

## Case report

# Dual left anterior descending coronary artery anomaly revisited

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### Abstract

Coronary artery anomalies are rarely encountered with a prevalence of approximately 1%-2% in population. There are four types of dual LAD coronary anomalies. Type 4 dual left coronary artery anomaly is detected in 1.2%-6.1% of population. Computed tomography has come up as a very reliable investigative tool for cardiac examination in recent years. Knowledge of proper course of coronary anomalies is important in diagnosis and management of coronary artery disease. Computed tomography cardiac angiography provides better opportunity in diagnosing these anomalies than catheter angiography.

**Key Words:** dual LAD, coronary anomalies, computed tomography (CT)

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### Background:

A 45-year-old male presented with complaint of breathlessness on exertion for approximately 10 days. He was a known hypertensive for last 3 years and was on regular anti-hypertensive treatment. Patient had a family history of his father suffering from coronary artery disease. His clinical examination, electrocardiogram and hematological & serological investigations were within normal limits. He had no other history of any previous significant medical or surgical history. To assess for early coronary artery disease a CT coronary angiogram was advised to the patient on a 128-slice dual source Siemens Definition Flash CT Scanner.

### Diagnosis

CT coronary angiogram showed left main coronary artery (LMCA) arising from right

coronary sinus through a separate opening than the one for right coronary artery (RCA) and continuing as long left anterior descending artery (LAD). The LMCA/ long LAD showed a transseptal course, short segment of myocardial bridging with long LAD coursing posterior to the right ventricle outflow tract (RVOT), reaching the anterior interventricular groove and supplying the mid and distal LAD territory (figure 1). The short LAD was a small branch of long LAD with no significant branches. LMCA bifurcated into a long LAD & a prominent diagonal branch and gave the first and other major septal branches (figure 2). The short LAD gave no significant branches. The left circumflex artery (LCX) arose from the left coronary sinus and showed a retroaortic course to reach the left atrio-

entricular groove. Right coronary artery (RCA) showed normal origin and course.

None of the arteries ha any significant calcium deposition or stenotic segment.

#### **Discussion**

LAD has the most constant course among all major coronary arteries [1]. Coronary artery anomalies are uncommon to say the least with a prevalence of approximately 1%-2% in general population [2,3]. Duplication of LAD is very rare with the largest case series of dual LAD prevalence was estimated to be 1% (23 cases in 2,140 persons) [4]. A more recent case series estimated the incidence of type 4 dual LAD at 1.2%-6.1% [5].

Cardiac computed tomography (CT) or coronary CT angiography has become the primary imaging modality for evaluation of coronary artery anomalies in recent years [6]. The LAD normally courses in the anterior interventricular groove towards the cardiac apex and gives off septal perforators to the interventricular septum and diagonal branches to the anterior wall of the left ventricle [7]. Dual LAD was first described and classified by Spindola-Franco et al in 1983 [4]. It consists of a long LAD, which originates mostly from main LAD proper (types 1-3) and rarely from right coronary sinus or RCA (type 4) & a short LAD that originates from long LAD [7]. The short LAD usually terminates high in the anterior interventricular groove whereas the long LAD after a proximal course outside the anterior interventricular groove returns to course in the groove in its distal course [4]. Four subtypes of dual LAD have been described. In types 1-3 the long LAD originates from the LAD proper with short LAD being a branch of long LAD. In types 1

& 2 the long LAD courses parallel to the short LAD in its proximal course on either left ventricle (type 1) or right ventricle (type 2) and reenters the anterior interventricular groove to supply the mid and distal part of left ventricle. In type 3 dual LAD, the long LAD has a proximal intramyocardial course [7]. Type 3 dual LAD was found to be the rarest in the study undertaken by Spindola-Franco et al with only one case in twenty-three of dual LAD cases [4]. Type 4 dual LAD is peculiar in the way that in it the long LAD originates from the right coronary artery takes an anomalous course and enters the anterior interventricular groove [7] (figure 3).

In dual LAD systems the source of major septal perforators is usually the short LAD whereas the diagonals are branches of long LAD/ LAD proper/ both in type 1, LAD proper in type 2, either of short or long LAD in type 3 and short LAD in type 4 [4,7].

In our case the long LAD was a continuation of LMCA, which originated from right coronary sinus from a separate opening than for right coronary artery. This is rarely seen even in type 4 dual LAD arteries because mostly the long LAD type 4 arises from right coronary artery. The main distinctive feature in our case was the presence of major septal branches from LMCA/ long LAD as compared to short LAD in previous case studies. Secondly a major diagonal from LMCA/ long LAD was present in our case, which is not commonly seen in dual LAD arteries.

Knowledge of dual LAD system is important for several reasons starting with planning surgical vascularization, avoiding incorrect placement of an arteriotomy and revascularization of incorrect vessel. For

example while grafting short LAD it is important that cardiac surgeon be aware of features of dual LAD to help him expose the vessel higher than usual in anterior interventricular groove [4,8].

Our patient had no atherosclerotic disease. Previous literature also points out to the fact that the anomalous course of these arteries may predispose such patients to greater degree of symptoms than amount of atherosclerotic disease. Vasospasm has been implicated as a possible mechanism for these symptoms [9]. The risk of mistaking the anomalous arteries (especially type 4) for mid-LAD

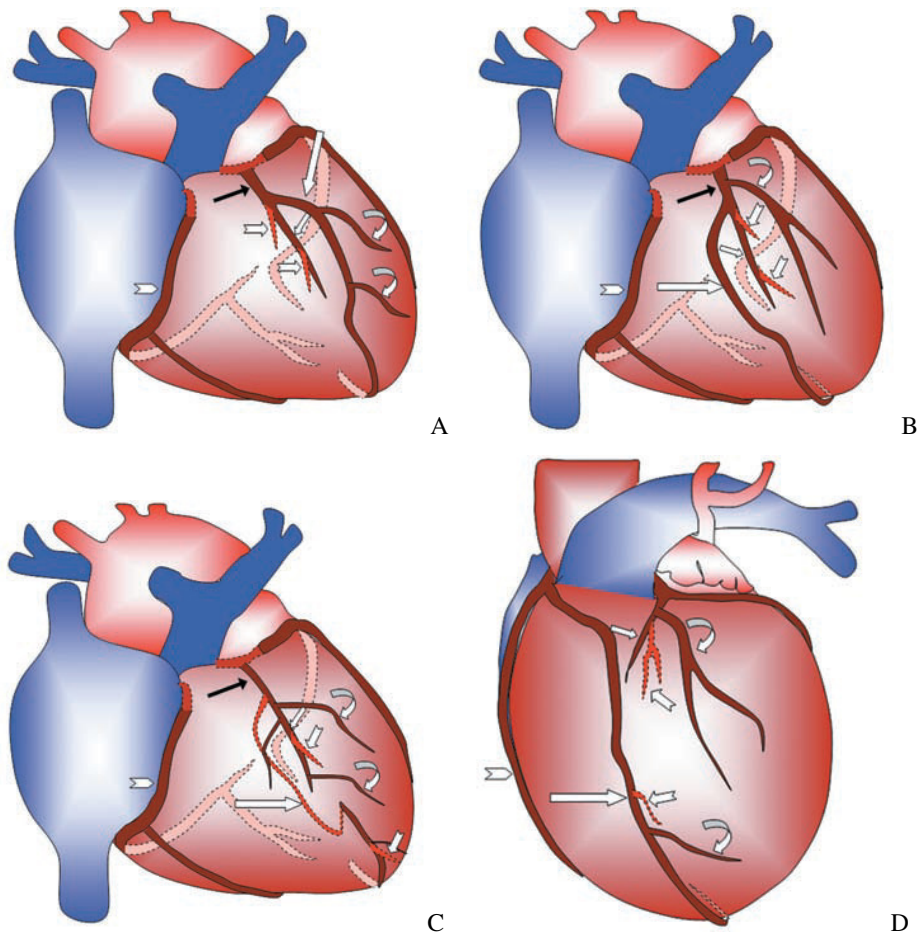
occlusion is always present during routine catheter coronary angiography, because it is difficult to visualize the additional vessel properly in these cases [7].

One of the positive attribute suggested of dual LAD system is that in case of significant atherosclerotic disease the binary distribution may limit the extent of ischemic insult to the myocardium [9] however the stents or grafts may be required to both the vessels especially because usually short LAD gives off major septal perforators whereas long LAD gives off diagonals [4].

Type	Short LAD	Long LAD	Origin of Major Septal Perforators	Origin of Major Diagonal Vessel/s
1	Origin from LAD proper, terminates high in anterior interventricular groove	Origin from LAD proper, descends on left ventricular side of anterior interventricular groove and reenters distal anterior interventricular groove	Short LAD	Long LAD, LAD proper, or both
2	Origin from LAD proper, terminates high in anterior interventricular groove	Origin from LAD proper, descends on right ventricular side of anterior interventricular groove and reenters distal anterior interventricular groove	Short LAD	LAD proper
3	Origin from LAD proper, terminates high in anterior interventricular groove		Short LAD > Long LAD	Short LAD > LAD proper
4	Origin from left main coronary artery, terminates high in	Origin from right coronary artery, anomalous	Short LAD	Short LAD

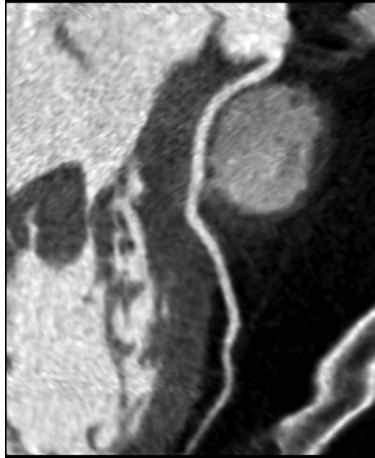
	anterior interventricular groove	prepulmonic course and reenters anterior interventricular groove		
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Table 1: Classification of Dual Left Anterior Descending Coronary Artery (LAD) [4,7]



**Figure 3:** Schematic diagrams showing four types of dual left anterior descending coronary artery (LAD) as described by Spindola-Franco et al. Types 1-3 (A-C) entail early bifurcation of LAD proper (black arrow) into short LAD (short white arrow), which terminates high in anterior interventricular groove, and long LAD (long white arrow). Notched arrows indicate septal perforators; curved arrows, diagonal vessels; chevron, right coronary artery.

- A. Type 1. Proximal long LAD courses parallel to anterior interventricular groove on left ventricle and is source of major diagonal vessels. Short LAD provides major septal perforating vessels.
- B. Type 2. Proximal long LAD courses parallel to anterior interventricular groove on right ventricle. Short LAD provides major diagonal vessel to left ventricle.
- C. Type 3. Long LAD has intramyocardial course.
- D. Type 4. Long LAD has anomalous origin from right coronary artery before entering anterior interventricular groove. [7]



**Figure 1.** MPR image showing the LMCA/ long LAD coursing posterior to the right ventricle outflow tract with short segment of myocardial bridging.



**Figure 2.** Volume rendered image showing the two LAD arteries with a prominent diagonal.

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