

CT myocardial perfusion imaging complementing coronary CT angiography in a patient with a history of unstable angina: A case report

Christian Rendy Chandra¹, Manoefris Kasim², Celly Anantaria Atmadikoesoemah²

From ¹Resident Physician, Department of Cardiology and Vascular Medicine, Universitas Indonesia, National Cardiovascular Centre Harapan Kita, West Jakarta, Indonesia, ²Consultant Cardiologist, Department of Cardiology and Vascular Medicine, Division of Nuclear Cardiology and Cardiovascular Imaging, Universitas Indonesia, National Cardiovascular Centre Harapan Kita, West Jakarta, Indonesia

ABSTRACT

Coronary computed tomography angiography (CCTA) could show the morphological status of coronary stenosis. Moreover, computed tomography (CT) myocardial perfusion (CTP) could provide additional information to identify hypoattenuating areas that might complement the limitation of CCTA in terms of evaluating the functional status, adding to the diagnostic performance of CCTA. We reported the imaging features of coronary artery disease in a female patient with a history of unstable angina by evaluating the anatomic and functional information through CCTA and CT myocardial perfusion in one stop modality.

Key words: Computed tomography, Coronary artery disease, Myocardial perfusion imaging, Unstable angina pectoris

The non-invasive approach of multislice computed tomography (CT) as a substitute to invasive coronary angiography, specifically coronary CT angiography (CCTA), has been developed to diagnose coronary artery disease (CAD) for many years [1,2]. CCTA is a solid diagnostic test for the morphologic evaluation of coronary stenosis and the potential use with myocardial perfusion at rest as a one-stop method, which provides anatomic and physiologic information for evaluating ischemic heart disease from the same scan of the single modality of the tool [3]. Evaluating myocardial ischemia through myocardial perfusion is an integral part of diagnosis, particularly beneficial when information on the anatomical finding is somewhat inconclusive, for instance, when moderate coronary stenosis was found [4].

We reported an interesting case of a 62-year-old female with a history of unstable angina with moderate stenosis. She visited the outpatient clinic for her scheduled CCTA evaluation. During her CCTA evaluation, CT perfusion imaging was performed alongside her CCTA evaluation which added more information as a “one-stop” modality, especially in a high-risk patient who is reluctant to have a more invasive test.

CASE REPORT


A 62-year-old female presented to the outpatient clinic for CCTA evaluation with a history of hospitalization due to

unstable angina pectoris (UAP) 1 month before with a pre-test probability (PTP) of >15% and was reluctant to have an invasive test. She had experienced the same situation 9 years ago with UAP, despite the normal result of the invasive coronary angiography at that time. She had been a regular patient in our hospital with histories of hypertensive heart disease, diabetes mellitus (DM) Type II, and dyslipidemia in the past 9 years with good controlled blood pressure, blood glucose level, and lipid profile status.

Her physical examination showed normal vital signs and physical examination. Laboratory findings showed good blood glucose levels but with a not optimal result of low-density lipoprotein (LDL) level of 100 mg/dl.

An electrocardiogram showed sinus rhythm with inverted T in V1-V3. Echocardiography revealed an average left ventricle ejection fraction of 70%, normal right systolic function with a tricuspid annular plane systolic excursion of 2.1 cm, global normokinetic, diastolic dysfunction Grade I, and good valves function. CCTA examination showed moderate stenosis of the distal part of the left anterior descending (LAD) artery with a normal result of other coronary arteries with zero calcium plaque burden (Fig. 1). Furthermore, a hypodense (low attenuation) area was noted at the apical septal during resting CT perfusion during the CCTA examination with 13–29 Hounsfield Unit (HU), which suggests rest ischemia (Fig. 2).

The patient was suggested to control her modifiable risk factors. Among those were to have more control of LDL level

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Correspondence to: Christian Rendy Chandra, Department of Cardiology and Vascular Medicine, Universitas Indonesia, National Cardiovascular Centre Harapan Kita, West Jakarta, Indonesia. E-mail: crendyc@gmail.com

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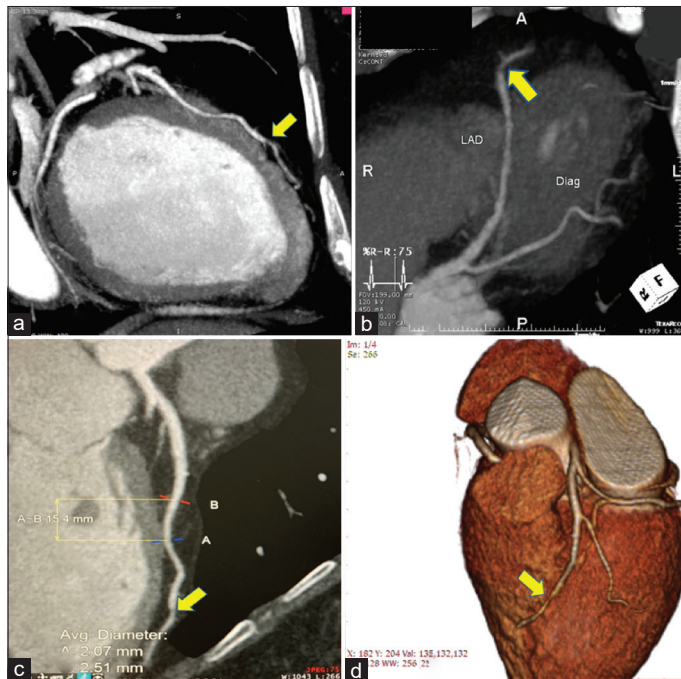


Figure 1: Evaluation of computed tomography (CT) angiography and volume rendering. (a-c) coronary CT angiography (CCTA) showed non-calcified plaque (yellow arrow) at the distal LAD with 50–60% stenosis. (d) CCTA with volume rendering showed similar stenosis at the distal of left anterior descending

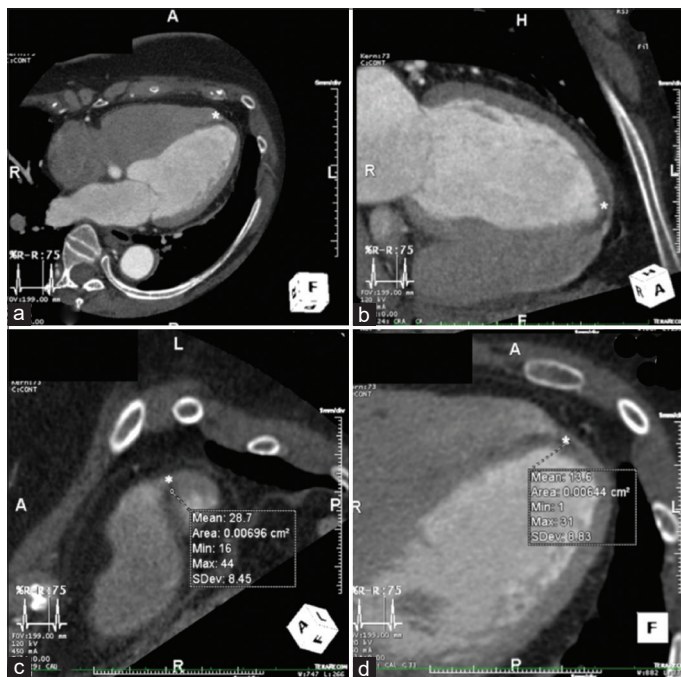


Figure 2: A 62-year-old woman with a previous history of unstable angina pectoris underwent a computed tomography (CT) perfusion scan during her coronary CT angiography evaluation. (a and b) There was hypodense area at the apical septal. (c and d) Hypodense area were seen at the apical septal area (asterisk) with 13.6–28.7 Hounsfield Unit

with a more aggressive higher dose of high-intensity statin. She was still visiting our outpatient clinic for regular check-up periodically with controlled modifiable risk factors and free from chest pain.

DISCUSSION

The primary usefulness of cardiac CT, specifically non-invasive CCTA, has been well known among patients with CAD symptoms [5]. CCTA has evolved as an emerging utility of assessment for CAD, which can evaluate the coronary wall and anatomy, thus allowing to differentiate the existence of obstructive and non-obstructive coronary plaques [6]. Non-invasive evaluation would offer more benefit in patients with PTP >15%, as seen in our patient with a high clinical likelihood of CAD [2]. Coronary atherosclerotic plaques could be comprised of calcified, non-calcified (soft), or mixed plaque [7]. Furthermore, the narrowing of the lumen could be classified as minimal stenosis (<25%), mild stenosis (25–49%), moderate stenosis (50–69%), severe stenosis (70–99%), and total occlusion [8]. According to the CCTA finding, our patient had non-calcified plaques at distal LAD with moderate stenosis (50–60%) and other normal coronary arteries.

CT myocardial imaging at rest has been acknowledged as an additional tool for evaluating the perfusion of the myocardium, which complements the weakness of CCTA to identify severe coronary calcification [3]. Additional information obtained from resting myocardial perfusion status from CCTA could aid the diagnosis of CAD concerning the affected of stenosed coronary territory and was a reliable method for detecting myocardial ischemia since it used the same raw data of the one modality [9]. One meta-analysis discovered that the sensitivity and specificity for known CAD with CT myocardial perfusion imaging were around 85% and 81%, respectively, which had good agreement with single photon emission CT or magnetic resonance perfusion modality [10].

Furthermore, myocardial ischemia could affect the myocardial microvascular resistance, which might decrease the capacitance of microvessels due to an increase in the subendocardial resistance during systole, leading to a characteristic of hypoenhancement [11]. This hypoattenuation area could be depicted with a low HU value. Based on a study by Ramsey *et al.*, the normal range of attenuation of myocardium was from 90 to 100 HU, and ischemic or infarcted myocardium showed hypoattenuation ranging from subzero HU to 30 HU [5]. The hypodense area was consistent with our case in which our patient showed a hypoattenuating area with a range of 13–29 HU.

It has been well known that patients with DM have a higher prevalence of CAD than non-diabetic persons with higher atherosclerotic plaque burden, larger atheroma volume, and smaller coronary artery lumen [12]. One study revealed myocardial hypoperfusion at rest in patients with DM despite no obstructive epicardial CAD [13]. Furthermore, a study in Indonesia by Kasim *et al.* demonstrated the strongest independent Major Adverse Cardiovascular Event predictor among diabetic patients with abnormal myocardial perfusion images compared to the non-diabetic group [14].

CONCLUSION

We reported a case of a female patient with a history of UAP sent for CCTA evaluation. CCTA findings showed moderate

stenosis of distal LAD, while CT myocardial perfusion imaging has shown additional evidence, which highlights and allowed a better assessment of the morphologic and functional evaluation of the patient with CAD in a “one-stop” modality.

DECLARATION OF PATIENT CONSENT

Patient’s consent is not required as the patient’s identity is not disclosed or compromised.

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