Super-dominant left circumflex coronary artery (LCx) — an unusual variant of left dominance

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DOI: 10.5603/FC.a2019.0029
Article type: Case Reports
Submitted: 2018-01-05
Accepted: 2018-01-21
Published online: 2019-03-27

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Super-dominant LCx

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Abstract
Single coronary artery (SCA) is a rare congenital anomaly of the coronary circulation, the incidence of which has been reported as being from 0.6–1.3% among the population undergoing coronary angiography. The absence of a right coronary artery (RCA) with the origin of the RCA arising from the distal circumflex artery is an exceedingly rare variant of the SCA. The exact incidence of this anomaly is uncertain, with very few cases reported. We here report the case of a 56 year-old diabetic, hypertensive male presenting with acute inferior wall myocardial infarction who was thrombolysed with tenecteplase. Subsequent coronary angiogram demonstrated RCA arising from the distal left circumflex coronary artery (LCx) as its extension, thereby making the LCx super-dominant. RCA had ostial plaquing, and therefore the patient was managed conservatively.

Key words: myocardial infarction; right coronary artery; super-dominant left circumflex coronary artery; single coronary artery

Introduction
An anomalous origin of the right coronary artery from either the left anterior descending artery or the left circumflex coronary artery, thus functionally presenting as a trifurcation of the left coronary artery, is an extremely rare entity. Coronary circulation from a single coronary artery usually carries little clinical significance; however, variability in anatomical origin and course may result in a stormy outcome in the form of sudden cardiac death and malignant arrhythmias. Coronary artery anomalies are found in 0.6 to 1.5% of coronary angiograms and are usually incidental findings [1]. Single coronary artery (SCA) is a rare congenital anomaly that describes the origin of both the right coronary artery and the left main coronary artery from a single aortic sinus. It is usually diagnosed incidentally during coronary artery angiograms or in post-mortems.

Case report

A 56 year-old male presented with sudden onset chest pain of three hours’ duration associated with profuse sweating. His risk factors were diabetes and hypertension which was properly controlled with drugs. Physical examinations were normal. Haemogram and renal profile were normal. Electrocardiogram showed ST segment elevation in leads II, III and aVF with reciprocal changes in leads I and aVL. Echocardiography revealed mild concentric left ventricular hypertrophy, regional wall motion abnormality in right coronary artery (RCA) territory, and an ejection fraction of 50%. He was successfully thrombolysed with tenecteplase. Coronary angiography was planned through the right radial route after proper consent. Cannulation of left main coronary artery showed its normal course dividing into left anterior descending artery (LAD) and left circumflex artery (LCx) (Fig. 1, 2A). However, right coronary artery (RCA) was originating from distal LCx after origin of terminal obtuse marginal branch (Fig. 1, 2A). On aortic root angiogram using a pigtail catheter, RCA could not be visualised from right aortic sinus (Fig. 2B). RCA had plaquing at its origin. To confirm the anomalous origin, and to better delineate the course of the artery, 128-slice multi-detector computed tomography (MDCT) coronary angiography was performed, which revealed single left coronary artery and RCA originating from the distal LCx, coursing posteriorly in the left posterior atrio-ventricular groove (Fig. 3, 4). In our case, the left main coronary artery was functionally trifurcating into LAD, LCx and RCA (Fig. 3). The patient was managed conservatively with aspirin — 150 mg, clopidogrel — 150 mg, Ramipril — 5 mg, metoprolol — 50 mg, and gilbenclaimide — 1mg daily.
Discussion

The LCx artery is the dominant vessel in 15% of patients, supplying the left posterior descending artery (PDA) from the distal continuation of the LCx. The RCA is dominant in 85% of patients, supplying the PDA and at least one postero-lateral branch. In 7.5% of patients, the left PDA and the left postero-lateral branches are provided by distal LCx artery, making it dominant (left dominant). In the remaining 7.5% of patients, the RCA gives rise to the PDA and the LCx provides the entire postero-lateral branch, thus making it co-dominant circulation. A vessel is considered super-dominant when it is extremely large and supplies the territory that is normally supplied by the other vessel [2]. In the largest retrospective survey of coronary anomalies, as reported by Yamanaka and Hobbs et al [1], the incidence of anomalies of distribution was 1.15%. Most of these cases have been reported in a structurally normal heart. Therefore they have been identified mostly as an incidental finding, and rarely present with coronary artery disease. Anomalous RCA usually arises from the left sinus itself, or directly from the left main coronary artery or its vicinity. Anomalous origin of RCA from LCx has rarely been reported in the literature. The incidence of anomalous RCA in congenital coronary anomalies is variable, with an incidence varying from 0.04–0.46% [3,4]. A single coronary artery is so classified if the entire coronary system originates from a single ostium in the aorta. Coronary circulation arising from a single coronary ostium remains silent except when the coronary artery has an interarterial course between two great vessels. This can lead to sudden cardiac death due to extrinsic compression.

In our case, left main was dividing into left anterior descending artery and circumflex artery and RCA was further arising from distal LCx. Therefore, all three arteries were functionally arising from a single ostium from the left sinus. Catheter based angiogram does not give any information about its course, therefore computed tomography of coronary artery should be carried out to describe the anatomy and course of a coronary artery, as was done in our case. This anomaly is usually considered benign. Possible reasons for its occurrence, in the absence of coronary atherosclerosis, may be interarterial course or the ‘coronary steal’ phenomenon as a result of either compromised flow in the anomalous artery or acute angle of take-off for the anomalous vessel.

LCx is described as super-dominant when it is giving rise to the PDA, the postero-lateral branch, and the entire RCA. There is no consensus about the best management strategy. This will depend on the clinical presentation, any co-morbid conditions, and the
underlying atherosclerotic burden, if any. In our case, as the ostial RCA had only plaque, it was decided to continue with a conservative strategy.

The clinical importance of having super-dominant vessels is the increased reliance of the heart on one particular vessel, which makes the consequences of its occlusion catastrophic. Coronary anomalies are best diagnosed using a CT angiogram, which gives three-dimensional information of the origin as well as the course of the coronaries. This can sometimes be useful in diagnosing potentially life-threatening coronary anomalies.

Conflict of interest
None

Acknowledgement
Vinay Singh (Radiation Safety Officer) for constructing the CT images

References


Figure 1. Left main trunk dividing into left anterior descending artery (LAD), left circumflex artery (LCx), and right coronary artery (RCA) arising from distal LCx (white arrow — RCA; A — antero-posterior caudal view; B — antero-posterior cranial view)
**Figure 2.** Left main trunk dividing into LAD, LCx and RCA arising from distal LCx (white arrow) A — left anterior oblique caudal view; B — aortic root angiogram showing absence of RCA from its usual location

**Figure 3.** Multi-detector computed tomography coronary angiography showing RCA arising from distal LCx showing plaquing at the ostia of RCA (white arrow); A — left anterior oblique cranial view; B — antero-posterior cranial view

**Figure 4.** Multi-detector computed tomography coronary angiography showing RCA arising from distal LCx showing plaquing at the ostia of RCA (white arrow); A — right anterior oblique cranial view; B — CT angiography volume-rendering technique images showing RCA running in the posterior left atrio-ventricular groove