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A Case Series in Evaluating Anomalous Coronary Artery Origins in Adults with 128-Slice-MDCT; Unmasking the Hidden Threats

Case Series

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Abstract

Anomalies in the origin of coronary arteries (AOCA) though rare can lead to serious clinical outcomes such as myocardial ischemia or even sudden death. MDCT has transformed noninvasive evaluation of the coronary arteries by providing high-resolution imaging capabilities. Here is a case series of overview of the imaging features, classification, and clinical implications of anomalous coronary origins as seen on 128-slice MDCT, emphasizing its critical role in diagnosis, evaluating risk, and guiding surgical management. In our institute, a total of 250 MDCT coronary angiograms have been done over a period of 2 years, after taking informed consents from the patients. Among them 5 cases had anomalies in the origin of coronary arteries (AOCA)—two cases of anomalous origin of RCA from left coronary sinus with malignant inter-arterial course, one with anomalous origin of Left main coronary artery from non-coronary cusp with retro-aortic course, one with anomalous origin of Left circumflex artery from the right coronary sinus with malignant inter-arterial course and one case of separate origins of Left anterior descending artery andLeft circumflex artery from left coronary sinus. Identification of benign and malignant courses is also of utmost importance, because the later may warrant surgical intervention. In our case series the incidence rate of anomalous origins is 2%, closely aligning with those of existing studies in the literature.

Introduction

AOCA refers to a group of congenital coronary anomalies that may be clinically silent or present with severe and potentially fatal consequences. The growing use of MDCT has markedly enhanced the identification and detailed assessment of these coronary variants [1, 2]. Conventional coronary angiography has historically been the gold standard for evaluating coronary anatomy, but it has limitations in delineating the exact origin and 3D course of anomalous coronary arteries, especially in relation to surrounding structures [3]. In recent years, 128-slice MDCT or higher scanners, has emerged as a valuable noninvasive imaging modality offering excellent spatial and temporal resolution [4]. MDCT provides detailed anatomical information regarding the origin, course and potential compression points of anomalous vessels, which is important for both risk stratification and surgical planning [7]. This review aims to outline the various AOCA observed on 128-slice MDCT. These coronary anomalies are believed to result from developmental errors in the embryonic formation of coronary buds and their attachment to the aortic sinuses. AOCA occurs in about 0.3% to 2% of individuals, and certain types are associated with elevated risks, especially during physical activity in younger patients [2,5].

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Classification of Anomalous origin of coronary arteries

AOCA can be classified into the following categories:

1. Anomalous aortic origin with normal course.

2. Anomalous aortic origin with anomalous proximal course.

3. Anomalous origin from the pulmonary artery.

4. Single coronary artery.

These categories display unique imaging characteristics and clinical significance, & certain anomalies may necessitate operative management [6].

Classification of AOCA by Anatomic course and clinical risk: [2,5,6]

Variant	Course	Risk Level	Clinical Concern
LCX from right sinus	Retro aortic	Low	Incidental, benign
RCA from left sinus	Inter-arterial	Moderate to High	Syncope, Sudden cardiac death
LCA from right sinus	Inter-arterial or intramural	High	Strongly linked with Sudden cardiac death
High take-off	Variable	Low to Moderate	May cause exercise-induced ischemia

LCX-Left circumflex artery; RCA- Right coronary artery; LCA-Left coronary artery;

Imaging Technique

128-MDCT scanners offer superior spatial detail, synchronized ECG acquisition, and 3D image reconstruction [1]. Beta-blockers and sublingual nitroglycerin are commonly administered before scanning to enhance image quality. High-resolution thin-section imaging, curved multiplanar reconstructions and 3D volume-rendered views are essential for assessing the origin, trajectory and ostial details of coronary vessels [5,7].

Case Illustrations

Case 1: A 70-year-old female with c/o dyspnea on exertion, case of hypertension and diabetes mellitus, demonstrated an anomalous origin of **Right coronary artery from left coronary sinus**, RCA seen passing between the pulmonary trunk & ascending aorta– **Malignant inter-arterial course of RCA**.

Case 2: A 36-year-old male smoker with c/o chest pain & positive stress test and without any comorbidities, demonstrated an anomalous origin of **Left main coronary artery from non-coronary cusp with retro-aortic course.**

Case 3: A 45-year-old male smoker & alcoholic with c/o chest discomfort & mildly positive stress test demonstrated an anomalous origin of **Right coronary artery from the left coronary sinus** with **malignant inter-arterial course**.

Case 4: A 68-year-old female with c/o chest pain, case of hypercholesterolemia and diabetes and concentric left ventricular hypertrophy in echocardiogram, demonstrated an anomalous origin of **Left circumflex artery from the right coronary sinus with retro-aortic course.**

Case 5: A 48-year-old female with chest pain for 2 days, normal echocardiography, mildly positive for inducible ischemia in TMT with hypercholesterolemia demonstrated an **anomalous separate origin of Left anterior descending and left circumflex artery from left coronary sinus**.

Clinical Significance and Management

Low-risk anomalies like retroaortic or prepulmonic routes are

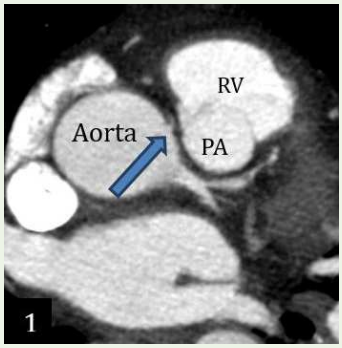

Figure 1: Case 1: Maximum intensity projection reconstruction shows anomalous origin of right coronary artery from left coronary sinus, RCA seen passing between the pulmonary trunk & ascending aorta– Malignant inter-arterial course of RCA. Note the narrow caliber and acute angulation of RCA.

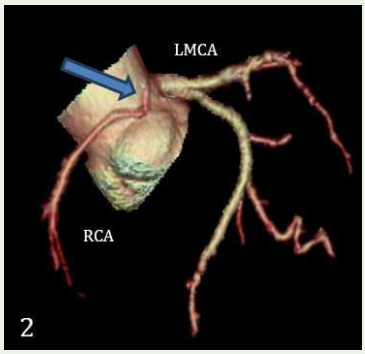

Figure 2: 3D volume rendered reformation shows anomalous origin of right coronary artery from left coronary sinus. Note the narrow caliber and acute angulation of RCA.

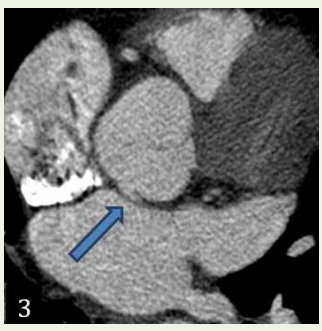

Figure 3: Case 2: Maximum intensity projection reconstruction shows anomalous origin of left main coronary artery from non-coronary cusp with retro-aortic course.

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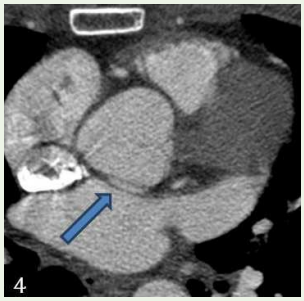

Figure 4: Maximum intensity projection reconstruction shows anomalous origin of left main coronary artery from non-coronary cusp with retro-aortic course.

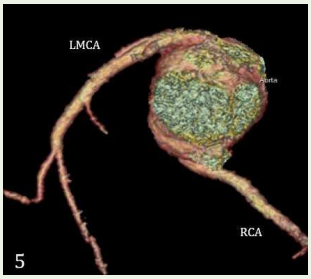

Figure 5: Maximum intensity projection reconstruction shows anomalous origin of left main coronary artery from non-coronary cusp with retro-aortic course.

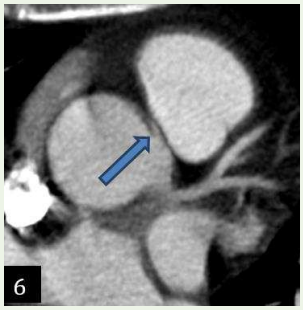

Figure 6: Case 3: Maximum intensity projection reconstruction shows an anomalous origin of Right coronary artery from the left coronary sinus with Malignant inter-arterial course. Note the narrow caliber of origin of RCA.

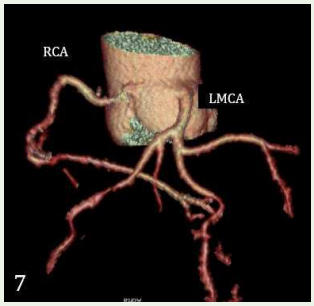

Figure 7: 3D volume rendered reformation shows an anomalous origin of Right coronary artery from the left coronary sinus. Note the narrow caliber of origin of RCA.

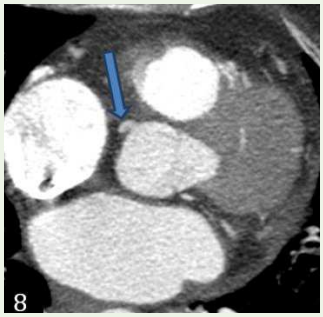

Figure 8: Case 4: Maximum intensity projection reconstruction and 3D volume rendered reformation shows an anomalous origin of Left circumflex artery from the right coronary sinus with retro-aortic course.

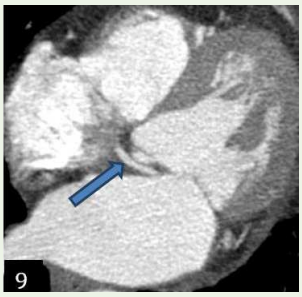

Figure 9: Maximum intensity projection reconstruction and 3D volume rendered reformation shows an anomalous origin of Left circumflex artery from the right coronary sinus with retro-aortic course.

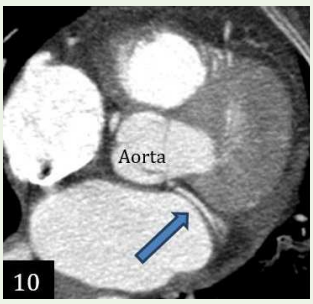

Figure 10: Maximum intensity projection reconstruction and 3D volume rendered reformation shows an anomalous origin of Left circumflex artery from the right coronary sinus with retro-aortic course.

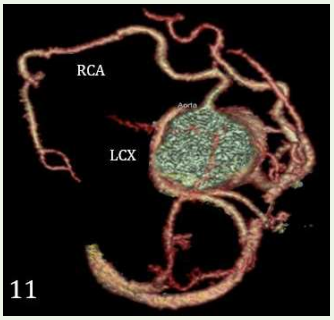

Figure 11: 3D volume rendered reformation shows an anomalous origin of Left circumflex artery from the right coronary sinus with retro-aortic course.

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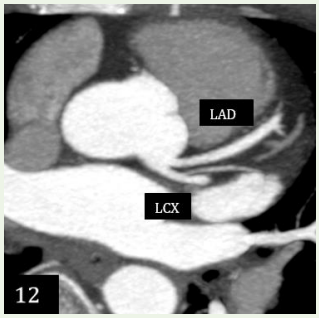

Figure 12: Case 5: Maximum intensity projection reconstruction & 3D volume rendered reformation shows an anomalous separate origin of Left anterior descending & left circumflex artery from left coronary sinus

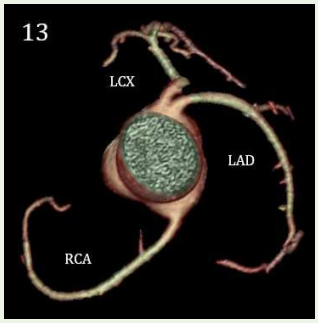

Figure 13: Maximum intensity projection reconstruction & 3D volume rendered reformation shows an anomalous separate origin of Left anterior descending & left circumflex artery from left coronary sinus

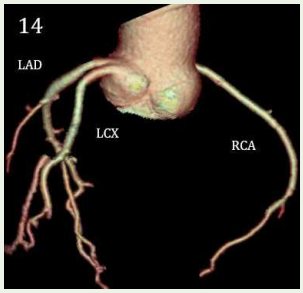

Figure 14: Maximum intensity projection reconstruction & 3D volume rendered reformation shows an anomalous separate origin of Left anterior descending & left circumflex artery from left coronary sinus.

usually treated with observation alone. Serious anomalies such as interarterial courses of the LMCA or RCA often require surgical treatment—like unroofing or reimplantation—making precise imaging and reporting crucial for preoperative strategy [4,5]. All the AOCA cases in our series are managed conservatively with observation.

Discussion

MDCT coronary angiography has emerged as the imaging modality of choice for delineating coronary anomalies owing to its high spatial resolution, non-invasiveness and ability to generate multiplanar and three-dimensional reconstructions. Our findings demonstrate that 128-slice MDCT reliably detected the origin & course of anomalous coronary arteries, including high-risk variants such as an inter-arterial course (between the aorta and pulmonary artery), which has been associated with sudden cardiac events. In contrast to conventional catheter angiography, MDCT provides superior visualization of the proximal vessel origin and its relationship with adjacent structures, which is often crucial for surgical or interventional planning [8]

Familiarity with the CT imaging features of coronary anomalies and their clinical relevance is vital for correct diagnosis and effective patient management [**5**]. While many coronary anomalies are harmless, those that travel between the major vessels pose a risk for ischemia and sudden cardiac death. The rising use of MDCT in cardiac imaging underscores the importance of detecting these anomalies through axial, multiplanar and 3D reconstructions [**1**]. AOCA cases in our series didn't undergo any surgical management but were managed conservatively with observation. Our studies underlines the indispensable role of 128-slice MDCT in the modern diagnostic approach to anomalous origin of coronary arteries.

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