

## Angiographic characteristics of coronary artery fistulas

### Koroner arter fistüllerinin anjiyografik özellikleri

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#### ABSTRACT

**Objectives:** Coronary artery fistula (CAF) in adults is a rare form of coronary artery anomaly. It is often diagnosed incidentally during coronary angiography. The aim of this study was to evaluate the clinical and angiographic characteristics of adult patients with CAF.

**Study design:** We retrospectively reviewed the database of 70,850 patients who had undergone coronary angiography in five different invasive cardiology centers in the southeastern region of Turkey. Among them, 56 patients had CAF (39 males, 17 females, mean age: 63.7±10.4 years). Demographic data, clinical evaluation and cardiac catheterization reports were reviewed from the medical records.

**Results:** A total of 58 fistulas were detected in 56 patients; two patients (3.6%) had bilateral fistulas originating from both the left and right coronary artery. In our angiographic series, CAF prevalence was 0.08%. Dyspnea on exertion and/or angina pectoris was the most common symptom (69%). Fifteen patients (26.8%) had concomitant obstructive coronary artery disease. Coronary artery fistulas originated mainly from the left anterior descending artery (n=30, 51.7%). Others originated from the right coronary artery (n=15, 25.9%), circumflex artery (n=6, 10.3%), and right sinus of Valsalva (n=3, 5.2%). In four patients (n=4, 7.1%), multiple micro fistula were draining into the left ventricle.

**Conclusion:** In our angiographic series, the prevalence of CAF was 0.08%, and the most common site of origin was the left anterior descending artery.

#### ÖZET

**Amaç:** Yetişkinlerde rastlanan koroner arter fistülleri koroner arter anomalilerinin nadir türleridir. Çoğu kez koroner anjiyografi sırasında rastlantısal olarak tanı konulur. Bu çalışmanın amacı koroner arter fistülü olan yetişkinlerin klinik ve anjiyografik özelliklerini değerlendirmektir.

**Çalışma planı:** Türkiye'nin güney ve doğu bölgesinden 5 farklı girişimsel kardiyoloji merkezinde koroner anjiyografi yapılan ardışık toplam 70850 hastanın verileri geriye dönük olarak incelendi. Bu hastalar arasından toplam 56 hastada (39 erkek, 17 kadın, yaş ortalaması: 63.7±10.4 yıl) koroner arter fistülü var idi. Hastaların demografik özellikleri, klinik değerlendirme bulguları ve koroner anjiyografi raporları hasta dosyalarından öğrenildi.

**Bulgular:** Elli altı hastada toplam 58 fistül tespit edildi; 2 hastada (%3.6) hem sol koroner arterden hem sağ koroner arterden köken alan iki taraflı fistül vardı. Anjiyografik serimizde koroner arter fistülü sıklığı %0.08 idi. Efor dispnesi ve / veya anjina pectoris en yaygın yakınmaları (%69). Hastaların 15'inde (%26.8) eşlik eden koroner arter hastalığı vardı. Koroner arter fistülleri en çok sol ön inen arterden köken almakta idi (n=30, %51.7). Diğer fistüller sağ koroner arterden (n=15, %25.9), sol sirkumfleks arterden (n=6, %10.3) ve sağ sinüs Valsalva'dan (n=3, %5.2) kaynaklanmakta idi. Dört hastada (%7.1) sol ventrikül içine dolan çok sayıda mikro fistül saptandı.

**Sonuç:** Anjiyografik serimizde koroner arter fistül sıklığı (%0.08) idi. Fistüller en sık sol ön inen arter kökenli idi.

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Coronary artery fistulas (CAFs) are abnormal communications between a coronary artery and a cardiac chamber or major vessel (vena cava, pulmonary veins, pulmonary artery, coronary sinus). They may be congenital or acquired due to trauma and iatrogenic causes. Angiographic series have revealed that the frequency of CAF is approximately 0.1-0.8% in adults. Many of these patients are asymptomatic and are diagnosed during coronary angiography incidentally. Hence, the natural history of CAFs remains unclear.<sup>[1-4]</sup> The hemodynamic consequences of the fistula vary depending on shunt size, shunt site and presence of other underlying cardiac diseases.<sup>[4,5]</sup> Several complications, including bacterial endocarditis, thrombosis, aneurysm formation, dissection, rupture, premature atherosclerosis, pulmonary hypertension, myocardial ischemia, or infarction, related to large or multiple fistulas, have been reported.<sup>[5]</sup> The management of CAFs is controversial, and recommendations are based on anecdotal cases or small retrospective series.<sup>[5-12]</sup> Data about the angiographic characteristics of these patients are inadequate.

In this study, one of the largest series in the literature, we defined the angiographic characteristics of CAFs in Turkish patients.

## PATIENTS AND METHODS

### Study populations

We retrospectively reviewed the database of 70,850

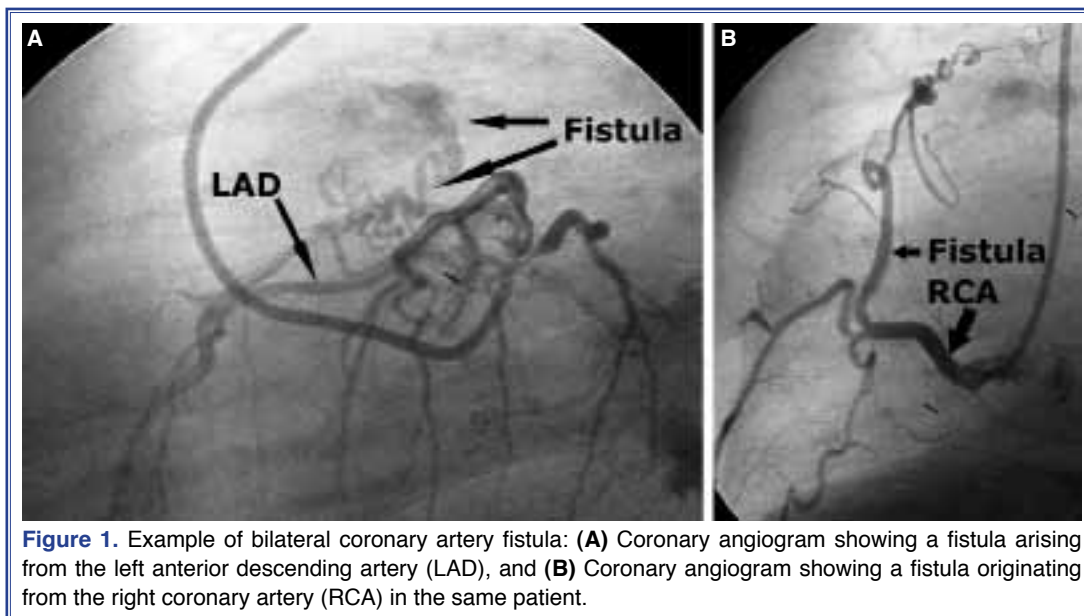
patients who had undergone coronary angiography in five different invasive cardiology centers in the southeastern region of Turkey. The 56 patients (39 males, 17 females, mean age:  $63.7 \pm 10.4$  years) with scientific term of “coronary artery fistula” in the coronary angiography reports were selected for the study. Selected coronary angiography records were re-examined by two experienced invasive cardiologists (CT, GA). Demographic data, clinical evaluation and cardiac catheterization reports were reviewed from the medical records. CAFs were described according to the origin and drainage sites.<sup>[9]</sup> Unilateral fistula indicated that one coronary artery contributed to the fistula formation. Bilateral fistula indicated that two separate coronary arteries were involved in the fistula formation. Multiple fistulas were described as multiple micro communications between one or more coronary arteries and the cavity of the cardiac chamber.<sup>[9]</sup> In the statistical analysis, data are presented as mean  $\pm$  SD or percentage.

#### Abbreviation:

CAFs Coronary artery fistulas

## RESULTS

A total of 58 CAFs were detected in 56 patients; two patients (3.6%) had bilateral fistulas originating from both the left and right coronary artery (Figure 1). In our angiographic series, the prevalence of CAF was 0.08%. Fifteen patients (26.8%) had concomitant obstructive coronary artery disease. The origin sites of



**Figure 1.** Example of bilateral coronary artery fistula: **(A)** Coronary angiogram showing a fistula arising from the left anterior descending artery (LAD), and **(B)** Coronary angiogram showing a fistula originating from the right coronary artery (RCA) in the same patient.

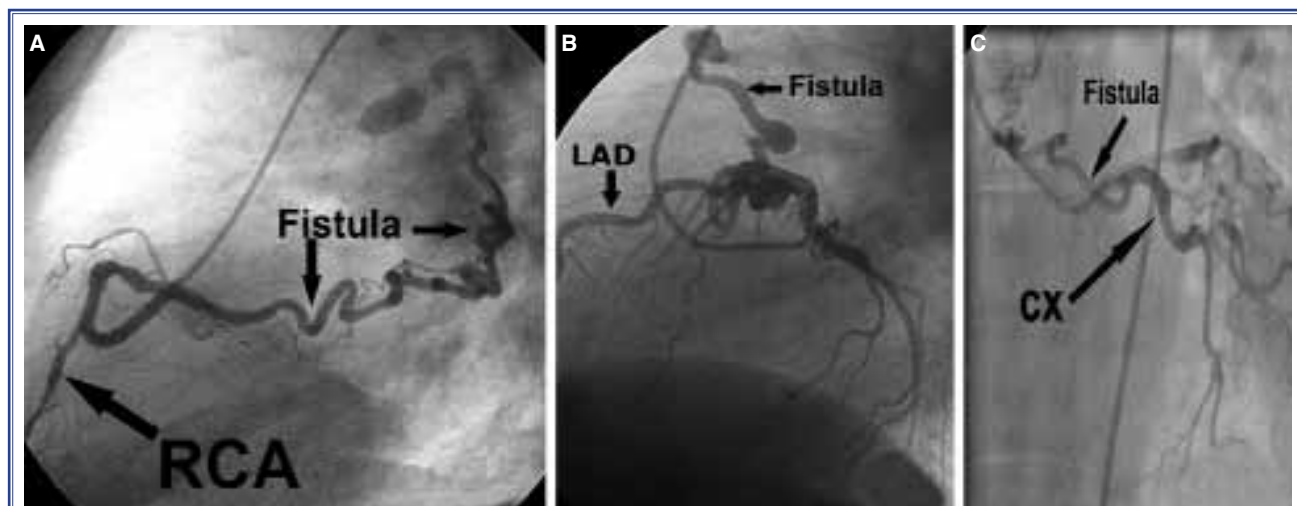
**Table 1.** The sites of origin of coronary artery fistulas presented in different studies

	Our study	Vavunarakis et al. <sup>[1]</sup>	Canga et al. <sup>[4]</sup>	Tirilomis et al. <sup>[6]</sup>	Abdelmoneim et al. <sup>[8]</sup>	Said et al. <sup>[9]</sup>	Sunder et al. <sup>[10]</sup>
Number of patients reviewed (n)	70850	33600	49567	–	–	30829	–
Number of patients with coronary artery fistulas (n)	56	34	54	13	30	51	25
Prevalence of fistula (%)	0.08	0.10	0.10	–	–	0.17	–
Age (years)	63.7±10.4		56.7±10.7	61.5±10.8	60±12.7	60.3	15±14
Total number of fistula (n)	58	34	59	15	36	63	29
Regions of fistula origin, n (%)							
Left anterior descending artery	30 (51.7)	11 (32.4)	30 (50.8)	10 (66.7)	14 (46.7)	29 (46.0)	8 (27.6)
Right coronary artery	15 (25.9)	19 (55.9)	20 (33.9)	1 (6.7)	6 (20)	21 (33.3)	15 (51.7)
Left circumflex artery	6 (10.3)	4 (11.8)	8 (13.6)	1 (6.7)	7 (23.3)	11 (17.5)	3 (10.3)
Right sinus of Valsalva	3 (5.2)						
Left main coronary artery				3 (20)	2 (6.7)	2 (3.2)	3 (10.3)
Left internal mammary			1 (1.7)		1 (3.3)		
Bilateral or more fistulas	2 (3.6)		5 (8.5)	2 (13.3)	3 (10)	10 (20)	4 (13.8)
Multiple micro fistula	4 (7.1)						

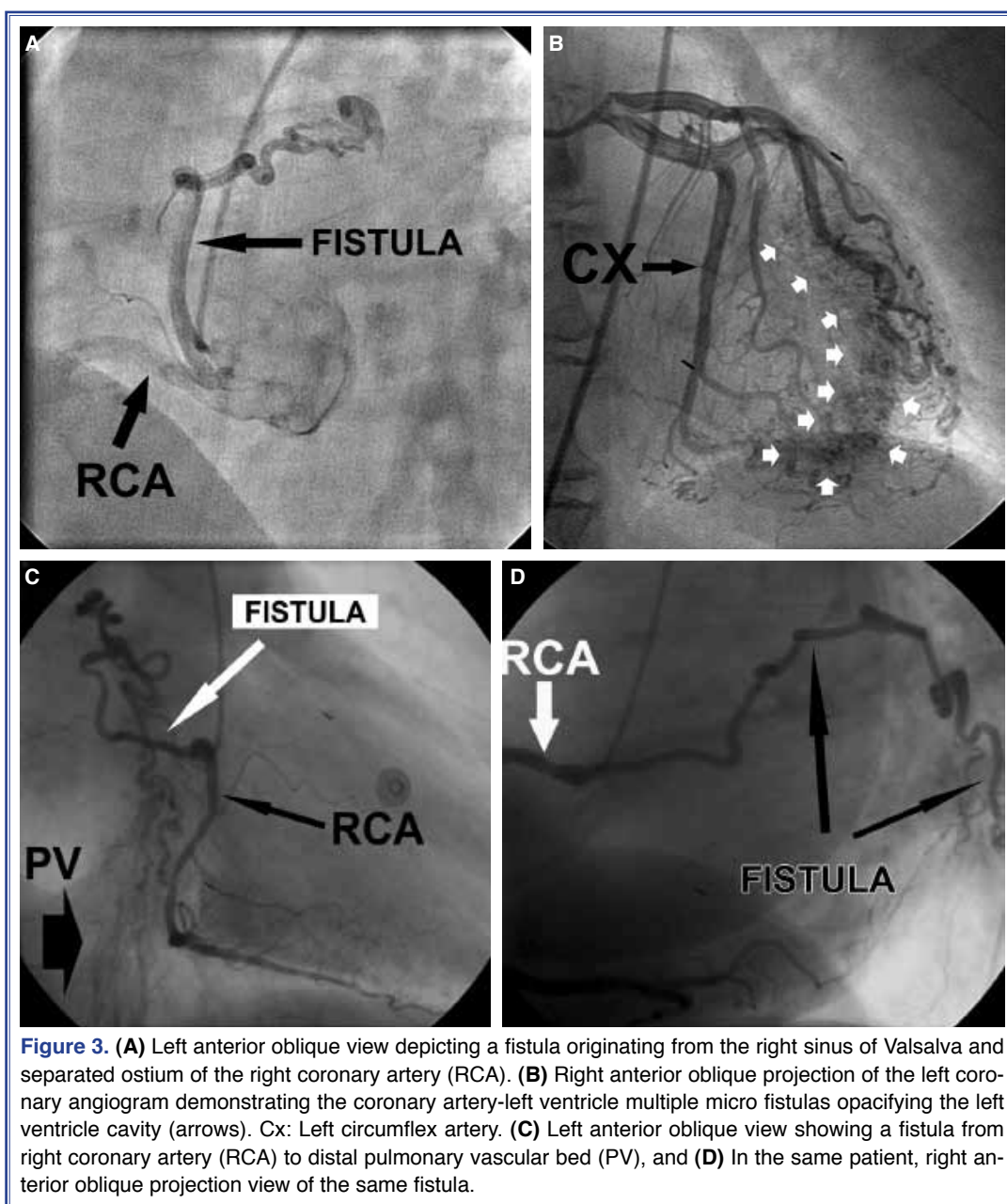
the CAFs are summarized in Table 1. Examples of fistula originating from the major epicardial coronary arteries are shown in Figure 2. CAFs originated mainly from the left anterior descending artery (n=30, 51.7%). Others originated from the right coronary artery (n=15, 25.9%), circumflex artery (n=6, 10.3%), and right sinus of Valsalva (n=3, 5.2%) (Figure 3a). In four patients (7.1%), multiple micro fistula (Figure 3b) were seen to drain into the left ventricle. In three patients (5.3%), fistulas originating from the coronary artery were seen to drain into the pulmonary vascular bed (Figure 3c, d).

## DISCUSSION

In our series, the prevalence of CAF was 0.08%, and this ratio was similar to that in previous reports.<sup>[1-5]</sup> A comparison of the origin of the CAFs in the present and previous series is shown in Table 1. As in previous reports,<sup>[4,6,8,9]</sup> most CAFs in our series originated from the left anterior descending artery. Additionally, we detected that some CAFs originated from the right sinus of Valsalva, a very rare localization (Figure 4). CAFs usually drain into the venous circulation with



**Figure 2.** Angiographic views of coronary artery fistulas: (A) A large fistula arising from the proximal segment of the right coronary artery (RCA), (B) A large fistula arising from the proximal segment of the left anterior descending artery (LAD), and (C) A large fistula originating from the proximal segment of the left circumflex artery (Cx).



low-pressure structures such as the pulmonary artery, right atrium, right ventricle, superior vena cava, and coronary sinus.<sup>[5,8-10]</sup> This may lead to significant left-to-right shunt.<sup>[1-5,8]</sup> We could not demonstrate which shunt drained to which vascular bed because detailed imaging methods such as transesophageal echocardiography and multislice computerized tomography angiography were not used. In three patients (5.3%), fistulas originating from the coronary artery were seen to drain into the pulmonary vascular bed. In four patients (7.1%), multiple micro fistula were seen to drain into the left ventricle cavity.

Recently, Canga et al.<sup>[4]</sup> reported the demographic and clinical characteristics and angiographic findings of Turkish patients with CAF. In their series, the prevalence of CAF was 0.1%, and the most common artery of fistula origin was the left anterior descending artery (50.8%). Concordant with these findings, in our series, the prevalence of CAF was 0.08%, and the left anterior descending artery was the most common site of fistula origin. Our study is one of the largest series in the literature evaluating CAFs angiographically.

Our series might be valuable for its description of

fistulas originating from the right sinus of Valsalva and of multiple micro-fistulas flowing into the left ventricle, which was not mentioned previously in angiographic series. Our findings are also valuable in terms of demonstrating our country's data.

### Limitations

The major limitation of our study is its retrospective design and lack of follow-up of the patients for adverse cardiac outcomes. Other important limitations of our study were the lack of detailed clinical and echocardiographic findings, which could not be obtained due to the retrospective nature of this study and the collection of data from different centers.

In conclusion, in our angiographic series, the prevalence of coronary artery fistula was 0.08%, and the most common site of origin was the left anterior descending artery.

**Conflict-of-interest issues regarding the authorship or article: None declared**

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**Key words:** Cardiac catheterization; coronary angiography; coronary vessel anomalies/diagnosis; fistula/diagnosis.

**Anahtar sözcükler:** Kalp kateterizasyonu; koroner anjiyografi; koroner damar anomalisi/tanı; fistül/tanı.