Bedside Echocardiography in Acute Myocardial Infarction Patients with Hemodynamic Deterioration

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Abstract: Ventricular septal (VS) rupture after acute myocardial infarction (AMI) is an uncommon complication in the reperfusion era. Bedside echocardiography (BECH) continues to be a strong diagnostic tool for emergency physicians treating dyspneic patients, especially for decision-making on the management strategies to use with these unstable patients. In the case we present here, a patient is diagnosed with a delayed mechanical complication after AMI, and a swift management plan is made with the aid of point-of-care BECH. The patient is a 72-year-old man with dyspnea who was admitted to the ED 5 days after receiving a primary percutaneous coronary intervention with stent implantation for AMI; in the ED, the patient was diagnosed, via BECH, with a VS rupture. On arrival, his vital signs and the results of his physical examination depicted shock and low perfusion with wet lung. A cardiac examination revealed a new 2/6 harsh holosystolic murmur along the left sternal border without pretibial oedema. Emergency physicians performed BECH, and subcostal views of the heart revealed a wide interventricular septal rupture and left-to-right shunting with minimal pericardial effusion. The patient underwent surgery immediately to repair the defect. The post-operative course was uneventful, and he was discharged in stable condition on the seventh day after the surgery. The use of BECH to recognize a VS rupture is critical because such a defect may be the most important determinant of mortality in AMI patients who are in shock. BECH thus can influence clinicians' acute management and disposition decisions.

Keywords: Acute myocardial infarction■Ventricular septal rupture■Bedside echocardiography

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INTRODUCTION

The differential diagnosis of dyspnea in emergency department (ED) patients is broad, and the cause of heart failure is a crucial consideration among these conditions due to different treatment strategies. The use of bedside echocardiography (BECH) to recognize a ventricular septal (VS) rupture is critical because such a defect may be the most important determinant of mortality in heart-failure (HF) patients with shock. BECH thus can influence clinicians' acute management and disposition decisions.[1]

VS rupture after acute myocardial infarction (AMI) is an uncommon complication in the reperfusion era[1]; however, this condition has a high mortality rate, even after surgical repair.[2] In patients with inferior myocardial infarction, VS ruptures generally involve the basal inferoposterior septum, and the communicating tract between the left and right ventricles is often serpiginous, with a variable degree of left-to-right shunting.[3] Dissection and septal rupture related to a previous myocardial infarction has been reported in very few cases,[4,5] and in most of them, this condition was diagnosed via post-mortem studies.[4] In the case we present here, a patient is diagnosed with a delayed mechanical complication after AMI, and a swift management plan is made with the aid of point-of-care BECH.

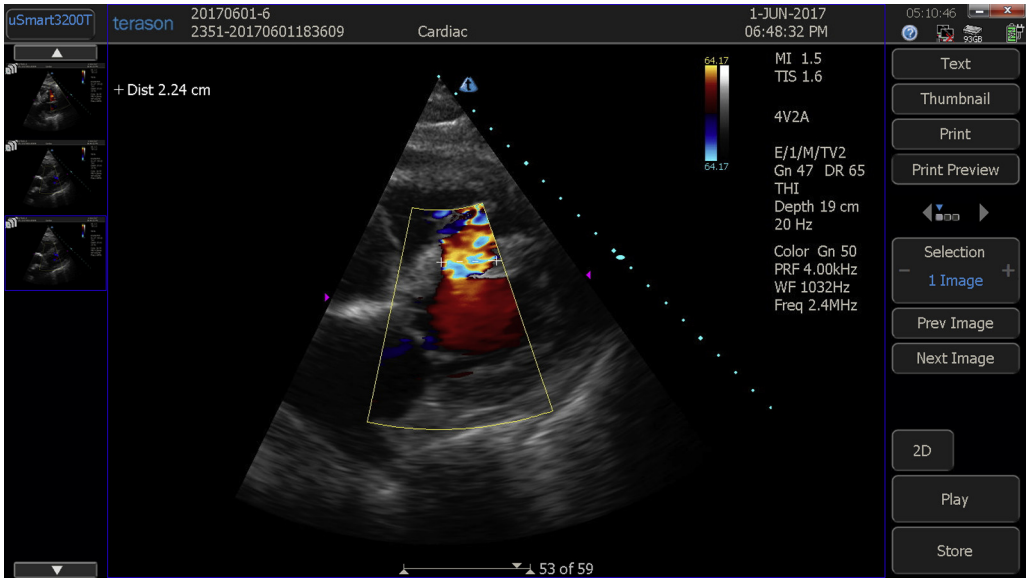
CASE

A 72-year-old man who came to our ED presented with dyspnea and with the symptoms of cardiogenic shock: hypotension (80/40 mm Hg), tachycardia (102 per minute), tachypnea (26 per minute), and hypoxia (76% on the pulse oximeter). On physical examination, his extremities were cold; he had delayed capillary refilling time; his breath sounds were bilaterally decreased; and he had bilateral rales on lung auscultation. A cardiac examination revealed a new 2/6 harsh holosystolic murmur along the left sternal border without pretibial oedema.

The patient had a previous history of hypertension and usage of angiotensin-converting enzyme inhibitors. He had been admitted to coronary care unit because of AMI with ST-segment elevation 5 days prior to the current presentation to our ED. During his previous admission, coronary angiography revealed total occlusion of the right coronary artery. A primary percutaneous coronary intervention was performed with stent implantation, resulting in Thrombolysis in Myocardial Infarction Score (TIMI) III flow and no residual stenosis. After two days of medical treatment, he was discharged at his request.

A 12-lead electrocardiogram showed no new ischemic findings; arterial blood-gas analysis revealed hypoxemia

Figure 1. Colour Doppler echocardiography reveals a wide interventricular septal defect (2.24 cm) due to myocardial rupture and left to right shunt.



and hypocapnia, together with a metabolic acidosis pattern that depicted his shock. His laboratory results were normal except for elevated results for his blood leukocyte count and serum lactate concentration, as well as an ischemic elevation on his renal and hepatic function tests. An ED physician performed BECH using a Terason uSmart 3200T-model portable ultrasound machine with a 3.6 mHz microconvex transducer (Teratech Corporation, USA); subcostal views of the heart revealed a wide (2.24-cm) interventricular septal defect due to myocardial rupture, as well as left-to-right shunting with minimal pericardial effusion (Figure 1). The patient underwent urgent surgery to repair the defect. He was discharged on the seventh day after surgery.

DISCUSSION

When a clinician suspects that a VS rupture complication is present after AMI, transthoracic and/or transesophageal echocardiography at the patient's bedside is the test of choice for early diagnosis and therapy guidance. This takes into account that complex forms of VS rupture with right ventricle involvement are critical prognostic factors.[6] For this purpose, the use of unconventional echocardiographic views with colour-flow Doppler mapping, especially the use of subcostal views to visualize VS defects, allows for the detection of septal ruptures. Myocardial rupture is one of the most important types of mechanical complication following AMI. Rupture of the ventricular free wall, the most detrimental form of myocardial rupture, may result in sudden and unexpected death. Other forms of involvement, such as ruptures of the papillary muscle or interventricular septum, are less damaging. Rupture of the interventricular septum usually occurs 2−6 days after the onset of myocardial infarction.[7] A septal rupture may occur as early as the first 24 h or as late as 2 weeks following the event.[8] Clinical deterioration with pulmonary and systemic congestion is typical. VS ruptures occur with equal frequency after anterior and inferior infarctions. The prognosis is poor, especially without surgical intervention; the prognosis for a septal rupture in association with an inferior myocardial infarction is worse than with an anterior MI. This may be partially explained by concomitant right ventricular involvement in inferior myocardial infarction. The diagnosis can be easily established via 2-dimensional colour Doppler echocardiography.

CONCLUSION

BECH continues to be a strong diagnostic tool for emergency physicians treating dyspneic patients, especially for decision-making on the management strategies to use with these unstable patients. Early diagnosis of myocardial rupture provided early surgery as in our case. Use of bedside ultrasonography and BECH in emergency department should be widespread so that unnecessary consultations are avoided and early treatment is provided in the management of patients with dyspnea.

ETHICAL APPROVAL

All procedures performed in studies involving human participants were in accordance with the ethical standards

of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

INFORMED CONSENT

Informed consent was obtained from all individual participants included in the study.

AUTHORS' CONTRIBUTION

TE performed the concepts, study design, data collection and analysis, and article's drafting; EU, study design, statistical analysis and article's drafting; and EK and SB study design, data collection, manuscript preparation, manuscript editing and manuscript review; NS and UE, literature search and article's drafting and SD and HK, article's drafting, data and manuscript editing.

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