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Cardiac Arrest in STEMI-Like Aortic Dissection and in STEMI-Like Pulmonary Embolism

Review Article

Oscar Jolobe MRCP(UK)*
Medical Division, Manchester Medical Society, UK

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***Corresponding author:** Oscar Jolobe MRCP(UK), Manchester Medical Society, Simon Building, Brunswick Street, Manchester M13 9PL, UK

Abstract

This is a review of clinical characteristics in 25 dissecting aortic aneurysm patients and 26 pulmonary embolism patients with the association of cardiac arrest and an electrocardiogram simulating ST elevation myocardial infarction (STEMI). Cases were culled from anecdotal reports dating from January 2000 to February 2020 using Pubmed, MEDLINE, EMBASE, and Googlescholar. Search terms were dissecting aortic aneurysm, pulmonary embolism, myocardial infarction, and ST segment elevation. Cases were included only if there was a specification of location of ST segment elevation and an account of presenting symptoms. Fifteen of the 25 dissecting aortic aneurysm patients were also evaluated by transthoracic echocardiography, which showed stigmata of aortic dissection in eleven. Ventricular tachyarrhythmia was the single most common electrocardiographic component of the cardiac arrest. There were 11 survivors. There were 26 cardiac arrest cases associated with pulmonary embolism, 17 of whom were evaluated by transthoracic echocardiography, which documented right ventricular dilatation in sixteen. Pulseless electrical activity was the single most common electrocardiographic component of the cardiac arrest. Thirteen pulmonary embolism patients received some form of thrombolytic treatment. Three were managed by surgical embolectomy. There were 12 survivors.

Patients were also categorised into those who were fast-tracked to percutaneous coronary intervention and those who were not. In the pulmonary embolism subgroup, those who had presented with chest pain were significantly (P=0.047) more likely to have been fast tracked to percutaneous coronary intervention..

Keywords:

cardiac; arrest;aorticdissection;pulmonary;embolism

Introduction

A clinical presentation characterised by an electrocardiogram (ECG) which shows ST segment elevation is now recognised to be an entity common to acute myocardial infarction [1], dissecting aortic aneurysm [*2*] and pulmonary embolism [3]. Underrecognition of this entity can lead to inappropriate percutaneous coronary intervention(PCI) and inappropriate thrombolytic therapy. Another consequence of inappropriate referral to PCI is to delay operative treatment of dissecting aortic aneurysm (DAA), thereby increasing the risk of cardiac arrest

attributable either to severe haemodynamic compromise or ventricular tachyarrhythmias during the interval between admission to hospital and arrival at the operating theatre. Inappropriate thrombolysis, on the other hand, incurs the risk of haemorrhagic complications when DAA is mistaken for acute myocardial infarction (AMI). The occurrence of cardiac arrest in a patient with a clinical presentation characterised by ST segment elevation brings into sharp focus all the diagnostic and therapeutic dilemnas associated with the challenge of differentiating between ST segment elevation myocardial infarction (STEMI), DAA, and PE. This review is an account of how clinicians have addressed this challenge during the period 2000 to 2020.

Clinical features in 25 DAA patients with cardiac arrest

These were patients who experienced cardiac arrest during the period leading up to operative intervention. There were 25 patients in this category [4-25]. Fifteen were fast tracked to PCI, and ten were managed without fast tracking to that modality.

DAA patients fast tracked to PCI (15 patients)

Mean age 61; 12 males and 3 females. Chest pain had been documented in 14, but not ascertained in the fifteenth patient. One of the patients with chest pain had back pain as well.

Seven patients were evaluated by TTE, which showed stigmata of DAA, namely, dissection flap, aortic regurgitation, aortic dilatation, pericardial effusion(singly or in various combinations) [26] in 5 patients.

The following were the ECG stigmata before the onset of cardiac arrest:-

Five patients had ST segment elevation in the inferior leads, including one patient with complete heart block.

Seven patients had ST segment elevation in the precordial leads, to the exclusion of ST segment elevation in the inferior leads or in AVR

Three patients had ST segment elevation in AVR.

ECG stigmata at the onset of cardiac arrest:-

Ventricular tachycardia (4 patients), ventricular fibrillation(3 patients), pulseless electrical activity(1 patient), asystole(1 patient), unspecified(6 patients).

Eight patients survived the immediate episode of cardiac arrest.

DAA patients not fast tracked to PCI (10 patients)

Mean age 56.7, 8 male and 2 female. Chest pain was documented in 8 patients, but could not be ascertained in 2 other patients. Two patients had chest pain as well as back pain.

Eight patients were evaluated by TTE, which showed stigmata of DAA in 6 patients.

ECG stigmata before the onset of cardiac arrest were the following:-

In 7 patients ST segment elevation occurred in leads II,III, AVF, singly or in various combinations with one another and also with or without concurrent ST segment elevation in AVR or precordial leads.

ST segment elevation was confined to the precordial leads in 2 patients.

ST segment elevation occurred in AVR in one patient.

ECG stigmata at the onset of cardiac arrest were the following:-

Ventricular tachycardia(2 patients), ventricular fibrillation(1 patient), pulseless electrical activity(3 patients), asystole(1 patient),unspecified(3 patients).

There were 3 survivors.

Clinical features in 26 PE patients with cardiac arrest

There were 26 patients in this category [27-52]. Thirteen patients were fast tracked to PCI, an 13 others were managed without PCI.

Pulmonary embolism patients fast tracked to PCI (13 patients)

Mean age 70; 10 males, 3 females. Chest pain was documented in 9, and breathlessness in seven. In one other patient neither chest pain nor breathlessness could be ascertained. Transthoracic echocardiography was undertaken in 9 cases, eight of whom were documented as having right ventricular dilatation. The following were the ECG stigmata before the onset of cardiac arrest:-

ST segment elevation was documented in leads V1-V4 in three patients, and in V1-V5 in one other patient, and in the anterolateral leads in one other patient, in all 5 instances without concurrent ST elevation either in AVR or in II,III,AVF.

In 6 patients ST segment elevation was documented in leads II,III,AVF with or without concurrent ST elevation in precordial leads.

In one patient ST elevation was documented in leads AVR, V1-V3.

At the onset of cardiac arrest the following were the ECG stigmata:-

Pulseless electrical activity(8 cases), ventricular fibrillation(2 patients), and ventricular tachycardia(1 patient). Some form of thrombolysis was undertaken in 8 cases, surgical embolectomy in 2 cases. There were 5 survivors

Pulmonary embolism patients not fast tracked to PCI (13 patients)

Mean age 50; 10 males and 3 females.Chest pain was documented in 3 patients. Two others had abdominal pain. In one patient pain status could not be ascertained. Breathlessness was documented in 10 patients, with concurrent chest pain in 2 instances, with concurrent abdominal pain in 2 other instances, and on its own in 6 instances. Transthoracic echocardiography was undertaken in 8 cases. Right ventricular dilatation was identified in 7, and "right ventricular overload" in one other instance.

The following were the electrocardiographic stigmata before the onset of cardiac arrest:-

In 6 instances ST segment elevation occurred in leads V1-V4 without concurrent ST segment elevation in inferior leads or in AVR.

ST segment elevation occurred in the anterolateral location in one other patient.

In 5 instances ST segment elevation occurred in leads II,III,AVF, singly or in combination, with or without concurrent ST elevation in AVR or in the precordial leads.

In one patient ST segment elevation occurred in AVR, and V1.

The following were the ECG stigmata at the onset of cardiac arrest:-

Pulseless electrical activity(6 patients), ventricular tachycardia(2 patients), asystole(1 patient), unspecified(4 patients). Thrombolysis was undertaken in 5 patients, and surgical embolectomy in 1 patient. There were 7 survivors.

Comparisons between subsets

There was little to choose between the four subsets of subjects, except for the prevalence of chest pain in PE subjects fast tracked to PCI vs the prevalence of chest pain in PE subjects not fast tracked to PCI. According to this review, there was a significantly (P=0.047) greater prevalence of chest pain in PE patients fast tracked to PCI then in counterparts managed without recourse to that modality.The electrocardiographic stigmata at the onset of cardiac arrest also appeared to differ in DAA subjects vs PE subjects. DAA subjects were characterised by a predominance of ventricular tachyarrhythmias. PE subjects, on the other hand, were characterised by a predominance of pulseless electrical activity.

Discussion

This review provides an account of real world clinical scenarios, and management of DAA-related cardiac arrest and PE-related cardiac arrest in the unique subset of patients with STEMI-like clinical presentation.

When cardiac arrest supervenes, the clinical challenge is to make a timely diagnosis and to base emergency treatment on that diagnosis. Identification of ECG stigmata at the onset of cardiac arrest, might have a role in differentiating PE-related cardiac arrest from other aetiologies for cardiac arrest, given the fact that pulseless electrical activity is highly prevalent in PE-related cardiac arrest [53]. TTE, however, is the diagnostic modality with the greatest potential, given the fact that, in this review, there was a high proportion of subjects characterised by the association of life-threatening PE and TTE documentation of right ventricular dilatation, the latter a well-recognised sign of right ventricular dysfunction [54]. Although it is true that TTE is not a valid "stand-alone" modality for diagnosing PE, it is equally true that, in a haemodynamically compromised patient with suspected pulmonary embolism, unequivocal signs of right ventricular overload(such as right ventricular dilatation) make the diagnosis highly likely, even to the extent of justifying emergency reperfusion treatment of that disorder [55]. Alternatively, if TTE rules out PE in a haemodynamically unstable patient, that observation narrows down the differential diagnosis to AMI vs DAA, the latter identifiable, in some cases, by TTE stigmata such as dissection flap, aortic dilatation, aortic regurgitation, and pericardial effusion [26]. Future studies would also have to evaluate the risk/benefit profile of an algorithm that incorporates point-of–care TTE into work-up of a patient with undifferentiated STEMI-like clinical presentation.

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