Successful Resuscitation for Cardiac Rupture
with Timely Diagnosis Aided by Hand-carried
Echocardiography — A Case Report

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Despite the progress in the era of reperfusion, cardiac rupture is still a prominent cause of early death after acute myocardial infarction (AMI). Mostly, electromechanical dissociation with sudden collapse is the scenario. Echocardiography is vital for prompt diagnosis, excluding other mechanical complications, and guiding emergent therapeutic pericardiocentesis prior to repair surgery. We present a 73-year-old male, who suffered from his first-time ST-segment elevation AMI, developing cardiac rupture with the presentation of sudden circulatory collapse, electromechanical dissociation, sinus bradycardia, and massive bloody pericardial effusion. He was encountered in the emergency department, and a hand-carried echocardiography device provided timely aid to the diagnosis, management and successful rescue of this patient.

Key Words: Myocardial infarction • Cardiac rupture • Cardiac tamponade • Hand-carried echocardiography system

INTRODUCTION

Cardiac rupture after acute myocardial infarction (AMI) is a disaster which poses a great challenge to physicians and patients. Despite the progress in the era of reperfusion, cardiac rupture is still a prominent cause of mortality and comprises 20% to 30% of early death after AMI. 1,2 The morbidity and mortality of cardiac rupture remain high at intensive medical and surgical care facilities. Usually the high mortality rate can be attributed to the acuteness of cardiac tamponade and not sufficiently prompt diagnosis for life-saving management, including pericardiocentesis and surgical repair. Cardiac rupture complicating AMI is characterized by elderly, hypertension and transmural infarction, most often in those with first infarction episode, and occasionally it is the presenting event in patients with silent or undetected infarction. Those features alert us to the increased possibility of cardiac rupture subsequent to myocardial infarction, but prompt diagnosis necessitates close monitoring and accessible device (echocardiography) on hand. Electromechanical dissociation with sudden collapse is often the scenario of ruptured myocardial infarction. Unexceptionally, echocardiography is vital for prompt diagnosis, excluding other mechanical complications and guiding emergent palliative pericardiocentesis prior to repair surgery. Here we present a patient who suffered from first-time ST-segment elevation AMI, developed cardiac rupture with the presentation of sudden circulatory collapse, electromechanical dissociation, sinus bradycardia and massive bloody pericardial effusion.

CASE REPORT

This 73-year-old man is a heavy smoker. No previous
chest tightness or exercise intolerance history could be revealed. He suffered from chest tightness in the afternoon 1 day prior to hospitalization; he visited local physician, where acute myocardial infarction was suspected. He was referred to the emergency department soon.

On arrival, he was in clear consciousness, afebrile, with a pulse rate of 95 beats per minute, a respiratory rate of 18 per minute, and a blood pressure of 168/96 mmHg. The jugular veins were flat, breath sound was clear. No cardiac murmurs were present and the extremities were not edematous. The electrocardiography (ECG) revealed ST segment elevation in lead V2 to V6. Five minutes later, sudden collapse occurred with loss of consciousness and cardiopulmonary resuscitation was initiated immediately.

Initial ECG monitoring demonstrated sinus bradycardia at a rate of 56/min. Epinephrine 1 mg and dopamine were administered and the patient was intubated to secure his airway. The oxygen saturation detected by pulse oximeter was 95%. The BP was 52/27 mmHg after inotropic agent administration. Emergent echocardiography with the aid of Optigo™ hand-carried ultrasound device (33 × 23 cm², 3.5 kg) (Andover, MA, U.S.A.) revealed massive pericardial effusion (Figure 1). Emergent pericardiocentesis was performed and 330 mL fresh blood was aspirated. His BP returned to 165/117 mmHg later, and a cardiovascular surgeon was consulted for repair of the cardiac rupture. During emergent operation, epicardial hematoma of the distal left anterior descending artery territory with fair left ventricular contractility and 200 mL bloody pericardial effusion were found. Cardiorrhaphy with Equine pericardium and BioGlue was performed, and intra-aortic balloon counterpulsation device (IABP) was inserted to stabilize hemodynamics. The serum creatine phosphokinase (CK) and creatine phosphokinase MB (CK-MB) isofrom levels peaked at 6711 U/L and 227 U/L, respectively. Mechanical ventilation and IABP were weaned off 3 days later and the patient was discharged after 15 days’ hospitalization.

DISCUSSION

In the current spectrum of cardiogenic shock after AMI, mechanical origin was reported to be 8%, and primary left ventricular failure accounted for 85%.

Cardiogenic shock of mechanical origin after infarction is important in that high mortality rate would ensue without prompt recognition and management, although it comprises a small portion of the cardiogenic shock spectrum. Regarding cardiac rupture, studies nowadays suggested that characters such as elderly, hypertension, relative large transmural MI and first time MI are associated with increased risk. When a patient suffered from AMI and subsequent sudden circulatory collapse, several diagnoses should be analyzed for correct life-saving management strategy. Differential diagnoses include fatal arrhythmia, mechanical complications, myocardial failure, pre-existing critical valvular heart disease, myocarditis, drug effect, aortic dissection, tension pneumothorax, pulmonary embolism, and concurrent bleeding, etc.

In this patient, fatal arrhythmia was excluded by ECG, and tension pneumothorax was excluded by auscultation of breath sounds. Massive pulmonary embolism was less likely due to no obvious desaturation in such a significantly perturbed hemodynamic situation. Aortic dissection flap can compromise coronary artery flow and cause myocardial infarction, which was reported to be existent in 10% to 20% of the dissections. It is not easy to definitely exclude aortic dissection in a minute, but typical angina history before AMI without mediastinal widening or pleural effusion on chest roentgenography suffice for decreasing its diagnostic priority ranking. Cardiac complication should always be considered and clarified as soon as possible.

Hand-carried echocardiography devices are inexpen-
sive, small, light-weighted, convenient, easy to operate, and portable for bedside usage. They can be used as a simple extension of the physical examination, and provide easy re-imaging of the patient. Also, the hand-carried echocardiography performed by trained technicians can provide remote real-time evaluation during patient transport, via an established wireless link data transmission system, hence offering the potential to facilitate triage and intervention to improve outcomes. The mean scanning time is quite short, reported to be 5.1 min by Rugolotto et al., and 9.5 min by Charles et al. Quick diagnostic yields are of utmost importance and help in emergent setting. For well-trained operators, hand-carried device usage not only provides adequate accuracy in the elective focused examinations for cardiac anatomy and function, but also improves diagnostic accuracy in the acute care setting. Although hand-carried devices falls far short of standard echocardiography in the evaluation of critically ill patients, they have the potential to compete against standard echocardiography in an emergency setting, considering their high portability and wide availability.

In this case, we demonstrated a properly used hand-carried ultrasound device could save AMI patients who develop sudden collapse not owing to fatal arrhythmia. Such devices can yield objective and crucial evidence and, consequently, optimize management strategy in time. The potential utility of hand-carried ultrasonography devices in the setting of emergent care is encouraging, and deserves further investigation.

REFERENCES

以手提式心臟超音波輔助及時診斷並成功救治
心臟破裂患者 — 一病例報告

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雖然已進入再灌流治療時代，但是心臟破裂仍然是急性心肌梗塞後死亡的一個重要原因；
其通常是以電氣機械解離合併突然循環衰竭來表現。心臟超音波對於正確診斷、排除其他
心臟結構性併發症，以及在手術修補前的心包膜積液抽取導引皆扮演關鍵性的角色。在此，
我們報告一位七十三歲男性病例，第一次發生 ST 波段上升急性心肌梗塞，併發心臟破裂，
而以突然循環衰竭、電氣機械解離、竇性心悸過慢、以及大量心包膜積液表現。在急診處
即以手提式心臟超音波來輔助正確診斷，並導引心包膜積液抽取術爭取時間，之後成功的以
手術修補救治。

關鍵詞：心肌梗塞、心臟破裂、心包膜填塞、手提式心臟超音波。