FULL LENGTH ARTICLE

Objective and subjective image quality with prospectively gated versus ECG-controlled tube current modulation using 256-slice computed tomographic angiography

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Introduction: **Radiation exposure is one of the major limitations of computed tomographic coronary angiography (CTA). The purpose of this study was to compare the objective and subjective image quality and radiation dose using prospective ECG gating (PGA) versus ECG-controlled tube current modulation (ECTCM) scanning techniques.**

Methods: **A prospective, single-center study was performed at Prince Sultan Cardiac Centre, Qassim, Saudi Arabia. A total of 104 patients with low-to- intermediate probability of coronary artery disease (CAD) underwent CTA with either PGA or ECTCM acquisition. PGA was performed during the study period and compared with the last 50 CTAs previously done using ECTCM. A 4-point scale was used to assess the image quality subjectively. Objective image quality was assessed using image signal, noise, and signal-to-noise ratio (SNR).**

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Results: **Patient's Baseline characteristics were not different between the two scanning protocols. The 4-point score of subjective image quality showed no significant differences between the PGA and ECTCM scans (2.9 ± 0.7, 2.96 ± 0.7, respectively; $p = 0.87$). The objective image quality showed significantly higher noise and lower SNR with PGA compared with ECTCM (31 ± 9, 27 ± 9, respectively; $p < 0.001$ for noise) and (15 ± 5, 17 ± 7, respectively; $p < 0.001$ for SNR), with no statistical difference in the image signal (434 ± 123, 425 ± 103 HU, respectively, $p = 0.7$).**

Radiation exposure was significantly lower with PGA than with ECTCM. The dose-length product (DLP) for PGA was 334 ± 130 mGy, compared with 822 ± 286 mGy for the ECTCM. This corresponds to a 59% reduction in radiation exposure ($p < 0.0001$).

Conclusions: **Although prospective ECG-triggered axial scanning increased image noise, it maintained subjective image quality and was associated with a 59% reduction in radiation exposure when compared with ECTCM.**

Keywords: Image noise, Radiation exposure, Coronary angiography

Introduction

Coronary computed tomography angiography (CTA) has become an important tool in the diagnosis of coronary artery disease. Despite developments in multi-detector computed tomography (MDCT) technology, exposure to ionizing radiation and the subsequent lifetime potential risk of cancer remains a limitation [1–4]. The 16-row MDCT has a 1.9–3.9-fold increase in effective radiation dose compared to conventional invasive coronary angiography, but this is less than

Abbreviations

BMI	body mass index
CAD	coronary artery disease
CTA	computed tomographic coronary angiography
DLP	dose-length product
ECTCM	ECG-controlled tube current modulation
HR	heart rate
HU	Hounsfield unit
MPR	multi-planar reconstruction
PGA	prospective gated axial
RGH	retrospectively-gated helical
SNR	signal-to-noise ratio

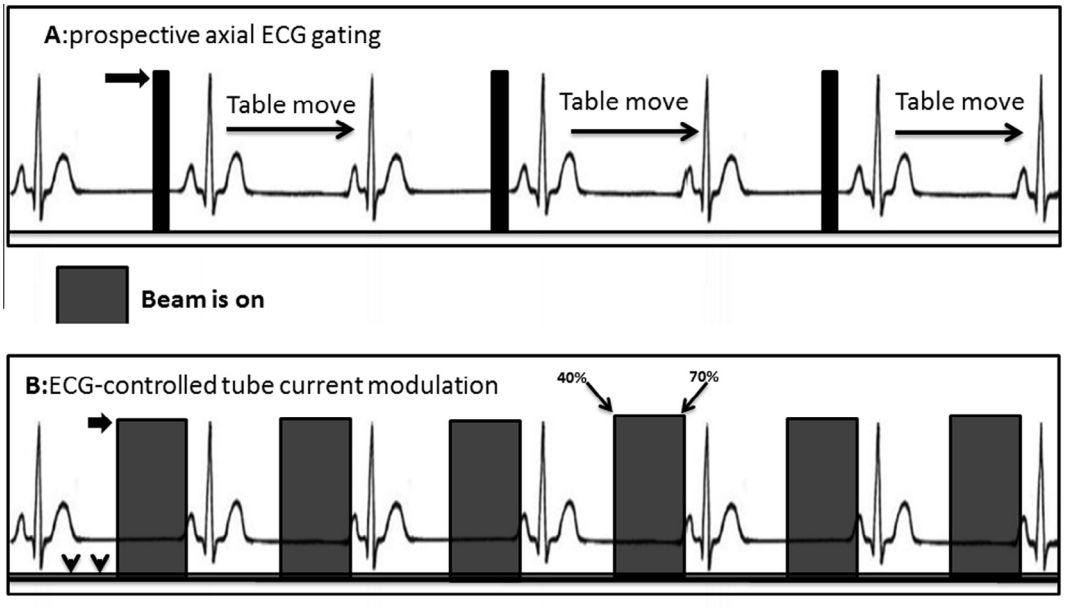

Figure 1. Model shows ECG Gating in PGA vs ETCTM: (A) prospective axial ECG gating: the X-ray is on during the scan only at the best diastolic phase black arrow. (B) ECG-controlled tube current modulation: X-ray is on throughout the cardiac cycle with maximum intensity between 40% and 70% of RR interval(black arrow),while it drop to 5% at the rest of RR(arrow head).