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Filippo Cademartiri

Cardiac CT: the missing piece of the puzzle

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F. Cademartiri
Department of Radiology,
Erasmus Medical Center,
Rotterdam, The Netherlands

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F. Cademartiri (✉)
Department of Radiology,
Azienda Ospedaliero-Universitaria
di Parma,
Parma, Italy
e-mail: filippocademartiri@hotmail.com

Until a few years ago, conventional coronary angiography was the only technique which could explore coronary arteries. Although magnetic resonance imaging offered some promise, computed tomography coronary angiography (CTCA) really opened a window for the non-invasive assessment of the coronary arteries. CTCA has rapidly became a real clinical tool, albeit with some important limitations (e.g. radiation dose and heart rate). Finally, CTCA is becoming a routine part of chest CT.

The paper deals with the clinical validation of a new CTCA geometry [1]. Compared with all previous algorithms, in this case the CT algorithm/geometry is a "hybrid". First, there was electron-beam CT with prospective ECG triggering. Then, there was spiral CT with retrospective ECG gating. Recently, prospective ECG triggering was introduced to reduce the radiation dose. With this "prospectively ECG-triggered high-pitch spiral acquisition", the two optimal techniques of cardiac synchronization are merged together [2]. In order to achieve this CT geometry, a mandatory requirement is extremely high temporal resolution (to provide the minimum of 180° required for one image), which for CT means <100 ms (in hardware). The average radiation dose for such CTCA is 0.8-0.9 mSv, the lowest ever reported. This was first possible with dual-source CT systems, but all CT manufacturers are coming up with their own solutions.

One major limitation still remains for CTCA, which is related to heart rate. In order to obtain the best image quality, a low and regular heart rate should be achieved (probably <60-65 bpm). However, this is nothing new, since all the development of CTCA has been performed with the extensive and aggressive use of beta-blockers [3]. For all generations of CT technology, the statement concerning heart rate, "the lower the better", has been a mantra for CT users. In addition, the re-introduction of prospective ECG triggering recently determined a "revival" of beta-blockers.

This new mode for CT data acquisition is a revolution and may cause another paradigm shift. In other words: the possibility to examine the heart with 0.8-0.9 mSv (within ~300 ms in total) and/or the possibility to examine the thorax with 1.2-1.4 mSv and have data about the heart "for free". With this technology, any chest CT may become a CT of the heart with a radiation exposure lower than ever before. In the cardiology community this will require some time to be understood. Within radiology, this is even more usual. Just

think about what happened with the introduction of multislice CT. At that time a CT angiogram was something special with specific CT protocol requirements. Afterwards, any chest/abdominal CT potentially became a CT angiogram (when performed in the arterial phase). Until 2000, the heart was the missing piece from the puzzle. Now the puzzle can be completed. In order to complete it, we need the radiology community to understand that cardiac imaging is going to be part of routine clinical practice and the core curriculum of most radiologists. In a few years from now it is likely that a standard report of chest CT will include the description of the heart and coronary arteries.

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