CASE REPORT

Angiotensin converting enzyme inhibitor and coenzyme Q10 as adjunctive treatment for patients with ventricular septal rupture following late onset myocardial infarction: a case report

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Abstract

Ventricular Septal Rupture (VSR) is a rare complication of acute myocardial infarction and has a high mortality rate. Surgery is the definitive treatment. However, in hospitals with limited facilities, treating acute myocardial infarction patients with ventricular septal rupture, is challenging. A 74-year-old woman came to the emergency room of Dr. Koesma General Hospital, Tuban, East Java in December, 2019 with late-onset Acute Myocardial Infarction. On the following day, a new holosystolic murmur was heard in the left lower sternal border with palpable thrill. Transthoracic echocardiography showed VSR with severe pulmonary hypertension. This was followed by a drop in the blood pressure to 80/50 mmHg. The blood pressure was dependent on vasopressors until lisinopril and coenzyme Q10 were introduced. After 3 months, the haemodynamics of the patient were stable. This proved that the use of angiotensin-converting enzyme and coenzyme Q10 promotes more energy production, enables tissue healing and leads to balanced remodelling to increase the survival rate in cases of non-surgical treatment.

Keywords: Lisinopril, Ventricular Septal Rupture, Heart Murmurs, Vasoconstrictor, Hemodynamics, Angiotensin's, Infarction, Coenzymes

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Introduction

Ventricular Septal Rupture (VSR) is a rare mechanical complication of acute myocardial infarction (AMI). Before the reperfusion therapy era, the frequency was 1 – 3 %. After the discovery of thrombolysis and primary percutaneous intervention (PCI), the probability of VSR as a complication of AMI declined to 0.2%. However, the mortality remains high, especially in non-surgical cases, with an 86.6% mortality rate within the first 30 days [1]

Surgical repair is the definitive treatment for this complication until now, although the recommendation for the timing of the surgery is not evident. American College of Cardiology guideline recommends immediate surgical repair regardless of the patient's haemodynamic status, while European Society of Cardiology guidelines recommend immediate surgical repair only in a patient with an unstable haemodynamic status that does not respond to medical therapy [2,3]. However, in a hospital with limited facilities, and the patient's and family's refusal to be referred to any other facility, treating AMI patients with VSR complications is challenging. Here we present a case of VSR after a recent AMI with unstable haemodynamics in an elderly patient who survived with conservative management in a limited resources hospital.

Case Report

A 74-year-old woman came to the emergency room of Dr. Koesma General Hospital, in Tuban, East Java in December, 2019. with chief complaints of typical chest pain in the past 2 days. She had a history of hypertension since 20 years. During the initial evaluation, her vital signs were as follows: normal blood pressure (BP) of 130/100 mmHg, heart rate of 82 bpm. Cardiac auscultation revealed no abnormalities. ECG evaluation showed ST elevation and deep Q pathologic waves in all precordial leads (Figure 1). Chest X-ray revealed cardiomegaly with aortosclerosis and right hillus thickening. Laboratory findings showed elevated CK-MB level (42 U/L).

Based on these findings, she was diagnosed with late-onset ST-elevation myocardial infarction (STEMI) and admitted to Intensive Cardiac Care Unit. Oral medications of aspilet 75 mg once daily (o.d), clopidogrel 75 mg o.d, bisoprolol 5 mg o.d, glyceryl trinitrate 2.5 mg twice daily (b.i.d), and atorvastatin 40 mg o.d were given. She also received a subcutaneous injection of fondaparinux 2.5 mg once daily.

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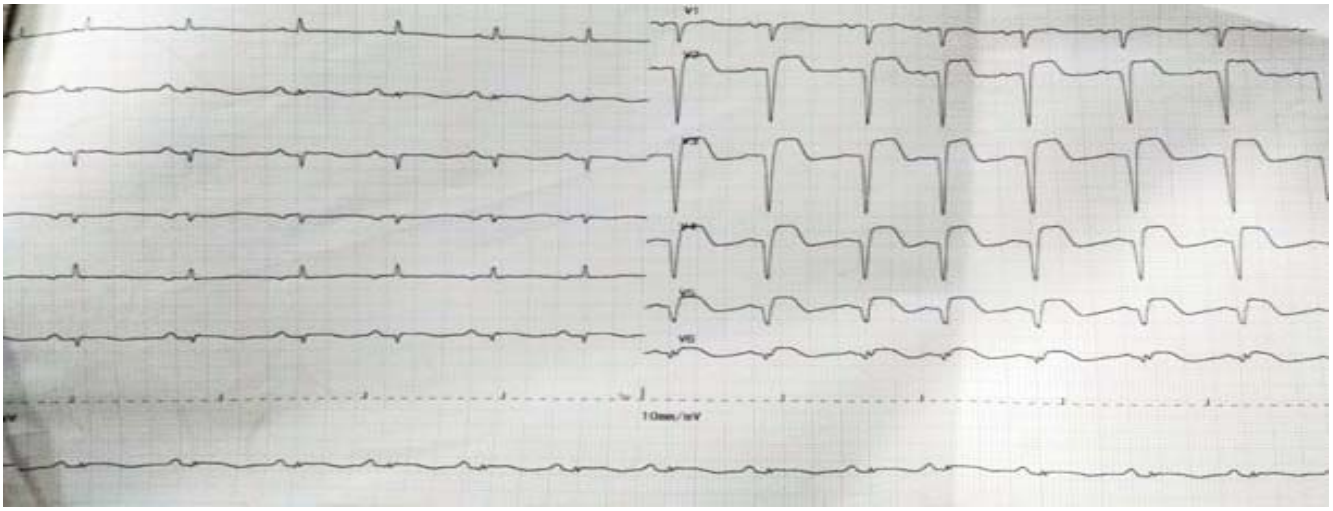

Figure-1: Initial evaluation at the emergency room revealed: a) ST-segment elevation with tombstone appearance and deep Q pathologic wave in all precordial lead

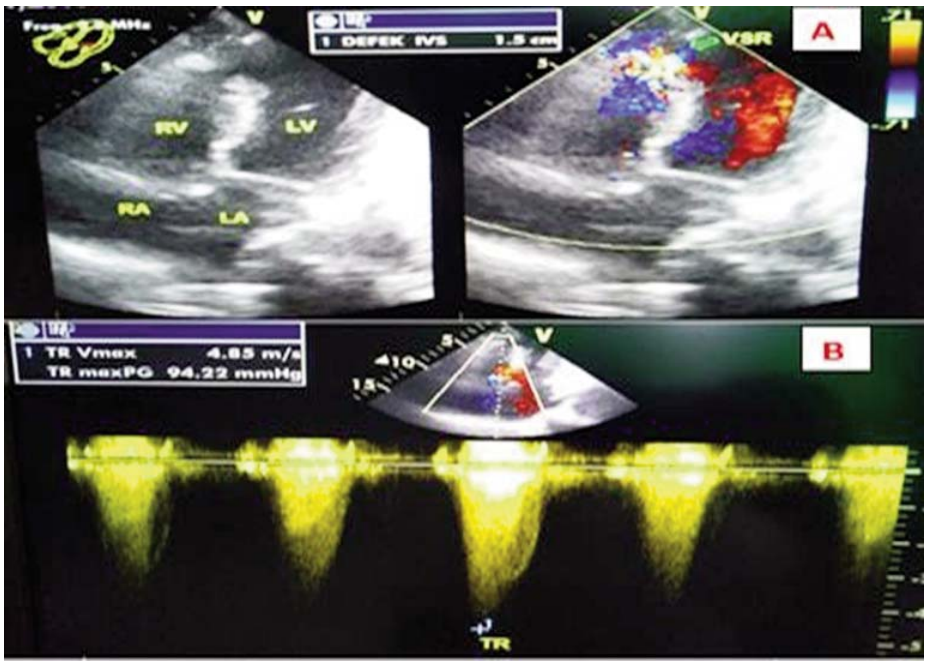

Figure-1: TTE evaluation showed: (A) moderate IVS defect (diameter 15 mm) at apical with flow L to R shunt (B) severe TR (TRmaxPG 94.22 mmHg) and high probability of severe pulmonary hypertension.

On the 2nd day, her chest pain was getting worse, accompanied by signs of cardiogenic shock with BP dropping to 85/50. On physical examination, there was a new loud high pitch holosystolic murmur grade 4/6 that was best heard in the left lower sternal border accompanied by the palpable thrill and bilateral rales at the base of the lung. Transthoracic echocardiography (TTE) showed a moderate intraventricular septal rupture with a diameter of 15 mm at apical side with Left to Right shunt, severe tricuspid regurgitation, severe pulmonary hypertension, decrease systolic and abnormal diastolic left ventricle (LV) function, concentric LV hypertrophy (LVH), and hypokinetic of anterolateral LV wall (Figure 2). She was then diagnosed with VSR and vasopressor drugs (dopamine 5 µg/kilogram bodyweight (kgBW) and norepinephrine 50 ng/kgBW) were administered. This caused a rise in the BP to 90/60 mmHg but was dependent on vasopressor drugs which persisted until the 4th day. The patient and the family were offered to be referred to a tertiary care referral hospital, but they refused.

It was then decided to give low dose lisinopril 2.5 mg daily, along with supplement coenzyme Q10, 200 mg once daily. Her condition improved after this change in therapy. On the 6th day, the BP was 110/70 mmHg without vasopressor drugs. She was kept under observation for 14 days and the haemodynamic status remained stable. She was then discharged home with double anti-platelet regimen of (aspirin 80 mg and clopidogrel 75 mg once daily), furosemide 40 mg once daily, glyceryl trinitrate 2.5 mg twice daily, lisinopril 5 mg once daily and supplement Coenzyme Q10 200mg once daily.

Routine follow-up at 1 month and 3 months after discharge showed minimum symptoms and slight

weakness but with stable haemodynamic status.

Discussion

The case of a 74-year-old female patient is presented. She was diagnosed with late-onset STEMI and VSR. Based on a previous prevalence study, our patient showed a high likelihood of developing VSR due to the senile age, and female gender with STEMI without reperfusion.[4] Her ECG demonstrated a tombstoning pattern, which is associated with extensive myocardial damage, major complications, and a poor prognosis[5].

The gold standard for diagnosing VSR is TTE, which not only reveals the size and location of the rupture but also the significance of the shunt and ventricular function[1].

As in our case, anterior infarctions are more likely to result in apical defects. The typical mechanism of septal rupture entails neutrophilic infiltration and coagulation necrosis of ischaemic tissue, which eventually results in the thinning and weakening of the septal myocardium. This subacute procedure takes three to five days[6].

Following VSR, unpredictable haemodynamic deterioration can occur for days or weeks, and long-term survival without the need for corrective surgery is incredibly rare. The preferred course of treatment should be emergency surgical repair, however, that was not the option in our case due to the patient's refusal. To stabilize the haemodynamics by reducing the afterload, to reduce the left-to-right shunt and to increase forward cardiac output, this situation required aggressive medication. In our case, the patient experienced cardiogenic shock, prompting the administration of vasopressors. Vasopressor medications must be used cautiously because they can lower cardiac output by raising systemic afterload and the Qp to Qs ratio when unopposed.[6].

Since the 4th day of treatment, the patient received additional treatment of low-dose angiotensin-converting enzyme inhibitor (ACEI) and coenzyme Q10. ACEI was given because of its anti-remodelling effect. After the injury of infarction and rupture, pro-inflammatory and pro-fibrotic growth factors, cytokines, and adhesion molecules are increasing, leading to infarct expansion that resulted in the wall thinning and ventricular dilatation, stimulating the intracellular signalling through the Angiotensin II release, resulting in the activation of TGF-β which increase fibrogenesis and collagens deposition. ACEI which reduces Angiotensin II in the proliferative phase of reactive fibrogenesis would reduce the pathological remodelling and thus improve the tissue repair by the cardiomyocytes[7] The goal is to have a balanced remodelling of the myocardium and enhance tissue healing, allowing friable tissue to strengthen, and become well-differentiated from surrounding healthy tissue, therefore facilitating a better chance of successful definite repair.[8] ACEI also helps to counterbalance the vasopressor effect by reducing afterload, which results in mitigating L to R shunt and oxygen consumption demand.

Meanwhile, coenzyme Q10 is a mitochondrial coenzyme that is essential for the production of ATP, inhibits free radical damage, and has membrane-stabilizing properties.[9] Its deficiency has been observed in cardiovascular disease including after AMI events and after the use of high-dose statin. Previous RCT in patients with AMI showed that after 28 days of treatment with 120 mg coenzyme Q10 per day, total cardiac deaths significantly reduced in the coenzyme Q group compared to the placebo group.[10] Coenzyme Q10 is also an efficient antioxidant reagent to improve angiotensin II-induced oxidative stress and endothelial dysfunction.[9] In our case, coenzyme Q10 might help to stabilize tissue healing and also by playing a role in fatty acid metabolism and energy production. Consent for Publication was obtained from the patient for promotion of science.

Conclusion

This case report showed an example of the potential benefit of adjuvant use of ACEI and coenzyme Q10 in a case of acute VSR after AMI. This benefit might be caused by the anti-remodelling, anti-oxidant, and ATP production properties of ACEI and coenzyme Q10 to have a balance remodelling of the myocardium after VSR, which helps increase the survival rate. Further observational or experimental studies are needed to prove this result

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Conflict of Interest: None.

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