

Protective Role of Intercoronary Communication between Right Coronary Artery with Chronic Total Occlusion and Normal Left Circumflex Artery against Recurrent Myocardial Ischemia

Seung-Hyun Lee, Sung-Ha Park, Ah Young Ji, Jung Hee Lee, Moonyun Jin, Changho Song, Insoo Kim, Young Ju Kim, Boyoung Joung

Division of Cardiology, Department of Internal Medicine, Yonsei University College of Medicine, Seoul, Korea

Intercoronary communication is a very rare congenital malformation, which differs from coronary collaterals in variable aspects. It is larger in diameter, extramural in location and more resembles normal mature arterial features histologically. There are no consensus for the definition of intercoronary communications, but some reports have suggested their protective role against myocardial ischemia due to its dual blood supply system. We report the case of a 72 year-old male smoker who had chronic total occlusion at the proximal portion of right coronary artery, which was communicated with a normal left circumflex artery. Although the patient had chronic total occlusion and subsequent in stent restenosis, there were no presentations of acute coronary syndrome or myocardial infarction.

Key Words: Coronary vessels, Communication, Anomaly, Myocardial ischemia, Coronary occlusion

INTRODUCTION

Intercoronary communication is a rare congenital anomaly of the coronary arteries of which the prevalence was reported as 0.002%.^{1,2} The mechanism of communications is thought to be continuation of the fetal connections, so the histological features of the communicating arteries are those of mature developed coronary arteries. It also differs from the collateral vessels in some aspects. Intercoronary communicating arteries are larger in diameter, extramural in location and more straight in its course.³ Despite these features, it is not easy to distinguish the communications from the collateral flows associated with coronary atherosclerosis. Although it is

typically regarded as a benign congenital anomaly, there are many conflicting reports regarding its functions. So, we report a case of a 72-year-old man with intercoronary communication between right coronary artery (RCA) and left circumflex artery (LCx), which was confirmed after the revascularization of a RCA CTO lesion.

CASE REPORT

A 72 year-old male smoker visited the outpatient clinic of cardiovascular hospital because of the three-month typical angina during the exercise. He had suffered from hypertension and dyslipidemia for ten years. Laboratory test, chest X-ray and 12-lead surface EKG were all within

Received: September 15, 2012
Accepted: October 9, 2012

Corresponding Author: Boyoung Joung, Department of Internal Medicine, Yonsei Cardiovascular Hospital, Yonsei University College of Medicine, 250 Seongsanno, Seodaemun-gu, Seoul 120-752, Korea
Tel: +82-2-2228-8460, Fax: +82-2-393-2041, Email: CBY6908@yuhs.ac

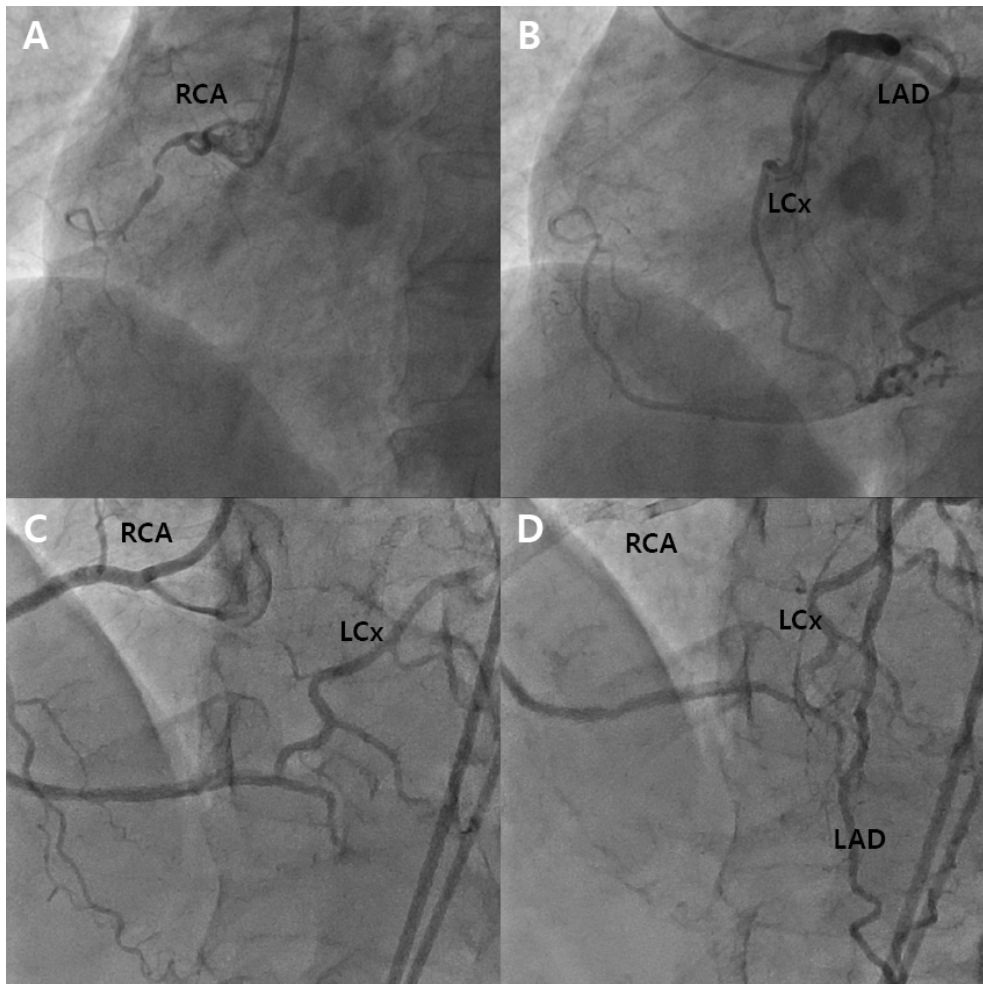


Fig. 1. In the first admission, coronary angiography showed total obstruction at RCA, and well developed collateral flows were observed (A, B). After the second stage PCI at RCA CTO lesion, the selective injection of the RCA showed retrograde filling of the whole LCx (C). In the selective injection of the LCA, retrograde filling reached only at the middle of the RCA (D).

ABBREVIATIONS

CTO - chronic total occlusion
 LCx - left circumflex artery
 LAD - left anterior descending artery
 RCA - Right Coronary Artery

normal limit. However, maximal treadmill test was positive with horizontal ST segment depression in V5 and V6 leads, and heart computed tomography findings showed significant narrowing at 3 major epicardial arteries.

Coronary angiography showed total occlusion of the proximal portion of RCA and significant diffuse eccentric stenosis from the proximal to middle portion of the left anterior descending artery (LAD) (Fig. 1A). The TIMI grade of collateral flow from the distal portion of LCx to the distal portion of RCA was good with grade II-III/III (Fig. 1B). So, percutaneous coronary interventions were performed at only proximal to middle portion of LAD with 3.0 x 18 mm and 3.0 x 13 mm sized sirolimus-eluting stents (CYPHER[®], Cordis Corp., Miami Lakes, FL, USA). Second stage percutaneous coronary intervention was

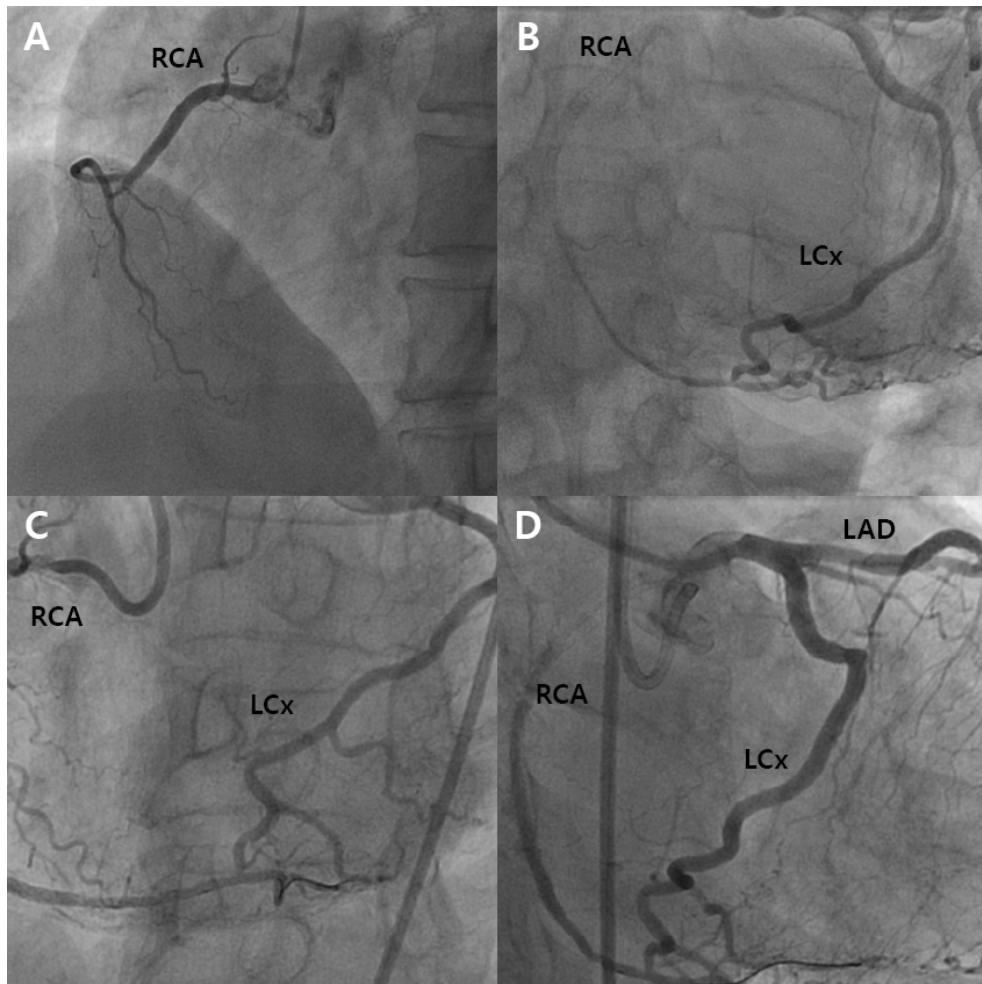


Fig. 2. In the third admission, coronary angiography showed total obstruction at RCA with ISR (A, B). After successful PCI, the selective injection of the RCA showed retrograde filling of the whole LCx (C). Selective injection of the LCA, retrograde filling reached at the middle of the RCA (D).

done at proximal portion of RCA three months after the first discharge. Coronary angiography showed patent previous stents from the proximal to middle portion of LAD and second stage percutaneous coronary intervention with 3.0 x 38 mm , 2.5 x 38 mm everolimus-eluting stents (Xience Prime, Abbott, Abbott Park, IL, USA) was successfully performed at proximal portion of RCA. Final angiography showed not collateral but intercoronary communication between distal LCx and d-RCA. Selective injection of the RCA showed retrograde filling of the whole the LCx (Fig. 1C). However, selective injection of the LCx showed retrograde filling reaching to only middle of the

RCA artery (limited bidirectional intercoronary communication) (Fig. 1D). The diameter of communicating vessel was very large and equal to the distal LCx. After the intervention, he received triple antiplatelet drugs (aspirin 100 mg daily, clopidogrel 75 mg daily, cilostazol 100 mg twice daily) due to CTO lesion and RV branch obstruction. Cilostazol was discontinued 1 month after the second discharge.

The patient was doing well without any symptom during the subsequent outpatient follow up. However, there was total in-stent-restenosis at the middle portion of RCA in 12 month follow up angiography (Fig. 2A, 2B). Percuta-

neous coronary intervention with 3.0 x 30 mm sized paclitaxel-coated balloon (SeQuent™ please, B. Braun Melsungen AG, Vascular Systems, Berlin, Germany) was performed at RCA ISR lesion. Due to the type B dissection of distal portion of RCA, 2.75 x 24 mm sized Biolimus A9-eluting stent (Nobori® Terumo Corporation, Tokyo, Japan) was implanted by "stent in stent" method successfully (Fig. 2C, 2D). Thereafter, triple antiplatelet therapy including cilostazol 100 mg twice daily was restarted for 1 month. Currently, dual antiplatelet drugs with aspirin and plavix are maintained without any chest pain.

DISCUSSION

Intercoronary communication, which is one of the interarterial intercommunications, has open ended pattern of coronary circulation.⁴ The true incidence is still unknown.⁵ In the previous studies, there were two types of connections : one was found as in our case between the RCA and the LCx in the posterior atrioventricular groove, the other was communication between the anterior and posterior interventricular arteries in the distal portion of the posterior interventricular groove. The mechanism of the communication is regarded as congenital in origin.⁶ Compared to the coronary collaterals, intercoronary communication has different features. As previously mentioned, it is an extramural, large sized vessel more than 1 mm in diameter and a straighter course than the collateral vessels. Some studies have suggested that determinant factors of coronary collateral circulation are angiogenic growth factors (vascular endothelial growth factor, transforming growth factor- α , basic fibroblast growth factor) and arteriogenic growth factors (transforming growth factor- β , granulocyte-macrophage colony-stimulating factor) during myocardial ischemia, the degree of pressure gradient and shear stresses,⁷ whereas intercoronary communication is almost always conge-

nital.

There are still conflicting views regarding the functional significance of the intercoronary communication. Some reports suggested that intercoronary communication could induce myocardial ischemia due to the coronary steal phenomenon,⁵ while others suggested that it could play a protective role if lesions develop in one of the two vessels it links together.^{8,9} In this particular case, we could not find evidence of cardiac enzyme elevation and any ischemic sign in the surface resting 12-lead electrocardiography and the only positive signs were observed during stress treadmill tests. Also, there were no evidence of myocardial infarction on echocardiography despite the totally obstructed lesion with in-stent-restenosis at RCA. Although the exact mechanism is not clear, these results showed the protective effects of dual blood supply against ischemia. Coronary artery flow was either unidirectional or bidirectional in these patients and there was always flow from the right to the left coronary artery.¹⁰ After the revascularization, we could observed the limited bidirectional, right to left dominant flow on coronary artery. The functional significance of this observed flow direction is still not known. Further research study is required to know the clinical significances of the communication types and blood flow directions.

REFERENCES

1. Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary arteriography. *Cathet Cardiovasc Diagn* 1990;21:28-40.
2. von Kodolitsch Y, Franzen O, Lund GK, Koschyk DH, Ito WD, Meinertz T. Coronary artery anomalies Part II: recent insights from clinical investigations. *Z Kardiol* 2005;94: 1-13.
3. Burri M, Bopp P. [Congenital intercoronary arterial anastomosis. Apropos of a case and review of the literature]. *Arch Mal Coeur Vaiss* 1986;79:1962-1964.
4. Voci G, Patel RB, Trivedi AD, Patel PV, Burris AC, Ruby

- SR. Angiographic demonstration of congenital intercoronary communication in normal adults. *Am J Cardiol* 1987;59:1205-1206.
5. Gur M, Yilmaz R, Demirbag R. Unidirectional communication between the circumflex and right coronary arteries: a very rare coronary anomaly and cause of ischemia. *Int J Cardiovasc Imaging* 2006;22:339-342.
6. Reig J, Jornet A, Petit M. Direct connection between the coronary arteries in the human heart. Intercoronary arterial continuity. *Angiology* 1995;46:235-242.
7. Koerselman J, van der Graaf Y, de Jaegere PP, Grobbee DE. Coronary collaterals: an important and underexposed aspect of coronary artery disease. *Circulation* 2003;107:2507-2511.
8. Esente P, Gensini GG, Giambartolomei A, Bernstein D. Bidirectional blood flow in angiographically normal coronary arteries. *Am J Cardiol* 1983;51:1237-1238.
9. Gavrielatos G, Letsas KP, Pappas LK, Markou V, Antonellis J, Tavernarakis A, Kardaras F. Open ended circulation pattern: a rare case of a protective coronary artery variation and review of the literature. *Int J Cardiol* 2006;112:e63-65.
10. Linsenmeyer GJ, 3rd, Schneider JF. Angiographically visible intercoronary collateral circulation in the absence of obstructive coronary artery disease. *Am J Cardiol* 1984;53:954-956.