

Electron-beam computed tomography (CT) has been used for coronary artery evaluation (calcium scoring) for more than a decade¹. Cardiac imaging was facilitated by a temporal resolution of 100 msec, achieved by avoiding mechanically rotating x-ray tubes².

The newest generation of 16 and 64 slice CT scanners allow spatial resolution of 0.4 mm with gantry rotation of 400 msec or less. With these scanners, scan length and the required breath-hold is 6-12 seconds³. Software innovations, such as prospective and retrospective electrocardiographic gating, allow coronary artery assessment with multi-detector row spiral CT. The combination of good temporal resolution (165-188 msec) and spatial resolution of 0.4 mm offers smaller voxel size coronary imaging and reduced partial volume averaging.⁴⁻⁷ Radiation doses reported with 16-MDCT coronary CT can reach 13 mSv⁵⁻⁷. The recent introduction of 64-MDCT machines may be associated with an even higher radiation exposure due to the use of thinner collimation and higher tube power. ECG pulsing (decreasing the tube current during the systolic phase of ECG) has been proposed by manufacturers for substantial reduction of radiation dose. ECG pulsing, has been reported to reduce the mean dose by up to 50% depending on the patient's heart rate^{8,9}. ECG-pulsed tube current modulation is a significant improvement minimizing coronary CT angiography (CCTA) related radiation. It is currently the only dedicated application for dose reduction in CCTA. It is performed in real time during cardiac CT scans, allowing a decrease in radiation exposure of 30 - 50%. The full tube current output is applied only during the relevant phases of the cardiac cycle¹⁰. The estimated radiation exposure using ECG pulsing is similar to or less than that of a conventional coronary angiography examination¹⁰.

The quality of these ECG pulsed studies is comparable to non-pulsed studies assuring no compromise in diagnostic ability.

CCTA appears to be an alternative, non invasive diagnostic modality allowing quick and effective coronary evaluation with a high negative predictive value^{4,6,7}.

ECG pulsed studies offer significant reduction in radiation exposure retaining effectiveness, as described.

References:

1. Rifkin RD, Parisi AF and Folland E. Coronary calcification in the diagnosis of coronary artery disease. *Am J Cardiol* 1979; 44:141-7.
2. Agatston AS, Janowitz WR, Hildner FJ, et al. Quantification of coronary artery calcium using ultrafast computed tomography. *J Am Coll Cardiol* 1990; 15:827-32.
3. Schoepf UJ, Becker CR, Ohnesorge BM, et al. Ct of coronary artery disease. *Radiology* 2004; 232:18-37.
4. Leschka S, Alkadhi H, Plass A, et al. Accuracy of msct coronary angiography with 64-slice technology: First experience. *Eur Heart J* 2005; 26:1482-7.
5. Raff GL, Gallagher MJ, O'Neill WW, et al. Diagnostic accuracy of noninvasive coronary angiography using 64-slice spiral computed tomography. *J Am Coll Cardiol* 2005; 46:552-7.
6. Heuschmid M, Kuettner A, Schroeder S, et al. Ecg-gated 16-mdct of the coronary arteries: Assessment of image quality and accuracy in detecting stenoses. *AJR Am J Roentgenol* 2005; 184:1413-9.
7. Mollet NR, Cademartiri F, van Mieghem CA, et al. High-resolution spiral computed tomography coronary angiography in patients referred for diagnostic conventional coronary angiography. *Circulation* 2005; 112:2318-23.
8. Jakobs TF, Becker CR, Ohnesorge B, et al. Multislice helical ct of the heart with retrospective ecg gating: Reduction of radiation exposure by ecg-controlled tube current modulation. *Eur Radiol* 2002; 12:1081-6.
9. Hunold P, Vogt FM, Schmermund A, et al. Radiation exposure during cardiac ct: Effective doses at multi-detector row ct and electron-beam ct. *Radiology* 2003; 226:145-52.
10. Abada HT, Larchez C, Daoud B, et al. Mdct of the coronary arteries: Feasibility of low-dose ct with ecg-pulsed tube current modulation to reduce radiation dose. *AJR Am J Roentgenol* 2006; 186:S387-90.

Orly Goitein MD

Cardiovascular Imaging
Department of Diagnostic Imaging

Sheba Medical Center
Tel Hashomer, 52621
Israel

Tel: +972-3-530-2530
Fax: +972-3-535-7315
Mobile:+972-52-6666681
E-mail: orly.goitein@sheba.health.gov.il