

TYPE IV DUAL LEFT ANTERIOR DESCENDING (LAD) CORONARY ARTERY SYSTEM

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INTRODUCTION

The normal anatomy of coronary arteries is well known but there is a great variety on its origin and distribution. Two exactly equal coronary trees do not exist. Congenital coronary artery anomalies are uncommon and detected in 0.64% to 1.3% of patients undergoing coronary angiography². Among all of the coronary arteries, the left anterior descending artery (LAD) has the most constant course³. Duplication of the LAD is a rare anomaly. The incidence of dual left anterior descending coronary artery (LAD) in normal hearts has been reported to range from 0.13% to 1%⁴. However, inadvertent incorrect placement of an arteriotomy due to nonrecognition of the anomaly, difficulties in identification and grafting of a short LAD proper and the intramyocardial course of the aberrant vessel are of concern during surgical revascularization. We report a case of dual LAD where Angiographic and MSCT findings were consistent with type IV dual LAD system.

CASE REPORT

A 65-year-old male, non-smoker, normotensive and a nondiabetic underwent coronary angiography 1 week after non-ST -elevation inferior wall MI. His cardiac Troponin- T was positive. Electrocardiography showed inverted T -waves in inferior leads. Echocardiography revealed hypokinesia of the mid and apical segments of the inferior and posterior wall. After informed consent was obtained, Coronary angiography was performed via the right radial artery using standard technique. Coronary angiography showed normal bifurcation of the LMCA, with a nondominant left circumflex artery, a short left anterior coronary artery terminating proximally in the anterior interventricular sulcus (AIVS) after giving rise to a major septal

perforator and diagonal branch (Fig. 1 a). The right coronary artery (RCA) showed a normal origin from the right aortic sinus with critical stenosis in mid course. Close to the origin of the RCA from the Right sinus, the long LAD originated. This vessel followed a posterior retro-aortic course and traveled to the left side turning downward in the midportion of the anterior interventricular groove (Fig. 1 b, c). Multiple diagonal branches originated from this vessel during its long course. These coronary angiographic findings were consistent with type IV dual LAD coronary artery. The lesion in the mid course of RCA was stented subsequently, with a good result. The origin and course of the anomaly was also documented by 128-slice multidetector spiral computed tomography, which confirmed the dual LAD distribution and the retro-aortic course of the aberrant vessel (Fig.2).

DISCUSSION

The Dual LAD coronary artery is a very rare congenital anomaly, consisting of two branches that supply the usual distribution of the LAD. While the short LAD terminates in the proximal aspect of the anterior interventricular sulcus (AIVS), the long LAD has a variable course outside the AIVS and returns to the inside distally. Spindola-Franco et al. first described and angiographically classified dual LAD in 1983⁵. Dual LAD consists of a short LAD that ends high in the anterior interventricular groove and a long LAD that most commonly originates as an early branch of the LAD proper (types 1-3) and rarely originates anomalously from the right coronary artery (type 4). These angiographic features are summarized in Table 1. Isolated coronary anomalies are uncommon diseases and anomalous origin of left anterior descending (LAD) artery from the proximal portion of the right coronary artery or from the right sinus of Val salva (type 4) is extremely rare ranging between 1.2-6.1 % of all coronary anomalies⁶.

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However, in our case we noticed that long the LAD did not originate from RCA, but from the right coronary sinus with an independent

ostium. The first description of a Type IV LAD was in 1939, by Waterson et al, in the case of Sir James Mackenzie, who had this binary

Table: classification of dual left anterior descending coronary artery (LAD)

Short LAD	Long LAD	Origin of Septal branches	Origin of Diagonal Vessels
Origin from LAD proper, terminates high in anterior intraventricular groove	Origin from LAD proper descends on left ventricular side of anterior intraventricular groove and reenters distal anterior intraventricular groove	Short LAD	Long LAD, LAD proper, or both
Origin from LAD proper, terminates high in anterior intraventricular groove	Origin from LAD proper, descends on right ventricular side of anterior intraventricular groove and reenters distal anterior intraventricular groove	Short LAD	Long LAD, LAD proper, or both
Origin from LAD proper, terminates high in anterior intraventricular groove	Origin from LAD, proper, intramyocardial in septum proximally and emerges in apical anterior intraventricular groove	Short LAD or Long LAD	Long LAD or proper LAD
Origin from left main coronary artery, terminates high in anterior intraventricular groove	Origin from high coronary artery, reenters anterior intraventricular groove	Short LAD	Short LAD or Long LAD

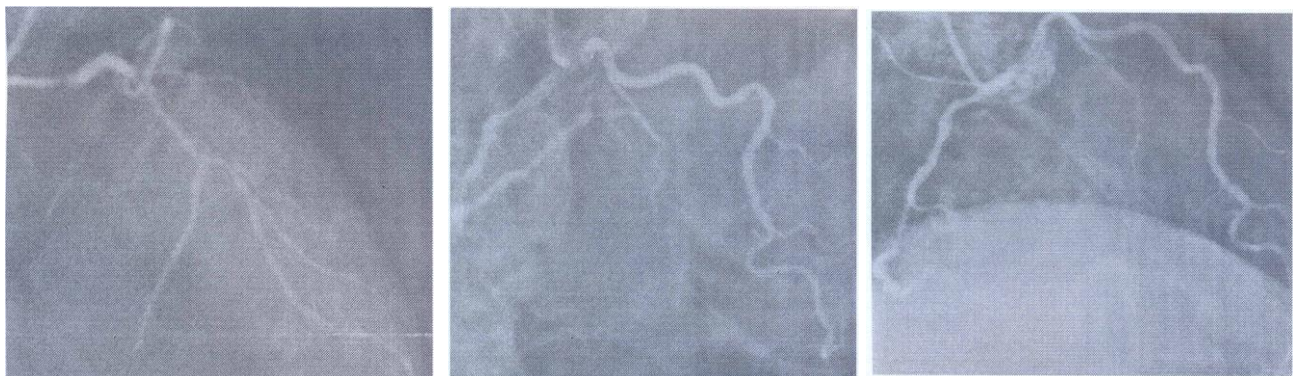


Fig 1a. AP cranial view showing short LAD giving rise to major Septal and Diagonal branches

Fig 1b. AP cranial view showing separate origin of long LAD from Rt aortic cusp

Fig 1 c. LAO view showing separate origin of long LAD from Rt aortic cusp

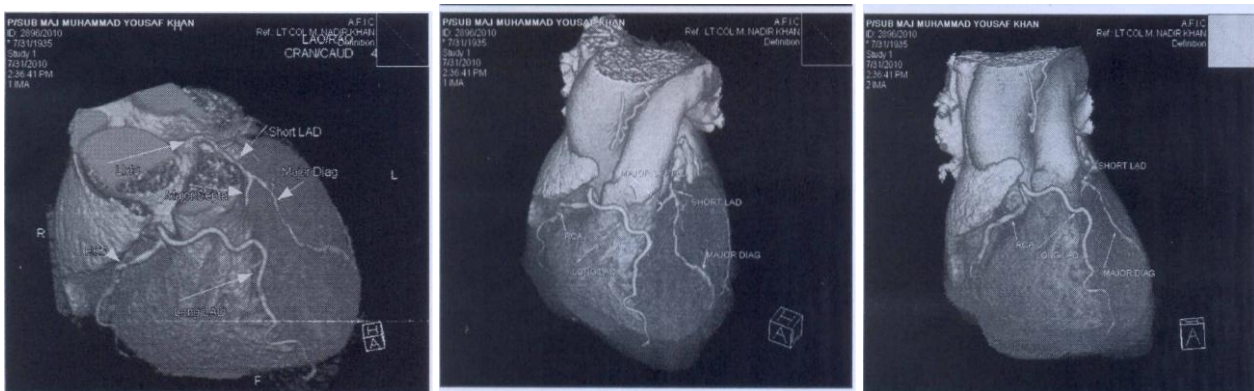


Fig. 2a, b, c: Showing dual LAD distribution and retro-aortic course of the aberrant vessels.

distribution in addition to ischemic heart disease⁷. Since then, only a few cases of this anomaly with an aberrant vessel from the proximal RCA have been reported^{8,9}. In a recent large series involving 70,850 unselected patients, a Type IV LAD was noted only in 3 out of 171 (1.8%) patients with major congenital coronary anomalies¹⁰. Apart from being an angiographic curiosity, the higher likelihood of missing such an anomaly during an angiographic study and the technical issues involved in the angioplasty of ostial RCA lesions, if required, makes it an important clinical entity. A paucity of distribution of vessels in the apical LAD territory with a small LAD proper during angiography of the left coronary system should alert the angiographer to this as one of the likely possibilities. Awareness and recognition of dual LAD are important for several reasons. Precise knowledge of the anatomic features of the coronary arteries is vital for planning surgical vascularization. Familiarity with the variants of dual LAD is essential for avoiding incorrect placement of an arteriotomy and for revascularization of the correct vessel. If both short and long LADs are severely stenosed, grafts to both the vessels may be needed because the major supply to the septum and the anterior left ventricular wall may come from the two separate vessels. In addition, because of inability to visualize the additional vessel, especially when the long LAD originates from the right coronary sinus, risk exists for mistaking the variant anatomic features at routine coronary angiography for mid-LAD occlusion. This oversight can lead to bizarre and seemingly discrepant findings of coronary artery lesions and regional wall motion abnormalities because in most cases the short LAD is the source of major septal perforators and the long LAD or LAD proper is the source of major diagonal vessels. The presence of an interarterial course, which runs between the aortic root and the right ventricular outflow tract, is believed to be associated with sudden cardiac death¹². Thus, it represents an

indication for surgical correction in the presence of myocardial ischemia or previous syncope¹³. The course of the long LAD can invasively be identified by angiography after insertion of a catheter into the pulmonary artery and another into the aorta¹⁴. However, MSCT is a noninvasive tool for detecting coronary anomalies¹⁵. Knowing the course of the long LAD is also important before cardiac surgery to avoid inadvertent cutting or ligation during operation¹⁶.

In conclusion, type IV dual LAD is a very rare coronary artery anomaly and, besides angiography, MSCT is helpful in identifying these coronary anomalies.

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