The role of Coronary Computed Tomography Angiogram in the Diagnosis of Spontaneous Coronary Artery Dissection: Two case reports

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Abstract:

Spontaneous coronary artery dissection (SCAD) is a rare acute coronary artery disease that mostly occurs in young women. The current algorithms applied for the diagnosis and follow up of suspected cases of SCAD does not include the utility of Coronary computed Tomography Angiogram (CCTA). It currently depends on invasive procedures such as conventional coronary angiogram (CAG). In this article, we are presenting 2 cases in which CCTA contributed significantly in both the diagnosis and the follow up of the disease. We demonstrate that the new emerging imaging modality could contribute to improving the flow of this cohort of patients in the treatment pathway. It also provides a wider option for diagnosis and follow-up.

Keywords: Spontaneous Coronary Artery Dissection, Coronary CT Angiography, Myocardial Infarction.

Introduction

Spontaneous coronary artery dissection (SCAD) is a rare acute coronary artery disease that mostly occurs in young women.[1-3] The usual presentation is with acute chest pain with clinical findings of acute coronary artery syndrome. The currently utilized pathways in the diagnosis of this disease involve invasive procedures such as conventional coronary angiogram CAG.[4] Despite the reported lower mortality rates related to SCAD, the knowledge of the mechanisms, diagnosis, and management of this disease is still under development.[5]

There have been few studies looking at the utility of Coronary Computed Tomography Angiogram (CCTA) in the diagnosis and the follow up of these patients. The fast-emerging evolution of CCTA in the diagnosis of multiple cardiovascular diseases is now widely accepted and incorporated in the treatment algorithms of different cardiac patients. The role of CCTA

in the early evaluation of patients presenting to the emergency with chest pain has been studied extensively.[4,6,7]

In this article, we are highlighting the important, but yet different roles and utilization of CCTA in the diagnostic workup of two cases diagnosed to have SCAD and how the CCTA was incorporated in their management.

Case Reports:

Case One:

A 34-year-old woman, 2 weeks post-partum. Presented with heavy chest pain, not related to exertion, not associated with orthopnea or paroxysmal nocturnal dyspnea. On examination; she was in pain with normal vital signs. She had no raised JVP or lower limb oedema. Her chest auscultation was clear with normal S1 and S2. The laboratory tests showed a high troponin level of 1000 pg/ml. Echocardiography showed a mildly dilated left ventricle with moderately impaired systolic function. Ejection fraction was 40% with global hypokinesia and grade II diastolic dysfunction. She was suspected to have either SCAD or Aortic dissection. Coronary and Aortic CTA was requested.

CCTA showed a dissection flap at the origin of the Left Anterior Descending (LAD) artery extending to the distal part. In the proximal LAD, both the false and true lumen appeared to be patent. However, in the middle part of LAD, there was complete thrombosis for a distance of 3.5 cm. The distal part of the LAD following the thrombosis demonstrated irregular lumen. The dissection appeared to also extend to the large first diagonal artery (D1). (Fig.1A,B)

The patient remained stable with down-trending of the troponin levels and resolution of the pain. She was managed conservatively and no intervention was done. She was discharged with a follow-up appointment after 2 months. The follow-up CCTA showed a re-cannulation of the middle part of LAD lumen with a development of mild aneurysmal dilatation of the LAD. (Fig.1C)

She presented at 6 months with acute chest pain. A follow-up CCTA showed progression of the aneurysmal dilatation of the proximal and part of the middle segments of the LAD with a poor filling of the middle and the distal segments. (Fig.1D)

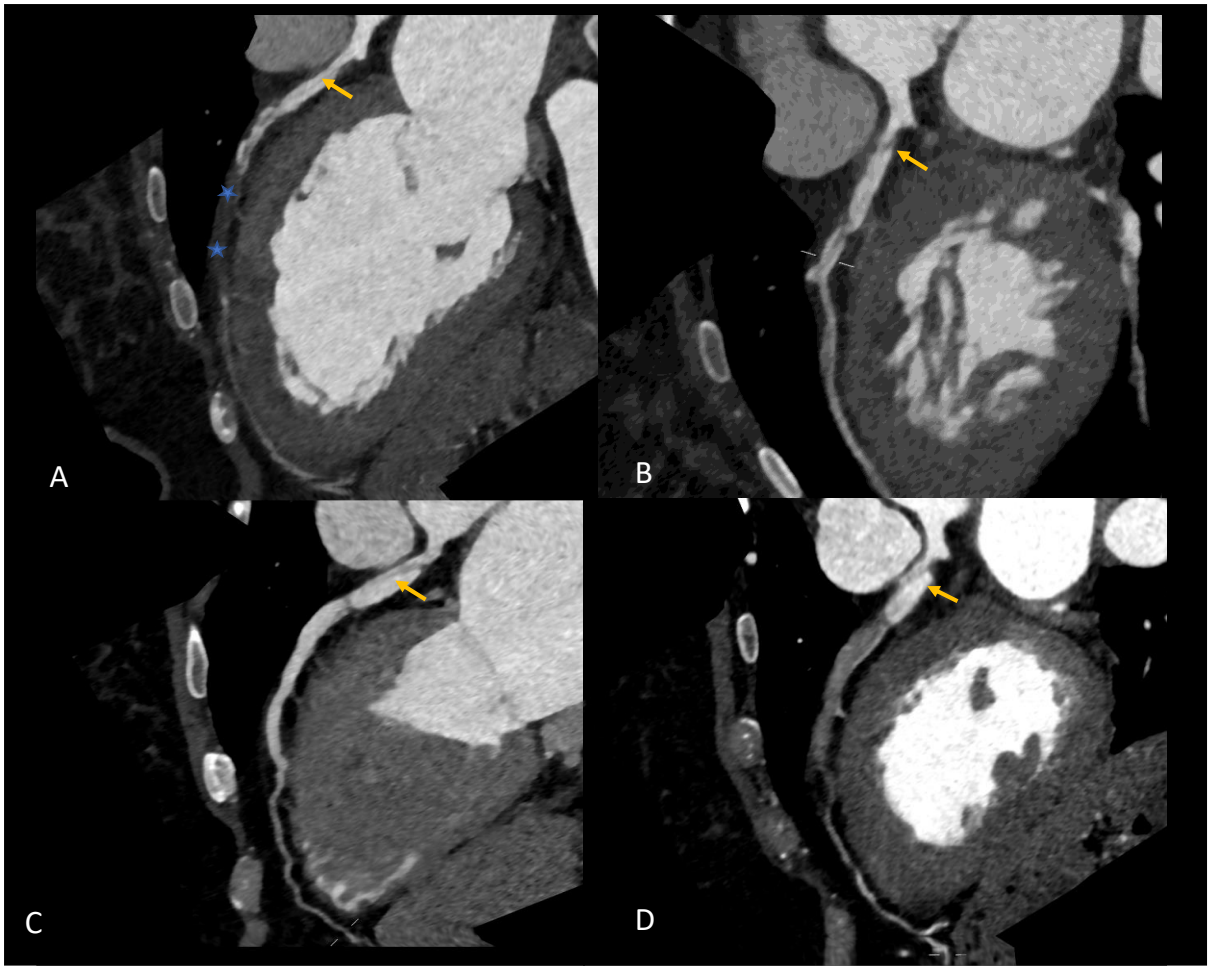

Figure 1: Images from multiple CCTA and CAG of the first patient. A) Curved Multiplanar reformation (MBR) of the LAD showing the dissection flap coursing from the ostium to middle part (orange arrow), the thrombosed middle LAD is marked by the blue stars. B) MBR images of the first diagonal artery showing the extension of the dissecting flap. C) MBR images of LAD from the follow up CCTA showing recannulation of the Middle LAD with persistent flap (orange arrow). D) MBR images from the third visit showing aneurysmal dilatation of the proximal LAD and poor filling of the middle part.

The patient underwent CAG that showed LAD dissection from the ostium with a narrow true lumen. A large aneurysm of the proximal segment involving the false lumen was confirmed. There was a faint antegrade filling of the true lumen and good retrograde filling of the middle and distal segments from the Right Coronary Artery (RCA). (Fig.2)

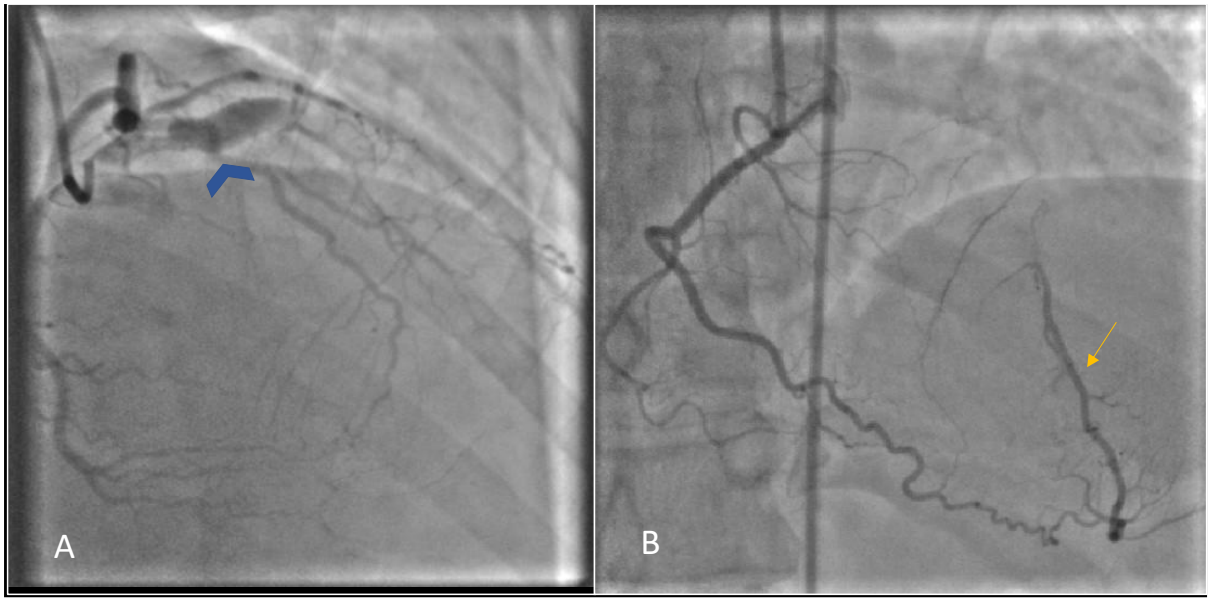

Figure 2: Images from the CAG demonstrating the large proximal aneurysm at LAD (blue arrow head) with absence of filling of the middle LAD and filling of the distal LAD via collaterals from the RCA (orange arrow).

She underwent coronary artery bypass surgery with a left internal mammary artery (LIMA) to distal LAD graft and reversed saphenous venous graft (SVG) to D1. A longitudinal proximal and mid LAD pseudoaneurysm plication was also performed.

The patient is currently doing well. At a follow-up CCTA, the LIMA-LAD graft was patent with good opacification of the distal LAD. Traces of contrast noted within the true lumen of the proximal LAD and middle part just before the graft anastomosis. The false lumen was not opacified. (Fig.3)

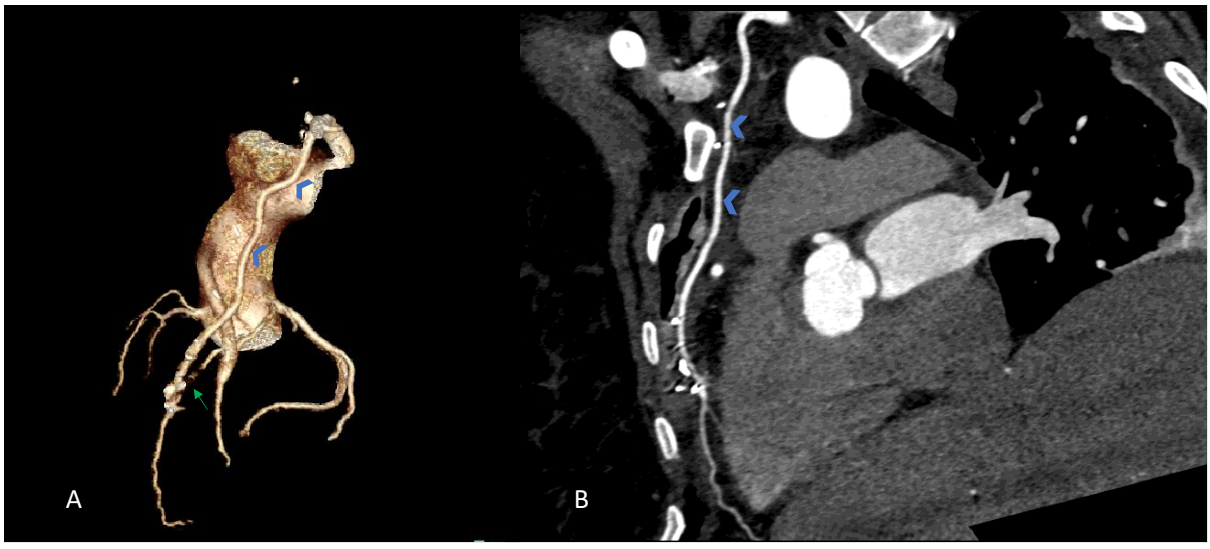

Figure 3: Volume rendered images (A) and MBR images (B) of the bypass grafted coronary demonstrating intact LAD-LIMA graft (blue arrow heads) and poor filling of the proximal and middle LAD (green arrow).

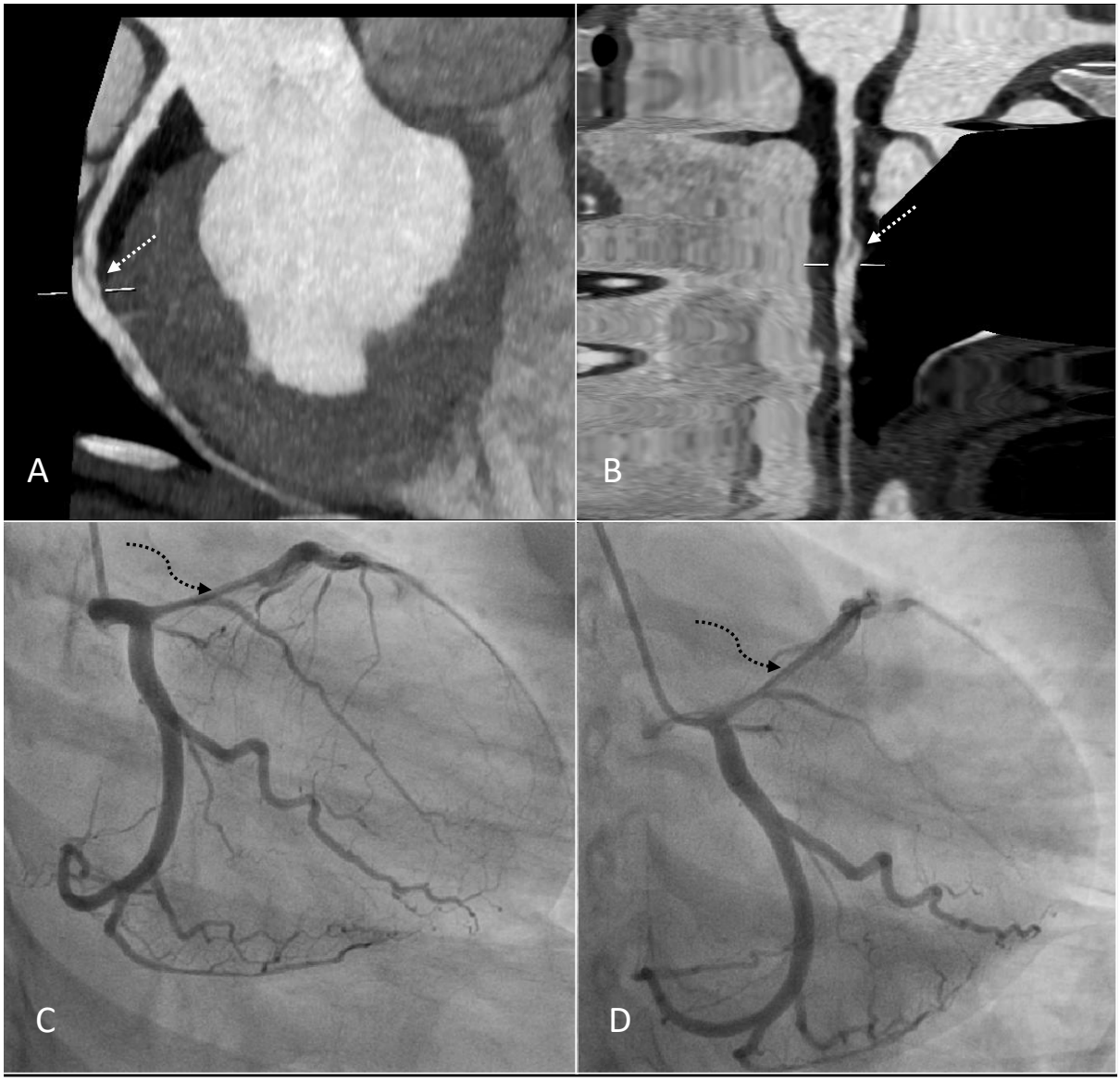

Figure 4: Selected images for the second patient. A&B) Curved and Straitened MBR images showing the dissected LAD (dotted white arrow) starting from the proximal to the distal part. C&D) Images from CAG showing diffuse luminal narrowing of the proximal to distal LAD with features of coronary artery dissection.

Case Two:

A 33-year-old woman, a mother of 5 children was 3 months post-partum, presented to the emergency department with severe, central chest pain not associated with orthopnea or PND. On examination, she was in distress with shortness of breath, but her vitals remained normal. Heart sounds were normal S1 and S2 with no added sound. The ECG showed T-wave inversion in leads I, aVL, V2-V6, and Q-waves in leads V1-V3. She was diagnosed to have anterior acute myocardial infarction.

The CAG showed SCAD of the LAD from ostium to the distal part. Other vessels were normal. (Fig.2C, D)

With conservative medical management, the patient became asymptomatic through the course of admission. At discharge, she was stable with no chest pain or shortness of breath.

At a 3 months follow-up, CCTA was requested. There was an abrupt appearance of a dissection flap with opacification of both the true and the false lumen at the proximal and middle segments of the LAD (Fig.2A,B). The findings of the follow-up CCTA correlated with initial CAG and were not showing any signs of progression or complication. It was thus decided to continue conservative treatment with regular follow-up.

Discussion

Spontaneous coronary artery dissection is a rare but recognized cause of acute chest syndrome. It particularly affects young women with no previous known risk for cardiovascular diseases.[2,8] The presumed mechanism is due to intimal tear and blood dissection into the intimal part of the vessel wall, other described etiology being venous bleed into the media of the vessel wall.[9,10] Tokura M et al reported that 0.86% of patients who underwent CAG were diagnosed to have SCAD of which 90% were female. In the majority of cases of young women, the occurrence of SCAD was associated to the peripartum period.[11] Tweet et al described a higher frequency of SCAD in the first month post-partum. He also found that hormonal and hemodynamic physiological changes during pregnancy, are associated with the development of SCAD.[12] SCAD has also been often linked to the presence of connective tissue disease in particular fibromuscular dysplasia (FMD).[4,11,13,14]

Conventional Coronary Angiography (CAG) is considered to be the gold standard for the imaging of patients suspected to have SCAD. In his study, Tweet et al divided the findings into 3 types; diffuse stenosis in 67% of patients, multiple lumens due to contrast staining into a false lumen in 29%, and an appearance mimicking atherosclerosis in 4% of patients. The findings on CAG could sometimes be misleading. In addition, due to the invasive natures of the test, the utility of CAG in follow up of these patients has not been recommended.[15]

Other invasive imaging modalities such as intravascular ultrasound and Optical Coherence Tomography (OCT) requires expertise and the availability of the technique. In addition, and is particularly with OCT, there is a theoretical risk of worsening the dissection with the intravascular hydraulic contrast injection.[15]

CCTA has a promising and evolving role. Recently, the SCOT-HEART multicenter study showed that in the group of patients suspected to have angina due to CAD, CCTA helped clarify the diagnosis and lead to major changes in investigations and treatments. There is a suggestion that this finding is associated with clear improvements in fatal and non-fatal

coronary events, but this needs to be confirmed by further long-term follow-up.[6] The continuously developing technology of cardiac CT is aiding in the wider utility of the modality in the diagnostic workup of cardiac diseases. In addition, the current introduction of CAD-RADS had helped create a standardized language and scoring system of the CCTA findings in coronary artery disease with very high interobserver concordance.[16]

CCTA is being used as a first modality in the imaging of certain patient populations presenting with acute chest pain in the emergency department. Currently, the triple rule-out Cardiac computed tomography protocol is used widely by the emergency departments for the distinction between coronary artery occlusion versus aortic dissection versus acute pulmonary embolism. [17,18]

In our cases, the first woman, presented with acute chest pain suggestive of coronary artery dissection. CCTA clearly demonstrated the dissection flap and the origin and extension of the dissection. The distinction between true and false lumens was also demonstrated with clear details. The data provided by the CCTA was sufficient for the diagnosis and contributed to the overall management decision. The limitations caused by coronary artery calcifications and the motion artifacts that Tweet et al mentioned in his article are not applicable in our case as the two patients are young and the high resolution of the new generation cardiac CT-scan helped in alleviating these limitations.[15] CCTA also proved valuable at the post-operative phase where the grafts and native vessels were evaluated. For the second patient, the CCTA contributed to the management with imaging at follow-up of the coronary dissection at a routine visit.

In both the first and the second cases, it was clear that the CCTA had provided a safer and quick approach for following SCAD patients.

Conclusion

CCTA is a valuable diagnostic modality for the diagnosis and the follow-up of patients with SCAD. It should readily be available in centers of excellence and its use will help in the diagnosis and management of acute coronary syndrome in scenarios similar to what we have demonstrated in this report.

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