Variants in origin of the left circumflex coronary artery with angiography

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ABSTRACT

Objective: The objective of this study was to assess the anatomic variations in the origin of the left circumflex coronary artery in a Turkish population.

Method: This study was carried out at the Sani Konukoklu Medical Center, Gaziantep, Turkey, during the period January 1999 through to May 2001. The angiographic data of 10,042 consecutive adult patients who underwent coronary angiography was analyzed for anomalous origin of the left circumflex coronary artery.

Results: Among 10,042 adults patients, 27 (0.3%) had anomalous origin of the left circumflex coronary artery. The left circumflex coronary artery arose from the left coronary sinus of valsalva in 15 (55.5%) patients, from the right coronary sinus of valsalva in 7 (25.9%) patients, and from the proximal part of the right coronary artery in 8 (29.6%) patients.

Conclusion: The anomalous origin of the left circumflex coronary artery may not always be benign. Therefore, recognition of this anomaly is mandatory to prevent the risk of infarction or sudden death. Special surgical considerations must be made when performing valvular replacement in patients with anomalous left circumflex coronary artery.

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The arterial supply of the heart is provided by the right and left coronary arteries. The left main coronary artery originates from the left coronary sinus of valsalva. It usually has a short common stem, which bifurcates or trifurcates. Its branches are the anterior descending (interventricular) coronary artery, the left circumflex coronary artery and median branch (merely a left ventricular branch which happens to originate from the main artery).[1-4] The branches of the left main coronary artery may vary in origin, distribution, number and size. The left circumflex coronary artery (LCx) may arise from. 1. The left coronary sinus of valsalva (separate ostium of the LCx and left anterior descending coronary artery within the left sinus of valsalva),[5-8] 2. The right coronary sinus of valsalva through an own orificium,[6-12] 3. The right coronary artery (proximal or distal part),[6-9,11,12] 4. The pulmonary artery[13,14] or 5. It may be absent.[6] Most patients with coronary artery anomalies are asymptomatic. Unfortunately, sudden death or complication after performing valvular replacements in the patients with the anomalous origin of LCx has been described in the literature. The knowledge of these variations may be important with regard to invasive catheter treatment or bypass surgery.

The aim of the study was to examine the anatomical patterns and frequency of occurrence of the anomalous LCx coronary artery in the Turkish population.

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Methods. We reviewed the database of the cardiac catheterization unit of the Sani Konukoklu Medical Center, Gaziantep Turkey. The medical records revealed that the patients had been admitted to the Cardiology Department of the Sani Konukoklu Medical Center for chest pain, palpitation or effort angina. The catheterization reports were analyzed, and those with anomalous LCx were selected for further assessment. All patients who underwent coronary arteriography from January 1999 through to May 2001 were included except for those who had coronary anomalies due to congenital heart disease. Coronary angiography was performed by Judkins femoral or Sones brachial technique in standard projections. Two independent investigators reviewed the films, which were selected for further assessment, preceding the final classification. The course of an anomalous artery was defined according to the guidelines of Yamanaka and Hobbs[6] and Serota et al.[15] When the LCx and the left anterior descending coronary artery arised from the left sinus of valsalva, anterior angulation of the catheter resulted in selective injection of the left anterior descending coronary artery (left anterior oblique (LAO projection), posterior angulation of the catheter resulted in selective injection of the LCx (right anterior oblique (RAO projection). When the LCx and the left anterior descending coronary artery could not be observed, they considered to be totally obstructed or congenitally absent.[6] When the left circumflex coronary arteries arose from the right sinus of valsalva or right coronary artery on RAO ventriculography or aortography, the contrast column of the LCx would be seen "on end" posterior to the aorta.[15] During LAO projection the LCx coursed to the left with a caudal-posterior loop.[6]

Results. The mean age of patients was 57-years with a range of 27-90 years. Sixty-eight percent were males and 32% females, and 87% had atherosclerotic heart disease, 12.9% had no atherosclerotic heart disease. The incidence of anomalous origin of the LCx was found to be 0.3% (27 of 10042 patients). Of 27 patients who had anomalous origin of the LCx, 14 were men and 13 were women (age range 36-72, mean 57.2 years). The LCx arose from the left coronary sinus of valsalva (there was separate orifice for the LCx and the left anterior descending coronary artery) in 12 (44.4%) patients (**Figure 1**), from the right coronary sinus of valsalva, (there was a separate orifice for the LCx and the right coronary artery) in 7 (25.9%) patients (**Figure 2**), from the proximal part of right coronary artery in 8 (29.6%) patients (**Figure 3**). In 15 patients the LCx originated from the right coronary artery or the right sinus of valsalva, and maintained a retro-aortic course.[6] Among 27 patients with the anomalous LCx, 15 (55.5%) had significant atherosclerotic disease; and the remaining 12 patients (44.4%) had only variations in the origin of the LCx without any other coronary artery diseases.

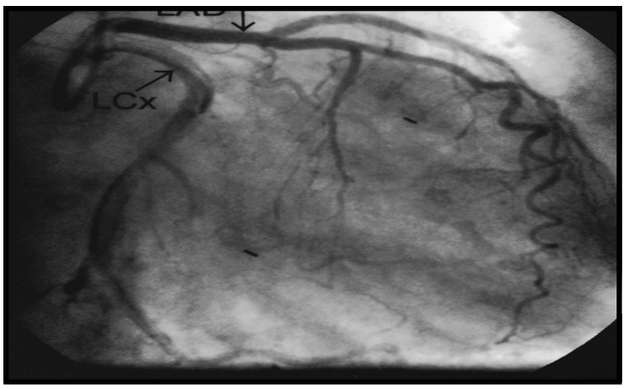

Figure 1 - Separate origin of left circumflex and anterior descending artery from the left coronary sinus of valsalva (absent left main trunk). (Left lateral projection) LCx - the left circumflex coronary artery, LAD - the left anterior descending coronary artery.

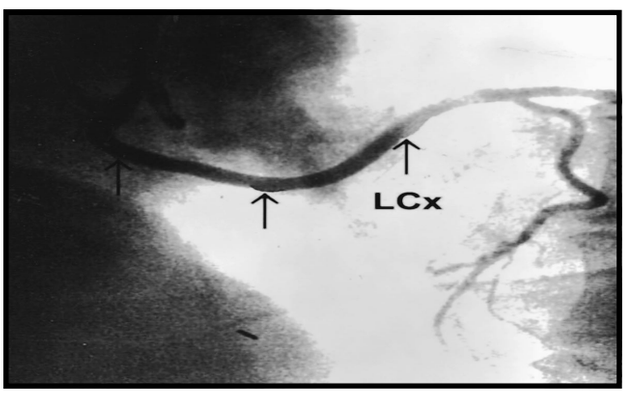

Figure 2 - Ectopic origin of the LCx from the right coronary sinus of valsalva. The anomalous LCx courses to the left with a caudal posterior loop. (LAO projection), LCx - the left circumflex coronary artery, LAO - left anterior oblique.

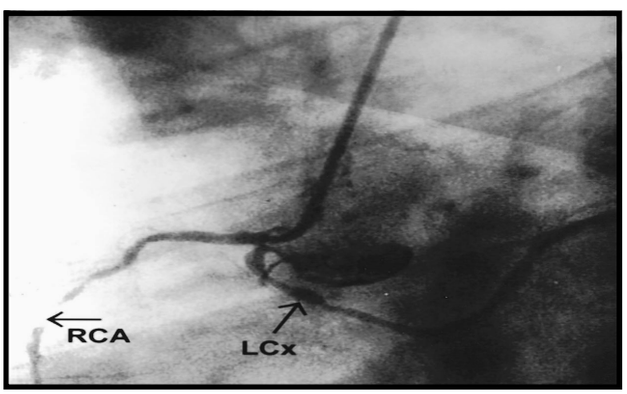

Figure 3 - Ectopic origin of the left circumflex coronary artery from the right coronary artery. The anomalous LCx courses to the left with a caudal posterior loop. (LAO projection), LCx - the left circumflex coronary artery, RCA - the right coronary artery. LAO - left anterior oblique.

Table 1 - The incidence of anomalous left circumflex coronary artery (LCx) in the patients who underwent coronary angiography.

Author	n of patients	Incidence of anomalous LCx (%)	Anomalous LCx						Population
			0	1	2	3	4	5	
Garg et al[12]	4100	0.3	14	*	12	2	-	-	Indian
Kardos et al[8]	7694	1.1	83	54	29		-	-	Central European
Kaku et al[10]	17731	0	7	-	7	-	*	-	Japan
Cieslinski et al[7]	4016	0.6	26	12	2	12	-	-	German
Topaz et al[9]	13010	0.2	22	*	9	13	-	-	Hispanic
Yamanaka & Hobbs[6]	126595	0.8	984	513	467		-	4	American
Our findings	10042	0.3	27	12	7	8	-	-	Turkish

0 - total number of anomalous LCx in the study, 1 - number of LCx originated from left sinus of Valslava, 2 - number of LCx originated from right sinus of Valsalva, 3 - number of LCx originated from right coronary artery, 4 - number of LCx originated from pulmonary artery, 5 - number of absent LCx, * - this type of anomalous LCx excluded from study, n- number

Discussion. There are some studies in the literature in which the incidences of different congenital coronary anomalies were reported. On angiographic studies, the incidence of anomalous origin of the LCx in adults ranged from 0-1% as presented in **Table 1**.[6-10,12] The angiographic incidence of the anomalous LCx was highest (1%) in a Central European population while the overall incidence of the congenital coronary anomalies was 1.3% in the same study.[8] The angiographic incidence of the anomalous LCx was lowest (0%) in Japan while the overall incidence of the coronary anomalies was 0.3% as the right coronary artery being affected most commonly.[10] The angiographic incidence of the anomalous LCx in a Turkish population was 0.3%. The angiographic incidence of the anomalous LCx is similar between Turkish and predominantly Hispanic population. In autopsy studies, the incidences of the anomalous LCx were 0.2 in Italian population and 0.8% in Iraq population according to Frescura et al[11] and Kurjia et al.[5] These data suggest that the incidence of anomalous LCx is variable in different populations. The possible explanation of this discrepancy may be genetic and geographic.

The patients with a separate orifice of the left anterior descending coronary artery and LCx within the left sinus of valsalva (absent left main trunk) were not taken into consideration in some related studies.[9,11,12] However, when these variations were also considered, a separate orifice of the left anterior descending coronary artery and LCx within the left sinus of valsalva were the most common anomalies of the LCx with the reported incidences of 52.1%, 56% and 65.8% by Yamanaka and Hobbs,[6] Cieslinski et al,[7] and Kardos et al.[8] In the present study, however, this type of anomalous LCx was the most common anomaly (44.4% of anomalies LCx). Kurjia et al[5] studied 119 autopsy specimens, and reported only one case that had its own separate orificium for the LCx and left anterior descending coronary artery within the left sinus of valsalva. Absence of the LCx was reported only by Yamanaka and Hobbs[6] who encountered with this condition in 4 cases (0.1 %). In 1988, Alexi-Meskishvili et al[13] reported that 2 infants aged 40 and 30 days had anomalous LCx which originated from the pulmonary artery. In 1995, Lee et al[14] stated that a 27-year-old woman with scimitar syndrome had abnormal origin of the LCx from the pulmonary artery. In this study, we did observe neither the absence of LCx nor a LCx originating from the pulmonary artery. A LCx originating from the left sinus of valsalva, right coronary artery or right sinus of valsalva, or its absence are considered benign anomalies of the LCx[6,11] while a LCx originating from the pulmonary artery is a serious condition.[13,14] Nevertheless, the anomalies of LCx, which are considered benign, can lead to serious conditions. Because, when performing valvular replacement, a LCx with benign anomaly can be compressed, thereby resulting in serious morbidity.[16,18] Leroy et al[19] followed up 30 patients who had anomalous origin of the LCx for an average 6.1± years. During the follow-up, they observed one death due to a cardiac problem, one case of myocardial infarction, 5 cases of angina pectoris, and performed 4 coronary bypass and 6 coronary angioplasty procedures. Only 30% (n=9) of 30 patients had no cardiac disease during follow-up. Rozenman et al[20] reported anomalous origin of the LCx from the right sinus of valsalva that caused myocardial ischemia and infarction at old age. Rivitz and Garratt[21] reported that a patient with evidence of persistent inferior wall ischemia after successful PTCA of a solitary right coronary artery lesion was

had an anomalous LCx arising from the ostium of the right coronary artery. A thorough search for such vessels is warranted in a patient with abnormal diagnostic tests and no apparent obstructive lesions in the normally positioned arteries.

In conclusion, the anomalous origin of the LCx may not be benign all the time. When ischemia does not resolve properly after successful treatment of a coronary stenosis, anomalous coronary arteries should be considered. Recognition of this anomaly is mandatory to prevent the risk of infarction or sudden death. Special surgical considerations should be performed when an anomalous LCx is encountered during valvular replacement surgery.

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