Percutaneous coronary intervention in a patient with a single right coronary artery: A case report and review of the literature

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The present report discusses a case of successful percutaneous coronary intervention to abnormally originating circumflex and diagonal

arteries arising from the right sinus of Valsalva in a patient with a single right coronary artery. The incidence of this rare abnormality, frequency of atherosclerosis and interventional procedures in this group of patients are discussed, and a review the literature is presented.

Key Words: *Coronary abnormalities; Percutaneous coronary intervention; Single right coronary artery*

Isolated single coronary arteries are rare congenital malformations. In this abnormality, a single coronary artery originates from the aortic trunk by a single ostium and supplies the entire myocardium regardless of its distribution (1). These arteries are just as prone to atherosclerosis as normally arising coronary arteries. Although stenoses of anomalous arteries have been previously described, percutaneous coronary interventions (PCI) on such anomalies are rarely reported. Some technical difficulties regarding PCI for a single coronary artery may occur because of the unusual course and tortuous angle of the coronary artery branch to be dilated. Good coaxial guide support is necessary during the procedure. We present a case with an R-IIIC-type single right coronary artery that had critical stenoses at the diagonal and (LCx) branches. Successful PCI was performed on both branches arising separately from a single right coronary artery.

CASE PRESENTATION

A 55-year-old woman with hypertension was admitted to the coronary care unit in the Dokuz Eylül University School of Medicine, Izmir, Turkey, with a diagnosis of non-Q wave myocardial infarction. Medical history revealed typical exertional chest pain over the previous six months. Her physical examination was unremarkable. An electrocardiogram showed lateral T-wave inversion. All cardiac enzymes were slightly elevated. The left coronary artery was not visible on angiography, which was performed two days after admission. Selective right coronary arteriography revealed a single ostium in the right sinus of Valsalva (RSV) giving rise to the right coronary artery, whereas the left anterior descending (LAD) and LCx arteries originated as a separate branch from this vessel after a very short common trunk. The LCx artery ran behind the aorta, whereas the LAD artery crossed the base of the heart anterior to the major great vessels, then descended along the anterior interventricular groove and coursed along with the diagonal artery in the normal position (Figure 1). The aortography

confirmed the absence of the coronary artery arising from the left coronary sinus of Valsalva. There was a 95% focal, eccentric stenosis in the distal portion of the diagonal artery and a 70% stenosis in the proximal portion of the anomalous LCx. No other associated congenital cardiac abnormality was detected by echocardiography. The patient was readmitted to the catheterization laboratory for elective PCI on the diagonal and LCx arteries. The single right coronary ostium was selectively engaged with a 6 Fr right Judkins catheter. The anomalous LCx was crossed with a 0.014 in hydrophilic floppy guidewire, and a 3.5 mm × 16 mm Clearflex stent (Clear Stream Technologies Ltd, Ireland) was implanted without predilation. However, a non-flow-limiting dissection occurred after the procedure. A second stent of the same size was deployed at the end of the previous stent to relieve the dissection. After this procedure, dilation of the lesion on the diagonal artery was attempted. Because of the acute angle at the origin of the anomalous LAD, a right Judkins guiding catheter did not give adequate support and the balloon catheter could not be advanced across the origin of the LAD. A right Amplatz II guiding catheter provided adequate support, and kept the catheter coaxial to the right coronary artery ostium. The lesion in the diagonal artery was recrossed with the same guidewire. Dilation of the lesion with a 1.5 mm × 15 mm Nimbus balloon (Clear Stream Technologies Ltd, Ireland) was followed by placement of 2.5 mm × 9 mm Clearflex stent. The angiographic results were excellent for both lesions (Figure 2). The patient was followed up with acetylsalicylic acid, clopidogrel, metoprolol and statin treatment and no further cardiac problems were observed.

DISCUSSION

Coronary artery abnormalities are rare in the absence of other congenital cardiac malformations. Their incidence has been reported as 0.6% to 1.3% in several angiographic series (2). There are no signs or symptoms in most of these abnormalities,

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Figure 1) Angiography of the single right coronary artery in a 35° left anterior oblique position (A). After a short common trunk, the left anterior descending (LAD) and left circumflex (LCx) arteries originated and distinctly coursed. Lesions at the diagonal (black arrow) and circumflex artery branches (white arrow) are clearly seen. The superior convex direction of the LAD artery is typical of the anterior course. B Angiography, anteroposterior and 37° cranial projection. Lesions at the diagonal (black arrow) artery can be seen

which are usually encountered as incidental findings at the time of catheterization. There have been sporadic case reports regarding myocardial infarction and sudden death in patients with anomalous arteries arising from the contralateral sinus and coursing between the aorta and pulmonary trunks (3).

Several classifications of single coronary arteries have been described; however, the most robust is the classification by Lipton et al (1). This classification combines site of origin and anatomical course of the single coronary artery (Table 1). Some authors have modified the Lipton classification by adding combined (C) and septal (S) types (2). Our case could be classified as Lipton type R-III or Yamanaka type R-IIIC (3). The incidence of anomalous origins of left coronary artery from the RSV is 0.017% and the incidence of R-III type is 0.004% (1).

Although these anomalies and stenoses of anomalous vessels have been described previously, treatment of atherosclerotic lesions by PCI has rarely been reported. There is a definite procedural risk during PCI in patients with a single ostium because dissection with the guiding catheter would result in a catastrophic event. Additionally, technical difficulties may occur due to the course of the branch to be stented. The angulations and route of the involved artery are important factors during PCI, but these problems usually can be solved with good coaxial guide support and selection of an appropriate guiding catheter. In the present case, the anomalous LCx artery was catheterized without difficulty by a right Judkins guiding catheter; however, this catheter did not give adequate support while passing the LAD and diagonal arteries, whose ostium had an acute and superior take-off from the main vessel. A right Amplatz catheter provided optimal support, allowing intervention to the diagonal artery arising from the RSV. The use of right or left Amplatz or multipurpose guiding catheters is helpful and recommended in these situations.

Quintal et al (4) reviewed 18 single coronary artery patients in whom PCI was performed in one or more branches. Ten

Figure 2) Final angiographic results (left anterior oblique-cranial view) of the diagonal and left circumflex artery after percutaneous coronary intervention

patients had an anomalous coronary artery originating from the RSV and only two of these 10 patients had two branches on which PCI was performed (4). According to this report, catheter interventions were performed on the right coronary artery in nine patients, the LCx artery or its obtuse marginal branch in five, the LAD artery in four, left main artery in one and the ramus intermedius branch in one. A subsequent review (5) reported 37 patients with anomalous coronary arteries in whom atherosclerotic stenoses were treated with PCI. Only five of

TABLE 1
Classification of coronary artery anomalies by site of origin, anatomical course and relationship with major vessels

Site of origin	Anatomical course	Relationship with major vessels
L type	Group I	A (Anterior)
Single coronary artery arising from the left sinus of Valsalva	Anomalous coronary artery as a distal portion of other coronary artery follows the anatomical course of either a right or left coronary artery	Anomalous coronary artery passes anterior to the pulmonary artery
R type	Group II	B (Between)
Single coronary artery arising from the right sinus of Valsalva	Anomalous coronary artery that arises from the proximal part of the normally located contralateral coronary artery then crosses the base of the heart to assume its inherent normal position	Anomalous coronary artery arises from the opposite sinus of Valsalva and passes between the aorta and the pulmonary artery
	Group III	P (Posterior)
	The left anterior descending and circumflex arteries arise separately from the proximal part of the normal right coronary artery	Anomalous coronary artery passes posterior to the aorta
		S (Septal)
		Anomalous coronary artery passes through the interventricular septum
		C (Combined)
		Ectopic origin of the left coronary and circumflex arteries passes the other side with several combinations

Data from references 1 and 2

TABLE 2
Reported percutaneous coronary interventions of patients with R-III type single right coronary artery

Reference	Age	Sex	Clinical presentation	Type of anomaly*	Vessel	Guiding catheter
8	60	NA	Stable angina	R-IIIP	RCA	Right Amplatz
7	59	M	Stable angina	R-IIIC	RCA	Right Judkins
6	57	F	AMI	R-IIIC	RCA	Left Amplatz 1
9	58	M	Stable angina	R-IIIB	LAD	Left Bypass
11	56	M	AMI	R-IIIC	LCx	Amplatz
10	75	M	Stable angina	R-IIIC	RCA	Right Judkins

*See Table 1 for explanation of classifications. AMI Acute myocardial infarction; F Female; LAD Left anterior descending artery; LCx Left circumflex artery; M Male; NA Not available; RCA Right coronary artery

these patients had a single right coronary artery. The stented segments in these cases were the LAD artery in two patients, the

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left main artery in two patients and the right coronary artery in one patient. Only one patient was stented in more than one branch (5).

A literature review identified six reports (6-11) of PCI performed in R-III-type single right coronary artery anomalies. Most cases were type R-IIIC and PCI was generally performed on the right coronary artery branch (Table 2). To the best of our knowledge, the present case is the first patient with a R-IIIC-type single coronary artery anomaly in whom PCI was performed to the diagonal artery.

CONCLUSION

We present a case of a patient with an R-IIIC-type single right coronary artery treated by successful PCI to the diagonal and circumflex arteries. Performing PCI in these arteries may be a therapeutic option to treat atherosclerotic stenosis; certain difficulties encountered during the procedure can be overcome.