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Examination of Coronary Artery Anomalies in an Adult Turkish Population

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Abstract: The objective of this study was to determine the frequency of anomalous aortic origins of coronary arteries, to classify these anomalies and to define their consequences. Therefore, 5000 coronary artery angiograms were analysed. Twenty-five (0.5%) coronary arteries with anomalous origins were found, and these anomalies were classified in four main groups. Origin of the circumflex artery from the right side was the most frequent anomaly (12 cases). In 8 cases the right

coronary artery originated from the left side, in 3 cases the left coronary artery originated from the right side and finally we found 2 left anterior descending arteries originating from the right side. The clinical importance of these anomaly categories was defined and our results were compared and discussed in the light of previous reports.

Key Words: Coronary arteries, angiography, anomaly

Introduction

The normal coronary artery distribution is well known and can be examined in a wide spectrum, as no two anatomical patterns are exactly alike. Coronary artery anomalies are present at birth and represent remarkable changes from the normal structure.

Most coronary artery anomalies are discovered accidentally during coronary angiography or autopsy; however, most anomalies are not symptomatic due to the absence of functional importance. Nevertheless diagnosis and understanding of anomalies in coronary circulation are important in considering the severity of coronary artery stenosis in regard to therapeutic manoeuvres such as by-pass surgery and angioplasty.

As coronary angiography is routinely used to evaluate coronary morphology for diagnostic and treatment purposes, it is important to be aware of these anatomical variants. There have been many studies about the angiographic, clinical and haemodynamic consequences of these anomalies (1-5). In the present study we examined the overall incidence in a Turkish population and described the importance of different forms of anomalous aortic origins of coronary anomalies with illustrations.

Materials and Methods

The database of the cardiac catheterisation laboratories of Ankara Güven Hospital was used in this

retrospective review. Reports from 5000 adult patients with symptomatic heart disease and therefore undergoing cardiac catheterisation between 1994 and 1997 were analysed. Among these 5000 patients, 3620 (72.4%) were male with a mean age of 52 and 1380 (27.6%) were female with a mean age of 54.

Schemes were drawn to show the right coronary artery (RCA), left coronary artery (LCA) and the atherosclerotic narrowings. All cineangiograms were reviewed by two independent investigators for this study.

Our main purpose was to examine the anomalous origins of the coronary arteries. Of no interest were

- 1) Patients with a high coronary origin in the aorta,
- 2) Origin from the non-coronary sinus of Valsalva,
- 3) Separate ostium of the left anterior descending (LAD) and the circumflex (Cx) arteries within the left sinus of Valsalva,
- 4) Separate origin of the conus branch or right ventricular branch from the right sinus of Valsalva,
- 5) Coronary anomalies occurring as part of a complex congenital heart disease.

Furthermore, fistulous connections between a coronary artery and a cardiac chamber or the pulmonary artery were considered as a separate issue and were not included in this series. Most of the selective coronary arteriographies were performed by Judkins (femoral) and the others were with Sones (brachial) methods. The

cine-films were taken with a 35-mm camera at 90 frames/s and different projections were used in every patient for the best visualisation.

Results

Among the 5000 patients who underwent coronary arteriography, 25 (0.5%) had anomalous origins of coronary arteries from the aorta. Origin of the Cx artery from the right aortic sinus or from the RCA is the most common anomaly of coronary arterial origin. In 12 cases (48%) the Cx artery had an anomalous origin. In 4 of these cases the Cx artery originated from the proximal part of the RCA (Figure 1), whereas in 8 cases the artery arose from the right sinus of Valsalva with a separate ostium (Figure 2). In all cases the initial course of the Cx artery was posterior to the aorta. The LAD artery originated from a separate ostium in the left sinus of Valsalva and had a normal distribution. LCA angiography displays an empty Cx artery distribution area and LAD artery with a long initial non-branching segment (Figure 3).

In 8 cases (32%) the RCA originated from the left sinus of Valsalva. The artery always coursed between the aorta and the pulmonary artery; however, its final distribution was normal. The origin and the distribution of the left coronary arteries in these cases were normal. The ostiums of the right and the left coronary arteries lay close to each other in the left sinus of Valsalva and so during the selective LCA catheterisation, the RCA and its branches became visible due to the escaping opaque material (Figure 4).

The LCA originated from the right sinus of Valsalva in 3 patients (12%). In no case was there a common ostium for both coronary arteries, meaning that there was not a single coronary artery. The LCA initially passed anterior to the aorta and then between the aorta and the pulmonary trunk. This artery coursed a longer way than its original and bifurcated into the LAD artery and the Cx artery (Figure 5).

A very rare origin of the LAD from the right side was found in 2 (8%) cases. The LAD artery originated contralaterally from the right sinus of Valsalva, coursed anterior to the pulmonary artery and then along the anterior interventricular groove (Figure 6).

Discussion

Although coronary artery anomalies are very rare, many researchers are interested in this subject. Most studies are about angiographic findings but there are some studies concerning autopsy material while other studies use both materials (6,7). We may also come across many case reports but these single cases do not help us to have an idea about a certain population or generation.

Our series is a gathering of anomalies studied among a Turkish adult population over a three-year period. Our patient archive excludes the more malignant anomalies since they have been detected earlier in life or resulted in sudden death. Like many other researchers we found that the presence of an anomalous vessel and coronary artery disease do not seem to be related (8-10). But these

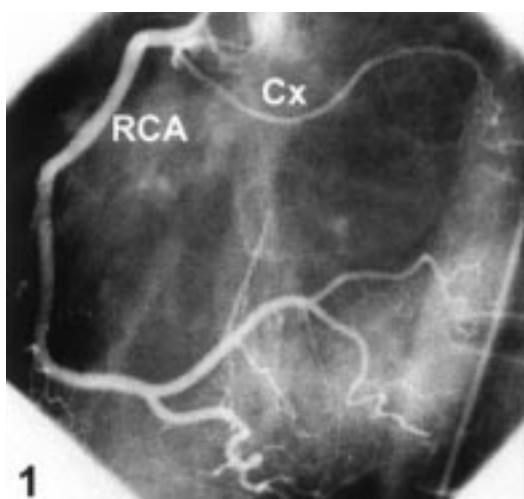


Figure 1. The Cx artery originating from the proximal part of the RCA.

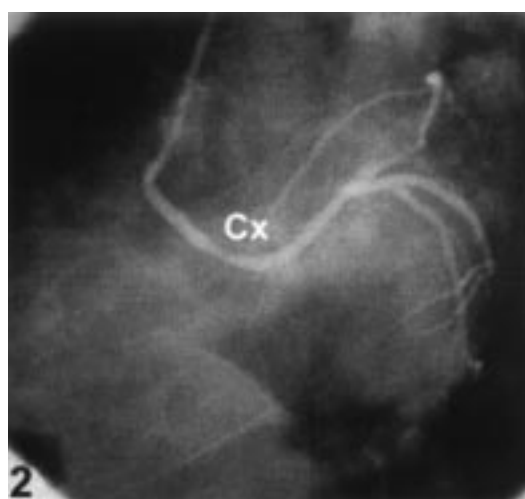


Figure 2. The Cx artery arising from the right sinus of Valsalva with a separate ostium.

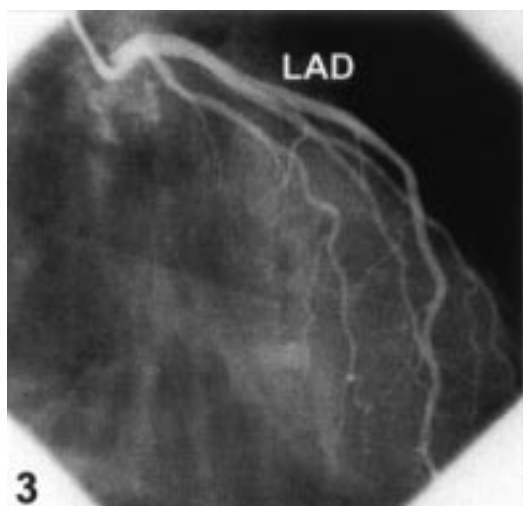


Figure 3. The LAD artery originating from a separate ostium in the left sinus of Valsalva and distributing normally.

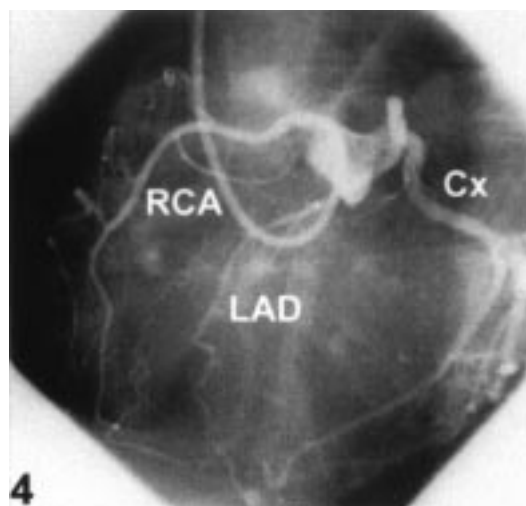


Figure 4. During the selective LCA catheterisation, the RCA and its branches also became visible due to the escaping opaque material because RCA is originating from the left side instead of its original position.

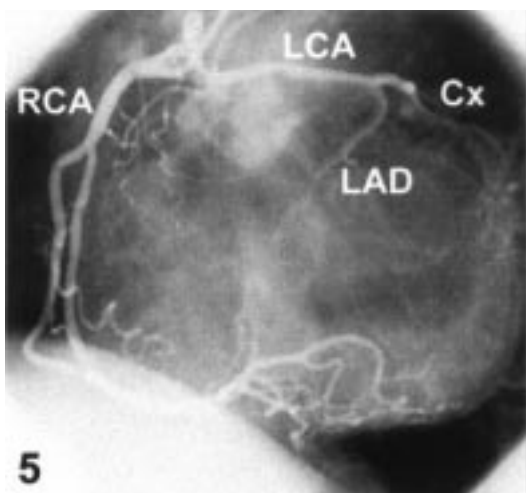


Figure 5. The LCA originating from the right sinus of Valsalva and coursing a longer way than original and bifurcating into the LAD artery and the Cx artery.

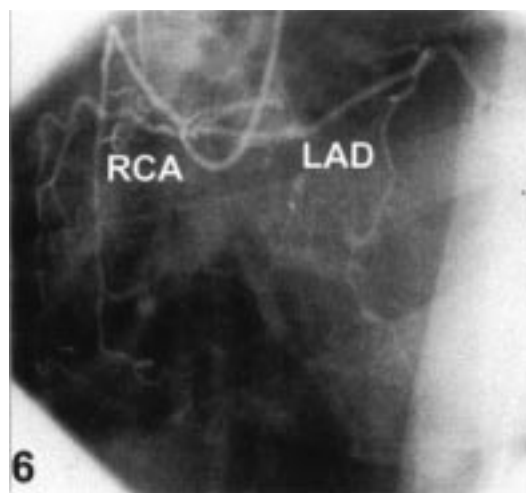


Figure 6. The LAD artery originating contralaterally from the right sinus of Valsalva, coursing along the anterior interventricular groove.

anomalies are frequently seen among patients with congenital heart disease (11).

Like in many other reports, Cx artery anomalies are the most frequent cases seen in our series. The anomalous Cx artery always coursed posterior to the aorta to reach its normal distribution and its course was typical in all our patients. It is generally agreed that this anomaly alone causes no functional impairment of the myocardium, and it is therefore considered benign. However, this anomalous artery should be recognised

during coronary arteriography, especially in patients with obstructive coronary artery disease or with aortic valve disease undergoing aortic valve replacement. The cardiac surgeon should be informed of the anomalous Cx artery in order to avoid accidental compression of the vessel during valve replacement (12).

Aberrant RCA origin from the left sinus of Valsalva is a less frequent coronary anomaly. The aberrant vessel can be demonstrated by selective injection into the aberrant ostium, which is always located in front of the LCA

ostium. The artery passed between the aorta and pulmonary artery before reaching the right atrioventricular groove. The distal distribution of the right coronary artery is the same as in the normal population. Ostial occlusion due to aortic dilatation during exercise may result in myocardial ischaemia (13). Clinical sequelae are rare, although angina pectoris, myocardial infarction, ventricular tachycardia, syncope, and sudden death in the absence of coronary atherosclerosis have been reported (10).

In all LCA anomalies we encountered, the entire left coronary artery arose from the right sinus of Valsalva. The RCA may arise separately, as in 3 of our cases, or share a common ostium with the anomalous LCA, which is considered a form of single coronary artery. The LCA may course anterior to the pulmonary artery, between the aorta and the pulmonary artery, posterior to the aorta, within the ventricular septum or as a combination of the previous four types. LCA anomalies, especially the 'between type', are very important, and since they may cause symptoms due to myocardial ischaemia and even lead to sudden death at a young age, special care should be taken to evaluate young patients with chest pain resembling angina (4).

Anomalous LAD artery may arise from the right sinus of Valsalva or the RCA. In our series we detected 2 anomalous LAD arteries originating from the right sinus of Valsalva.

The LAD artery originating from the right sinus of Valsalva is a rare anomaly and is considered a potentially serious anomaly. LAD may run to the left side of the heart anterior to the right ventricular infundibulum, between the aorta and the pulmonary artery or in the ventricular septum beneath the right ventricular infundibulum (5).

In conclusion, these aberrations should be recognised when evaluating the coronary vessels for cardiac catheterisation as well as during surgical procedures. In addition, information like this can be important if the results can be extended to other populations.

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