

Review Article

Cardiac Multidetector Computed Tomography: Where Do We Stand?

STAMATIS KYRZOGPOULOS^{1,2}, LISANNE A.E. NIEFFES², PIM DE FEYTER²¹Oncor's Cardiac Surgery Center, Athens, Greece; ²Department of Cardiology and Radiology, Erasmus Medical Center, Rotterdam, The Netherlands

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Significant advances in medical technology have made noninvasive cardiac imaging more effective and appealing. This review will describe recent technical developments in cardiac computed tomography (CT) and will evaluate current and potential clinical applications.

History

Multidetector-row CT (MDCT) scanners for the noninvasive detection of coronary artery disease (CAD) were introduced in 1999, with the 4-slice scanners that allowed small and rapidly moving structures like the coronary arteries to be visualized with sufficient image quality.¹ Soon, the technology advanced further, with the introduction of 16-, 40-, and 64-slice scanners (current systems) and prototype 256- and 320-detector-CT. The new generation of 64 MDCT scanners permitted greater patient coverage per gantry rotation and thus a shorter scan time. Breath-hold time with the current 64-slice scanners is 5-10 s, resulting in less patient discomfort and fewer artifacts induced by respiratory motion or heart rate variability. The shorter acquisition time allows the use of smaller volumes of intravenous contrast material (90-100 ml) and reduces radiation exposure. Recently, dual-source MDCT scanners were launched, having two pairs of X-ray sources and multislice detectors mounted at 90° to each other.² This technology al-

lows faster scanning and achieves a temporal resolution of 83 ms, thereby limiting motion artifacts caused by rapid heart rates, a problem faced by single source scanners, which required beta blockade in patients with heart rates >65 bpm. Table 1 illustrates the effect of multiple slices, faster rotation time and dual-source technology on spatial and temporal resolution.

Data acquisition

Retrospective ECG gating

Cardiac CT is achieved by continuous, low pitch, spiral scanning (table feed/gantry rotation), with the patient moving at a constant speed through the gantry. This results in oversampling of information across different phases of the cardiac cycle and across several consecutive heart beats. The ECG is recorded simultaneously, allowing retrospective reconstruction of images at any desired phase of the cardiac cycle (usually the one with least cardiac motion). The actual phase used for data reconstruction, quoted as a percentage of the RR interval (e.g. 70%) or absolute time (e.g. 350 ms), can vary for each coronary artery or each coronary segment. Another advantage of retrospective gating is that it permits the reconstruction of data sets at multiple time instants during the cardiac cycle, thereby allowing "dynamic imaging" and functional analysis.

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Address:
Stamatis Kyrzopoulos

39-41 Dersimelidon St.
15 343 Ag. Paraskevi,
Athens, Greece
e-mail:
stkyrcr@gmail.com

Multidetector Computed Tomography Technology Advances In Imaging Techniques

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