

Abnormal Origin of the Right Coronary Artery Resulting from the Left Coronary System Discovered During an Acute Coronary Syndrome: Report of Two Cases and Brief Literature Review

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ABSTRACT

The abnormal right coronary artery originating from the left coronary system is an extremely rare variation of isolated single coronary artery. It is often a benign entity and the patients remain asymptomatic. Nevertheless, it can lead to sudden death during exertion. The treatment of this coronary anomaly may be medical, percutaneous and/or surgical. We present here a right coronary artery originating from the proximal left anterior descending artery in the first case and from the left main coronary artery in the second case. Both patients were seen to have an acute coronary syndrome with multi-vessel coronary artery disease.

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Introduction

Coronary anomalies are usually found incidentally during coronary angiography, the incidence of coronary anomalies was reported as 1.3% in a large registry of patients undergoing coronary angiogram. Anomalous origin of the right coronary artery originating (RCA) found in approximately 0.11% of patients undergoing conventional coronary angiography [1]. The majority of these anomalies are benign and the patients remain asymptomatic, but they can occasionally cause symptoms, it may even lead to sudden death during exertion [2].

We present here a very rare coronary anomaly of an RCA originating from the proximal left anterior descending artery (LAD) in the first case and from the left main coronary artery (LMCA) in the second case. Both patients were seen to have an acute coronary syndrome with multi-vessel coronary artery disease.

Observations

Case 1

A 54 year-old man was admitted to our hospital complaining of chest pain. His medical history consisted of diabetes and hyperlipidemia. He was a non-smoker and he had no history of chest pain. On admission, his ECG showed ST segment depression in anterolateral and inferior leads and cardiac enzyme levels were high. Transthoracic echocardiography was within normal limits.

The coronary angiography objectified a triple vessel coronary artery disease with significant stenosis of the proximal and middle segment of the LAD, stenosis of the proximal circumflex. An anomalous right coronary artery as a separate small branch arose from the proximal LAD occluded at its 2nd segment which is supplied by the left coronary system "Fig. 1".

The patient has been treated with left internal mammary artery bypass grafts to the left anterior descending and diagonal coronary arteries, and right internal mammary artery

bypass grafts to the right posterior descending artery and left marginal artery. At follow-up, it was observed that the patient had an asymptomatic clinical status.

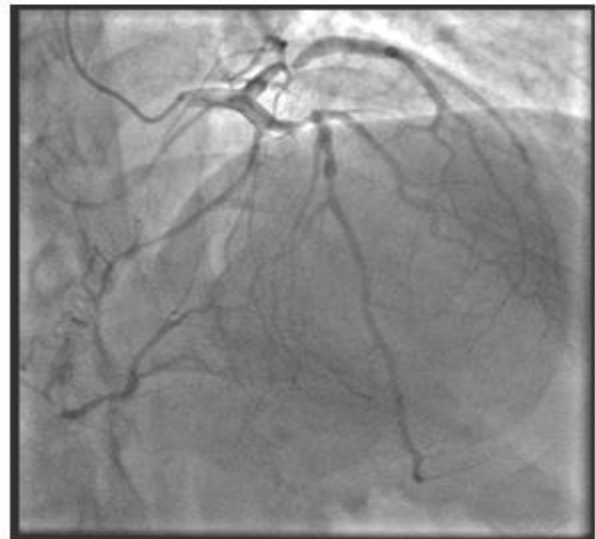


Figure 1. Cranial view of left coronary injection showing origin of the right coronary artery from the proximal left anterior descending artery.

Case 2

A 76 year-old male suffering from chest pain for 3 days and for the first time. He is having as cardiovascular disease risk factors the age, sex, diabetes since 7 years and hypertension. The ECG indicated an antero-septo-apical ST segment elevation myocardial infarction. The echocardiography showed a severe left ventricular dysfunction and a heterogeneous contractility. The coronarography defined an occlusion of the LAD, during catheterization, a right coronary ostium could not be depicted neither by selective catheter intubation of the right coronary ostium nor by contrast injection in the aortic root.

Therefore we repeated the intubation of the left coronary ostium keeping the catheter at the beginning of LMCA which displayed an anomalous origin of the right coronary artery from the left common trunk, with a double tight stenosis of the middle and distal parts of the posterior interventricular artery "Fig. 2" The patient was only given long-term medical therapy.

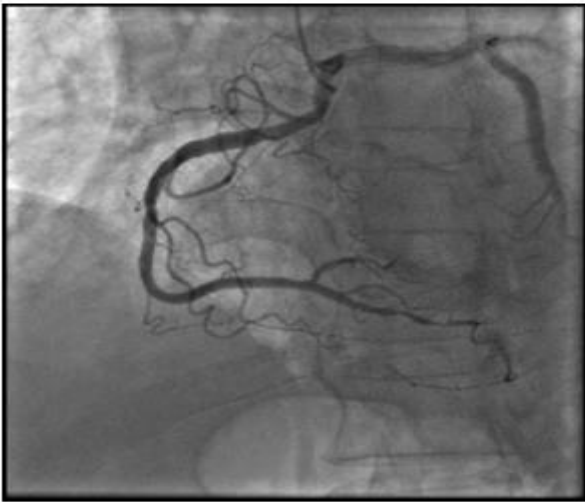


Figure 2. Cranial view of left coronary injection showing origin of the right coronary artery from the left main coronary artery.

Discussion

The origin of an anomalous RCA may be from the left sinus of Valsalva, the posterior sinus of Valsalva, the ascending aorta, the pulmonary artery (PA), the left ventricle, the LMCA, the left circumflex artery or the LAD [3].

Cases of anomalous RCA from the LMCA or LAD have only been rarely reported in the literature. We report two cases of anomalous origin of the right coronary artery in serie of 880 patients who underwent routine coronary angiography at the rate of 0.22%. Yamanaka and Hobbs [1] led a research about 126,595 patients, anomalous RCA was reported at the rate of 0.26%. According to Turkmen et al, 0.031% was the incidence of single coronary artery anomaly in a series of 215,140 patients who underwent routine coronary angiography [4].

Anomalous origin of the RCA from the LAD is more common than those originating from the LMCA, Yurtdas and Gülen had gathered cases that have been published about Anomalous origin of the right coronary artery from the LAD, to which we joined the cases published recently (Table 1).

That abnormal origin is revealed in about half of the cases by underlying coronary atherosclerosis, in about 47,8% of reported cases in table 1.

However, in the absence of coronary artery atherosclerosis, the abnormal coronary artery may cause myocardial ischemia during exertion and can even lead to sudden death. Some theories have been proposed to explain this, such as: i) spasm of the anomalous coronary artery, possibly as a result of endothelial injury or ischemia caused by its long distance of traveling; ii) the acute angle of take off of the anomalous vessel; iii) slit-like orifice; iv) intramural course of the anomalous vessel; and v) compression of the anomalous artery between the pulmonary and aortic trunks (Figure 4) [3].

This congenital disease may be asymptomatic, although it can be manifested with clinical symptoms such as myocardial ischemia especially following exercise.

ECG and echocardiography maybe without anomalies, especially for patients with atherosclerosis. Treadmill exercise electrocardiogram, cardiovascular stress testing and nuclear medicine can be useful for diagnosis. The coronary angiography represents the gold standard.

Coronary computed tomography angiography is necessary if the RCA could not be seen by conventional coronary angiography, it also allows to well determinate the course, termination and position, and could also be helpful for the therapeutic decision. IRM cardiac is beneficial mainly for patients with congenital defect.

The medical treatment is reserved for benign forms. Percutaneous coronary intervention (PCI) for an anomalous RCA arising from the left coronary system has been reported by a variety of authors but some difficulties may be encountered because the anomalous artery can take abnormal course or angulation making cannulation difficult and different catheter exchanges may cause spasm or dissection of RCA ostium [26]. If the medical prognosis is threatened, surgery becomes necessary. The most used technique is coronary artery bypass graft, mainly when we have other coronary artery disease to correct. Other surgical options are also recommended as ostioplasty, translocation of the RCA to the aorta and Pulmonary artery translocation.

Conclusion

The RCA originating from the left coronary system is an extremely rare variation of isolated single coronary artery, it can be asymptomatic as it can cause myocardial ischemia or more serious than that: sudden death. This anomaly is discovered in half of the cases during atherosclerosis disease. The coronary angiography and coronary computed tomography angiography remain the main diagnostic tools. Treatment for this coronary anomaly may be medical, percutaneous and/or surgical.

Table 1. Overview of published reports defining patients with anomalous right coronary artery originating from the left anterior descending artery.

Author [reference]	Age	Sex	Symptom	ECG	Origin of RCA	Course of RCA	CAD	Treatment
Hughes [5]	77	M	Exertional angina	Posterior infarction pattern	Prox LAD	NA	LAD 50%, CX 100%, anomalous RCA 70%	Medical
Rath and Battler [6]	77	M	Exertional fatigue	Normal	Mid LAD	Anterior to PA	Non-critical	Medical
Akcaay and al. [7]	35	M	Angina	ST-T wave changes	Prox LAD	NA	No	Medical
Teragawa and al. [8]	88	F	Hoarseness	NA	Prox LAD	Anterior to PA	No	Medical

Jammula and al. [9]	45	F	Exertional angina	Normal	Mid LAD	NA	Non-critical	Medical
Bayram and al. [10]	51	M	Angina	Normal	Mid LAD	Anterior to PA	NA	Medical
Amasyali and al. [11]	62	M	Angina	Normal	LAD S1	Intraseptally	Anomalous RCA	Medical
Meyers and al. [12]	50	F	Angina	Normal	LAD S1	Intraseptally	No	Medical
Iyisoy and al. [13]	53	M	Angina	Normal	Mid LAD	Posterior to Ao	No	Unknown
Kamran and Bogal [14]	39	M	Symptoms related to Endocarditis	NA	Mid LAD	Anterior to PA	No	Medical
Saravanan and al. [15]	59	F	Angina	Normal	Mid LAD	Anterior to PA	No	Medical
Erdogan and al. [16]	44	F	Angina	Normal	Mid LAD	Anterior to PA	CX	Medical
Hsueh and al. [17]	72	F	Angina	ST-T wave changes	Mid LAD	NA	LAD 95%	PCI
Calalbro and al. [18]	53	M	Angina	Normal	Mid LAD	NA	LAD	PCI
Takano and al. [19]	35	M	Angina	ST-T wave changes	Mid LAD	Anterior to PA	LAD severe	PCI
Kaul and Javangula [20]	57	M	Unstable angina	NA	Three different Branch from mid LAD	Anterior	LAD and CX	Surgery (CABG)
Smith [21]	66	F	Lethargy slurring of speech	NA	Prox LAD	Anterior to PA	Non-critical	Death due to no cardiac causes
Izumiyaama and al. [22]	57	M	Angina	Infarction pattern	Prox LAD	Anterior to PA	LAD	Surgery (CABG)
Izumiyaama and al. [22]	52	M	Angina	Normal	Prox LAD	Anterior to PA	Anomalous RCA	Surgery (CABG)
Simkoff and al. [23]	56	M	Angina	Infarction pattern	Prox LAD	NA	LAD 70% RCA diffuse	Surgery (CABG)
Yurtdas [23]	65	M	angina	Normal. ST segment depression during exercise.	mid LAD	Anterior to PA	No	Medical
Gitsios [24]	66	F	exertional dyspnea and atypical angina	ST depression during exercise	Mid LAD	Anterior to PA	Non-critical	Medical
Savas Sarikaya [25]	50	F	exertional dyspnea and atypical angina	NA	Mid LAD	Anterior to PA	No	Unknown
Hbali and El-Ouafi	54	M	angina	ST segment depression	Prox LAD	Anterior to PA	2 LAD 70%, CX 70%, anomalous RCA 100%	Surgery (CABG)

References

- [1] Yamanaka O, Hobbs RE. Coronary artery anomalies in 126,595 patients undergoing coronary angiography. *Catheter Cardiovasc Diagn* 1990;21:28–40.
- [2] Florence B, Coolen N, Nataf P, Tchetché D. Sudden death related to an anomalous origin of the right coronary artery. *Ann Thorac Surg*. 2008;85:1077–1079.
- [3] Mustafa Yurtdas, Oktay Gülen, Anomalous origin of right coronary artery. *Cardiology Journal* 2012, Vol. 19, No. 2, pp. 122–129 10.5603/CJ.2012.0023.
- [4] Turkmen S, Yolcu M, Sertcelik A, et al. Single coronary artery incidence in 215,140 patients undergoing coronary angiography. *Folia Morphol (Warsz)* 2014;73:469–74.
- [5] Hughes MM. Anomalous origin of the right coronary artery from the left anterior descending coronary artery. *Cathet Cardiovasc Diagn*, 1997; 42: 308–309.
- [6] Rath S, Battler A. Anomalous origin of the right coronary artery from the left anterior descending coronary artery. *Cathet Cardiovasc Diagn*, 1998; 44: 328–329.
- [7] Akcay A, Tuncer C, Batyraliev T et al. Isolated single coronary artery: A series of ten cases. *Circ J*, 2008; 72: 1254–1258.
- [8] Teragawa H, Okada K, Sueda T. Anomalous origin of the right coronary artery from the left anterior descending coronary artery. *Heart*, 2004; 90: 1492.
- [9] Jammula P, Gupta R, Uretsky BF. Anomalous origin of the right coronary artery from the left anterior descending artery. *Heart*, 2005; 91: e30.
- [10] Bayram E, Kocaturk H, Kantarci M, Fil F, Colak MC. Anomalous origin of the right coronary artery arising from the left anterior descending artery in a case with single coronary artery anomaly: Multi-detector computer tomography imaging. *Anad Kardiyol Derg*, 2008; 8: 385–386.

- [11] Amasyali B, Kursaklioglu H, Kose S et al. Single coronary artery with anomalous origin of the right coronary artery from the left anterior descending artery with a unique proximal course. *Jpn Heart J*, 2004; 45: 521–525.
- [12] Meyers DG, McManus BM, McCall D, Walsh RA, Quaife MA. Single coronary artery with the right coronary artery arising from the first septal perforator. *Cathet Cardiovasc Diagn*, 1984; 10: 479–484.
- [13] Iyisoy A, Kursaklioglu H, Barcin C, Barindik N, Kose S, Demirtas E. Single coronary artery with anomalous origin of the right coronary artery as a branch from the left anterior descending artery: A very rare coronary anomaly. *Heart Vessels*, 2002; 16:161–163.
- [14] Kamran M, Bogal M. Anomalous right coronary artery originating from the left anterior descending artery. *J Invasive Cardiol*, 2006; 18: 221–222.
- [15] Saravanan P, Mennim P, Hancock JE. Anomalous origin of right coronary artery from the mid left anterior descending artery. *Heart*, 2006; 92: 1212.
- [16] Erdogan O, Buyuklu M, Aktoz M. Anomalous origin of the right coronary artery from the left anterior descending artery in a patient with single left coronary artery: A rare coronary artery anomaly and review of the literature. *Int J Cardiol*, 2008; 127:280–283.
- [17] Hsueh SK, Youssef AA, Fang CY. Percutaneous coronary intervention of a stenotic left anterior descending artery with anomalous origin of right coronary artery. *Chang Gung Med J*, 2009; 32: 574–578.
- [18] Calabro P, Bianchi R, Palmieri R, Sordelli C, Bigazzi MC, Calabro R. Evidence of right coronary from mid-left anterior descending coronary: A rare case coronary anomalous origin. *Eur Hear J*, 2009; 30: 565.
- [19] Takano M, Seimiya K, Yokoyama S et al. Unique single coronary artery with acute myocardial infarction: Observation of the culprit lesion by intravascular ultrasound and coronary angiography. *Jpn Heart J*, 2003; 44: 271–276.
- [20] Kaul P, Javangula K. Single left coronary artery with separate origins of proximal and distal right coronary arteries from left anterior descending and circumflex arteries: A previously undescribed coronary circulation. *J Cardiothorac Surg*, 2007; 2: 20.
- [21] Smith JC. Review of single coronary artery with report of 2 cases. *Circulation*, 1950; 1: 1168–1175.
- [22] Izumiyama O, Yamashita A, Sugimoto S, Baba M, Hasegawa T. Coronary artery bypass grafting in two patients with single coronary artery. *Kyobu Geka*, 1999; 52: 143–147.
- [23] Simkoff WI, Murphy ES, DeMots H, Khonsari S, Abbruzzese P. Anomalous origin of the right coronary artery from the left anterior descending: Angiographic diagnosis in a patient with coronary artery disease. *Cathet Cardiovasc Diagn*, 1982; 8: 49–53.
- [24] Gitsios Gitsioudis, Grigorios Korosoglou. Single Coronary Artery with Anomalous Rising of the Right Coronary Artery: A Rare Coronary Anomaly Diagnosed by 256-Multidetector Computed Tomography. *Case Rep Med*. 10.1155/2011/108709.
- [25] P Saravanan, P Mennim, J E Hancock. Anomalous origin of right coronary artery from the mid left anterior descending coronary artery. *Heart*. 2006 Sep; 92(9): 1212. 10.1136/hrt.2005.078733.
- [26] Goutam Datta, Durga Prasad Rai. Abnormal origin of right coronary artery and use of Tiger catheter through femoral route. *Indian heart journal* 68(2016)102-105.