ULTRA-LOW DOSE CORONARY CT ANGIOGRAPHY WITH LESS THAN 0.1 MSV RADIATION EXPOSURE
USING PROSPECTIVELY ECG-TRIGGERED HIGH-PITCH SPIRAL ACQUISITION AND ITERATIVE
RECONSTRUCTION

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Authors: Dieter Ropers, Christian Layritz, Jasmin Eisentopf, Werner Daniel, Michael Lell, Tobias Pflederer, University of Erlangen Department of Cardiology, Erlangen, Germany

Background: Technical developments and improved scan protocols allow coronary CT angiography (CTA) at a significantly reduced radiation exposure. In addition, iterative image reconstruction algorithms permit low dose data acquisition with sufficient image quality. This study investigates the feasibility of ultra-low dose CTA below 0.1 mSv by combining prospectively ECG-triggered high-pitch spiral acquisition and iterative reconstruction.

Methods: A total of 20 patients (8 women, 54±18 y, body weight 74±14 kg, BMI 25±4, sinus rhythm, heart rate 56±10 bpm) were investigated. Coronary CTA was performed using a dual-source CT system (Definition Flash, Siemens, Germany) with 2 x 128 x 0.6 mm collimation, a 0.28 s rotation time, a pitch of 3.2 and a total of 60 cc of contrast agent (flow rate 6 cc/s). Tube voltage was 80 kV, tube current 50 mAs. Images were reconstructed with standard filtered back projection and iterative reconstruction (SAPHIRE, Siemens, Germany). Image noise, signal-to-noise (SNR) and contrast-to-noise ratio (CNR) were evaluated and compared between the two image reconstruction protocols. In addition a subjective classification of image quality (using four categories from 0 = unevaluable to 3 = excellent image quality) was used and the number of evaluable segments was assessed for the data sets computed by iterative reconstruction.

Results: The effective dose was 0.084±0.02 mSv (0.07- 0.13 mSv). The use of iterative reconstruction led to a 30±10% reduction (p < 0.001) in image noise with an equivalent significant increase of CNR and SNR when compared to filtered back projection. On a per-segment analysis the mean subjective image quality score was 2.4±0.4 after iterative reconstruction with a total of 22 unevaluable coronary segments (22/320; 7%). In all evaluable segments no significant stenosis has been detected.

Conclusions: Ultra-low dose, high-pitch spiral CT with less than 0.1 mSv radiation exposure and iterative reconstruction allows the evaluation of the coronary arteries with an acceptable and diagnostic image quality in selected patients with low heart rates, normal body weight and without significant coronary artery disease.