Anomalous Origin of Right Coronary Artery with Malignant Course – Few Case Reports

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Abstract: *Congenital anomalies of the coronary arteries are the important causes of morbidity and mortality associated with chest pain or sudden death. This clinical and hemodynamic significance makes the study of variations by using noninvasive imaging modalities like Multi Detector Computed Tomography Coronary Angiography (MDCT CA) and Magnetic resonance imaging (MRI) for preoperative evaluation. In this case series we report anomalous origin of right coronary artery with malignant inter arterial course in three patients detected on MDCT CA.*

Keywords: *Coronary artery, MDCT CA, Right coronary artery (RCA) Anomalous origin, Malignant inter arterial course.*

I. Introduction

Primary congenital anomalies of the coronary arteries have an incidenceof 1–2% in the general population[1]. The incidence of anomalous right coronary artery (RCA) originating from the left sinus is 0.13%[2]. Noninvasive techniques such as MRI, electron-beam CT, and MDCT depict these anomalies with high accuracy [3,4].MDCT in particular provides high-resolution 3D data sets that allow precise definition of 3D spatial relations of the anomalies. Patients with anomalous coronary arteries, MDCT is superior to angiography as there is definite opacification of vessels regardless of anatomy and helps to visualize abnormal vessels in relation to the great mediastinal vessels in MDCT[3]. However MDCT is less invasive compared to conventional angiography.

II. Case Reports

Case 1: A 40 year old female was referred to MDCT CA to rule out coronary artery disease by cardiologist. MDCT (256 slice) coronary angiogram revealed anomalous origin of right coronary artery (RCA) from left coronary sinus with inter-arterial course. Soft plaque noted in the distal left anterior descending artery (LAD) causing upto 20-30% stenosis (Fig 1).

Case 2: A 34 year female patient presented with chest pain and dyspnea. TMT in this patient was positive. MDCT (256 slice) coronary angiogram revealed anomalous origin of RCA from the peripheral portion of left sinus of valsalva with inter arterial (Malignant) course (Fig 2).

Case 3: A 70 year old female patient presented with grade III shortness of breath. Echocardiogram revealed left ventricular hypertrophy and diastolic dysfunction. MDCT (256 slice) coronary angiogram showed anomalous origin RCA from the peripheral portion of left sinus of valsalva with inter arterial (Malignant) course.Mid LAD shows kink. Hard plaque noted in left circumflex artery causing 30-40% stenosis (Fig 3).

III. Discussion

3.1 Normal Anatomy [3, 5]:

Left main coronary artery (LMCA) – Arises from left sinus of valsalva and usually after 10 to 15mm it bifurcates into left anterior descending (LAD) artery and the circumflex artery (CXA) or trifurcates with an additional intermediate ramus branch. LAD typically travels in the anterior interventricular groove and gives rise to septal branches to anterior 2/3rds of septum and variable diagonal branches. CXA runs in left artrioventricular groove to supply lateral ventricular branches to the lateral and postero-lateral walls of left ventricle (Fig 4).

Right coronary artery (RCA) originates from the right coronary sinus of valsalva and travels in right artrioventricular groove to the bottom of the heart.it gives off conus and acute marginal branches to lateral walls of right ventricle. It supplies posterior descending, posterior left ventricular and postero-lateral arteries (Fig 4).

Coronary artery anomalies are found in 0.5% - 1.0% of patients undergoing coronary angiography[6]. Anomalous origin of right coronary artery is a rare congenital anomaly and was first described in 1948 by White and Edwards[6]. Schmidt and colleagues evaluated the role of MDCT in the visualization of coronary artery anomalies and divided them into two groups, depending on the origin and course of the coronary artery: Benign or minor coronary anomalies and Malignant or Major coronary anomalies[7]

3.2 Benign or minor coronary anomalies:
These are the most common anomalies with no clinical relevance. The two most frequent anomalies are
3.2.1. Left circumflex artery (CX) arising from the right aortic sinus – present in 50% of the cases.
3.2.2. Independent origin of LAD artery and CX arteries from the left sinus of valsalva or from one common ostium.

3.3 Malignant or major coronary anomalies:
These comprises of arteries with ectopic origin from contralateral side of heart and then course between aortic root and pulmonary trunk to the other side.

They are:
1. RCA arising from the left aortic sinus.
2. LMCA arising from the right aortic sinus.
3. Anomalous origin from the LMCA, LAD or RCA from the pulmonary trunk.
4. Coronary artery fistula.

Kragel and Roberts categorized anomalous RCA from the left sinus into four types [8]:
Type A. From within the left sinus.
Type B. From above the left sinus.
Type C. Directly above the commisure between theleft and right cusps and
Type D. From a common ostiumwith the left main coronary artery, which straddles the left sinus and the commisure between the left and right cusps.
Type D was proved to be of the least incidence accounting for 2/25 (8%) of all four types.

In our cases, right coronary artery anomalies like origin from contralateral coronary sinus and course of the artery between aortic root and pulmonary trunk were demonstrated in Multiplanar reformatting (MPR), Maximum intensity projection (MIP) and 3D volume rendered reconstructed images, confirming the usefulness of above said noninvasive investigative modality.

IV. Conclusion
Coronary variants and anomalies are commonly encountered. Knowledge of anomalies by radiologists helps in prior recognition and better patient management. Use of MDCT in cardiac imaging with MPR, MIP and 3D Volume rendered reconstructed images renders better recognition of coronary anomalies.

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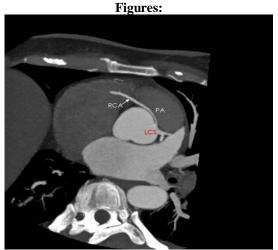
Figures:

Fig 1 : MIP (maximum intensity projection) image showing anomalous origin of right coronary artery (RCA) from left coronary sinus with inter-arterial course.
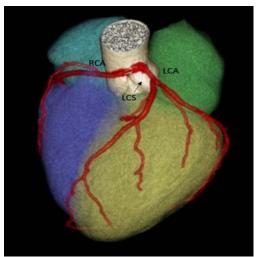

Fig 2: VRT (volume rendered technique) image showing anomalous origin of RCA from the peripheral portion of left sinus of valsalva with inter arterial (Malignant) course.
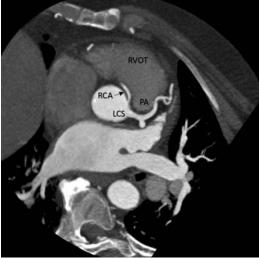

Fig 3 : MIP (maximum intensity projection) image showing anomalous origin RCA from the peripheral portion of left sinus of valsalva with inter arterial (Malignant) course.
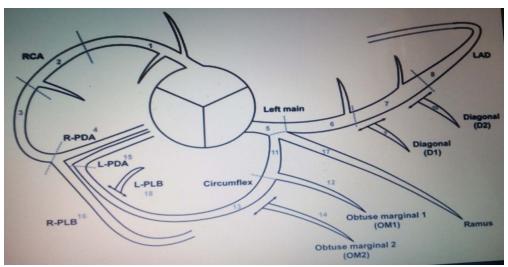
Fig 4: line diagram showing coronary segments proposed in and used by Society of Cardiovascular Computed Tomography [3]. RCA = right coronary artery, LAD = left anterior descending artery, R-PDA = right posterior descending artery, L-PDA = left posterior descending artery, L-PLB = left posterolateral branch, R-PLB = right posterolateral branch.