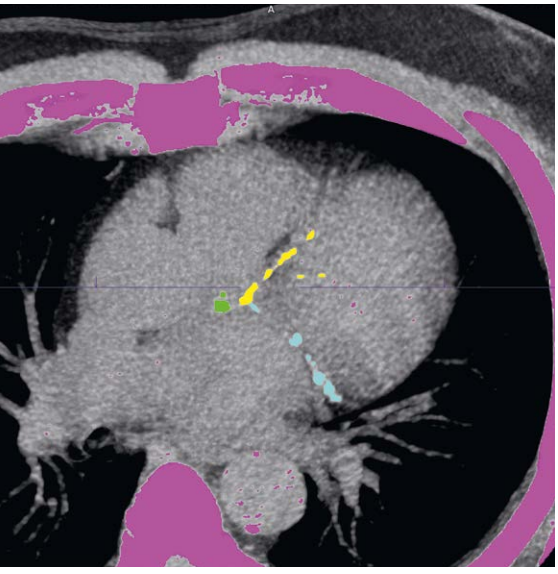
Time to Rethink the Calcium Scoring Workflow

The relationship between calcium deposition and the development of coronary artery diseases (CAD) has been well known for decades. As early as 1990, Arthur Agatston and his colleagues introduced the first practically applicable procedure to quantify calcium in coronary arteries – but the acquisition methods for this quantification have not evolved much since then. This is set to change.



syngo.CT CaScoring provides a quantitative measure of coronary calcium by means of Agatston score or calcium mass score.

CACS history at a glance

Agatston and his colleagues considered any structure with a density of greater than 130 Hounsfield units (HUs) and an area of at least 1 mm² encountered in the coronary arteries to represent calcified plaque.[1]

To be able to produce pictures in sufficient quality, Agatston set his Electron Beam CT (EBCT) to 130 kV. His procedure became standard for Coronary Artery Calcium Scoring (CACS) – also widely known as the Agatston Score – and so did his tube settings.

Up until now, reliable CACS results meant limiting image acquisition to 130 kV or, thanks to the improved spatial and temporal resolution of multidetector CTs (MDCT), to 120 kV. That lead to a significant lack of flexibility. "Nowadays, calcium score at 120 kV can result in a radiation dose comparable to some coronary CTA protocols," says Hugo Marques, MD, radiologist at the Hospital da Luz in Lisbon, Portugal. Modern imaging equipment, however, has advanced considerably since then, particularly the introduction of low kV for image acquisition and the associated benefits of radiation dose reduction.[2] This raises the question: Is there a way to get CACS results comprising these benefits that neither over- nor underestimate the Agatston Score but are not subject to the usual "historic" restrictions? Luckily, the future is just around the corner.

Tackling restrictions with reconstruction

Currently, only Siemens Healthineers provides a special reconstruction kernel along with their proven low kV capabilities and the unique 10 kV step

selection. With this powerful combination, the traditional restriction to 120 kV is tackled and kV settings can be chosen freely allowing for Agatston-equivalent calcium scoring with any kV. In CAD research – especially in trending topics like calcium subtraction – but also in everyday clinical use, this innovative approach has huge potential to become a game changer:

"Having the possibility of doing calcium score at lower kVs not only could result in big radiation dose saving, but would also allow for similar kV settings in both calcium score and cCTA acquisitions."

Hugo Marques, MD

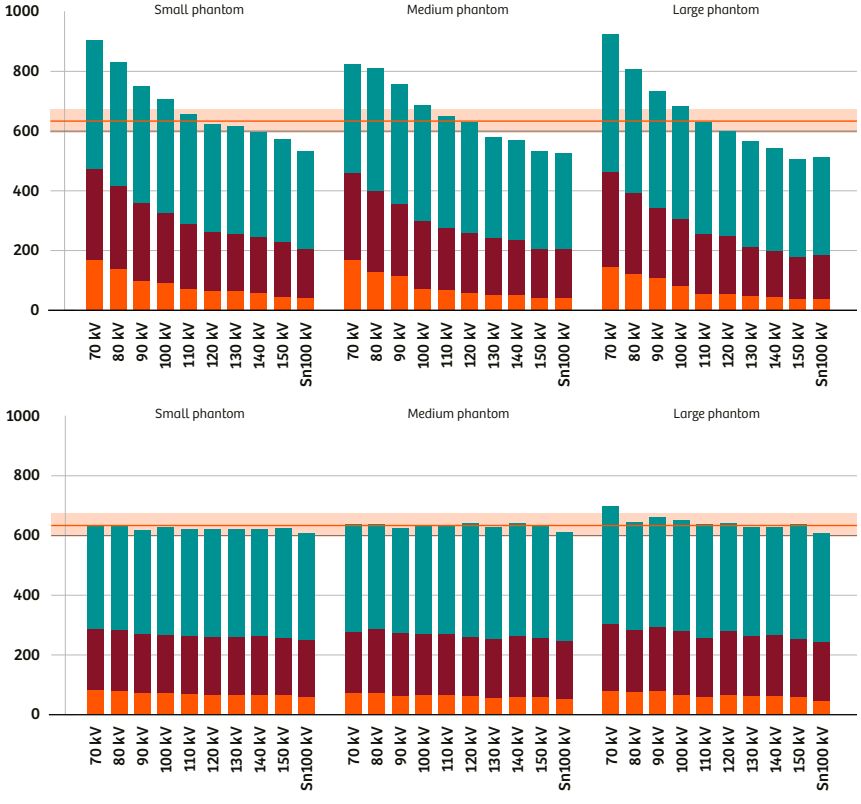
Following the same people-centered path as many other clinical fields, imaging technology will be matched to patients' needs, rather than the other way around.

This approach also offers great benefits for patients compared to conventional CACS: Most importantly, it introduces the advantages of low kV scanning but could also allow the re-use of scans that were initially acquired for a different purpose. If there are existing images – for example native thorax acquisitions – it may be possible to use these directly for the quantitative measure of coronary calcium. Reducing the number of scans necessary and lowering the voltage whenever possible opens up the potential to significantly save radiation exposure to patients. "Dose optimization for calcium score could have a big population impact since CACS as an advanced cardiovascular risk assessment exam is gaining acceptance especially for intermediate risk asymptomatic individuals," Marques adds.

Ready to become an innovation leader?

Low-kV scanning and Tin Filter technology have proven their value in other domains of cardiovascular imaging – and a few visionary pioneers have already realized how they can benefit from this new approach to calcium scoring in their daily routine. Now the time is right to join them.

References
[1] Agatston AS, et al. J Am Coll Cardiol. 1990 Mar 15;15(4):827-32.
[2] Bischoff B, et al. JACC Cardiovasc Imaging. 2009 Aug;2(8):940-6.



Agatston Score values derived from measurements of the calcium scoring reference phantom based on the uncorrected Qr36f (top) and the new, corrected Sa36f reconstruction (bottom). Sn100kV: 100 kV setting combined with Tin Filter

Hugo Marques, MD, is a radiologist – specializing in cardiovascular imaging and intervention – at the Hospital da Luz Lisboa and the Hospital de Santa Marta Lisboa. About 2,600 cardiac scans are conducted there annually which usually are preceded by calcium scoring.

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