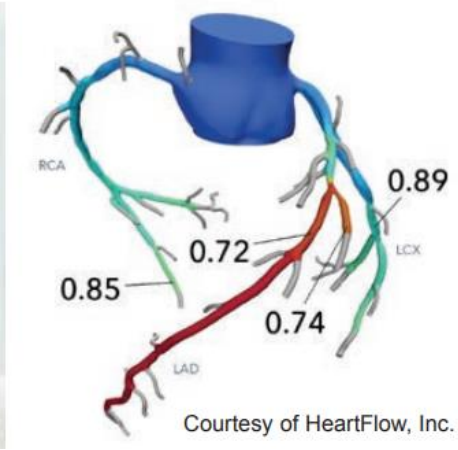

The Case for Coronary CTA

By Mark T Finch MD FACC, FASNC, Director, Advanced Cardiac Imaging, Virtua Health

Coronary CTA (CCTA) has been available to cardiologists for at least 20 years. However, until recently, it has not been widely used for the diagnosis of coronary artery disease (CAD) in the United States. This is largely because the technology has been too expensive for cardiologists to own, and the diagnostic accuracy was thought to be inferior to stress testing. This perception changed in 2019, when the European Society of Cardiology made CCTA a level 1A recommendation for the evaluation of stable chest pain—even preferable to "functional" stress testing in some populations. This paradigm shift was fueled by several studies that showed CCTA was more accurate than stress testing and had a far superior "negative predictive value." Even when CCTA did not detect obstructive CAD, the finding of coronary atherosclerosis changed risk factor management and patient behavior with better medication compliance (especially statins), and fewer subsequent acute coronary events. In 2021, the ACC/AHA guideline for the evaluation of stable chest pain syndromes also followed suit and elevated CCTA to a level 1A recommendation. Additionally, this multi-societal consensus document provided guidance regarding which patients benefit from either "anatomic" coronary CTA or "functional/physiologic" stress testing. Both diagnostic modalities have their respective ideal patient attributes, as well as patient-specific contraindications. To understand these differences, it is important to review the current state of the technology of both modalities.

Coronary CTA is truly an anatomic test that utilizes radiation (albeit minimal) and intravenous contrast to reconstruct the lumen of a coronary artery. Under optimal patient conditions, it can "look inside" coronary arteries at atherosclerosis and characterize plaque extent and morphology and identify high-risk features that can be associated with poor short-term outcomes, even in non-obstructive lesions. An adjunctive feature, CT-FFR (fractional flow reserve), is a noninvasive technique, similar to its invasive namesake, that can further predict the physiologic significance of a particular atherosclerotic plaque. This increases the accuracy of CCTA for diagnostic purposes and may aid in future interventional planning, if indicated.

Coronary CTA can also identify a patient who has little or no atherosclerotic plaque and provide excellent negative predictive value and good prognosis. However, CCTA has several important drawbacks. It cannot evaluate the lumen of heavily calcified arteries or the inside of most stents. Therefore, patients with established CAD or who have been revascularized with stents are poor candidates for CCTA. Also, because the heart and arteries are in motion, CCTA requires a low, regular heart rate, a fast camera and a cooperative patient who can hold their breath and not move for up to 10 seconds. Accordingly, patients who have irregular heart rates (atrial fibrillation, frequent PVCs), are also not ideal candidates for CCTA.

Stress testing exploits coronary supply and demand physiology to assess extent and severity of obstructive CAD indirectly through perfusion imaging, left ventricular wall motion and ST segment assessment. It is very versatile for a variety of patient types and is very familiar to most cardiologists. It too provides decent negative predictive value, but has inferior positive predictive value, as compared to CCTA. Patients sent to the cath lab based on an "abnormal stress" test have an almost 60% chance of

having no or non-obstructive CAD as compared to 20% of patients who have an abnormal CCTA. Cardiac PET-CT stress is an exception to this comparison, and was highlighted in the chest pain guideline, as preferred stress modality over stress echo and SPECT, for diagnostic accuracy.

So in a perfect world, when all these tests are at our disposal, which one best suits our patient with a chest pain syndrome? The answer… it depends. It depends on three factors: the aforementioned clinical CAD history, the patient's heart rhythm and rate, and of course, the insurance industry. So, having a history of CAD with known disease, stents, or bypass, limits our ability to evaluate disease with CCTA. New CT algorithms using "photon counting" technology will likely overcome this limitation. Until then, it's best to order a stress test on these patients, unless one is interested in graft patency; a subpopulation that CT does well. The second factor is very important with CT. Ideally, patients should have a heart rate between 55-60 BPM, and the rate should be regular, without PVCs, etc. The faster and/or the more irregular the heartbeat, the more likely the coronary arteries will move and cause artifacts. Atrial fibrillation, in particular, poses a significant challenge, though it is not a rigid contraindication. Finally, the insurance industry is becoming more assertive in their ability to dictate which tests can be ordered. For example, we are increasingly seeing physicians order heart catheterization (or even imaging stress testing) only to have the insurer deny the exam and instead recommend cardiac CTA. Remember, a trip to the cath lab is a big expense for them, so a technology that efficiently selects patients that are most likely to need revascularization (i.e., CTA with CT-FFR) is more "cost-effective."

Since we have begun our coronary CTA program (using CT-FFR) in late June, and as of this writing, we have completed 266 coronary CTAs. Fifty-four percent (54%) of these patients were women and 80% were under the age of 65; in all, reflecting a low-to-moderate risk population. Over 98% of the scanned patients had no previously known CAD. After scanning, 19% had significant, obstructive CAD of at least one vessel (>50% luminal stenosis). Forty-one percent (41%) of patients had no atherosclerotic plaque. This leaves 36% of patients with non-obstructive CAD who likely would have had a normal stress test, but who still have atherosclerosis and need more aggressive risk factor modification (i.e., aspirin and statin). Herein lies an important difference between anatomic and functional testing for CAD in that CCTA often gives us an opportunity to provide more appropriate cardiovascular risk stratification.

Our colleagues have enthusiastically supported our program. The table below breaks down are referral sources.

Source	N	%
North	90	34
Central	64	24
South	50	19
West	50	19
Structural	2	1
Non Virtua C	6	2
PCP	4	2
Total	266	100

Our success has largely been driven by the new ACC/AHA chest pain guidelines and to a small degree by the insurance industry. I predict the program will continue to grow, as physicians incorporate CCTA into their practices and they experience the value this technology brings to their patients. Our indications are also expanding, as we hope to support Virtua's structural heart program, our electrophysiology colleagues as well as the emergency room and our inpatients. I recognize that this rate of growth does have its "growing pains" as, at present, it is taking three to four weeks to schedule a patient for a CCTA. In the short term, we hope to close that gap by adding more capacity at Virtua Health & Wellness Center Cherry Hill (Brace Road). My ideal is to have one-to-two-week availability for scheduling. Within the next year, we hope to triple our capacity with new "one beat" cameras at Virtua Our Lady of Lourdes Hospital in Camden and at Marne Highway in Moorestown.

Finally, I would like to thank and acknowledge the support of Virtua in sponsoring four cardiologists this year (Drs. Delcine Sood, Raghu Dudda, and Scott Gabler, as well as myself), who have become board certified by the Certification Board of Cardiac CT. There has been additional support for others, as next year we hope to add at least six more cardiology readers as we expand the program to other sites in Moorestown and beyond. **Privileging pathways for new and existing cardiologists are available, and I encourage those who are interested to contact me at MFinch@virtua.org**.

In closing, we must temper our enthusiasm somewhat, as this type of expansion will require significant capital investment, advanced planning and take some time. I welcome your ideas and feedback as our program grows. Together, I am confident that we will soon provide a state-of-the-art, comprehensive, quality cardiac CT program that will benefit our patients and programs for many years to come.

.