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Case Report

Intercoronary communication in chronic total occlusion: In search of recognition

Mohit D. Gupta *, M.P. Girish, Sudhansu Sekhar Parida, Sanjay Tyagi

Department of Cardiology, GB Pant Hospital and associated Maulana Azad Medical College, New Delhi, India

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ABSTRACT

Intercoronary communications (ICC) or open-ended coronary circulation is rare. We describe intercoronary communication in a case of chronic total occlusion, and discuss the pathophysiological and clinical significance of these rare entities. The present case also demonstrates the anatomical presence of ICC despite angiographic absence for the first time using CT coronary angiography.

1. Introduction

Coronary cascade also known as intercoronary communication (ICC) is a rare congenital anomaly in which there is open-ended uni- or bidirectional blood flow between two coronary arteries. Although it was initially described by Cheng et al. in 1972, very few cases have been reported till now both in normal and stenotic coronary artery. True incidence of ICC is still unknown, but literature reports it to be between 0.002% and 0.04%. It is histologically different from collaterals but clinical significance of these communications is still uncertain. We report a case of ICC between left anterior descending artery (LAD) and right coronary artery (RCA) in a chronic total occlusion of RCA. We discuss the pathophysiologic and clinical significance of this entity and also for the first time highlight role of noninvasive imaging modality in detecting them.

2. Case

A 65-year-old male nonsmoker, nondiabetic presented with recent onset angina. His electrocardiogram showed T-wave inversion in lead V1–V4. Troponin *T* test was negative. Two-dimensional echocardiography revealed no regional wall motion abnormality with normal left ventricular ejection fraction. Routine blood reports were within normal limits. Diagnosis of unstable angina was made and he was planned for an elective coronary angiogram. His angiography showed normal left main (LM) coronary artery, significant stenosis of mid left anterior descending artery (LAD), normal left circumflex artery (LCX), and complete occlusion of mid segment of right coronary artery (RCA). RCA was retrogradely filling from LAD through intracoronary communication (ICC) joining posterior descending artery (PDA) (Figs. 1 and 2 and Video 1). Percutaneous intervention of RCA followed by LAD was planned. The lesion in RCA was attempted to cross with balanced middleweight wire (Abbott Vascular, USA). However, we were unable to cross it. Finally, the lesion was crossed with Cross IT 300 wire (Abbott Vascular Inc.). Retrograde filling of RCA from LAD through ICC served as a guide to ascertain the proper course of the wire. Predilatation of lesion was done sequentially with sprinter 1.25 mm × 6 mm, 1.5 mm × 10 mm, and 2 mm × 15 mm balloons (Medtronic Vascular, USA). When anterograde flow was restored in RCA, a typical *milking phenomenon* (Fig. 3 and Video 2) was observed in PDA branch (classical of ICC). The RCA was then stented with 2.5 mm × 37 mm and 3 mm × 40 mm biomime drug eluting stent (Meril Life Science, Vapi, India). Post-dilatation was done with noncompliant balloon after stenting. Sequential angiogram of the left coronary artery followed by RCA demonstrated no filling of RCA from LAD (through ICC), normal flow in the RCA, and retrograde filling of LAD from RCA through ICC in the end (Video 3). However, simultaneous injection of both arteries demonstrated ICC clearly (Fig. 4 and Video 4). Interval stenting of LAD was done 2 days later during the same admission. After PCI

* Corresponding author at: Room 125, Academic Block, First Floor, Department of Cardiology, GB Pant Hospital, New Delhi 110002, India. Tel.: +91 9810121311; fax: +91 11 23235453.
E-mail address: drmohitgupta@yahoo.com (M.D. Gupta).

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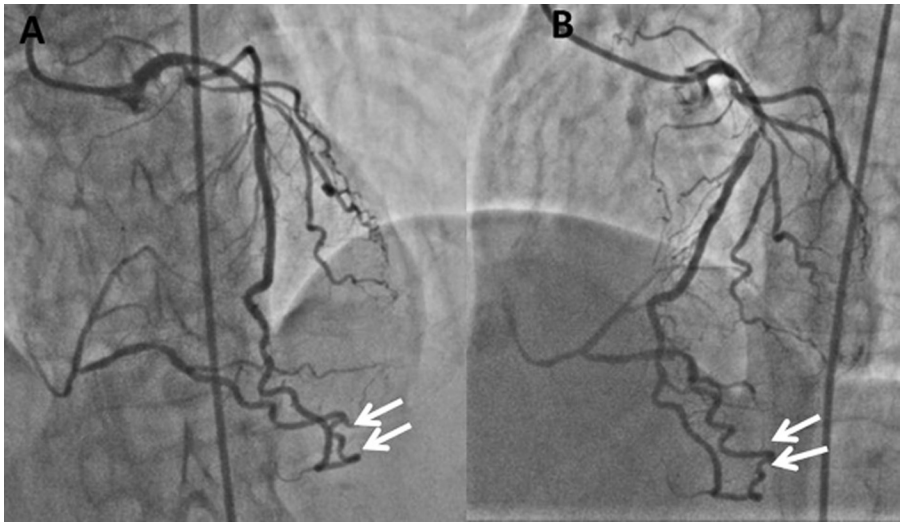

Fig. 1. (A) Coronary angiogram of left coronary artery in posterior-anterior cranial view showing stenosis in the mid left anterior descending artery (LAD) with retrograde filling of the right coronary artery through intercoronary communication (arrow) from the LAD. (B) Coronary angiogram of left coronary artery in Left anterior oblique cranial view showing stenosis in the mid left anterior descending artery (LAD) with retrograde filling of the right coronary artery through intercoronary communication (arrow) from the LAD.

Fig. 2. Coronary angiogram of right coronary artery in left anterior oblique cranial view showing occlusion in mid part.

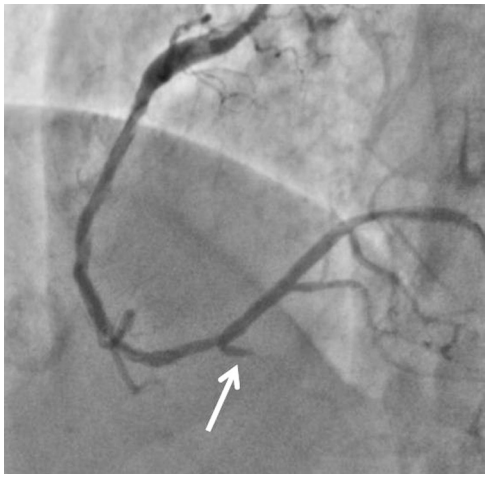

Fig. 3. Coronary angiogram of right coronary artery in left anterior oblique cranial view showing restoration of flow in RCA up to posterior left ventricular artery. However, posterior descending artery is partially opacified due to competitive flow (see video 2).

of LAD, there was complete disappearance of ICC from both arteries. When CT coronary angiogram was performed, surprisingly ICC was clearly visualized despite being not seen on conventional angiography (Fig. 5). Patient has been asymtomatic on follow-up of 6 months. His treadmill test is negative for inducible ischemia at high workload.

Supplementary Video 1 related to this article can be found, in the online version, at doi:10.1016/j.ihj.2016.07.005.

Supplementary Video 2 related to this article can be found, in the online version, at doi:10.1016/j.ihj.2016.07.005.

Supplementary Video 3 related to this article can be found, in the online version, at doi:10.1016/j.ihj.2016.07.005.

Supplementary Video 4 related to this article can be found, in the online version, at doi:10.1016/j.ihj.2016.07.005.

3. Discussion

ICC or open-ended coronary circulation is a rare entity in which there is congenital communication between two coronary arteries with both uni- and bidirectional blood flow. Most common type of

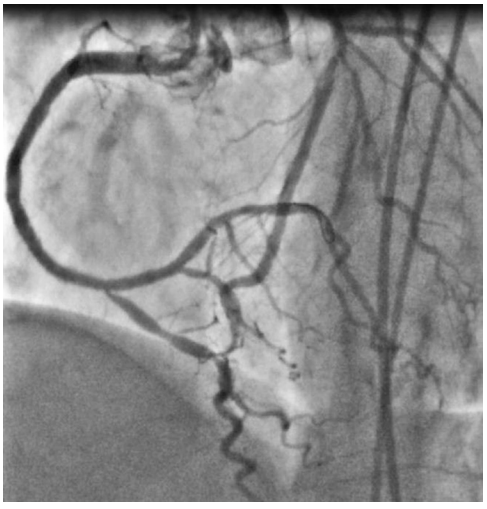

Fig. 4. Coronary angiogram of left and right coronary arteries with simultaneous injection after stenting of RCA showing complete opacification of both the arteries.

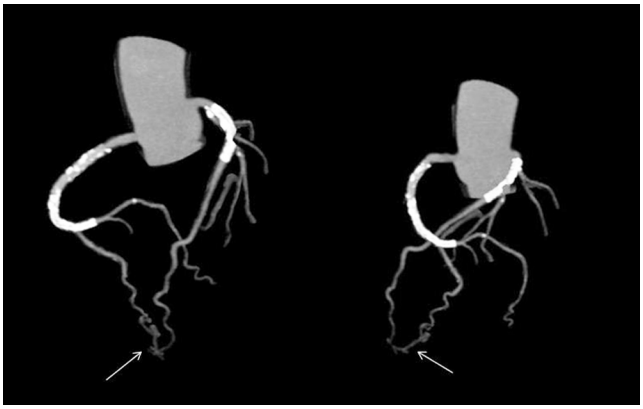

Fig. 5. CT coronary angiography in left anterior oblique cranial view showing persistent intercoronary communication despite nonvisualization on conventional angiography.

communications is between LCX and RCA followed by LAD and PDA. In the present case, ICC was demonstrated in the setting of percutaneous intervention of a chronic total occlusion of RCA for the first time. There are several distinct observations that need to be highlighted.

The present case clearly shows that ICC is distinct from coronary collaterals morphologically. They are much larger caliber vessels, are extramural, usually single, and mostly follow an epicardial course,[1] as demonstrated in this case. On the contrary, collaterals are of smaller caliber, multiple, and are tortuous with mainly intramural course. The ICC in this case showed some tortuosity, but that may be present in certain epicardial connections.[1] Even histologically, ICC is similar to normal artery with well-defined muscular layer, which is absent in collaterals.[1] ICC may be due to faulty embryological development, whereas collaterals are due to ischemic stimulation. Being an open-ended circulation, the supply to the myocardium is much better by the ICC than the collaterals. This may also be responsible for an almost preserved LV function in the patient despite having significant occlusive disease in two vessels.[1] Another interesting and intriguing observation is the milking phenomenon observed in the vessels. This is nothing but a competitive blood flow in the vessels communicating through the ICC. When RCA was completely occluded, only flow from LAD to R-PDA was observed. When antegrade flow was restored in RCA, clear competitive flow was observed in R-PDA due to differential pressure head between the two vessels. However, when the flow in RCA was completely normalized after stenting, the competitive flow was shifted to distal LAD due to higher pressure head in the right circulation and lower in LAD due to proximal stenosis. This has a significant clinical implication. It shows the capability of ICC to have unidirectional and/or bidirectional blood flow depending upon the degree of stenosis. In other words, it can act as a major source of supply to either vessel depending on the degree of stenosis. Such phenomenon is never seen in collaterals.

After PCI of both the vessels, the ICC could not be demonstrated angiographically. But CT coronary angiography clearly demonstrated presence of these channels between the two vessels. This conclusively shows that these channels persist anatomically and become functional in case of any obstruction to the epicardial coronary artery. It would be pertinent to say that these channels function to supply the blood to the jeopardized myocardium in case of any obstruction. Hence, they are of immense clinical relevance. Such an anatomical demonstration of open-ended coronary circulation has never been described in the literature. In fact, they have been erroneously considered as type of collaterals and hence their importance is often undermined. The coronary collateral circulation after revascularization of the diseased artery cannot be demonstrated on CT angiography. Presence of ICC can also provide a road map for intervention of occluded arteries. Hence, their knowledge is of importance to a cardiologist.

To conclude, the present case for the first time demonstrates presence of ICC on coronary CT angiography despite its absence on conventional angiography after revascularization.

Conflicts of interest

The authors have none to declare.

Statement of human rights

All authors state that studies have been approved by the appropriate institutional and/or national research ethics committee and have been performed in accordance with the ethical standards as laid down in the 1964 Declaration of Helsinki and its later amendments or comparable ethical standards.

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