

A New Variant of Dual Left Anterior Descending Artery Anomaly Type XI

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نوع جديد من ازدواجية الشريان التاجي النازل الامامي النوع الحادي عشر

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ABSTRACT: A dual left anterior descending (LAD) artery is a rare congenital anomaly which is classified into different types based on the origin, course and termination of the short and long LAD arteries. To date, 10 variants of dual LAD artery anomalies have been described. We report a 44-year-old woman who was referred to the Department of Radiology, Royal Hospital, Muscat, Oman, in 2017. Coronary computed tomography angiography revealed a dual LAD artery anomaly in which the short and long LAD arteries shared a common *ostium* with the right coronary artery from the right coronary sinus. To the best of the authors' knowledge, this type of variant has not been previously reported in the literature.

Keywords: Coronary Angiography; Congenital Abnormality; Coronary Vessel Anomalies; Case Report; Oman.

المخلص: تعتبر ازدواجية الشريان التاجي النازل الامامي من الحالات الوراثية النادرة والتي تصنف الى عدة انواع اعتمادا على أصل ومسار ونهاية كل من الشريان التاجي النازل الامامي القصير والشريان التاجي النازل الامامي الطويل. حتى الان توجد هناك عشرة انواع مختلفة من ازدواجية الشريان التاجي النازل الامامي. نعرض هنا حالة امرأة تبلغ من العمر 44 عاما تم تحويلها الى قسم الاشعة في المستشفى السلطاني، مسقط، عمان، في عام 2017 لتصوير الشرايين التاجية باستخدام الأشعة المقطعية والتي كشفت عن وجود ازدواجية الشريان التاجي النازل الامامي والذي يتميز بكون كل من الشريان التاجي النازل الامامي القصير والشريان التاجي النازل الامامي الطويل يشتركان في المنشأ من الجيب التاجي الأيمن. هذا النوع من ازدواجية الشريان التاجي النازل الامامي لم يسبق وان تم تصنيفه من قبل.

الكلمات المفتاحية: تصوير الاوعية التاجية؛ تشوهات خلقية؛ تشوهات الشريان التاجية؛ تقرير عن حالة؛ عمان.

ADUAL LEFT ANTERIOR DESCENDING (LAD) artery is a rare coronary anomaly with an estimated incidence of 0.03–0.2% among patients undergoing routine coronary catheterisation.¹ It is defined as the presence of both short and long LAD arteries.² Awareness of the different types of dual LAD artery anomalies is critical when planning percutaneous and surgical reperfusion strategies.^{2–4} This report describes a unique case which, to the best of the authors' knowledge, does not fall into any of the 10 categories of dual LAD artery anomalies currently reported in the literature.^{5,6}

Case Report

A 44-year-old woman was referred to the Department of Radiology, Royal Hospital, Muscat, Oman, in 2017 for coronary computed tomography angiography (CCTA). She had a history of chest pain, shortness of breath upon exertion and palpitations. However, a physical examination, electrocardiogram and cardiac enzyme testing were

normal. Therefore, 384-slice CCTA was performed at 2 × 192 kW. This revealed a dual LAD artery anomaly in which the short and long LAD arteries shared a common *ostium* with the right coronary artery from the right coronary sinus [Figure 1A]. The short LAD artery followed a course caudal to the pulmonary artery and through the interventricular *septum* to the left, before emerging within the proximal anterior interventricular groove where it terminated as the first diagonal branch. The long LAD artery coursed anterior to the pulmonary artery to the left and then entered the distal interventricular groove [Figure 1B]. The left circumflex artery originated from the right coronary sinus then followed a retroaortic course before reaching the left atrioventricular groove [Figures 1C and D].

There was no evidence of coronary artery atherosclerotic disease and no other congenital anomalies were detected. As there were no signs of any *stenosis* of significant haemodynamic severity, the decision was made to keep the patient under regular observation and follow-up.

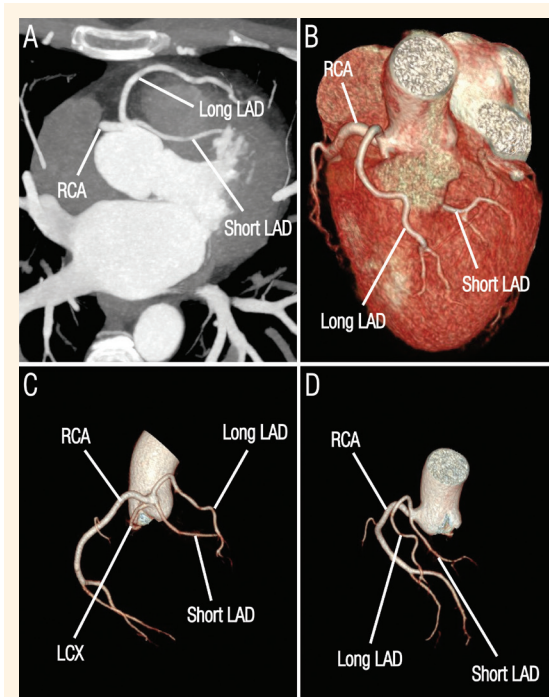


Figure 1: Coronary computed tomography angiography (CCTA) sequence of a 44-year-old woman with a dual left anterior descending (LAD) artery anomaly. **A:** Axial maximum-intensity projected CCTA image showing the anomalous origin of the long and short LAD arteries from the right coronary sinus with a prepulmonic course for the long LAD artery and transeptal course for the short LAD artery. **B:** Three-dimensional volume-rendered CCTA image showing the course of the long LAD artery anterior to the right ventricular outflow track and entering the distal anterior interventricular groove. **C & D:** Three-dimensional volume-rendered CCTA images showing the common origin of the long LAD artery, short LAD artery, right coronary artery and left circumflex artery from the right coronary sinus.

LAD = left anterior descending artery; RCA = right coronary artery; LCX = left circumflex artery.

Discussion

Normally, the LAD artery originates from the left main coronary artery and then courses within the anterior interventricular groove towards the *apex* where it gives rise to diagonal and septal branches. In contrast, a dual LAD artery is a rare congenital anomaly characterised by the presence of short and long LAD arteries.^{1,2} It is traditionally classified into four different types based on the origin, course and termination of the short and long LAD arteries.^{2,5,7} However, CCTA has since enabled the recognition of other variants. To date, 10 dual LAD artery variants have been described [Table 1].^{5,6} The short LAD artery typically originates from the main stem of the LAD artery and terminates in the proximal interventricular groove. The long LAD artery takes a more variable course around the short segment, returning to the interventricular groove distally.^{2,6,8,9}

In previously described cases of dual LAD artery anomalies, the short LAD artery originates from either

Table 1: Types of dual left anterior descending artery variants^{5,6}

Type	Short LAD artery		Long LAD artery	
	Origin	Course	Origin	Course
I	LMCA	Proximal AIVG	Proximal LAD artery	Epicardial course on the LV side of the proximal AIVG and then re-enters the distal AIVG
II	LMCA	Proximal AIVG	Proximal LAD artery	Epicardial course on the RV side of the proximal AIVG and then re-enters the distal AIVG
III	LMCA	Proximal AIVG	Proximal LAD artery	Intramycardial course in the proximal <i>septum</i> followed by an epicardial course in the distal AIVG
IV	LMCA	Proximal AIVG	RCA	Epicardial course anterior to the RVOT and then enters the distal AIVG
V	LCS	Proximal AIVG	RCS	Intramycardial course within the septal crest and then emerges in the distal AIVG
VI	LMCA	Proximal AIVG	RCA	Course between the RVOT and aortic root and then enters the mid or distal AIVG
VII	LAD artery	Proximal AIVG	LAD artery	Epicardial course on the LV side of the proximal AIVG and then re-enters the distal AIVG*
New variant of type VII	LMCA	Proximal AIVG	RCS	Course on the LV side of the proximal AIVG and the re-enters the distal AIVG*
VIII	LMCA	Proximal AIVG	Mid-RCA	Epicardial course on the inferior wall of the RV and then turns around the <i>apex</i> and reaches the distal AIVG†
IX	LAD	Mid AIVG	LAD artery	Epicardial course on the LV side of the proximal AIVG and then re-enters the distal AIVG and terminates before reaching the <i>apex</i> ‡
X	LMCA	Proximal AIVG	RCS	Epicardial course anterior to the RVOT and then enters the distal AIVG
Current case (XI)	RCS	Intramycardial course within the proximal <i>septum</i> and then emerges in the proximal AIVG	RCS	Epicardial course anterior to the RVOT and then enters the distal AIVG

LAD = left anterior descending; LMCA = left main coronary artery; AIVG = anterior interventricular groove; LV = left ventricular; RV = right ventricular; RCA = right coronary artery; RVOT = right ventricle out-flow tract; LCS = left coronary sinus; RCS = right coronary sinus. *The LMCA originates from the RCS and has an interarterial malignant course. †The LMCA originates from the RCS and has a retroaortic course. ‡The posterior descending coronary artery extends distal to the AIVG.

the main stem of the LAD artery or the left main coronary artery.^{1–10} However, the current case was unique in that the short LAD originated from the right coronary sinus and then coursed within the proximal *septum* before emerging in the proximal interventricular groove. The long LAD artery originated from the right coronary sinus and then coursed anterior to the main pulmonary artery before entering the distal interventricular groove. To the best of the authors' knowledge, this type of LAD artery anomaly has not been previously reported in the literature and may be considered a new variant (type XI).

During conventional coronary angiography, the entire coronary vasculature might not be visible, particularly in cases wherein the coronary arteries have anomalous origins. Awareness of potential dual LAD artery variants is therefore crucial when interpreting cardiac imaging as well as in the planning of percutaneous and surgical reperfusion strategies. For example, among patients with variants in which the long LAD artery originates from the right coronary sinus, only the short LAD artery can be visualised via angiography which means it may be mistaken for a mid-LAD artery occlusion.⁶ Furthermore, among patients requiring a coronary bypass graft, a lack of awareness may result in a bypass to only one artery, thus leading to deficient revascularisation if both the short and long LAD arteries are stenosed. In addition, awareness of the various dual LAD artery variants can prevent vascular injuries during a median sternotomy in cases wherein the long LAD artery courses anterior to the pulmonary artery behind the *sternum*.^{6,10}

Conclusion

A dual LAD artery is a rare congenital anomaly and awareness of the various types of dual LAD artery variants is critical. The current case report describes a new variant of dual LAD artery anomaly, provisionally designated type XI, in which the short LAD artery orig-

inated from the right coronary sinus and then coursed within the proximal *septum* before emerging in the proximal interventricular groove, while the long LAD coursed anterior to the pulmonary artery to the left and then entered the distal interventricular groove.

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