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First-In-Human: Photon Counting in Coronary CT Angiography

A recent study led by French researchers examined the benefits of combining a photon counting CT system (PCCT) with coronary CT angiography in diagnosing coronary heart disease.

The U.S. FDA approved the first photon counting CT for clinical use back in September 2021. Photon counting CT represents a technological leap beyond previous generation of scintillation-based CT scanners. Previous technology measured photon indirectly through scintillation-based detector and could not capture spectral energy, whereas photon counting CT directly measures where each photon hit as well as the energy carried by each photon (spectral imaging).

These innovations carry important implications for coronary CT angiography, by offering better spatial resolution and soft-tissue contrast. Coronary CT angiography is important for assessing coronary artery disease but is hampered by limited spatial resolution and soft-tissue contrast. Capturing and measuring the spectral energy of each photon separately reduces noise, blooming, and beam-hardening artifacts. Overall, photon counting CT imaging potentially offers better images for coronary CT angiography and fewer artifacts when imaging coronary calcification, stent, and non-calcified plaque cases.

Thus, the quality of coronary CT angiography scans obtained with a clinical prototype of a PCCT system were compared to those obtained through a conventional energy-integrating detector (EID) dual-layer CT system.

Fourteen participants underwent both coronary PCCT and EID CT angiography. Three radiologists performed a blinded analysis to determine overall image quality, diagnostic confidence, and diagnostic quality of structures known to produce blooming and beam-hardening artifacts.

They found that PCCT had greater diagnostic quality score improvement for 100%, 92%, and 45% of the coronary calcification, stent, and non-calcified plaque cases, respectively. A phantom study assessing the detectability of coronary lesions was also performed. PCCT in comparison to EID CT imaging respectively showed 2.3- and 2.9-fold increased detectability index for coronary lumen and non-calcified plaques. Incidentally, the radiologists noticed a dramatic image quality improvement of cardiac structures, like valves. Imaging these structures accurately is especially important for pre- and postprocedural CT angiography of transcatheter valve implantation.

Overall, the PCCT system outperformed an EID CT system in coronary CT angiography, demonstrating improved image quality and conferred better diagnostic confidence.

Source: Radiology

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