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Spontaneous Coronary Artery Dissection Treated with Intravascular Ultrasound Guided Percutaneous Coronary Intervention

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ABSTRACT

Spontaneous Coronary Artery Dissection (SCAD) is an unusual but important cause of acute coronary syndromes. We presented a case suffering from acute myocardial infarction with extensive SCAD confirmed on angiography. The use of intravascular ultrasound enabled identification of the extent of the disease and served as an important adjunct to successful percutaneous interventional treatment.

1. Introduction

Spontaneous Coronary Artery Dissection (SCAD) is a non-traumatic and non-iatrogenic separation of the coronary arterial walls creating a false lumen. This separation can occur with or without an intimal tear, but will involve intramural hematoma formation between the layers of the arterial wall resulting in decreased blood flow and ischemia. Its precise etiology is still uncertain. However, associated factors, such as the peripartum period, strenuous exercise, smoking, cocaine abuse, atherosclerosis, and vascular tissue disorders, have been implicated in its pathogenesis (1). Moreover, no guidelines or consensus exists regarding its definitive management, and its optimal management remains individualized on a case-to-case basis.

2. Case Presentation

A 45-year-old diabetic and dyslipidemic male presented with severe chest pain at the emergency room. Family history was positive for diabetes and hypertension. He was a previous smoker and occasional alcoholic beverage drinker, but denied any history of illicit drug use. Physical examination was normal. Electrocardiogram revealed inferoposterior ST segment Elevation Myocardial Infarction (STEMI, Figure 1A). Troponin T was elevated at 12486 ng/L, while echocardiography showed an ejection fraction of 57% with regional wall motion abnormalities in the inferior wall. The patient was loaded with aspirin and ticagrelor. Coronary angiography via the right radial approach showed that the left coronary system had minor disease with luminal irregularities. On cannulation using a Judkins Right 6F guide, the Right Coronary Artery (RCA) showed an extensive spiral dissection from the proximal to distal segment causing slow flow and total occlusion of the right atrioventricular groove branch (Figure 1B). The true lumen was navigated carefully using a Sion blue guidewire (Asahi Intecc Co. Ltd, Japan) and was positioned distally. After predilatation using 1.0 mm and 1.5 mm balloons, Intravascular Ultrasound (IVUS) was used to confirm the wire position in the true lumen. An intimal tear (Figure 1C) was noted with the presence of intramural hematoma (Figure 1D). Vessel size was estimated to be around 2.5 - 3.0 mm using IVUS. We then proceeded to perform Percutaneous Coronary Intervention (PCI) with overlapping Drug Eluting Stents (DES) covering the proximal, mid, and distal RCA and also stented the right atrioventricular groove (Figures 2A, 2B, 2C, 2D). After post dilatation using a 3.0 mm non-compliant balloon for

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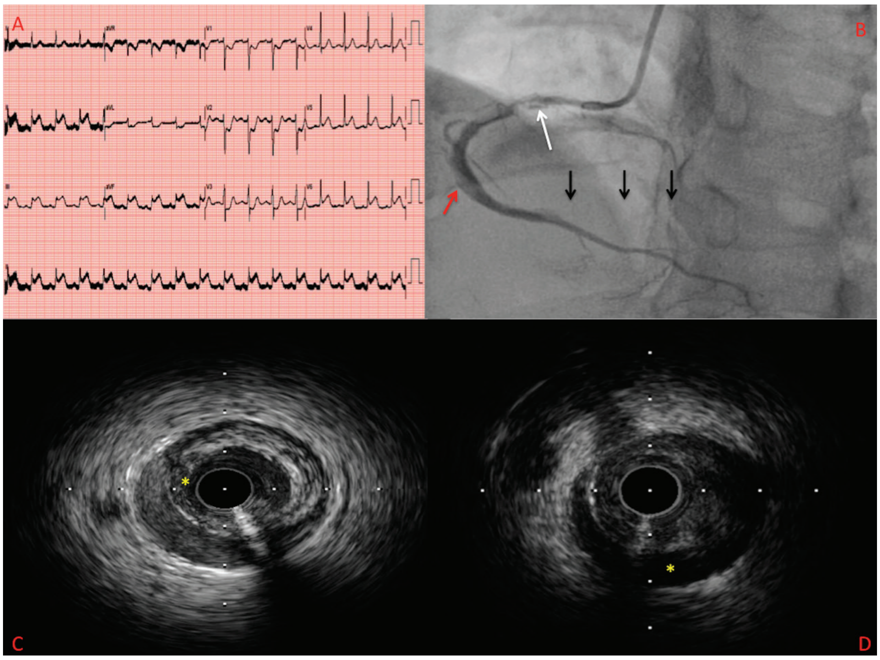

Figure 1. A) Electrocardiogram Showing ST Elevation Myocardial Infarction in Leads II and III, and AVF and ST Segment Depression in the Anterior Precordial Leads. (B) Type 1 SCAD of the RCA in the AP Cranial View. Note the Radiolucent Filling Defect (White Arrow) Representing an Intimal Flap with Contrast Extravasation and the Appearance of a Double Lumen (Red Arrow). The Right Atrioventricular Groove Branch of the RCA (Black Arrows) Was Totally Occluded and Could Not Be Visualized. (C) IVUS of the RCA Showed Extensive Circumferential Dissection with Intimal Tear (Yellow Asterisk). (D) IVUS Showing the Presence of Heterogeneous Predominantly Hypoechoic Crescentic Focus Representing Intramural Hematoma (Yellow Asterisk). (SCAD, Spontaneous Coronary Artery Dissection; RCA, Right Coronary Artery; IVUS, Intravascular Ultrasound).

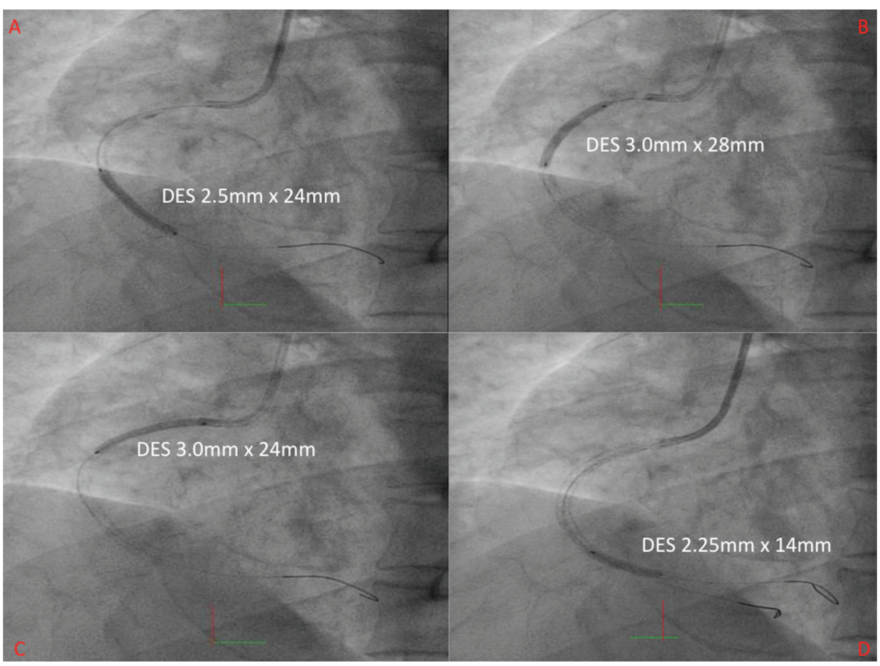

Figure 2. (A) After IVUS Assessment and Lesion Preparation, a DES Was Implanted at the Distal RCA Using a Nobori 2.5 x 24 mm Stent (Tokyo, Japan). (B) DES Implanted in the Mid RCA Using a 3.0 x 28 mm Nobori Stent (Tokyo, Japan) Overlapping with the Previously Deployed Stent in the Distal RCA. (C) Proximal RCA Stent Implantation Using a 3.0 x 24 mm Nobori Stent (Tokyo, Japan) Overlapping with the Previously Deployed Mid RCA Stent. (D) Proceeded to Complete Full Metal Jacket Stenting of the RCA with Stent Deployment to the Right Atrioventricular Groove Using a 2.25 x 14 mm Biomatrix Neoflex Stent (Biosensors International, Singapore). (IVUS, Intravascular Ultrasound; DES, Drug Eluting Stent; RCA, Right Coronary Artery).

up to 20 atmospheres, coronary angiography showed good angiographic results with no residual stenosis and TIMI 3 flow (Figures 3A and 3B). Final IVUS interrogation also showed fully covered dissection lesion with good stent apposition (Figure 3C). Indeed, aortogram injection did not show any dissections (Figure 3D). The rest of the hospital stay was unremarkable and the patient was then discharged improved. He was stable and asymptomatic during follow-up.

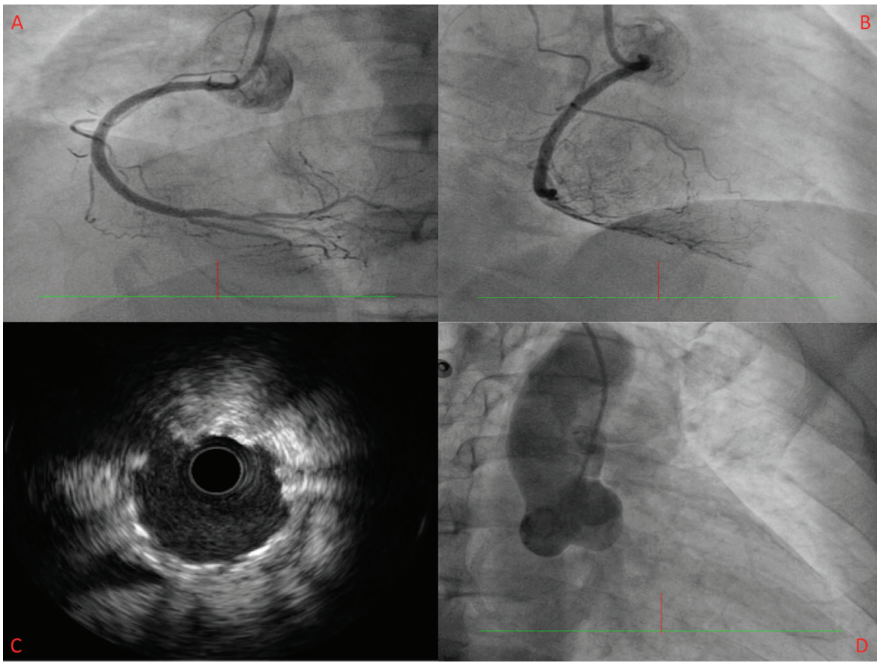

Figure 3. (A) Coronary Angiography of the RCA; Left Anterior Oblique View after PCI; No Residual Stenosis and TIMI 3 Flow. (B) Right Anterior Oblique View of the RCA Post Stenting Showing Good Angiographic Result in the Proximal to Mid Segment. (C) Final IVUS Image Post Stenting Showing a Well Expanded Stent with Fully Covered Dissection Lesion and Good Stent Apposition. (D) Aortogram Injection Showing No Presence of Any Dissections. (IVUS, Intravascular Ultrasound; RCA, Right Coronary Artery; PCI, Percutaneous Coronary Intervention).

3. Discussion

The prevalence of SCAD is still uncertain. There is certainly a predisposition for women without known cardiovascular risk factors in peripartum and postmenopausal periods as well as those with fibromuscular dysplasia and other autoimmune disorders. There is a reported 1:4 male to female ratio. Considering men, SCAD mostly presents in those with atherosclerotic factors and precipitated by exertion. All these conditions may impose increased stress on the coronary arterial wall in susceptible individuals. ST elevation can be the presentation in up to 49% of cases although depending on the extent, this can range from unstable angina to sudden cardiac death (2).

There are three types of SCAD described via angiography: Type 1 is the classic description of a longitudinal filling defect representing the intimal flap and often with contrast staining and appearance of multiple radiolucent lumens, which were present in our patient. Type 2 is usually seen as diffuse stenosis of varying severity degrees representing intramural hematoma that can extend distally. Type 3 is described as multiple focal tubular lesions that mimic atherosclerosis (3). While coronary angiography has long been considered the gold standard, it is poor in visualizing the arterial wall and cases with type 2 and type 3 SCAD may be missed even with a high index of suspicion. It has been advocated that the use of intravascular imaging techniques, such as optical coherence tomography and IVUS, would allow adequate visualization of the extent of the disease for a more precise diagnosis (4).

With no prospective randomized data available, management of SCAD remains controversial. Medical management appears similar to that of acute coronary syndromes, such as dual antiplatelet therapy and beta blockers. The benefit of anticoagulation, especially in patients with intramural hematoma, is unclear and thrombolytics are generally contraindicated. Most patients with no hemodynamic instability can be managed medically and conservatively with note of spontaneous healing of the dissection (5).

The decision for revascularization depends on the patient's hemodynamic status, presence of ongoing ischemia, and the affected anatomy. The algorithm provided by Saw et al. can serve as a useful guide on the decision-making for performing revascularization (6). In general, PCI can be performed in patients with feasible anatomy, while bypass is reserved for the lesions involving the left main coronary artery. Performance of PCI is associated with a high degree of procedural failure rate (> 50%), which may be due to lesion complexity, displacement of hematoma, and propagation of dissection (7). In this regard, the use of IVUS in our patient enabled the attainment of procedural success with meticulous and cautious technique (8). Generally, this technique provides complementary information regarding determination of the presence and extent of the tear and hematoma, true lumen identification, wire positioning, appropriate stent sizing, and optimal deployment (9, 10).

3.1. Conclusion

SCAD causing acute myocardial infarction presents unique challenges in both diagnosis and management. Intracoronary imaging modalities, such as IVUS, provide a useful tool to facilitate successful percutaneous treatment in patients with clinical indications. The present case served to highlight the importance of a pragmatic individualized approach as well as integration of clinical, angiographic, and adjunctive intravascular imaging modalities for optimal management.

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Authors' Contribution

Lucky Cuenza: Review of the literature, data collection, preparation of the manuscript; Kay Woon Ho: Review of the literature, checking and approval of the manuscript

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