

Posterior Descending Artery Arising as A Continuation of Hyperdominant Left Anterior Descending Artery

C.S.RAMESH BABU, S.KHARE, A.K.ASTHANA, S. SAXENA, O.P.GUPTA

ABSTRACT

Coronary artery anomalies are rare with an incidence of 0.3% to 1.0% in general population and are discovered incidentally. Many such anomalies may remain asymptomatic. Posteroinferior part of the muscular interventricular septum is normally supplied by posterior descending artery which may arise from right coronary artery (in right dominance or co-dominance pattern) or from left circumflex artery (in left dominance pattern). Supply of the posteroinferior septum

by a hyperdominant left anterior descending artery continuing as posterior descending artery is extremely rare and sporadically reported in the literature. We present here a case of hyperdominant left anterior descending artery continuing as posterior descending in the presence of a diminutive right coronary artery. An anomalous branch arising from left anterior descending artery was supplying the left atrium. To the best of our knowledge no such anomalous left atrial branch from left anterior descending is described in the literature.

Keywords: Anomalous left atrial branch, Coronary artery anomaly, Posterior ascending coronary artery, Super dominant left anterior descending artery

CASE REPORT

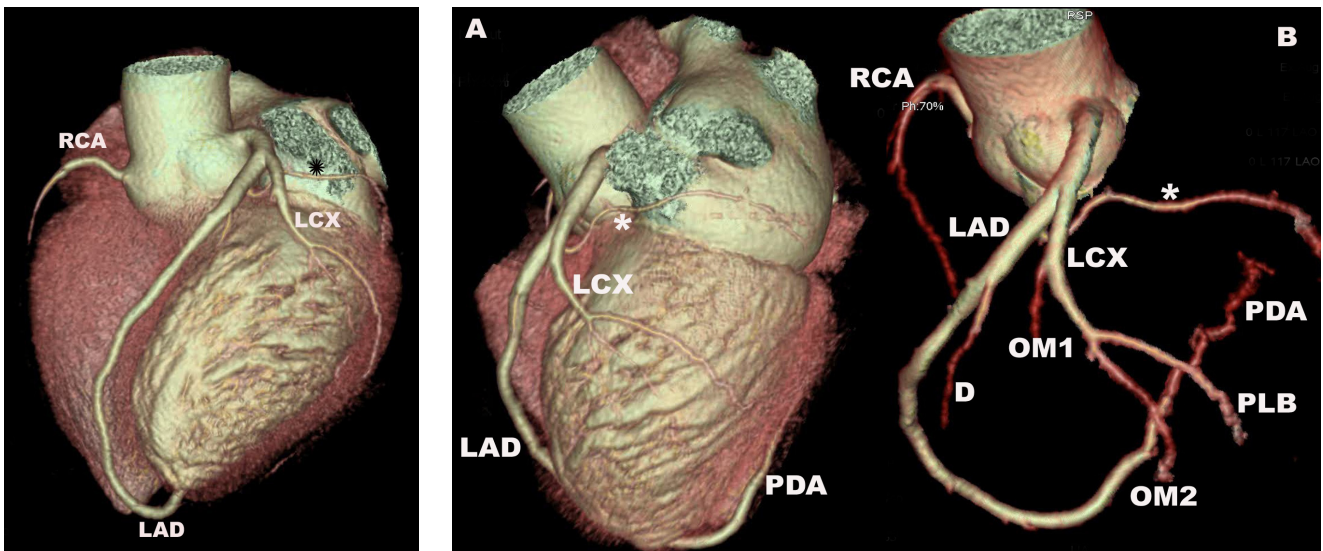
A 22 years old male with chest pain was referred to our diagnostic centre for undergoing ECG-gated multidetector computed tomography (MDCT) coronary angiography. The patient preferred the non-invasive MDCT – CA in place of invasive conventional coronary angiography. Scanning was done by a 64-channel multidetector CT (GE Optima 660) and 90-100 ml of non-ionic contrast (Omnipaque 300 mg/ml) was injected by a power injector at the rate of 4 ml/s intravenously. Written informed consent was obtained from the patient before contrast injection. Sections of 0.625mm mm thickness obtained were further analysed in a separate workstation (GE: AW Volume share 4). Volume rendered (VR), Multiplanar reformatted (MPR) and Maximum intensity projection (MIP) images were obtained.

The angiogram revealed normally originating RCA from the right sinus of Valsalva, but diminutive in size (2.7 mm diameter), ending on the anterior right ventricular wall [Table/Fig-1]. The left main coronary artery (6.1 mm diameter) originating from the left coronary sinus bifurcated into LAD and LCX [Table/Fig-1]. The LCX (2.8 mm diameter) gives off two obtuse

marginal (OM) arteries before ending as the posterior left ventricular (PLB) branch supplying the diaphragmatic surface of left ventricle [Table/Fig-2a,2b]. The LAD was large (4.2 mm diameter) descending in the anterior interventricular groove to reach the cardiac apex and gave off a diagonal artery. Proximally, the LAD gave rise to a large branch (2.3mm diameter) which crossed deep to LCX to reach the base of heart and supplied left atrium [Table/Fig-2a,2b]. The LAD 'wraps around' the cardiac apex to continue as PDA in the posterior interventricular sulcus almost reaching the crux of the heart [Table/Fig-3a,3b]. None of the coronary arteries and their branches revealed any pathological changes and the calcium score was zero.

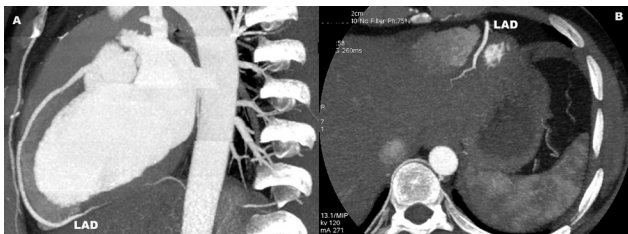
DISCUSSION

Coronary artery anomalies may be found incidentally in 0.3 % to 1 % of healthy individuals [1]. In the largest study of coronary angiograms of 126,595 patients, coronary anomalies were observed in 1.3 % of patients [2]. Clinically coronary anomalies are classified as "benign" (hemodynamically insignificant) or "malignant" (hemodynamically significant) based on their potential to cause any adverse outcome. Anatomically these



[Table/Fig-1]: Volume rendered (VR) image showing a diminutive right coronary artery (RCA) taking origin from the right coronary sinus. The left main artery is bifurcating into left anterior descending (LAD) and left circumflex (LCX) branches

[Table/Fig2]: VR (A) and Coronary tree (B) images show a large LAD after giving rise to Diagonal (D) artery winds round the apex to continue as posterior descending artery (PDA) on the diaphragmatic surface. The LCX is not coursing through coronary sulcus and gives two obtuse marginal arteries (OM1, OM2) and a posterior left ventricular branch (PLB) supplying inferior surface of left ventricle. A large left atrial branch (star) from the proximal LAD passes to the left deep to LCX to supply the left atrium



[Table/Fig-3]: Sagittal (A) and axial (B) maximum intensity projection (MIP) images showing continuation of LAD as PDA in the posterior interventricular groove

anomalies are classified into those of origin and distribution and those with fistulae. Most coronary anomalies do not result in signs, symptoms, or complications, and usually are discovered as incidental findings at the time of catheterization, autopsy or other radiological investigations. Normally posteroinferior part of the interventricular septum is supplied by the posterior descending artery (PDA) whose variable origin is reflected by the concept of coronary dominance. The posterior descending artery can arise from right coronary artery (RCA) in a pattern of right dominance (85% of patients) and co-dominance (7% of patients) or from the left circumflex artery (LCX) in a pattern of left dominance (8% of patients) [3]. An extremely rare form of left dominant coronary circulation reported in the literature is the continuation of left anterior descending artery (LAD) around the apex into the posterior interventricular sulcus as the PDA supplying most of the interventricular septum. We have reported here a case of anomalous origin of PDA

as continuation of hyperdominant LAD in the presence of a hypoplastic, non-dominant RCA and an anomalous branch of LAD supplying left atrium.

Levin and Baltaxe studied 200 coronary angiograms and described four abnormal patterns of PDA from RCA as double PDA (6%), early origin of PDA before the crux (5%), partial supply of the diaphragmatic septum by a posterior right ventricular branch (8%) or by an acute marginal artery (7%) [4]. They did not observe the variation of LAD continuing as PDA in their study on 200 coronary angiograms.

We have presented here a rare type of left dominant circulation in which a large LAD is continuing as PDA after winding round the apex in the presence of a diminutive RCA. Such a large LAD continuing as PDA is referred as “hyperdominant” [5, 6] or “superdominant” [7,8]. Continuation of LAD around the apex onto the posterior interventricular groove to reach the crux of the heart has also been described as “posterior ascending artery” [7]. Some authors describe such a LAD as “wrap around LAD” though “wrapped LAD” is defined as a LAD supplying at least one-fourth part of inferior surface of left ventricle and the interventricular septum [9]. Normally the LAD winding round the apex extends for a short distance onto posterior interventricular groove to anastomose with the normally arising PDA and supply a small part of inferior septum.

Presence of a hyperdominant LAD continuing as PDA with a diminutive RCA has been observed by others also [5,6, 9 -11].

Occurrence of acute inferior wall myocardial ischemia due to occlusion of LAD continuing as PDA is also reported [9]. John observed one case of anomalous origin of PDA from proximal LAD which then crossed anterior to root of pulmonary trunk and right ventricle to reach the acute margin and extend onto inferior surface to supply posteroinferior septum [12]. Clark et al., noted unusual origin of PDA from LAD in three patients undergoing coronary angiography [13]. Musselman and Tate reported a rare form of left dominant coronary circulation in which LAD wraps around the apex forming the PDA and also supplying atrioventricular node [14]. An anomalous case of single coronary artery in which RCA originated from proximal LAD with distal LAD continuing as PDA has been reported [3]. In another type of left dominant circulation, PDA arises as a branch of septal perforator from LAD and reaches the posterior interventricular groove passing through the interventricular septum [15]. Normally the left atrium is supplied by branches from the LCX as it courses through coronary sulcus. In the present case, a large anomalous branch (2.3 mm in diameter) arising from proximal LAD passes deep to LCX to reach the base of the heart to supply left atrium and LCX, after giving off two obtuse marginal (OM) branches, continue onto the inferior surface of the left ventricle as PLB. To the best of our knowledge, no such left atrial branch arising from the proximal LAD has been described in the literature and we believe it to be the first case.

CONCLUSION

Posterior descending artery has a variable origin from the right coronary artery or left circumflex artery reflected by the concept of coronary dominance. Very rarely it may arise as a continuation of "hyperdominant" left anterior descending artery. In the presence of a "hyperdominant" LAD continuing as PDA, the entire interventricular septum is perfused by the LAD and its occlusion can lead to catastrophic consequences. Physicians, interventional cardiologists and cardiac surgeons should be aware of such a rare anomaly as it has a considerable impact on clinical outcome of a patient with occluded "hyperdominant" LAD jeopardising a large segment of the myocardium.

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