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Ventricular Septal Rupture following Anterior Acute Myocardial Infarction: a Challenge to a Sub-District Physician

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ABSTRACT

Background: Ventricular septal rupture (VSR) is one of the most serious mechanical complications following acute myocardial infarction (AMI). Although a rare complication, it is associated with significant mortality and morbidity. The purpose of this report was to present a case of VSR following anterior AMI in our hospital.

Case Description: A 54-year old Javanese male presented a persistent episode of breathlessness and lower limb swelling for the last two days with prior chest pain 7 days ago. Physical examination revealed a grade 3/6 holosystolic murmur loudest over the apex, S3 gallop, ralesbibasally of the lung. Electrocardiographic evidence revealed a recent anterior myocardial infarction. Chest X-Ray showed cardiomegaly and pulmonary congestion. Transthoracic echocardiography revealed VSR at mid-anteroseptal with an estimated length of 8-10 mm, preserved LVEF 51% with mid-apicoseptalakinesis. Multiple readmissions were noted for this patient in the follow-up with worsened conditions.

Discussion: This is a challenging case report since our hospital is an incapable cath-lab sub-district hospital and far from a PCI-capable center. It is critical that all patients with AMI have a brief evaluation for mechanical complications such as VSR. All patients who developed hemodynamic instability during AMI should be comprehensively examined for the murmur and any other heart sound that may provide valuable information.

Conclusion: Every clinician especially in the low-resource setting should be aware of this potentially fatal mechanical complication as the mortality remains significantly high. Early prompt diagnosis and treatment is the key to achieve an optimal outcome.

INTISARI

Pendahuluan: Ruptur septum ventrikel (RSV) merupakan salah satu komplikasi mekanik paling fatal paska infark miokard akut (IMA). Meskipun hal tersebut merupakan komplikasi yang jarang, namun hal tersebut berhubungan dengan tingkat morbiditas dan mortalitas yang signifikan. Tujuan dari laporan kasus ini adalah untuk penyajian kasus VSR paska IMA anterior di rumah sakit kami.

Laporan Kasus: Seorang laki-laki datang dengan keluhan sesak napas persisten dan bengkak kedua tungkai sejak dua hari terakhir didahului dengan nyeri dada sejak 7 hari yang lalu. Pemeriksaan fisik didapatkan adanya bising jantung holosistolik 3/6 yang terdengar paling keras di apeks, gallop S3, ronkhi basah halus di basal paru. Elektrokardiogram didapatkan adanya IMA. X-ray thorax didapatkan adanya kardiomegali, dan kongestiparu. Ekhokardiografi transthorakal diperoleh adanya RSV pada septum ventrikel anteroseptal dengan estimasi ukuran 8-10 mm, LVEF 51%

dengan adanya akinesis mid apikoseptal. Tercatatter dapat beberapa kali readmisi pada periode follow-up pasien.

Diskusi: Kasus ini merupakan kasus yang cukup jarang dijumpai mengingat rumah sakit kami tidak dapat melakukan tindakan cath-lab dan cukup jauh dari pusat cath-lab. Diagnosis dan evaluasi awal pada kasus RSV sebagai komplikasi IMA menjadi penting. Seluruh pasien IMA dengan hemodinamik tidak stabil harus dilakukan pemeriksaan komprehensif untuk mendeteksi adanya komplikasi mekanik yang menyertai.

Kesimpulan: Setiap dokter terutama pada kondisi sumber daya terbatas harus mewaspadai segala kemungkinan komplikasi mekanik pada kasus IMA dikarenakan tingkat mortalitas yang signifikan. Diagnosis dan manajemen awal yang tepat dapat mencapai luaran yang optimal.

Introduction

Ventricular septal rupture (VSR) is one of the most life-threatening mechanical complications following acute myocardial infarction (AMI). Although a rare complication, it is associated with significant mortality and morbidity. Without any surgical or device closure, patients with VSR have an in-hospital mortality rate varied between 46% to 90%.[1,2] Even after surgery, the mortality rate is still high up to 40%.[2,3]

The incidence of post-infarction ventricular septal rupture (PI-VSR) in the pre-reperfusion erawas estimated to be 1-2% of AMI presentations.[1] In the more recent studies incidence of PI-VSR is to be increasingly rare, complicating between 0.20 and 0.31% of patients with AMI.[2,4]

The pathogenesis of PI-VSR is thought to be a sub-acute process (3-5 days). In the first 24 hours of AMI, coagulation necrosis of ischemic tissue is just starting then followed by neutrophils infiltration within the infarcted tissue. This process cause thinning and weakening of the myocardial septum.[1] Physical shear stressors and hypercontractility of myocardium later increased the risk for septal rupture during the first five days.

The purpose of this study was to present a case of VSR following anterior AMI including its diagnosis, early management, and clinical evolution during the hospitalization in our hospital.

Case Presentation

A 54-year-old Javanese male patient presented to the emergency department with a persistent episode of breathlessness and lower limb swelling for the last two days with prior chest pain 7 days ago. The patient has medical history of type 2 diabetes mellitus and former smoker. At admission blood pressure was 91/60 mmHg, respiratory was 24 per minute, heart rate was 70 bpm. Physical examination revealed a grade 3/6 holosystolic murmur loudest over the heart apex, S3 gallop, and minimal ralesbibasally of the lung.

The electrocardiogram (ECG) showed sinus rhythm, Q-waves, and ST-segment elevation (> 2 mm) in lead V1-V5 suggestive of acute anterior myocardial wall infarction). On admission, levels of CK-MB were not elevated 21.1 U/L and slightly increased of random plasma glucose (232.3 mg/dL). A chest X-ray showed cardiomegaly with signs of pulmonary congestion (Figure 2).

Transthoracic echocardiography (TTE) showed a VSR at mid-anteroseptal with an estimated length of 8-10 mm, preserved left ventricular ejection fraction (LVEF) 51% with mid-apicoseptalakinesis. A left-to-right shunt turbulent jet across the defect was also observed (Figure 3).

During the first episode of hospitalization, the patient was given dual anti platelet therapy (DAPT), anticoagulant co-therapy, intravenous furosemide 20 mg BID, Captopril 25 mg TID, Spironolactone 25 mg OD, Isosorbidedinitrate 5 mg TID, and Simvastatin 20 mg OD. The patient was discharged at day 8 hospitalization.

The second admission was noted 10 days after discharge, the physical examination found significant rates bilaterally of the lung. ECG showed sinus rhythm and bigemini ventricular extra systole. The patient was assessed as acute pulmonary edema, VSR, recent STEMI Anterior. Intravenous syringe pump furosemide 3 mg/hour was given to this patient during the first three days of hospitalization. Later, the patient was discharged at day 5. At this episode, the patient denied to being referred to the tertiary hospital.

The third readmission was recorded a month after the first admission. Significant hemodynamic instability (cardiogenic shock), ICU admission, intravenous Dobutamine5-20 mcg/kg/min, and vasopressor 0.5 mcg/kg/min and longer hospital stay were noted during this admission (Table 1; Figure 4).

The patient then was referred to the Karyadi Hospital for further investigation and treatment. Regrettably, the patient deceased 3 days after intra-aortic balloon counter pulsation (IABP) placement in the Karyadi hospital before undergoing surgery.

Discussion

This is a challenging case since our hospital is an incapable cath-lab sub-district private hospital and far from a PCI-capable center. It is critical that all patients with AMI have a focused and brief evaluation of any mechanical complications such as VSR. Rupture of the ventricular septum is a rare but potentially fatal complication of acute

myocardial infarction that has to be considered by all emergency physicians.

Table 1.
Timeline visualization of patient's clinical data.

Time	Descriptions
9-16 September 2019	First presentation of chest pain, breathlessness and lower limb edema. First admission to the hospital. TTE revealed ventricular septal rupture.
19 September 2019	Outpatient clinic visit after discharged
26-30 September 2019	Second admission to the hospital due to congestive heart failure. ECG showed normal sinus rhythm with bigeminy VES.
13-22 October 2019	Third admission to the hospital due to cardiogenic shock. ICU admission (4 days) Continuous inotropic and vasopressor was administered
22 October 2019	Patient referred for VSR closure to the Kariadi Hospital
25 October 2019	The bridging therapy using IABP placement.
28 October 2019	The patient deceased

The incidence of PI-VSR has significantly declined to 0.20%-0.31% since the introduction of reperfusion in the management of AMI. In the MIDAS study, patients with PI-VSR were found 7 times increased risk for in-hospital mortality compared to those without VSR (OR = 6.83, 95%CI = 5.62-8.31).[2] In the GUSTO-1 trial, PI-VSR also associated with a significant increase risk of 30-day mortality rate, which was 73.8% compared to 6.8% in those without VSR.[4]

In MIDAS and GUSTO-1 trial, described that the risk factors for the development of PI-VSR included old age, female gender, chronic kidney disease, and congestive heart failure.[2,4]

In our case, the patient was noted several findings in the term of clinical evolution such as significant hemodynamic instability (cardiogenic shock), change in ECG pattern, ICU admission, and also prolong the length of hospital stay. It was also noted that the patient deceased in 60-days since the first presentation in our hospital.

Cardiogenic shock is strongly associated with the presence of VSR which gives rise to a left-to-right shunt, followed by right ventricular volume overload, significantly increased pulmonary blood flow, and secondary volume overload of the left atrium and ventricle which finally results to left ventricular function deterioration.[1] The development of cardiogenic shock and prolong hospital length of stay in our patient were consistent with APEX-AMI and MIDAS study result.[2,5]

According to the ECG and TTE findings, the authors suggest that the patient suffered anterior wall AMI. It was also consistent with the GUSTO-1 study result which stated that VSR commonly occurs in the setting of anterior wall AMI 70% of the time compared to other locations.[4]

According to the recent guideline, the treatment approach was based on two parameters including hemodynamic profile and defect size.[6] Delayed surgery at >7 days with bridging therapy (e.c: IABP or LVAD) was commonly used in this situation.[7,8] However, the delayed of referral to the tertiary hospital due to the patient's reason (denied to being referred) was a challenge in this management. In our hospital, we could only stabilize the patient until surgery can be performed in the tertiary hospital. In our case, we focused on the treatment of acute heart failure (AHF) as a complication of VSR following AMI and we successfully optimized the medical treatment until referral could be done according to AHF guideline from ESC.[9] As had already known, VSR is one of the possible mechanical causes underlying AHF.

During the first admission, the patient showed a "warm-and-wet" and cardiac-type congestion clinical profile, therefore intermittent intravenous (IV) loop diuretics and vasodilator were administered. In the second admission, our patient was admitted to our hospital with a worsening condition. The patient was in "wet-and-cold" but SBP >90 mmHg therefore continuous IV loop diuretic was given without an inotropic agent. Continuous IV loop diuretic was chosen because it showed more benefit on diuretic effects as showed in several meta-analyses.[10-12] In the third admission, the patient getting worsened with cardiogenic shock therefore inotropic and vasopressor agent was added. After had been stabilized, we referred the patient to the tertiary hospital for possible surgical intervention. In this case, every clinician including an emergency physician plays a significant role in early hospital management and stabilization of the patient.

Finally, one of the treatment strategies for VSR following AMI was surgical intervention, but even surgical repair was conducted the in-hospital mortality remains significantly high (33-45%).[7,13,14]

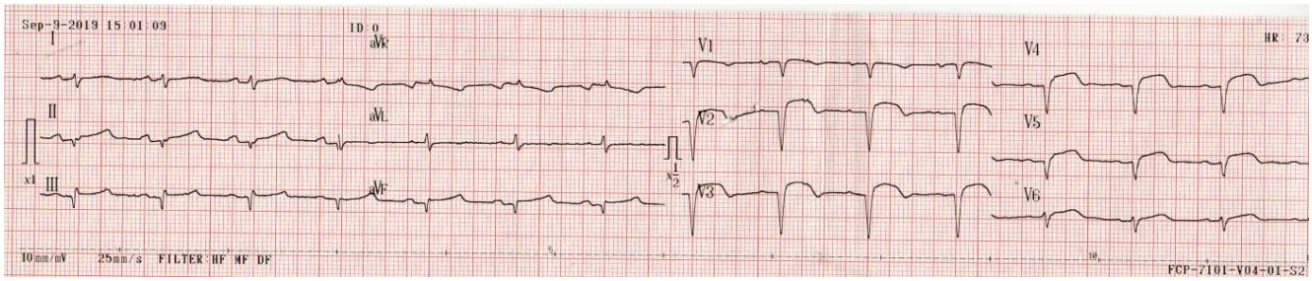
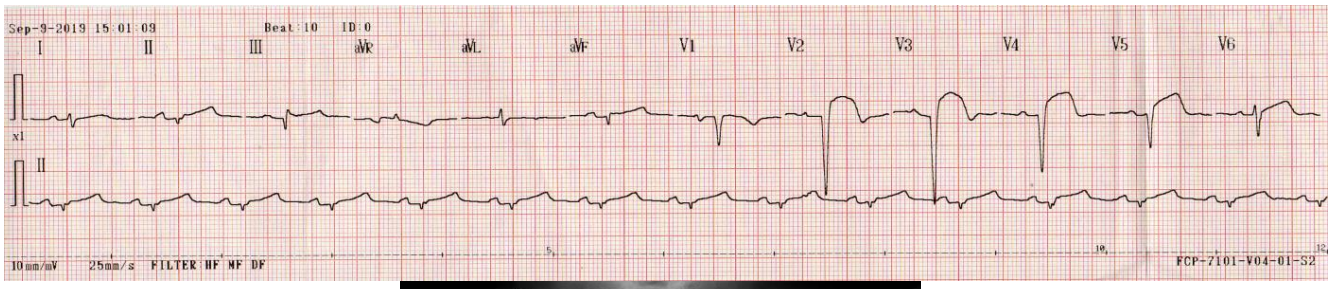


Figure 1.
On admission initial ECG showing >2 mm coved ST segment elevation and Q waves in the anterior leads (V1-V5) consistent with acute anterior wall myocardial infarction.



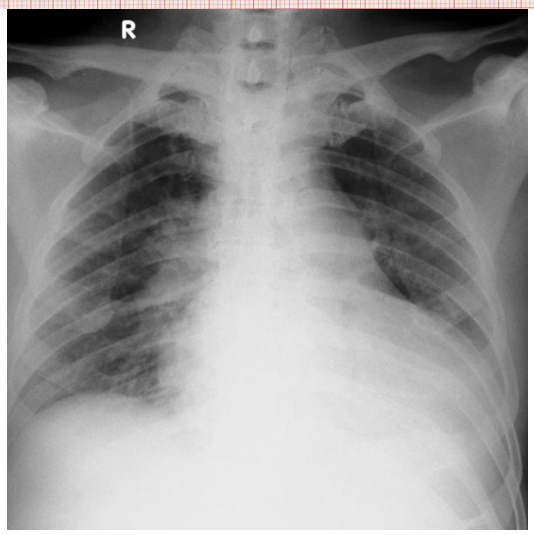


Figure 2.
On admission Chest X-Ray showing a prominent cardiomegaly and bilateral pulmonary congestion

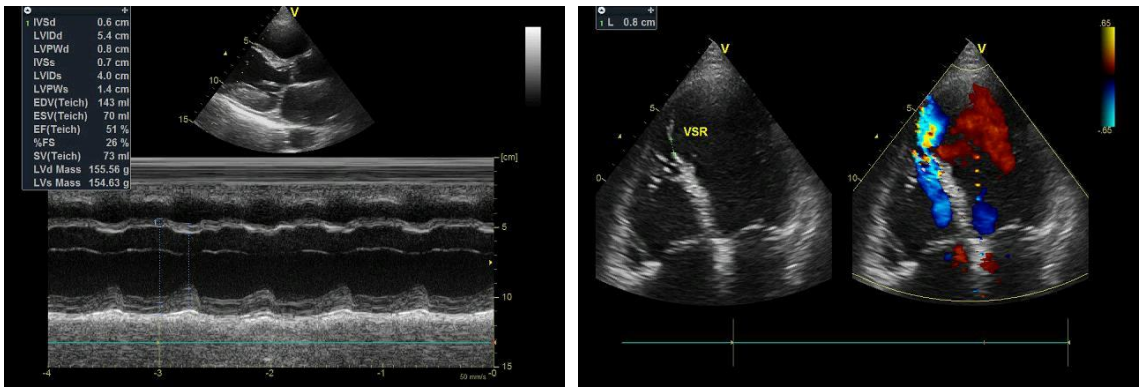


Figure 3.
(A) Detailed echocardiographic profile of the patient. LVEF was 51% (B) Apical 4 chamber view to visualize interventricular septum defect at mid-anteroseptal with estimated length for 8-10 mm with left-to-right shunt by Color Doppler Mapping.

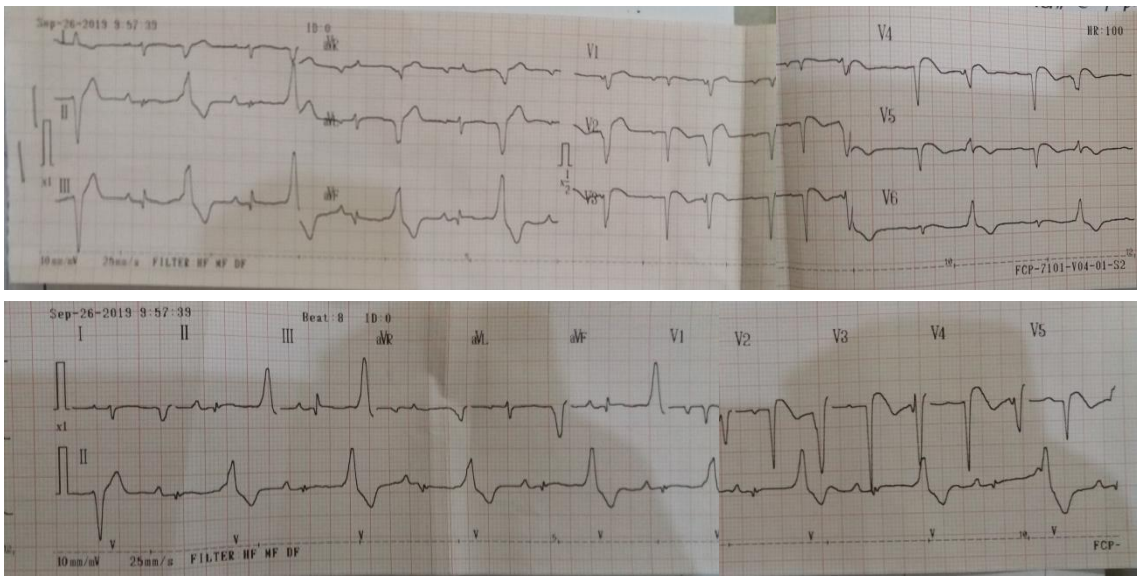


Figure 4.
Second admission ECG for the same patient showed normal sinus rhythm and bigeminyventricular extrasystole (VES).

Conclusion

Every clinician especially in the low-resource setting should be aware of this potentially fatal mechanical complication as the mortality remains high, regardless of the incidence was significantly declined in the reperfusion era. Early prompt diagnosis and treatment is the key to achieve an optimal outcome, specifically prior to the referral procedure. VSR repair should be performed in every case, but the timing and indication for the surgical or percutaneous intervention may be different between cases.

Disclosures and Ethics

The authors have no conflicts of interest to declare. A written informed consent was obtained from the patient.

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