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ST-segment elevation myocardial infarction could be the primary presentation of acute aortic dissection

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ABSTRACT

Background: Stanford type A aortic dissection (TAAD) may lead to coronary artery occlusion and malfunction. However, TAAD manifesting as acute ST-segment elevation myocardial infarction (STEMI) has not been studied. In the present study, we reported 8 TAAD cases with STEMI as the primary presentation, and analyzed their clinical characteristics and outcome.
Methods: The records were reviewed for patients admitted to the large comprehensive university hospital for PCI due to STEMI from January 1, 2002 to January 1, 2017.
Results: The incidence of STEMI secondary to TAAD in our center was 0.51% (8/1,576). A total of 5 patients underwent urgent coronary angiography (CAG) without awareness of TAAD. Compression at the ostium of right coronary artery (RCA) was found in 2 patients, dissected flap of RCA in 1 patient, and heterogeneous filling and false lumen in RCA in 1 patient. Three of these 5 patients received surgery and survived. One patient accepted urgent RCA stenting because of cardiogenic shock and died after refusal of surgical therapy and failure of medical treatment. Another 2 patients received thrombolytic therapy died prior to CAG. Thus, the total in-hospital mortality was 37.5% (3/8).
Conclusions: TAAD presenting as STEMI was a rare condition that predominantly involved RCA. A quick and correct clinical diagnosis of STEMI caused by TAAD prior to invasive procedure would be important. Urgent CAG without awareness of TAAD could provide important information for a timely diagnosis. High level of suspicion and awareness is the key to establishing the diagnosis and achieving optimal clinical outcome.

1. Introduction

Aortic dissection (AD) is a life-threatening vascular lesion that is not easily detectable until an acute and often catastrophic complication occurs [1,2]. When the Stanford type A aortic dissection (TAAD) extends to the coronary artery (either due to tear of the vessel wall or hematoma compression), a complete acute coronary occlusion may occur, leading to ST-segment elevation myocardial infarction (STEMI) [1-5].

The diagnosis of STEMI secondary to TAAD is challenging, and could be easily misdiagnosed as the uncomplicated regular STEMI. Chest pain, which is similar to STEMI, is more commonly associated with Type A AD than type B AD. Von Kodolitsch and colleagues [6] introduced a model for the initial prediction of AD based on three variables (acute aortic pain, mediastinal widening and/or aortic widening, pulse and/or blood pressure differentials). Careful assessment of the three variables could identify 96% of acute aortic dissection cases. However, these typical clinical and radiographic findings might not always be present for every patient with AD. Therefore, other diagnostic modalities like D-dimer and computed tomography (CT) could be important to establish the diagnosis of typical AD [7]. However, the imaging studies for STEMI patients may not be done initially because it could increase the "door to balloon" time in the emergency setting.

Primary percutaneous coronary intervention (PCI) is of great importance for STEMI patients to re-establish the coronary blood flow quickly and effectively. However, PCI may delay the preparation for the surgery for TAAD patients. On the other hand, prompt coronary revascularization could provide the TAAD patients the critical time for the preparation for the surgical treatment. If the patients were sent to a hospital without PCI capability, these patients could very likely receive thrombolysis for STEMI with potential catastrophic outcome. It is very difficult to make the correct and timely diagnosis for the TAAD patients who present with STEMI, and the appropriate management for these

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patients remains challenging and even controversial. In the present study, we summarized the data and clinical characteristics as well as the outcome for 8 TAAD patients with the initial manifestation as STEMI.

2. Methods

2.1. Patients

The research protocol of the present study was reviewed and approved by the Medical Ethics Committee of the Second Xiangya Hospital of Central South University in Changsha, China. The records were reviewed for patients admitted to the large comprehensive university hospital (with over 3500 licensed beds) for PCI due to STEMI from January 1, 2002 to January 1, 2017(Fig. 1.) All of the patients were sent from the emergency department (ED) when they were diagnosed with STEMI by ED physicians. The diagnosis of STEMI was based on the latest criteria established by the American College of Cardiology and European Society of Cardiology, including chest pain lasting for more than 30 min, persistent ST-segment elevation (≥0.1 mV in limb leads or ≥0.2 mV in precordial leads) in at least two contiguous leads on a 12-lead electrocardiogram (ECG), and an increase of cardiac biomarker values [preferably cardiac troponin (cTn)] with at least one value above the 99th percentile of the upper reference limit (URL) [8]. The patients were then urgently evaluated by interventional cardiologists to determine if a PCI was needed. If clinically indicated, the patients were sent to the catheterization lab for urgent cardiac catheterization and PCI if needed. All the patients' data were recorded electronically in the hospital and in the catheterization lab. All the patients with the final diagnosis of TAAD were included and analyzed in the present study. Patients with TAAD who were diagnosed as STEMI initially were identified retrospectively when the diagnosis of TAAD was established with clinical presentation, diagnostic modalities including cardiac catheterization and imaging studies, and coronary angiography (CAG) findings. TAAD was diagnosed when the lesion involved the ascending aorta and arch, and was proximal to the left subclavian artery as described [9].

The CAG imaging was characterized and analyzed in the patients with STEMI in the setting of acute TAAD, and evaluated for primary PCI as described previously [5,10-16]. A thorough English-language literature search was performed through PubMed for any study on AD with specific focus on the studies regarding coronary artery occlusion from AD. The data from the present study were compared with the published data in terms of patient demographics, management, and outcomes.

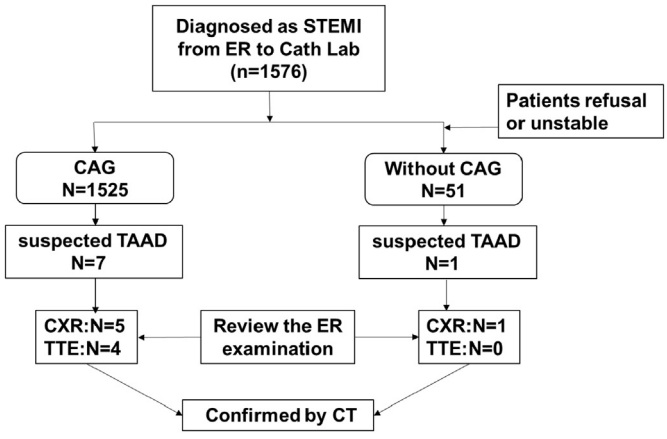

Fig. 1. STEMI: ST-segment elevation myocardial infarction; ER: Emergency Room; Cath Lab: Catheterization Lab; CXR: Chest radiography; TTE: Transthoracic Echocardiography; CAG: coronary angiography; CT: Contrast computed tomographic scan.

2.2. Statistical analysis

Continuous variables were presented as mean and standard deviation (SD) or median (range), depending on whether the data were normally distributed. Categorical variables were presented as frequencies and percentages. The data were unable to be analyzed statistically due to the small size of patient population that was clearly a major limitation of the present study.

3. Results

A total of 1576 patients were admitted to the large university hospital with STEMI for primary PCI between January 1st, 2002 and January 1st, 2017. Only 8 patients (0.51%, 4 males and 4 females with their ages from 40 to 84 and average of 57.5 years old) were finally diagnosed with TAAD. The clinical characteristics of these 8 patients were summarized in Table 1. Anterior chest pain was the initial presenting symptom for all 8 patients. Two patients also suffered from back pain, and were found that their dissections were extended to the descending aorta. There was no history of Marfan syndrome, coronary artery diseases, prior AD or aneurysm or prior cardiac surgery in these patients. One woman had hemodynamic instability, and received an intra-aortic balloon pump (IABP) before CAG.

In the 8 patients, physical examination revealed diastolic heart murmurs in the third intercostal space at the left sternal border after admission in 2 patients (case1 and case2) before CAG and a bedside transthoracic echocardiography (TTE) revealed intimal flaps in the ascending aorta. The chest radiography of case 7 showed widened mediastinum, and her TTE showed ascending aortic dilatation prior to catheterization. Thus, computed tomography angiography (CTA) was performed and confirmed the diagnosis of TAAD. The diagnostic evaluations of all 8 cases were summarized in Table 2. Of note, CAG findings were only suggestive of the presence of TAAD, but not considered diagnostic for TAAD. Thus, a confirmative imaging studies especially chest CT scan with contrast were used to establish the diagnosis.

The other 5 patients underwent urgent CAG without awareness of TAAD. All these 5 patients had right coronary artery (RCA) involvement. An extrinsic compression at the RCA ostium was found in 2 patients (cases 3 and 5), and an intimal flap at the RCA ostium in one patient (case 4) (Fig. 2A and B). Aortography (case 3, 5) and CT imaging confirmed the presence of TAAD in the 2 patients with RCA ostium compression (cases 3 and 5). Complete obstruction at the RCA ostium was seen in a male patient (case 6). His aortography did not show the pathology; however, a CTA clearly identified a horizontal tear of the right coronary sinus (Fig. 3). The case 8 was a male patient, whose CAG showed heterogeneous filling of the RCA with many parts supplied by the false lumen. During the procedure, it was noticed that he had no pulse in the lower limb. An urgent CTA demonstrated that his dissection had extended to the iliac arteries.

Table 1
Clinical Characteristics of the Patients with TAAD Presenting as STEMI

Patient	Age (year)	Sex	Hypertension (years)	Smoking	Chest pain	Back pain	Cardiogenic shock
1	40	F	+(2)	−	+	−	−
2	55	F	+(8)	+(480)	+	−	−
3	56	M	+(11)	+(400)	+	−	−
4	52	M	+(26)	+(1200)	+	−	−
5	74	F	−	−	+	−	+
6	60	M	+(4)	+(1200)	+	+	−
7	84	F	−	−	+	−	−
8	59	M	+(10)	+(400)	+	+	−
		50%	75%	62.5%	100%	25%	12.5%

STEMI: ST-segment elevation myocardial infarction; TAAD: Type A aortic dissection; CAD: Coronary artery disease; F:Female, M:Male;smoking index = cigarettes number per day multiply smoking years;

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