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Expert Perspectives

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Impact of spectral CT in coronary assessment and outcomes

Dr. Raman Danrad, a leading expert in spectral CT, shared his experience with detector-based spectral CT for cardiac applications during a recent spectral CT virtual summit hosted by Philips. He has found that coronary CTA is feasible using detector-based spectral CT, as it has the advantage of providing spectral cardiac scans without any compromise. Diagnostic quality is achievable for most of the patients seen by Dr. Danrad's team. In addition, preliminary data shows spectral CT improves score determination in CADRADS 3 and above. CADRADS is the coronary artery disease reporting and data system, a standardized method to report findings of coronary CTA.

"Conventional CT works very well for a CADRADS score of 2 and 0, with a high negative predictive value. The problem occurs when the CADRADS score is higher: 3 and above. That's where conventional CT starts working poorly, and in fact tends to overcall the stenosis. We believe that with spectral results we can improve the accuracy of the coronary CTA, particularly in the higher grades," says Dr. Danrad.

Spectral CT and coronary CTA

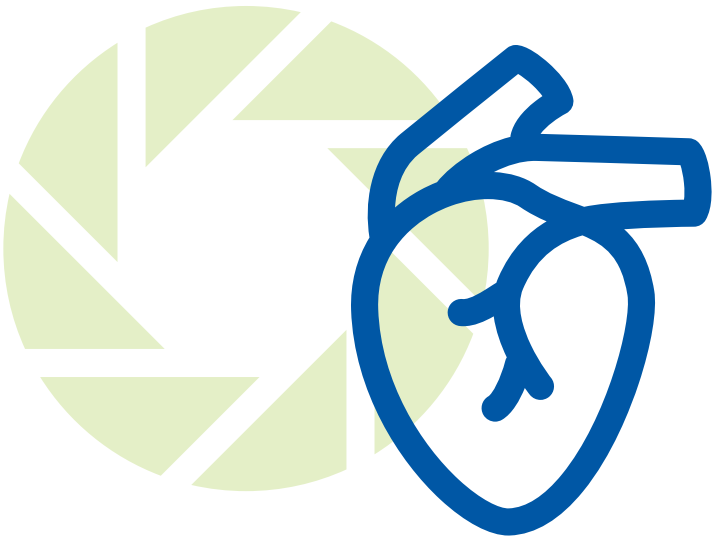
Dr. Danrad notes that the Society of Cardiovascular Computed Tomography has issued guidelines for the performance and acquisition of coronary CTA that are endorsed by the North American Society for Cardiovascular Imaging.[1]

- Minimal detector requirement is a 64-slice CT scanner (collimation of 32 x 2 or 64 x 1, or newer generation systems, which typically have detector element widths < 0.625 mm)
- CT systems with fast gantry rotation*

Dr. Danrad feels that, beyond meeting the guideline requirements, the detector-based spectral system is ideally suited for cardiac imaging due to its exact spatial and temporal alignment. With a detector-based system, spectral is always on, so there is no need for a separate protocol for spectral scanning. This results in improved workflow, and makes it easy to detect and report incidental findings. Detector-based spectral scanning is neutral as far as dose and body habitus, which benefits a wide range of patients.

Advantages and limitations of spectral CT for cardiac imaging

In addition to coronary CTA, the detector-based spectral CT makes it easy to differentiate between thrombus and flow artifact, particularly in the left atrial appendage (LAA) and to assess pulmonary embolism (PE). It's possible to use a low contrast dose based on weight. A user can also potentially rescue results of a suboptimal bolus because spectral is always on, so that 45 KeV low monoenergy data virtually brightens the contrast. Detector-based spectral CT is dose-neutral because there is no requirement for a dual scan, dual tube or KV switching.



Necessary adjustments to scanning protocols for CCTA and cardiac CT

Dr. Danrad notes the system is able to easily accommodate a heart rate < 75 bpm, and he believes it is more important to have heartbeat variability of +/- 5 bpm. The team uses contrast dose of 50-70 ml, and a three-phase contrast bolus (100%, 60/40% and 0%). Scanning parameters include retrospective gating, pitch of 0.16, and ample use of Iterative Model Reconstruction technology (IMR), particularly in the functional phases to decrease the amount of radiation dose during the scan.

The right coronary artery is prone to motion artifacts and can pose challenges in cardiac CT. The team is able to demonstrate images of the right coronary artery (RCA) without significant motion artifacts at a wide range of heart rates from low to high (50-100 bpm). Patients with higher heart rates are scanned during the isovolumic relaxation phase with a 5% phase tolerance; data is then reconstructed using a 1% reconstruction interval to find a relatively motionless RCA.

Premature ventricular contraction (PVC) is edited on the fly to obtain diagnostic images.

For bolus rescue, Dr. Danrad finds that if automatic extraction of views of the coronary arteries is not adequate, he is able to go immediately to the low monoE 45 KeV, which boosts iodine opacification, thereby enabling automated extraction and saving time in interpretation.

He believes that spectral results can improve the accuracy of the coronary CTA, particularly for higher CADRADS grades. Data from an unpublished study of more than 500 exams demonstrates that detector-based spectral CT correctly altered the CADRADS score for a significant number of patients.

* Philips IQon spectral-detector CT system has a gantry rotation time of 270 ms with a 64-slice detector element of 0.625 mm, resulting in 4 cm coverage.

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>
> – Raman Danrad, MD

Spectral results for cardiac imaging

Four types of spectral results are especially useful for cardiac scanning, including assessing all coronary arteries and their branches, coronary stent, infarction, LAA defect, PE and acute aortic syndrome, even for patients with large body habitus.

- MonoE
- Virtual non-contrast (VNC)
- Iodine no Water
- Iodine Density

Future directions

Dr. Danrad sees great promise in spectral noninvasive fractional flow reserve (FFR), perfusion and improved plaque characterization. The continual refinement of noninvasive assessment of suspected coronary artery disease has great potential to save costs and improve quality of life for patients.

Conclusions

Dr. Danrad summarizes his team's findings on the use of detector-based spectral CT in coronary CTA.

- Coronary CTA is feasible using detector-based spectral CT
- For most of the patients that the team sees, diagnostic quality is achievable with protocol modifications (such as for high irregular heart rate)
- Preliminary data shows spectral CT improves score determination in CADRADS 3 and above
- Given the advantages of detector-based spectral CT, cardiac imaging should not be excluded in spite of the system not currently being a dedicated cardiac CT scanner

See the video on the impact of Spectral CT in coronary assessment and outcomes
https://youtu.be/GtQhkH5-aJE

Reference
1. Abbara S, Blanke P, Maroules CD, et al. SCCT guidelines for the performance and acquisition of coronary computed tomographic angiography: A report of the society of Cardiovascular Computed Tomography Guidelines Committee: Endorsed by the North American Society for Cardiovascular Imaging (NASCI). J Cardiovasc Comput Tomogr. 2016;10(6):435-449. DOI, 0.1016/j.jcct.2016.10.002.

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