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A Case of Combining Coronary Angiography and CT Angiography to Diagnose an Acute ST Segment Elevation Myocardial Infarction and a Single Coronary Artery

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Abstract: Coronary artery anomalies encompass a wide spectrum of clinical presentations and pathophysiological mechanisms, exhibiting significant heterogeneity. The majority of coronary artery anomalies exhibit negligible clinical manifestations.. Among these anomalies, the occurrence of a single left coronary artery with congenital right coronary artery agenesis represents an exceedingly rare manifestation. This case report presents the clinical profile of a 37-year-old male patient who underwent intervention and coronary CT to confirm his acute myocardial infarction and a solitary left coronary artery. A thorough understanding of coronary variations and the identification of coronary lesions can enable cardiovascular physicians to adopt more personalized treatment strategies for their patients.

Keywords: Coronary Angiography; CT Angiography; Myocardial Infarction; Single Coronary Artery

1. A synopsis of the case

On November 10, 2022, a 37-year-old male patient was admitted to the hospital with a complaint of chest pain and tightness that had persisted for six hours. The patient presented with chest pain of unknown etiology that had begun six hours prior, characterized by persistent posterior sternal pressure pain that worsened in paroxysms without relief. The patient reported no accompanying symptoms such as fever, heartburn, acid reflux, nausea, vomiting, palpitations, or dyspnea. Following evaluation at a local hospital, an electrocardiogram indicated an acute inferior wall ST-segment elevation myocardial infarction, and urgent examination revealed ultrasensitive troponin T (hs-TnT)levels of 1556.0 pg/ml and N-terminal pro-brain natriuretic peptide (NT-proBNP) levels of 773 pg/ml. The patient received treatment consisting of “BAY ASPIRIN 300 mg, POLIVET 300 mg”. Subsequently, emergency coronary angiography and percutaneous coronary intervention (PCI) were conducted through the emergency green channel. The catheter was directed to the left coronary artery using a 5F Tig, and multi-angle angiography was performed. The results indicated no apparent abnormalities in the left main trunk. However, the distal segment of the circumflex branch displayed a blood vessel occlusion stump, resulting in thrombolysis in myocardial infarction(TIMI) grade of 0 forward blood flow(Figure 1). Subsequently, the catheter was directed towards the right sinus utilizing 5F TIG, SAL 1.0, and AL0.75, consecutively. The absence of the right coronary artery was observed, leading to the conclusion that the patient possessed a solitary coronary artery (Figure 2). Following this, the femoral artery was punctured, and the 7F EBU3.75 was substituted into the left coronary artery orifice.An attempt to occlude the lesion via the circumflex using a Runthrough guidewire was unsuccessful. Subsequently, the PILOT50 guidewire was substituted to traverse the occlusion to the distal end, revealing that the lesion was obstructing the right coronary artery originating from the circumflex, as evidenced by the guidewire trajectory (Figure 3). After pre-expansion balloon Maverick 2.0×12mm was used to dilate the lesioned vessel, PROMUS PREMIER 2.75×38mm and RDESI I 3.0×24mm DES were delivered along the guidewire to the lesion site for accurate positioning and released at 10atm. Subsequently, post-expansion balloon Quantum 3.0×15mm was employed to dilate the stent. Upon conducting a subsequent coronary angiogram, it was observed that the stent had undergone satisfactory expansion, exhibiting robust walls and the reinstatement of antegrade flow with a TIMI grade of 3. (Figure 4-5).After undergoing surgery, a computed tomography angiography (CTA) of the coronary arteries indicated the presence of a single coronary artery (Type I). Following coronary artery stenting, the patency of the stent was confirmed(Figure 6-7). The patient continued to receive postoperative medication, resulting in a significant improvement in their chest pain and other symptoms compared to pre-surgery. Six months post-discharge, the patient remained asymptomatic and in good overall health without any notable discom fort.

2. Discussion

Coronary artery anomalies encompass a heterogeneous array of lesions that exhibit varying degrees of clinical significance. Literature reports a prevalence rate of 1.3% for coronary artery abnormalities, with the majority of such anomalies being asymptomatic and incidental findings[1]. Various forms of coronary variants comprise fistulous coronary arteries, single coronary arteries, aneurysmal dilatation of coronary arteries, and anomalous origins of coronary arteries. A solitary coronary artery, which emerges from the aortic arch, perfuses the entirety of the myocardium.. Smith[2] classified a solitary coronary artery into three distinct types based on the distribution of its arteries: type I, which exhibited a conformal alignment with the typical left and right coronary arteries; type II, which bifurcated into two branches following the left and right normal coronary arteries, respectively; and type III, which lacked a discernible travel pattern.

Myocardial ischemia can be induced in patients with coronary artery malformations and coronary atherosclerosis due to insufficient blood supply to the myocardium caused by coronary stenosis, as well as the potential for the malformed coronary arteries to exacerbate the flow-limiting effect[3]. The patient in this case presented with acute myocardial infarction and a solitary left coronary artery. Despite a decade-long smoking habit, which is a known risk factor for coronary heart disease, the patient was previously asymptomatic and in good health, without any atypical discomfort or symptoms such as chest tightness, chest pain, or syncope.The patient under consideration exhibited a singular left coronary artery and acute myocardial infarction. Prior to the onset of the ailment, the patient was asymptomatic with regards to chest tightness, chest pain, or syncope, despite having smoked for a decade, which is a significant risk factor for coronary heart disease. Multiple angiographies of the right coronary artery were conducted at varying angles, but failed to reveal its presence.Circumflex occlusive segments exhibit vascular morphology in their distal regions. Subsequently, the physician opted to employ a guide wire and balloon dilated vascular imaging technique to ascertain the presence of a solitary coronary artery in this region, which fell within the normal right coronary artery's blood supply range. Notably, there was a discernible amelioration in symptoms post-intervention.

Various techniques are available for identifying coronary artery malformations, such as coronary angiography, coronary computed tomography, coronary MRI, and stress echocardiography. Each imaging modality presents distinct advantages and disadvantages. It is widely acknowledged that coronary angiography is the benchmark for diagnosing coronary artery disease, while coronary computed tomography (CT) imaging is a valuable tool for detecting coronary artery abnormalities[4]. Owing to its ability to offer a detailed depiction of the coronary arteries, it furnishes a comprehensive account of the genesis and interrelation of anomalies in the coronary arteries, great vessels, and ventricles, thereby providing complete three-dimensional information. The principal therapeutic interventions for coronary anomalies that result in clinically significant events are cardiac surgery or percutaneous coronary intervention.In recent years, the advent of interventional catheterization devices has led to the emergence of distinctive advantages and features of percutaneous coronary intervention (PCI) in the management of patients with coexisting coronary malformations and coronary artery disease[5, 6]. In the context of acute myocardial infarction and an abnormal coronary origin, it is imperative for an interventional cardiologist to expeditiously assess and analyze the patient's coronary artery. This assessment is based on the findings of guidewire travel angiography. In order to effectively preserve the lives of patients, cardiologists must possess a comprehensive understanding of cardiac vascular anatomy and execute precise interventional procedures on the affected vessel in a timely manner.

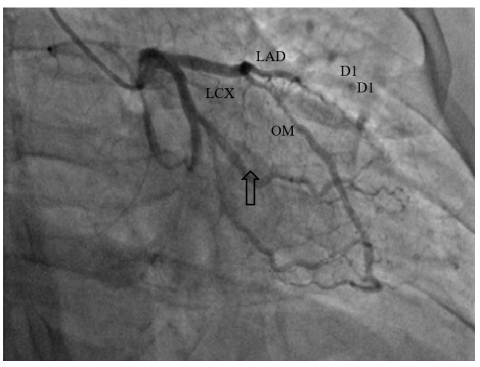
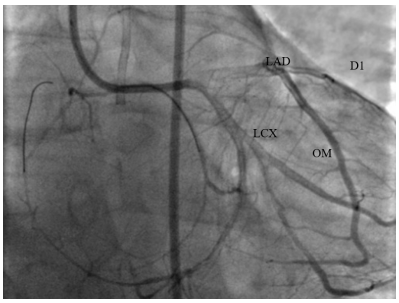


Figure 1

Figure 2



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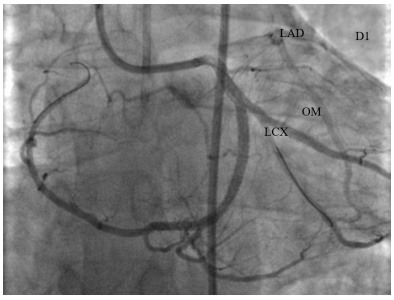

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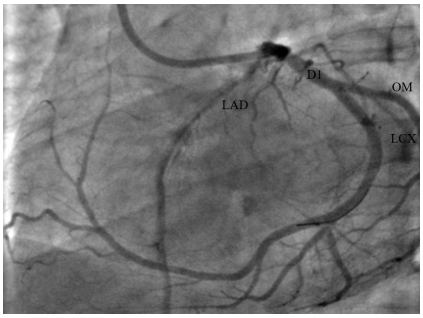

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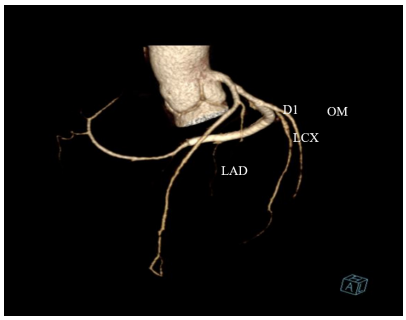

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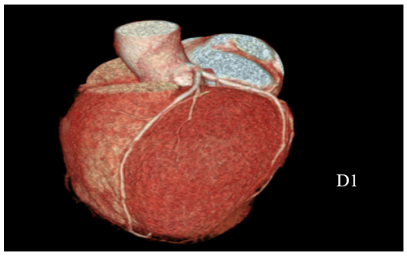

Figure 7

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