PERCUTANEOUS CORONARY INTERVENTION OF ANOMALOUS CORONARY ARTERIES: ROLE OF PRE-PROCEDURAL CORONARY CT ANGIOGRAPHY

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ABSTRACT

Anomalous coronary arteries are occasionally discovered during urgent invasive coronary angiogram. The knowledge about the origin and anatomical course of these arteries is essential for management and decision-making. This information is difficult to obtain during cardiac catheterization. Coronary CT angiography (CTA), due to its improved ability to depict spatial relationship of thoracic structures can overcome these shortcomings. Additional important information obtained from CTA can help better plan for the subsequent revascularization. We report three cases of acute coronary syndromes, where information from coronary CTA was complimentary in proper diagnosis and management. We advocate the use of CTA prior to PCI in non emergent cases.

Key Words: Acute Coronary syndromes, Anomalous coronary arteries, CT angiography.

INTRODUCTION

Anomalous origin of one or more coronary arteries has an incidence of 0.2 to 1.2% in patients undergoing cardiac catheterization[1-4] Anomalous coronary arteries with a retroaortic course may not pose an incremental risk of cardiovascular symptoms. In the more concerning interarterial course symptoms may arise from vessel compression between the aorta and the pulmonary artery. Exertional angina, syncope, malignant ventricular arrhythmias and sudden death have all been reported[5-7]. Latter is more common in anomalous left coronary artery arising from the right and coursing between the great vessels[8-9]. In addition to symptoms arising from an interarterial course, anomalous arteries with a slit like ostium and oblique angle of origin may collapse during exercise thereby causing myocardial ischemia[10]. There is no clear association between coronary anomaly and increased risk of obstructive coronary atherosclerosis. Nevertheless, as with normal coronary arteries, anomalous coronary arteries are affected by symptomatic atherosclerotic obstruction. In the setting of anomalous coronary artery, performing percutaneous coronary intervention (PCI) may present with unique challenges regarding the origin and course of the artery and guide catheter selection. Coronary CT angiography (CTA) is able to precisely localize the origin and anatomic course of anomalous coronaries and is now the preferred imaging modality for this condition[11]. Furthermore, information from CTA of atherosclerotic disease segment length, relation to more proximal vessels and to side branches and projection angle that best displays the diseased vessel may be used in planning PCI. Herein we report three cases where information from coronary CTA was complimentary in proper diagnosis and management.

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CASE #1

Forty-two year old gentleman was transferred to our hospital with anterior STEMI for primary PCI. Diagnostic angiography from a right radial access showed thrombotic occlusion of left anterior descending coronary artery (LAD). A high grade stenosis was also noted in mid right coronary artery (RCA) which originated anomalously from left coronary sinus of Valsalva. The infarct related artery (LAD) was successfully intervened. Staged PCI of RCA was performed on third hospital day. Failure to have good guide support from a radial artery access because of acute angle of origin of RCA and secondary curvature required conversion to a femoral approach with good procedural outcome. Due to disagreement regarding the course of RCA on invasive angiography, interval CTA was performed which confirmed an anterior course between the aorta and right ventricular outflow tract (Figure 1A, 1B).

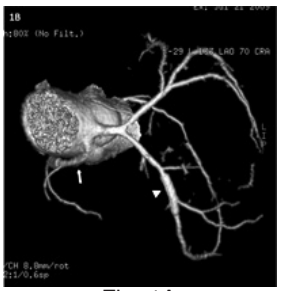

Fig. 1A

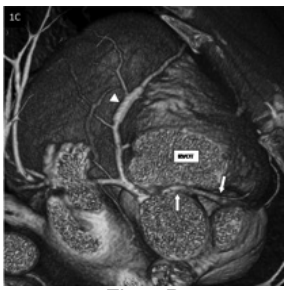

Fig. 1B

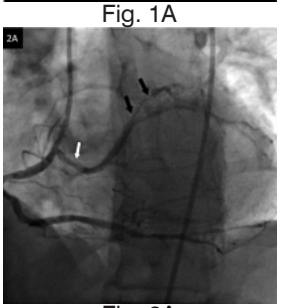

Fig. 2A

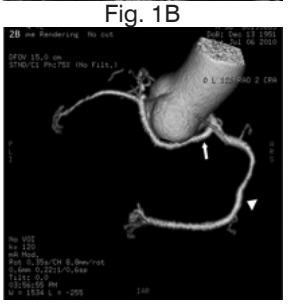

Fig. 2B

Fig. 2C

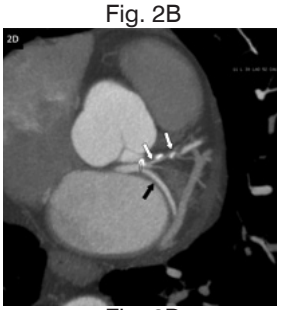

Fig. 2D

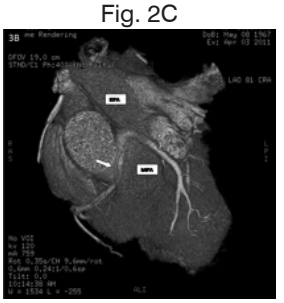

Fig. 3A

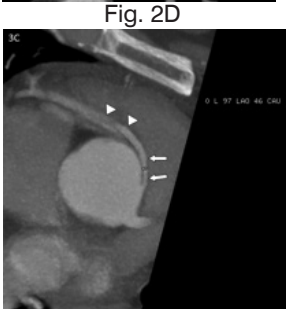

Fig. 3B

Fig. 3C

CASE #2

Fifty-nine year old man with type II DM, hypertension and hyperlipidemia presented with NSTEMI. Diagnostic catheterization from the radial artery showed aberrant origin of left main coronary artery arising from the right coronary cusp. Long segment of severe stenosis extending from the proximal to mid LAD was noted. The course of the left main could not be accurately determined by invasive angiography (figure 2A). Coronary CT angiogram clearly outlined the retro aortic course of left main and more clearly demonstrated the relationship of the proximal LAD lesion to the LAD ostium and the ostium of left circumflex coronary artery (figure 2B, 2C and 2D). Coronary intervention was successfully carried out via a femoral approach. Projection angle that best displayed the LAD lesion on CTA was also selected during PCI.

Table 1: Incidence of Coronary Anomaly

Type	% overall Incdence	% of Anomalies
Absent LM (separate ostium of LAD & LCX arising from LSV)	0.41	30.40
LCX from RSV or RCA	0.37	27.70
RCA from ascending aorta	0.12	11.20
RCA from LSV	0.11	8.10
Others	0.01	22.60

CASE # 3

Forty-three year old man with no cardiovascular risk factors was hospitalized with NSTEMI. Coronary angiography demonstrated normal left coronary system. RCA arose aberrantly from the left coronary cusp. It could not be selectively engaged. Aortic root angiogram demonstrated TIMI III flow down the anomalous RCA which was suspected to have a retroaortic course. Inadequate vessel opacification, however, precluded angiographic analysis. After clinical stabilization CTA was performed on the second hospital day. In contrast to invasive angiography, CTA confirmed a more concerning interarterial course of the RCA which arose from the left coronary sinus of Valsalva. Additionally, severe narrowing of the ostial and proximal RCA was noted (3A, 3B and 3C). Further history at this time failed to identify a relationship of his symptoms to out of ordinary physical activity as is sometimes the case in anomalous coronary arteries with an interarterial course. With regards to management patient was reluctant to consider mechanical therapeutic options, PCI or surgical, for the RCA lesion. He was placed on beta blockers and other standard post MI care. Amlodipine was added to the medical program to counter any vasospastic component. Following medical optimization an exercise

echocardiogram was performed. Patient exercised to a workload of 10.2 mets with no exertional symptoms and no stress related ECG changes or wall motion abnormality. This information was cautiously interpreted with recognition that results of stress testing may be misleading in patients with coronary anomaly[12].

DISCUSSION

Normal coronaries originate below the tubular aorta at right angles to the wall of the corresponding sinus. Anomalous coronary arteries can be classified by their origin, course or termination. Incidence of coronary anomaly based on vessel origin is described in Table 1.[13]

Determining presence and precise anatomic course of anomalous coronary arteries can be challenging during conventional coronary angiogram. Vessels arising anomalously may have an acute angle of origin, slit like orifice or marked angulations. These anatomical features may pose difficulty during conventional invasive angiogram and PCI. During PCI of anomalous coronaries AL1 guiding catheter[14-15], left Judkins[16], Judkins with a larger secondary curve[17], and multipurpose guide have all been successfully used and may provide superior support compared to conventional guides. However, generalization regarding guide selection cannot be made. Multiple catheters may be used before finding one that is coaxial with the vessel lumen and provides good support during PCI. Coronary CTA with its improved ability to depict spatial relationship of thoracic structures has now become the preferred imaging modality in patients suspected of having coronary artery anomaly. In our first patient because of the acute angle of origin and marked secondary angulation proper guide support was not achieved from radial artery but was adequate from right femoral approach thus signifying the importance of site selection in addition to guide selection. Therefore in non emergent cases anticipation of these potential procedural difficulties can be minimized with further evaluation using CTA. Additional information from CTA may help in guide selection and possibly cut down on procedure length and improve procedural success. Furthermore, in patients with multivessel coronary artery disease requiring bypass surgery identifying the origin and the course of the anomalous artery is helpful in surgical planning.

CONCLUSION

With broadened application of percutaneous coronary interventions familiarity of possible variations in anomalous coronary arteries is essential. As in our reported non emergent percutaneous coronary intervention cases, coronary CTA should be performed to resolve many uncertainties including the origin, anatomical course and type of anomaly. Coronary CTA will also be helpful in guide selection prior to the procedure.

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AUTHOR'S CONTRIBUTION

Following authors have made substantial contributions to the manuscript as under:

Jamil G: Design of work, intellectual content, final approval.

Jamil M: Drafting the work.

Shamsi ARA: Making appropriate modification.

Nuaimi S: Coordinating and revising the work.

Ahmed A: Looking at accuracy and integrity of the work.

Khairalla B: Planning the work.

Malik A: Acquisition and analysis.

Qureshi A: Data interpretation.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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