If at first you do not succeed: try another phase! Rescue reconstruction of an anomalous coronary artery in a patient with atrial fibrillation

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An 81-year-old woman with a background history of hypertension, hypercholesterolaemia, and diabetes mellitus presented with exertional dyspnoea and was referred for coronary computed tomography angiography (CTA). At coronary CTA, the woman was incidentally found to be in atrial fibrillation with a heart rate ranging from 50 to 88 bpm. The CTA was performed on a dual-source scanner with full tube current throughout the entire cardiac cycle to permit unlimited reconstructions (total radiation dose 20.3 mSv). Standard reconstructions at the 65–80% phases of the R–R interval rendered the woman’s coronary CTA scan uninterpretable for the exclusion of significant coronary artery disease (Figure 1 A–C). Subsequent manual editing of the electrocardiogram (ECG) to reconstruct at 100 ms prior to the QRS complex however resulted in diagnostic image quality. This patient had a single coronary artery anomaly, with the left coronary artery arising from the right coronary artery and taking a retroaortic course (Figure 1 D–F). Despite minor calcified plaque within the LMS and the LAD, there was no significant obstructive coronary artery disease.

Atrial fibrillation currently remains a relative contraindication to performing coronary CTA. The primary reason for this is improper gating due to the marked R–R interval variations that result in significant phase mismatch and coronary motion artefact. Emergence of dual-source and 320 multidetector CT technologies may help overcome this difficulty by providing improved temporal resolution and the ability to image the entire heart in a single gantry rotation, respectively. In addition, the diagnostic accuracy of coronary CTA in patients with atrial fibrillation may be enhanced by (i) selecting patients with rate-controlled atrial fibrillation, (ii) avoiding patients with ventricular ectopy, and (iii) disabling dose modulation to permit reconstructions at all parts of the cardiac cycle, as in the current report. Provisional data suggest that, even in atrial fibrillation, well over 90% of all coronary segments are evaluable when these techniques are combined with use of a dual-source or 320 multidetector scanners. Small studies also show similar diagnostic performance by coronary CTA in patients with and without atrial fibrillation for detecting coronary stenosis.

The current case demonstrates the clinical application of a technical solution to a patient with unsuspected atrial fibrillation in whom standard reconstruction algorithms were insufficient to exclude significant coronary disease. Coincidently, overcoming the arrhythmia with manual ECG editing confirmed the diagnosis of a rare single coronary artery anomaly.

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