

Ventricular Septal Rupture Post Myocardial Infarction: Baseline Characteristics and In-Hospital Outcomes

Amjad R. Bairam *FICMS*, Mohammed A. Shuailah *FIBMS*, Zainab A. Dakhil *FIBMS*, Alaa H. Alwan *FIBMS*

Ibn Al-Bitar Cardiac Centre, Baghdad, Iraq

Abstract

Background	Ventricular septal rupture (VSR) is a rare but catastrophic complication of acute myocardial infarction (MI), usually leading to congestive heart failure and cardiogenic shock with high mortality.
Objective	To study the clinical profile and outcomes of the VSR complicating acute MI in tertiary center in Baghdad.
Methods	This is a single center retrospective study recruited patients who were admitted to Ibn Al-Bitar Cardiac Center from September 2016 to February 2020 who were diagnosed with acute MI and admitted to this facility then MI course complicated by VSR as well as patients who were referred for surgical intervention from other hospitals where have been diagnosed of VSR.
Results	A total 22 patient admitted with AMI complicated by VSR, 14 patients were male (64%), 8 patients were female (36%), 14 patients were hypertensive (64%). Sixteen patients developed anterior ST elevation myocardial infarction (STEMI) (72%) and 6 with inferior STEMI (28%). Eight patients had surgery, two of them during index hospitalization and the other 6 patients as elective scheduled procedures. Twelve patients (54%) died during hospitalization, all of them were in cardiogenic shock at presentation.
Conclusion	VSR complicating acute MI is a catastrophic mechanical complication that carries high in-hospital mortality, need high index of suspicion and aggressive medical support with early surgical intervention.
Keywords	Ventricular septal rupture, myocardial infarction mechanical complication
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List of abbreviations: cTn = Cardiac troponin, IHD = Ischemic heart disease, MI = Myocardial infarction, STEMI = ST Elevation myocardial infarction, VSR = Ventricular septal rupture, URL = Upper reference limit

Introduction

Post infarction ventricular septal rupture (VSR) can be defined as an opening in the ventricular septum that results from rupture of acutely infarcted myocardium ⁽¹⁾.

Since it has high mortality rate, it is considered as a fatal complication of acute myocardial infarction (MI). Although reperfusion therapy has reduced the incidence of septal rupture, rapid diagnosis, aggressive medical management, and surgical intervention are required to optimize recovery and survival. Prior to reperfusion therapy, septal rupture complicating 1-3% of acute MI ⁽²⁾. VSR occurs more with anterior than with other types of

acute MI^(3,4). In the era before thrombolytic therapy, the main risk factors for VSR were older age (60-69 years), female sex, hypertension, and the absence of a history prior MI or ischemic heart disease (IHD)⁽⁵⁻⁷⁾. Prior angina or infarction can lead to myocardial preconditioning along with development of coronary collaterals, both of which can reduce the likelihood of VSR⁽⁸⁾. In thrombolytic era, use of thrombolytics, older age, female sex, non-smoking associated with higher risk of VSR⁽⁴⁾. Moreover, extensive MI and right ventricular infarction are risk factors for VSR⁽⁴⁾.

It had been believed that a waiting period of 3-6 weeks before surgery for VSR is the standard protocol as the myocardium is too fragile for the safe repair, so delaying surgery can allow the margins of the infarcted myocardium to develop a firm scar to facilitate the surgical repair⁽⁹⁾. Yet it had been observed that early surgical repair increased survival^(10,11).

Up to our knowledge, there is limited data from the Middle East and none from Iraq that discussed the clinical profile and outcomes of patients with acute MI who developed VSR, so, we sought to study the clinical characteristics and outcomes of patients with acquired ventricular septal rupture complicating acute myocardial infarction.

Methods

Setting and design

Retrospective single center study conducted at Ibn Al-Bitar Cardiac Centre.

Duration of study

From September 2016 to February 2020.

Selection of patients

Study included patients diagnosed with acute MI and admitted to Ibn Al-Bitar Cardiac Centre then MI course complicated by VSR as well as patients who were referred for surgical intervention from other hospitals where they have been diagnosed with VSR.

The study adopted MI definition by detection of a rise and/or fall of cardiac troponin (cTn) values

with at least one value above the 99th percentile upper reference limit (URL) and with at least one of the following: symptoms of acute myocardial ischemia with new ischemic electrocardiographic changes, pathological Q wave development, imaging evidence of new loss of viable myocardium or new regional wall motion abnormality in a pattern consistent with ischemic etiology⁽¹²⁾.

Data collection

After admission of a patient with acute MI, a detailed history of demographic features such as age and sex were recorded. Risk factors were reviewed: they included hypertension, smoking, dyslipidemia, and history of previous ischemic heart disease (IHD). A proper physical examination was then performed, the vital signs of pulse rate, respiratory rate, blood pressure were checked. Cardiac and chest examinations were performed, looking for any physical signs indicating cardiac complication of acute MI, especially those with cardiogenic shock (the definition of cardiogenic shock that was adopted in this study is systolic blood pressure <90 mm Hg with adequate volume and clinical or laboratory signs of hypoperfusion. Clinical hypoperfusion: Cold extremities, oliguria, mental confusion, dizziness, narrow pulse pressure. Laboratory hypoperfusion: Metabolic acidosis, elevated serum lactate, elevated serum creatinine)⁽¹³⁾. Basic available investigation such as complete blood count (CBC), blood sugar, blood urea, serum creatinine and electrolytes were ordered for each patient. The diagnosis of VSR was confirmed by bedside echocardiography.

Hospital Course and Follow up

After confirmation of the acute VSR that complicated acute MI, anti-ischemic measures including antiplatelet, lipid lowering agent, and other drugs were accordingly implemented. If needed, oxygen therapy and vasopressors were added for patients who were hemodynamically unstable. Urgent surgical consultation was requested. Urgent coronary angiography was

done for patients who were able to lie flat; with acceptable hemodynamic to identify the culprit artery and the anatomy of other vessels before surgery. Surgical outcome was taken from surgical department records. Follow up for patients who survived was done on outpatient basis and included repeating echocardiography.

Statistical Analysis

Data were coded and inserted using statistical package for social sciences (SPSS) version 24, categorical parameters were compared using Chi square, nominal parameters were compared using t-test, multi-regression analysis was done to assess significance of predictors of in-hospital death.

Ethical Approval

The study was approved by ethical and scientific committees at Iraqi Board for Medical Specializations, and it was concordant with Helsinki declaration. An informed consent was obtained from all included patients.

Results

Twenty-two patients were admitted with MI complicated by VSR and included in the study, 14 patients were males (64%) and 8 were females (36%). The mean age was (63±8 years). Hypertension was the most frequent reported risk factor. Anterior STEMI was more frequent than inferior STEMI, Half of patients were in cardiogenic shock state on presentation (Table 1).

Table 1. Baseline characteristic of the study population

Baseline characteristic	Number	Percentage
Male gender	14	64%
Hypertension	14	64%
Diabetes mellitus	7	32%
Smoking	6	27%
History of ischemic heart disease	4	18%
Anterior MI	16	73%
Inferior MI	6	27%
Examination findings		
Systolic murmur	15	68%
Thrill	6	27%
Cardiogenic shock	11	50%
Use of thrombolytic therapy	9	41%

During echocardiography examination, apical location of VSR was recorded in 64% of patients and was more frequent than mid septal VSR. Ejection fraction was less than 50% in 55% of patients (Figure 1).

Coronary angiography was done for 13 patients (59%) during index hospitalization: Nearly, half of them have more than one diseased vessel; the left anterior descending (LAD) artery was the most frequent culprit artery (Figure 2).

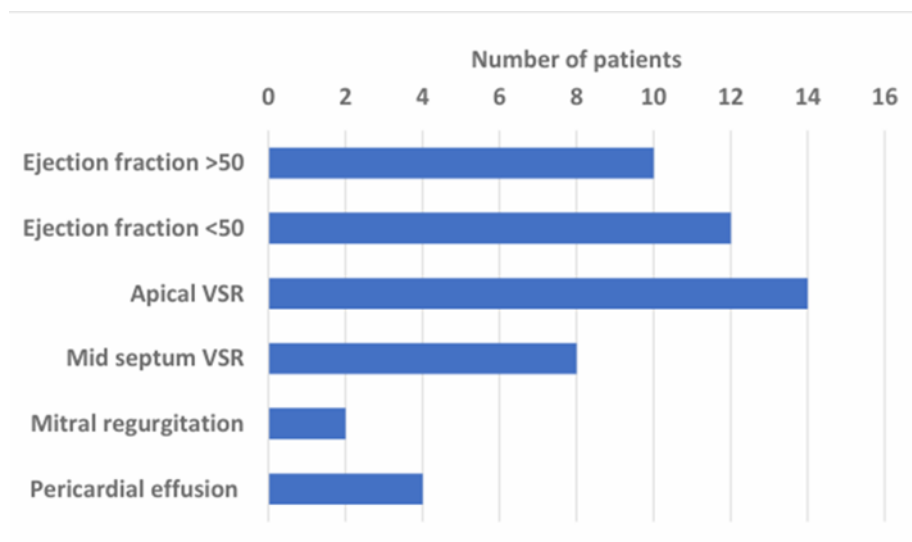


Figure 1. Echocardiographic profile of the study population

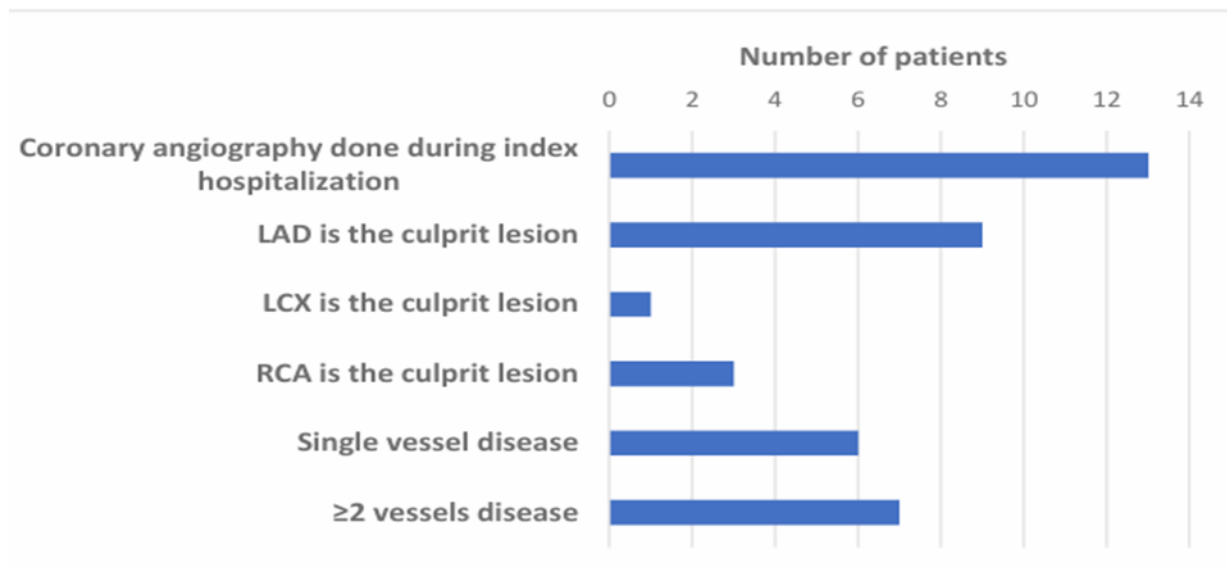


Figure 2. Coronary angiographic profile of the study population

Two patients underwent surgery, while in the index hospitalization, while six others had elective surgeries scheduled at a later date. Twelve individuals (54% of total) died while hospitalized; all had presented in cardiogenic shock (Figure 3).

Among all included variables, presence of cardiogenic shock was the strongest predictor

for in hospital death (P value <0.001). Nevertheless, hypertension was another significant predictor for death among hospitalized patients (P value = 0.033). Sex, wall involved in infarction, diabetes and smoking; all have no effect regarding mortality among patients admitted to hospital with VSR complicated acute MI (Table 2).

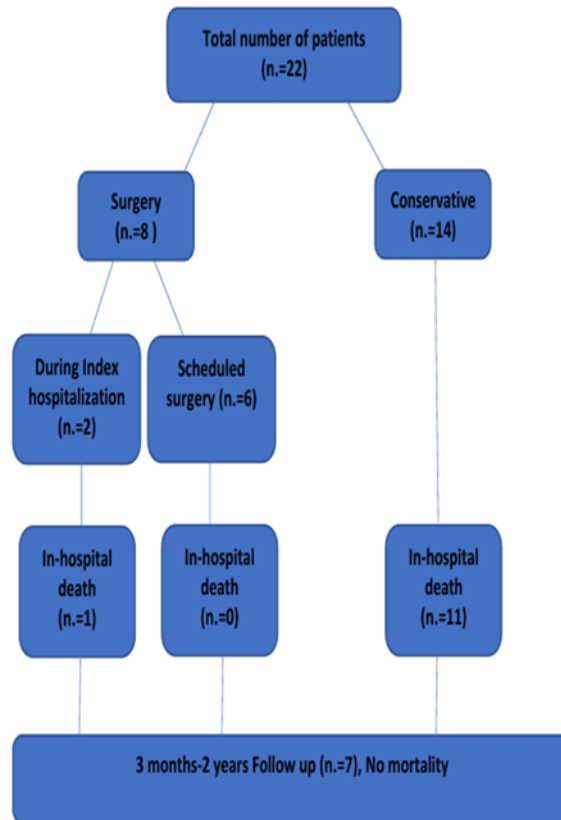


Figure 3. A flow chart revealing in-hospital management strategy and outcomes of the study

Table 2. Predictors of in-hospital death in study population

Predictor	P value
Sex	0.405
Hypertension	0.033
Diabetes	0.876
Involved myocardial wall in myocardial infarction	0.252
Cardiogenic shock	<0.001
Smoking	0.098
Use of thrombolytic therapy	0.212

Discussion

In this study, the males present larger proportion of VSR patients, contradicting a study by Moreyra et al. ⁽¹⁴⁾, whose study showed that women were more frequently affected (52%) and also with Serpytis et al. ⁽¹⁵⁾ (63% women) as well as with Crenshaw et al. ⁽⁴⁾ (57% women).

Hypertension was most reported cardiovascular risk factor as well as a poor prognostic predictor,

in same line with Serpytis et al. ⁽¹⁵⁾ (90% were hypertensive) and Crenshaw et al ⁽⁴⁾ (57% were hypertensive, while Moreyra et al. ⁽¹⁴⁾ reported that 28% of his VSR population were hypertensive and he suggested that concentric myocardial hypertrophy due to hypertension may confer some protection against VSR.

Prevalence of diabetes in current study was higher than what reported by Moreyra et al. ⁽¹⁴⁾ (18%), and Crenshaw et al. ⁽⁴⁾ (21%), but lower

than what reported by Serpytis et al. ⁽¹⁵⁾ (65%). Moreyra et al. ⁽¹⁴⁾ explained lower prevalence of diabetes in VSR patients by the possible protective effect of diabetes against VSR by higher prevalence of multivessel coronary artery disease with collateral circulation to the ischemic septum and preventing its rupture. Current study group had higher rate of smoking compared to prior reports by Crenshaw et al. ⁽⁴⁾ (13% were smokers).

Current study showed that ischemic heart disease reported in less than fifth of patients which was concordant with prior researchers ^(4,15), this can be explained by that myocardial preconditioning and presence coronary collaterals can decrease the likelihood of septal rupture ^(8,16). In current study, anterior MI (due to occlusion of LAD) was more common than inferior STEMI and it is associated with worse outcomes, this was supported by other researchers ^(4,15,17) and contradicted by others ⁽¹⁴⁾, this may be explained by that in anterior MI a larger area of affected myocardium.

Cardiogenic shock was recorded in half of current study group while Moreyra et al ⁽¹⁴⁾ reported 39% of VSR patients were in shock and Crenshaw et al. ⁽⁴⁾ reported 67% of VSR patients were in shock.

In-hospital mortality rate of present study population was 54% while Crenshaw et al ⁽⁴⁾ reported 72% mortality rate within 30 days with lower mortality rate in those who were treated surgically (47% versus 94% at 30 days, p value <0.005). Moreyra et al ⁽¹⁴⁾ observed no significant differences in adjusted mortality rates at 30 days or 1 year between those who were treated surgically compared to those who were treated conservatively.

The 2017 European Society of Cardiology guidelines in management of acute MI in patients presenting with ST-segment elevation recommended early surgery in all patients with VSR and severe heart failure if not responding rapidly to aggressive medical treatment while delayed surgical repair might be considered in those with good response to medical treatment ⁽¹⁸⁾. This was considered because early surgery is associated with high mortality reaching to 40%, and high risk of ventricular rupture, alternatively, delayed surgery can facilitate

septal repair in the scarred tissue, yet, there is high risk of death while awaiting surgery because of rupture extension and sudden hemodynamic deterioration ^(18,19). In same line the American Heart Association/American College of Cardiology guidelines in management of acute myocardial infarction in patients with ST-segment elevation also recommended urgent surgery for post MI VSR, however, it is possible to delay the procedure if patients do not develop cardiogenic shock, even in the presence of heart failure ⁽¹⁹⁾.

In conclusion, VSR complicating acute MI is a catastrophic mechanical complication that carry high in-hospital mortality, need high index of suspicion and aggressive medical support with early surgical intervention. Mechanical complications should be kept in mind when treating any patient with acute MI in general and those who developed cardiogenic shock or sudden decompensation in particular. Early coronary angiography to assess coronary anatomy and early surgical intervention for revascularization and VSR repair are the evidence-based cornerstone for management.

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Author contribution

Dr. Bairam and Dr. Shuailah: collect the data and did the interpretations. Dr. Dakhil and Dr. Alwan prepare the manuscript and did the statistical analyses.

Conflict of interest

The authors declare there is no conflict of interest.

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Correspondence to Dr. Mohammed A. shuailah

E-mail: dr.mohammedshuailah@hotmail.com

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