



Case Report

Importance of multi-detector computed tomography for percutaneous coronary intervention in a patient with type V dual left anterior descending artery

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ABSTRACT

A 58-year-old woman came to our hospital because of chest pain. Multi-detector computed tomography (MDCT) showed type V dual left anterior descending artery (LAD) and a 90% stenosis in segment 1 of the right coronary artery. Two days after examination, she was admitted to our hospital because of recurrent chest pain. She was diagnosed with acute myocardial infarction. Coronary angiography showed a 99% stenosis in segment 1 and a dual LAD. She received successful percutaneous coronary intervention (PCI) to segment 1 with a bare metal stent. Type V dual LAD is a rare and complicated coronary anomaly with the short LAD originating from the left sinus of valsalva and the long LAD originating from the right sinus of valsalva. Identifying anatomy of the coronary artery is important when making a strategy for PCI. In types IV–VI dual LAD, the anatomic features can be misinterpreted at coronary angiography. MDCT was useful in understanding the anomaly of dual LAD and performing PCI in the present case.

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Introduction

The identification of coronary arterial anatomy is important in coronary artery disease. However, identifying anatomy in a patient with a rare coronary anomaly during coronary angiography is sometimes difficult. Multi-detector computed tomography (MDCT) provides three-dimensional images, as well as visualization of the size, location, and extent of a vascular lesion. Type V dual left anterior descending artery (LAD) is a rare and complicated coronary anomaly [1]. We report a case of acute myocardial infarction due to 99% stenosis of the right coronary artery (segment 1) associated with type V dual LAD detected by MDCT.

Case report

A 58-year-old woman was referred to our hospital in November 2011. She suffered from chest pain on effort every day for a week. She had a history of hypertension and ulcerative colitis. Physical examination, electrocardiogram, chest X-ray, and echocardiography were normal. We suspected unstable angina. We recommended her to undergo cardiac catheterization. She refused

it and accepted undergoing MDCT. MDCT revealed a 90% stenosis, spotty calcification, and low attenuation plaque in segment 1 of the right coronary artery. In addition, MDCT revealed a coronary anomaly named type V dual LAD (Fig. 1). Two days after MDCT, she was admitted to our hospital because of recurrent chest pain. Her cardiac enzymes were elevated (aspartate aminotransferase 72 IU/l, lactate dehydrogenase 251 IU/l, creatinine kinase 619 IU/l). Electrocardiogram revealed ST-segment depression in leads aVL and V_{1–6}. She was diagnosed with acute myocardial infarction. Her coronary angiography revealed that the short LAD originated from the left sinus of valsalva and that the left main coronary artery originated from the right sinus of valsalva (Fig. 2B and C). The ostium of the right coronary artery was separated from the ostium of the left main coronary artery and originated from the right sinus of valsalva (Fig. 2A). The left main coronary artery had a long LAD. A 99% stenosis was detected in segment 1 (Fig. 2A). She received percutaneous coronary intervention (PCI) with a bare metal stent to segment 1. Final coronary angiography showed a thrombolysis in myocardial infarction III flow. Her symptoms disappeared after treatment. She was discharged without any complications.

Discussion

Coronary anomalies occur in 1.3% of patients undergoing coronary angiography [2]. The first report on types I–IV dual LAD was in 1983 by Spindola-Franco et al. [3]. New types were detected and identified as type V dual LAD in 2010 and type VI dual LAD in 2011

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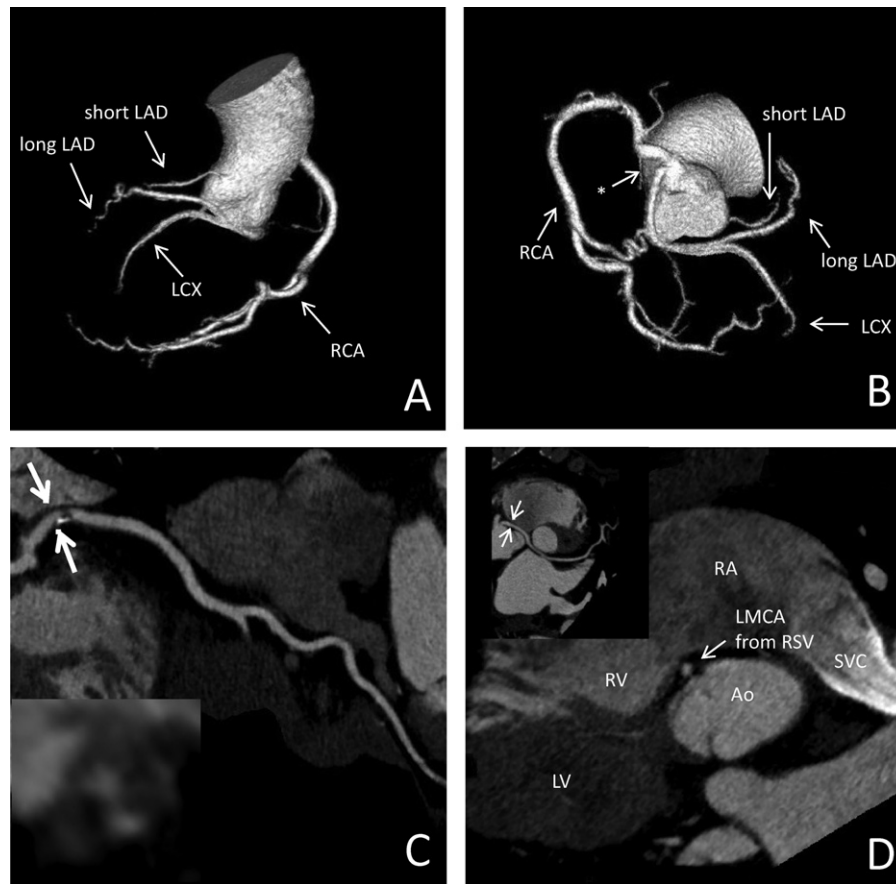


Fig. 1. Non-invasive coronary angiography by multi-detector computed tomography. (A) and (B) Shaded surface display of the coronary tree shows the short left anterior descending artery originates from the left sinus of valsalva. The left main coronary artery with the long left anterior descending artery originates from the right sinus of valsalva. The origin of the left main coronary artery is indicated by '*'. The right coronary artery originates from a common origin. (C) Curved planar-reformatted display of the right coronary artery with a cross-sectional view shows spotty calcification and low attenuation plaque of the culprit lesion. (D) Curved planar-reformatted display of the left main coronary artery with a cross-sectional view shows an epicardial course on the right ventricle around the aortic root. LAD, left anterior descending artery; LCX, left circumflex artery; RCA, right coronary artery; LMCA, left main coronary artery; RSV, right sinus of valsalva; RA, right atrium; SVC, superior vena cava; RV, right ventricle; Ao, aorta; LV, left ventricle.

by MDCT [1,4]. The prevalence of dual LAD is 0.13–1.0% [3,5]. Table 1 summarizes the classification of dual LAD. In types I–III dual LAD, both the short LAD and the long LAD originate from the left main coronary artery or the proximal portion of the LAD. In type IV dual LAD, the short LAD originates from the left main coronary artery of the left sinus of valsalva, and the long LAD arises from the right coronary artery or the right sinus of valsalva. Type IV dual LAD is an extremely rare anomaly, reported in 0.04% of patients undergoing coronary angiography [6]. Type V dual LAD was proposed in 2010 by Manchanda et al. [1]. In type V dual LAD, the short LAD orig-

inates independently from the left sinus of valsalva and the long LAD originates from the right sinus of valsalva. Type VI dual LAD was described in 2011 by Maroney and Klein [4]. In type VI dual LAD, the short LAD originates from the left main coronary artery. In addition, the long LAD arises from the right coronary artery and follows a route underneath the right ventricular outflow tract to the anterior interventricular groove (Table 1).

Our patient's left main coronary artery has the long LAD which originates from the right sinus of valsalva. The short LAD originates directly from the left sinus of valsalva and runs on the proximal

Table 1
Classification of dual left anterior descending artery.

Type	Short LAD		Long LAD	
	Origin	Course	Origin	Course
I	Proximal LAD	Proximal IVG	Short LAD	Epicardial course on the left ventricle
II	Proximal LAD	Proximal IVG	Short LAD	Epicardial course on the right ventricle
III	Proximal LAD	Proximal IVG	Short LAD	Intramycardial course in the septum
IV	LMCA	Proximal IVG	RSV or RCA	Epicardial course on the right ventricle or intramycardial course within the septal crest
V	LSV	Proximal IVG	RSV or LMCA from RSV	Epicardial course on the right ventricle or intramycardial course within the septal crest
VI	LMCA	Proximal IVG	RCA	Underneath the RVOT in the area of the interventricular septum origin course origin course type

LAD, left anterior descending artery; LMCA, left main coronary artery; LSV, left sinus of valsalva; IVG, interventricular groove; RSV, right sinus of valsalva; RCA, right coronary artery; RVOT, right ventricular outflow tract.

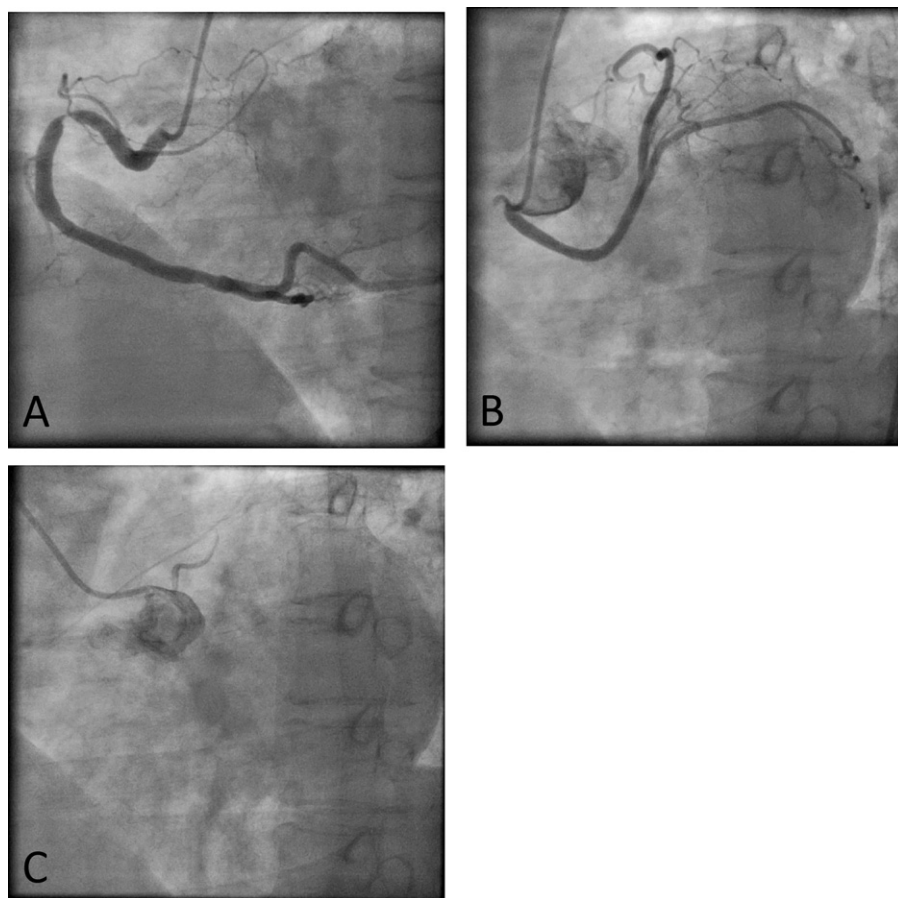


Fig. 2. Coronary angiography. (A) Right coronary artery: a 99% stenosis was detected in segment 1. (B) Left coronary artery from the right sinus of aorta. (C) Short left anterior descending artery from the left sinus of aorta.

interventricular groove. Thus, our patient can be categorized as type V dual LAD.

Left main coronary artery from the right sinus of aorta or from the proximal right coronary artery follows one of four pathways: interarterial course, anterior free wall course, retro-aortic course, and septal course. The interarterial course is most frequently associated with sudden death and myocardial infarction among the four pathways [7]. Our case is a retro-aortic course and has a long LAD. The left main coronary artery takes an epicardial course on the right ventricle around the aortic root (Fig. 1D).

There are some reports about the usefulness of MDCT in coronary anomalies [8]. When the long LAD originates from the right sinus of aorta as in types IV–VI dual LAD, the anatomic features can be misinterpreted at coronary angiography. MDCT gives us useful information about an additional LAD of dual LAD in prior to PCI [9]. In fact, there was a case report on acute coronary syndrome in a patient with type IV dual LAD by Matsumoto et al. [10]. At the first coronary angiography, they mistook a short LAD for a mid-left anterior descending artery occlusion.

The anatomy of coronary anomalies is especially important in surgery [5]. Surgeons must be aware of rare coronary anomalies for complete revascularization of coronary artery disease.

In conclusion, dual LAD is a rare and complicated coronary anomaly. Thus we should understand the anatomy for PCI and cardiac surgery. MDCT is a valuable tool for the identification and treatment of dual LAD.

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