

# Presence of Anomalous Coronary Seen on Angiogram Is Not Associated with Increased Risk of Significant Coronary Artery Disease

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Int J Angiol 2014;23:243–246.

## Abstract

It is unclear if anomalous coronary arteries are at higher risk for atherosclerosis. The link between anomalous coronary artery and early coronary artery disease has been suggested. The aim of this study is to determine whether the coronary artery anomaly predisposes to development of significant coronary disease. Using retrospective chart review, patients with documented anomalous coronary arteries recognized during coronary angiography between years 2000 to 2007 were analyzed. Prevalence of significant atherosclerotic coronary artery disease (defined as more than 50% luminal narrowing) was compared between normal and anomalous coronaries. A total of 147 patients with anomalous coronary arteries were found. Right coronary artery was the most common anomalous artery 128 of 148 (86.5%) in our dataset. There was no difference in the occurrence of atherosclerosis between anomalous and nonanomalous coronaries. Significant atherosclerosis was present in 59 of the 148 anomalous coronary arteries (37.8%), and 112 of the 293 nonanomalous coronary arteries (38.2%,  $p = 0.9$ ). On the basis of our study, there is no evidence that anomalous coronary arteries predispose to significant coronary artery disease in comparison to normal coronary arteries.

## Keywords

- ▶ anomalous coronary
- ▶ atherosclerosis
- ▶ coronary artery disease
- ▶ angiogram
- ▶ cardiac catheterization

Coronary artery anomaly which is frequently recognized during cardiac catheterization, is not uncommon.<sup>1</sup> The most commonly described anomaly is that of the origin of coronary arteries, followed by anomalous course, while the least commonly described anomaly is at the termination.<sup>2</sup>

Many studies have reported these anomalies to be incidental findings discovered during angiography or autopsy.<sup>3–5</sup> However, other studies have suggested coronary artery anomalies to be associated with catastrophic outcomes ranging from cardiac arrhythmias<sup>6</sup> and myocardial infarction to sudden death.<sup>7</sup> Coronary anomalies may also be present in

association with other congenital heart diseases.<sup>8</sup> The link between anomalous coronary artery and early coronary artery disease is questionable. Previously conducted small studies have provided contradicting evidence. Some suggested no increase in the risk of atherosclerosis,<sup>9,10</sup> whereas others have showed a strong association.<sup>11</sup> Thus, it remains unclear if the anomalous nature of a coronary artery is associated with development of atherosclerosis. Besides, these anomalies can sometimes cause management difficulties during coronary intervention due to difficulty in engaging the ostium.<sup>12</sup>

published online  
 August 19, 2014

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 Tel: +1(212) 584-4662.

DOI <http://dx.doi.org/10.1055/s-0034-1384839>.  
 ISSN 1061-1711.

With these conflicting data regarding susceptibility for atherosclerosis in coronary arteries, we investigated whether the coronary artery anomaly predisposes to development of significant coronary artery disease in comparison to normal coronaries.

## Methods

### Study Design

We reviewed coronary angiographic data from Maimonides Medical Center, Brooklyn, NY between years 2000 and 2007 retrospectively. Angiographic data of patients with at least one anomaly of any major coronaries such as right coronary artery (RCA), left anterior descending artery, or left circumflex artery were included in this study. From among all the patients who underwent cardiac catheterization, those with anomalous coronaries, either of the origin, course, or termination were identified from catheterization reports.

For each patient, the degree of stenosis was extracted from cath report. In patients with multiple angiograms, the most severe degree of stenosis in each coronary artery was selected and recorded. Demographic data of the study population were also obtained, including age, sex, and risk factors such as diabetes mellitus, hypertension, and hyperlipidemia. The Institutional Review Board at Maimonides Medical Center, Brooklyn, NY approved all aspects of the study. The presence of significant coronary artery disease was defined as angiographically documented diameter stenosis of more than 50%. These reports were previously reviewed and confirmed by the interventional cardiologist who performed the procedures. The prevalence of significant coronary artery disease in anomalous coronary arteries was documented and compared with normal coronary arteries in the same patients, thus serving as internal controls.

### Statistical Methods

Our data were recorded using Microsoft Office Excel 2010 and analyzed using SPSS version 17. Prevalence of significant coronary artery disease in anomalous coronary arteries was compared with prevalence of significant coronary artery disease in normal coronary arteries in the same patient group, which served as the control group. We used chi-square test to compare the presence of significant coronary artery disease in anomalous coronaries and normal coronaries. A *p* value of  $< 0.05$  was accepted as statistically significant.

## Results

We included angiographic results from 147 patients who had either one or more of anomalous RCA, left anterior descending artery, or left circumflex artery detected during the study period. Our final analysis included a total of 148 anomalous coronary arteries: 128 (86.5%) were anomalous RCAs, 19 (12.8%) were anomalous left circumflex arteries, and 1 (0.7%) was anomalous left anterior descending artery. There were also 293 nonanomalous coronary arteries from the same patient group, which served as the control group.

The mean age of the study group was 69.5 years and 90 out of the 147 patients (61.2%) were men. Hypertension was present in 107 (72.8%) patients, diabetes mellitus in 45 (30.6%), and hyperlipidemia in 99 (67.3%) patients. Significant atherosclerosis was present in 59 of the 148 anomalous coronary arteries (37.8%), and 112 of the 293 normal coronary arteries (38.2%). There was no statistically significant association between prevalence of significant coronary artery disease in anomalous coronary arteries in comparison to normal coronary arteries ( $p = 0.9$ ).

## Discussion

The present study is one of the largest cohorts of anomalous coronary artery patients assessed to investigate whether these anomalies predispose to atherosclerosis. Our study found RCA to be the most common anomalous vessel in a large majority (86.5%) of the patients. This is in contrast to some of the other studies, which reported left circumflex coronary artery<sup>9,13,14</sup> to be the most frequent anomalous vessel. However, other studies<sup>15</sup> have reported RCA to be the one most commonly involved.

The incidence of coronary artery anomalies has traditionally varied due to heterogeneous definitions and classifications used in the studies. For instance, Angelini et al reported an incidence of 5.6%,<sup>16</sup> whereas Click et al observed mere 0.3% incidence of anomalies in angiography patients.<sup>17</sup> Some studies have included common innocuous variations in coronary artery anomalies, whereas others have not. This might explain in part the difference in incidence reported between studies. Since the majority of these anomalies are asymptomatic, they are frequently diagnosed when angiography is performed. Due to this "referral bias," the actual incidence of coronary artery anomalies remains unknown in the general population.<sup>18</sup>

Earlier studies suggested a relationship between coronary artery anomalies and atherosclerosis. Numerous mechanisms were proposed to explain such an association. For instance, Silverman et al<sup>19</sup> proposed that an abnormal angle of origin and tortuous course accelerates atherosclerosis in anomalous arteries, whereas Liu et al<sup>20</sup> postulated susceptibility of lipid accumulation to be responsible. Anomalous arteries cause turbulence of blood flow which might disrupt endothelial function, thus increasing the rate of atherosclerosis. Most of the studies that support this hypothesis were small, observational in nature with lack of a control group. These studies were limited by the absence of a control group. Alterations in mechanical forces and the consequent changes in wall tension (Laplace law) are also presumed to be atherogenic. Click et al<sup>17</sup> included an age, gender, and symptoms matched control group in their study and found a statistically significant relationship between coronary anomalies and stenosis. For a comparison group, we included the angiographic findings of coronary arteries from same patients as that of coronary anomalies. We believe that an internal control group is the one least subjected to bias. We did not find any relationship between coronary artery anomaly and atherosclerosis. The prevalence of atherosclerosis was similar between the two

groups (37.8% in the anomalies group and 38.2% in the controls).

## Limitations

This study was a retrospective study limiting our results. Anomalous left anterior descending artery was underrepresented in our study, thus limiting our results to right coronary and circumflex artery. We evaluated only the presence of significant coronary artery disease in our study and not clinical events such as myocardial infarction, arrhythmias, or death. Therefore, we cannot exclude any theoretical detrimental effect of anomalous coronary on clinical outcomes.

## Conclusion

This study shows that there is no association between coronary artery anomaly and atherosclerosis. Further studies are needed to identify anomaly specific risks.

**Conflict of Interest**  
None.

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