



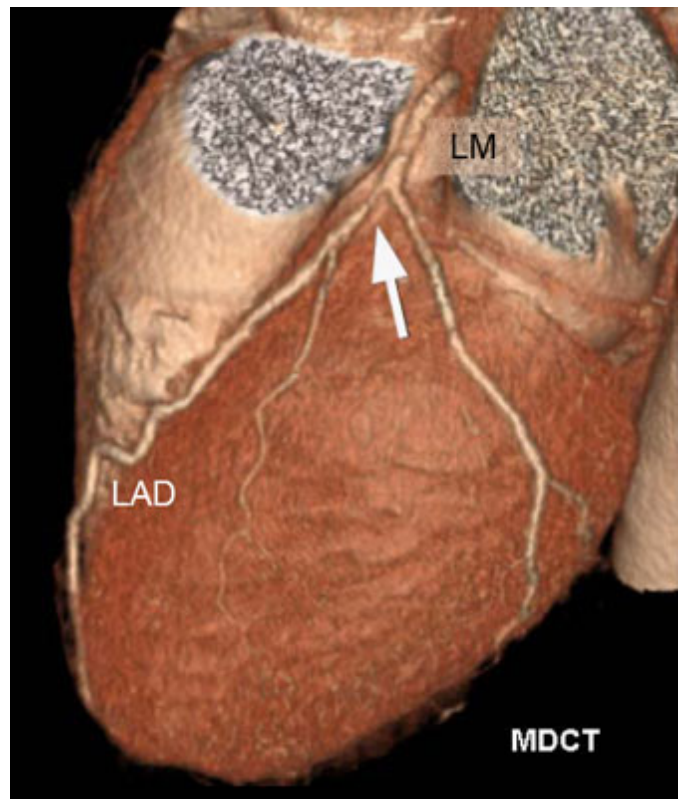
## Coronary CTA

- Coronary angiography remains the “gold-standard” for evaluating coronary artery disease.
- Coronary CTA is a non-invasive alternative to angiography for some patients.
- The clinical indications for coronary CTA are not completely established but patients most likely to benefit are those who have atypical symptoms and are at intermediate coronary risk.

The current “gold standard” to assess stenosis in diseased coronary arteries is selective catheter-based angiography. CT-based coronary angiography is a new, non-invasive alternative for some patients, made possible by the development of high-speed multi-detector CT (MDCT) scanners. MDCT scanners have an array of detectors that collect data from 4-64 slices with one revolution of the CT gantry. These scanners acquire imaging data extremely rapidly, which allows selective imaging of the heart in a specific phase of the cardiac cycle while a bolus of contrast agent passes through the arteries. Cardiac gating and short breath-holds ensure that the images are free from motion artifacts. After data processing, images can be viewed as cross-sections of the heart, 3-D reconstructions of the heart and coronary arteries, and 3-D reconstructions that appear as planar images along the length of the arteries.

Clinical studies have shown that coronary CTA is reliable for the non-invasive assessment of stenoses in the proximal and mid regions of the coronary arteries, where the majority of stenoses are found. Both the sensitivity and specificity for the detection of clinically significant stenoses are about 90%.

Coronary CTA does have some advantages over catheter-based angiography. First, coronary CTA can image blood vessel walls and the anatomy of the heart and can, therefore, be used to assess the pericardium, cardiac chamber size and shape, and to detect ventricular aneurysms. Secondly, it can also be used to map the pulmonary veins prior to pulmonary vein ablation for atrial fibrillation or biventricular pacemaker placement. In addition, both calcified and non-calcified atherosclerotic plaques can be seen in coronary CTA images and, therefore, it is possible to assess a patient’s total calcified



Volume rendered 3-D coronary CTA showing a stenosis in the left anterior descending artery.

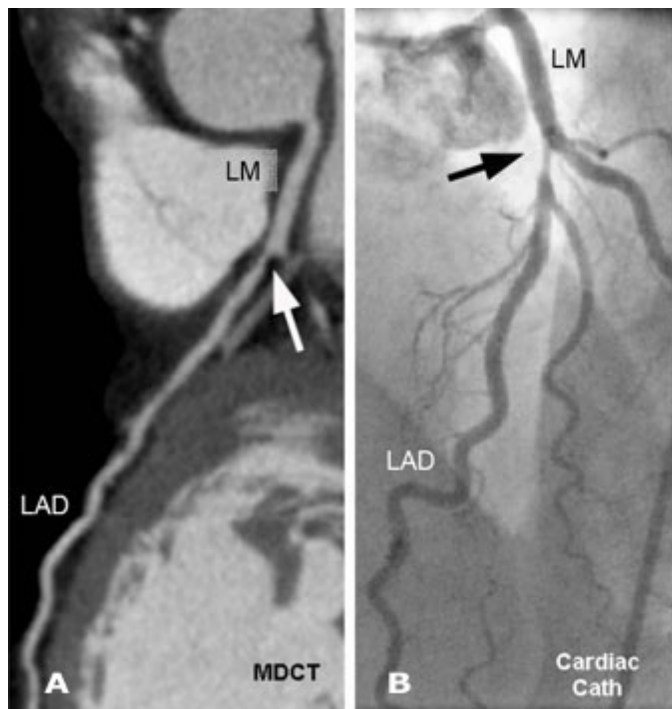
and non-calcified plaque burden as high, medium or low. However, it is not yet possible to reliably distinguish between lipid-rich and fibrous plaques, and predict which lesions are more likely to rupture and cause an acute cardiac event.

## indications for Coronary CTA

At this time, the clinical indications for coronary CTA are not completely established. However, patients who are most likely to benefit from coronary CTA are those who have atypical symptoms and are of intermediate risk for coronary artery disease. A nuclear cardiology stress test is more appropriate to define myocardial ischemia. In patients with typical angina, conventional angiography may be more suitable, as this procedure can be followed

by an intervention. However, in rare cases, poor perfusion of the myocardium is missed during a nuclear cardiology test because of multiple blockages in all the coronary arteries. If the nuclear cardiology examination is negative but there is reason to think that perfusion is poor, non-invasive coronary CTA can show whether there are stenoses present.

	Advantages	Disadvantages
<b>Coronary CTA</b>	<ul style="list-style-type: none"> <li>Non-invasive</li> <li>Can rule out coronary stenoses with high accuracy</li> <li>Can establish patency of by-pass grafts and stented arteries</li> <li>Can visualize cardiac and coronary venous anatomy</li> <li>Can assess calcified and non-calcified plaque burden</li> </ul>	<ul style="list-style-type: none"> <li>Not suitable for patients with irregular heart beat or those who are pregnant</li> <li>Need <math>\beta</math>-blocker to lower HR to <math>&lt; 65</math></li> <li>Difficult to assess in-stent re-stenosis</li> <li>Patients must hold breath 15-20 sec, 3-4 times</li> </ul>
<b>Coronary Angiography</b>	<ul style="list-style-type: none"> <li>Well established "gold standard"</li> <li>Can perform interventions (e.g. angioplasty, stent placement)</li> </ul>	<ul style="list-style-type: none"> <li>No visualization of wall structures</li> <li>Cannot detect early disease before lumen narrowing</li> <li>Risk of groin hematoma, pseudoaneurysm, or A/V fistula, 1-3%</li> <li>Risk of heart attack or stroke, 0.1%</li> </ul>



**A.** Image from the same patient as that on p. 1, showing 3-D reconstruction that flattens the artery into a single plane.  
**B.** Catheter-based angiography confirms the presence of the stenosis, indicated by arrows.



Tomographic image from Coronary CTA, showing the coronary artery as it leaves the aorta.

## Patient Preparation and Procedures

In order for coronary CTA imaging to be successful, the heart rate must be less than 65. Therefore, if a patient's heart rate is more than 70, he or she must take a  $\beta$ -blocker the evening before and the morning of the scan. If the heart rate is too high immediately before the scan, intravenous  $\beta$ -blockers may be administered. No food or drinks should be consumed in the last 4 hours before the scan. As a precaution when using contrast agents, (see the October 2004 issue of Radiology Rounds on [Minimizing Adverse Reactions to Contrast Agents](#), for more information) all patients must have a recent measure of their serum creatinine level. Pregnant patients and those with poor renal function, multiple myeloma, or a history of anaphylactoid reactions to iodinated contrast agents may be excluded. Patients may take their regular medication, with the exception of

## Scheduling

Coronary CTA examinations may be scheduled online through Radiology Order Entry (ROE) or by calling the CT Operations Manager, 617-724-8519.

Most insurance carriers cover coronary CTA (but not cardiac CT for calcium scoring).

## References

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metformin (Glucophage), which should be discontinued for at least 48 hours after the scan.

The coronary CTA scan takes 10-15 minutes to perform. As the heart is scanned, 80-100 ml of non-ionic iodinated contrast agent is injected the patient through an IV line at a rate of 3-5 ml/s to maintain homogeneous vascular contrast throughout the scan. During the scan, the patient will be asked to hold his or her breath 3-4 times for approximately 15-20 seconds. The images will be displayed as volume rendered 3-D images of the heart and coronary vessels and flattened images showing the full length of the coronary arteries, as well as standard tomographic images. Radiology reports will be available within 24 hours.

## Further Information

For further questions on coronary CTA, please contact Cardiac Radiologist Suhny Abbara, M.D., [sabbara@partners.org](mailto:sabbara@partners.org) (617-726-0796) or Cardiologist Ik-Kyung Jang, M.D. Ph.D., [jang.ik@mgh.harvard.edu](mailto:jang.ik@mgh.harvard.edu) (617-726-9226).

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