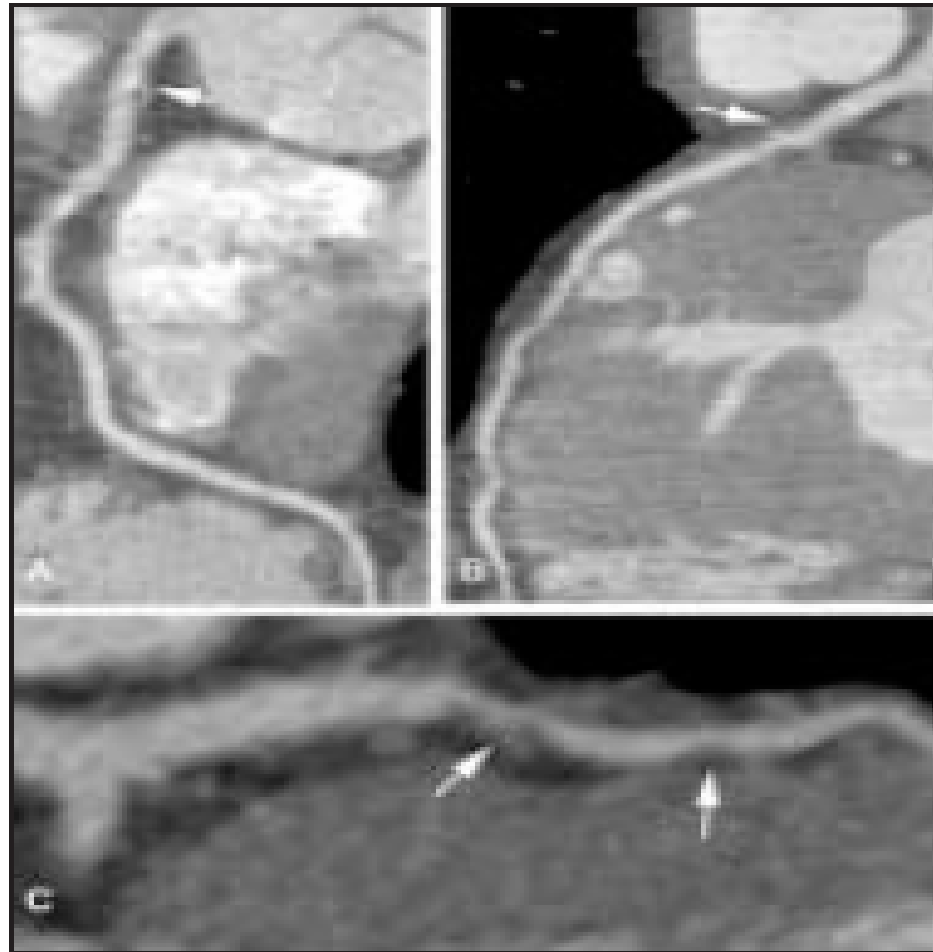


Figure 5. CT coronary angiogram demonstrating atherosclerotic plaques (arrows) in the right coronary (A), left anterior descending (B), and first diagonal (C) arteries. Patient had elevated cholesterol but was asymptomatic and had no previous diagnosis of CAD.

Case 3#

- 33 y/o, female
- HDL > 60mg/dL and LDL < 100mg/dL
- Stress test(-)
- Family history: CAD
- Noninvasive angiography
- Invasive angiography: no significant flow-limiting stenosis

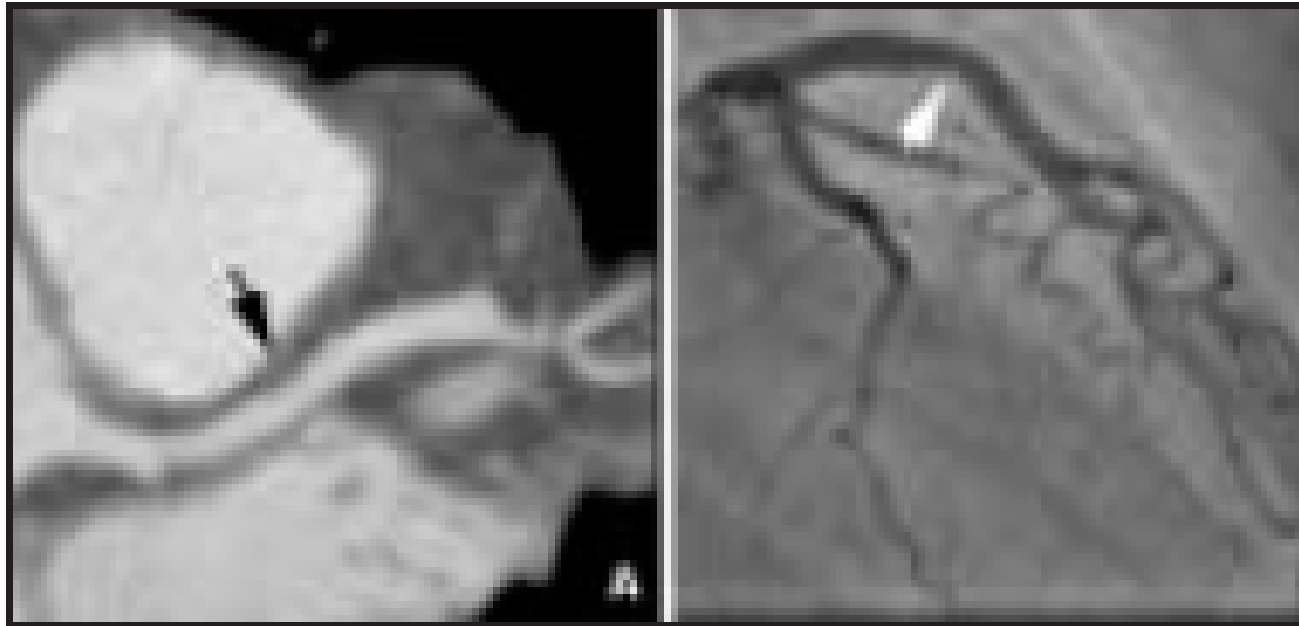


Figure 6. CTA (A) and invasive coronary angiogram (B) of a 33-year-old woman with strong family history of coronary artery disease. The plaque seen on the CTA (black arrow) could easily have been missed on the invasive angiogram (white arrow).

TABLE 1. COMPARISON OF CALCIUM SCORING, CTA, AND INVASIVE CORONARY ANGIOGRAPHY

	Calcium score	CTA	Invasive coronary angiography
Hospital stay	One hour (includes time to fill out paperwork)	One hour (similar to calcium score time)	Four to five hours minimum (includes time before procedure and bed rest after)
Procedure time	Less than five minutes	Less than five minutes	Roughly one hour (including patient prep time, but not including recovery area stay)
Level of invasiveness	No IV	IV in antecubital fossa	Femoral/radial/brachial artery puncture
Cost	Around \$500	Around \$2000	Around \$6000
Contrast given	None	Approximately 150 cc	Variable, can be as little as 20 cc
Functional evaluation	No	Yes, ejection fraction	Yes, ejection fraction
Covered by insurance	Rarely	Yes, for certain diagnoses	Yes, for most cardiac diagnoses
Scheduling	Can be performed on the same day it's ordered; may be requested by an individual without a physician order	Can be ordered and performed on the same day in most cases	Can be ordered and performed on the same day in most cases

Risk of procedure	Very small—risks are theoretical and related to small amount of radiation exposure	Very small—only risks are those from contrast-related complications	Very small—however, because test is invasive, there is a chance of death, stroke, bleeding, infection, and contrast-related complications
Exclusionary criteria	<ul style="list-style-type: none"> • Irregular or fast heart rate • Inability to hold breath for 30 seconds • Inability to hold still or follow instructions 	<ul style="list-style-type: none"> • Irregular or fast heart rate • Inability to hold breath for 30 seconds • Poor IV access • Renal Insufficiency or contrast reactions 	<ul style="list-style-type: none"> • Inability to give consent
Therapeutic options at the time of procedure	Diagnostic modality only	Diagnostic modality only	Ability to transition to a therapeutic modality immediately (i.e., angioplasty) if a significant stenosis is discovered
Availability	Available at some hospitals as well as stand-alone clinics for a fee	Newer modality, available at only a few hospitals around the country	Available at all tertiary-care centers and a large percentage of community hospitals

TABLE 2. PATIENTS WHO WOULD BENEFIT FROM CTA

- Patients who are not symptomatic, for early detection
- Patients who have a low to moderate probability of having significant coronary disease
- Patients who have risk factors, but who are reluctant to start on medication
- Patients with symptoms consistent with coronary artery disease, but who are reluctant to undergo invasive testing. CT can be used for both diagnostic as well as prognostic evaluation (can picture normal as well as single-vessel disease)

Conclusion

- Calcium scoring and CTA:
new and noninvasive
- CTA for patients with low to moderate risk
of coronary disease.
- Invasive angiography for patients with
positive stress tests but very low pretest
probable false-positive.