CASE REPORT

SUCCESSFUL PERCUTANEOUS CLOSURE OF POST-MYOCARDIAL INFARCTION, VENTRICULAR SEPTAL RUPTURE IN A PATIENT WITH COVID-19: A CASE REPORT

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Ventricular septal rupture (VSR) is a rare life-threatening complication of myocardial infarction. Transcatheter or surgical closure could be both used for VSR management but using the transcatheter method is associated with less mortality rate. Regardless of the controversial issues, the best timing for the procedure in post-myocardial infarction, the patient's clinical condition and underlying diseases might complicate the management. We present a patient with positive COVID -19 test who developed VSR, following myocardial infarction. Successful transcatheter closure was carried out and the health condition improved, as well.

Keywords: myocardial infarction, ventricular septal rupture, COVID-19

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INTRODUCTION

Cardiovascular disease (CVD) is the world's common cause of mortality and morbidity and the acute myocardial infarction (MI) is the most important which requires closely observation.[1,2]

Ventricular septal rupture (VSR) is an infrequent fatal complication of acute MI that could occur mostly on the first day and also three to five days later.[3] The VSR incidence varies from 0.7% in those who underwent percutaneous coronary intervention (PCI) to 1.1% in those receiving thrombolytic therapies.[4] Surgical closure is a challenging procedure that affects diversely the mortality rates; somehow depends on the time of intervention and the lesion's location.[5]

Although it has been suggested that immediate closure of VSR reduces the duration of poor hemodynamic state and decreased systemic perfusion and resultant refractory multiple organ failure and death; the majority of closures take place in the sub-acute or chronic phases.[3,6,7]

Delayed operation in specific patients may produce complete tissue remodeling and avoid ineffective suturing of necrotic tissues. Considering the high surgical mortality and less tendency to perform early surgical defect-closure, transcatheter closure is an alternative strategy for early management in those who are not candidates for surgery.[6] Moreover, it could be either a definitive single therapy or a bridge to surgery and also a helpful strategy in residual defects after surgical repair.[8] While all these rules apply to routine practice in the COVID-19 era, critical cases should be managed by considering many other aspects regardless of the best management strategy. In the present report, we discuss a case of post-MI VSR in a patient with COVID-19 infection who was successfully managed by an atrial septal defect (ASD) occluder device.

The informed consent was obtained from patient to take part his data in this research study.

CASE REPORT

A 51-year-old male patient was referred to our center for the transcatheter closure of post-MI VSR. He had a history of primary percutaneous coronary intervention (PCI) in the left anterior descending artery (LAD) following an anterior-MI 28 days before admission. Twenty days after the first MI episode, he experienced another MI and was undergone extra PCI into his left circumflex artery (LCX) due to a significant lesion of the proximal part of the artery.

Regardless of these successful interventions, the patient developed new onset of dyspnea, orthopnea type, NYHA functional class III-IV, as a low-grade fever (axillary temperature of 37.9°C). Getting tested for COVID-19 polymerase chain reaction (PCR), a positive result was obtained. Moreover, the high-resolution computed tomography (HRCT) showed typical basilar ground glass pattern in both lungs (Figure 1) Transthoracic echocardiography (TTE) was performed and a moderate to large size VSR was diagnosed at apico-muscular region of

intraventricular septum (Figure2). The patient was ill on admission and physical exam revealed systemic blood pressure of 78/56 mmHg, heart rate of 100 beats/minute, respiratory rate of 20 breaths/minute, and an axillary temperature of 38.1°C. Also, a new onset of harsh 3/6 systolic murmur was heard at the left lower sternal border and the apex. The electrocardiography revealed ST-segment elevation and Q wave formation and also biphasic T waves in V1-V4 leads. Under the daily drug regimen, he was given Aspirin (80mg), Clopidogrel (75mg), atorvastatin (89mg), and bisoprolol (2.5mg).

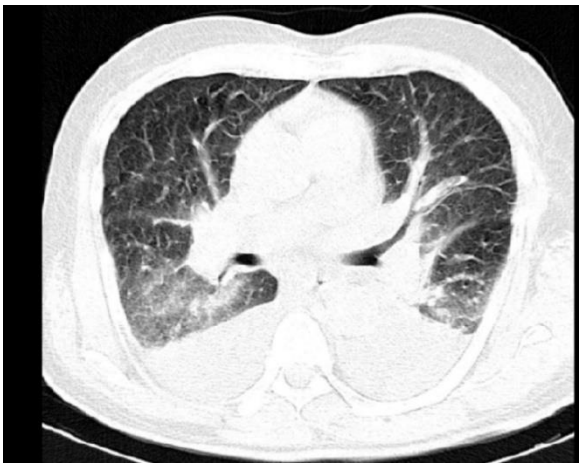

Figure 1: Typical basilar ground glass pattern in both lungs in high resolution computed tomography indicated to COVID-19

TTE was repeated and it has shown left ventricular (LV) enlargement with moderate systolic dysfunction and evidence of elevated LV filling pressure. RV was moderately enlarged with the systolic function impairment. The sequel of anterior myocardial infarction was detected with a large and thin apical aneurism without any clots. Septum akinesia and thinning in mid-inferior and anterior segments were detected. VSR was located in the apico-muscular segment (Figure 2) at about 14mm from the apex, and 9mm from the moderator band, with significant LV to RV shunt (systolic PPG: 59mmHg). There were multiple defects with two larger (inter-distance: 4mm) and two smaller flame-like jets. The larger defect was estimated 13.5x9mm. The marginal septum of the defect was thin (about 3-4mm). Mild pericardial effusion and bilateral pleural effusion were also observed.

The patient health condition was hemodynamically unstable and seemed to be on pre-cardiac shock, thus he could not be a candidate for surgical VSR. The high-risk necrotic septal tissue, with the concomitant of COVID-19 pulmonary infection was existed. Although the patient had a complex large defect nearby the moderator band, we decided to perform percutaneous VSR device closure.

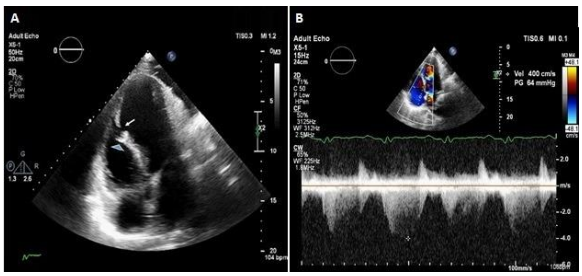

Figure 2: Echocardiographic study showing: A- septal rupture (arrow), located at 14mm from the apex, and 9mm from the moderator band (arrow head). B- Tricuspid regurgitation Doppler signal, with TRG: 64mmHg. C- Color Doppler study showed significant shunt from LV to RV. D- Trans-gastric view in TEE, showing multiple defects in the septum: two larger and two small and flame–like color signals

Planning for VSD device closure was complicated because of the possible risk of contamination of the hospital staff with COVID-19 also the device selection for VSR closure. Therefore, due to the patient's critical situation, we decide on device closure on the 5th day of admission (30 days post-MI and 8 days after COVID-19 infection and VSR diagnosis). We restricted the numbers of attendee due to protection against COVID-19 virus for joining Cath laboratory, including two interventional cardiologists (the operator, and the aid), an echo-cardiologist, an anesthesiologist, and a trained nurse.

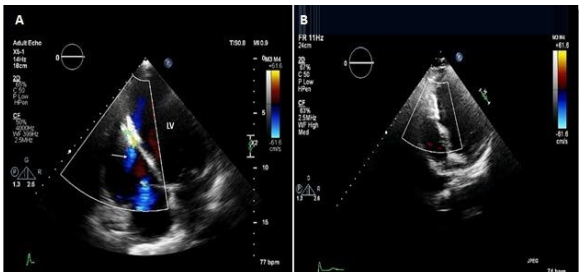

Figure 3: Post device closure; Color Doppler study in TTE, showing residual shunt (arrow) through the disks, into RV cavity (A); After two months, there was no shunt detected in TTE (B)

Due to our limitation of VSD device Occluder and inaccessible optimal size in our center, we made a decision to use an ASD Occluder (AMPLATZER™ ASD Occluder device: 15 figular). In addition, the thin apical IVS led us toward this off-label device.

After genertal anesthesia, the right femoral artery and vein cannulated. The VSD was crossed from the right ventricle to the left ventricle through remnant VSD using a Judkin's 5 French right catheter, and Terumo wire using a retrograde arterial approach. The ASD Occluder device was placed at an acceptable site across the VSD (Figure 4). Although a small residual shunt was observed in transesophageal echocardiography; the device was released. Based on our previous experience, this small residual shunt diminishes after a few weeks of device closure in favor of endothelization.

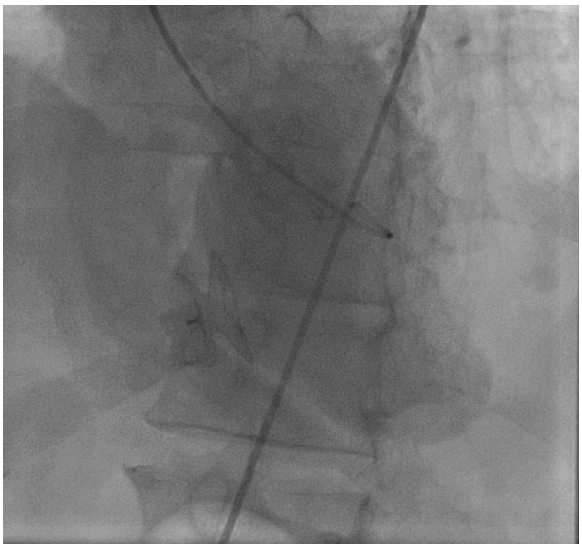

Figure 4: The appropriate placement of AMPLATZER™ ASD Occluder across ventricular septal defect with trace residual shunt

After successful implantation of the ASD device, its appropriate place was checked by trans-esophageal echocardiography (TEE) and it revealed no compression effect on the moderator band.

There was a slightly residual flow passing through the disks which was not notable. Before the patient's discharge, TTE was repeated and showed the improvement of RV hemodynamic. Although the residual shunt was still apparent; but it was not hemodynamically important (Figure 3A). The patient's symptoms were controlled after device closure, and the systolic/diastolic blood pressure raised to 110/80 mmHg. Eventually, the patient was discharged without any complications eight days after the procedure. Two months later, the patient followed up and he was in good health condition, no symptoms except concise dyspnea (NYHA functional class II) that contributed the moderate left ventricular systolic dysfunction as no remnant shunt (Figure 3B) was observed at the interventricular septum by echocardiography. Also, LV systolic and diastolic function, RV size and systolic function and pulmonary artery pressure were all improved obviously.

DISCUSSION

The present report was demonstrated the successful management of a post-MI VSD in a COVID-19 patient by ASD Occluder. Ventricular septal defect (VSD) is an important complication of acute MI occurring mostly within the first week. This potentially lethal complication is due to necrosis of the inter-ventricular septum following transmural infarct. Infarction of the different coronary artery territories results in VSR. While infarctions in LAD territory usually cause VSR in apical segments as seen in our patient; RCA infarcts mostly cause basal infero-posterior VSR.[9]

Regardless of the effect of COVID-19 pandemic on the management of different cardiovascular diseases requiring surgical approach, the management of post-MI VSD is a controversial issue depending on many factors, including the VSD characteristics and the severity of the clinical symptoms.

In our patient, regarding the lack of appropriate devices and the thin apical IVS; we decided to use off-label devices. Therefore, an ASD occluder was used, and the follow-up echocardiography was confirmed that using an ASD occluder was an appropriate decision. Similar to our study, using an Amplatzer ASD occlusion device has been reported in other studies for the management of VSR. Aggarwal et al. evaluated the effectiveness of trans-catheter closure of post-MI VSR by using Amplatzer ASD occlusion device and favorable survival outcomes was noted.[10]

Although the time of VSR closure is controversial, the patient's clinical condition and the lesion's characteristics mostly determine the best time. A recent systematic review of 31 studies using Amplatzer occluder was demonstrated that delaying the VSR closure for about 14 days improves the survival rates especially in patients presented with cardiogenic shock. Thus, delayed intervention allows the myocardial tissue to recover and makes patients' hemodynamic more stable.[11] As a result, our decision regarding the time to VSR closure was made based on the clinical characteristics of the patient as well as his COVID-19 infection. The early stages of COVID-19 infection and the worsening of his clinical condition made us perform the trans-catheter device closure. Although there is not any available guideline for identifying the cardiothoracic surgeries' candidates; it is stated that urgent surgical intervention without any feasible alternative should take place during the COVID-19 outbreak.[12] Undoubtedly, all the recommendations were kept to protect the staff from

COVID-19, and no one in our team was contaminated in the next 14 days.

AUTHORS' CONTRIBUTION

BA, HP, SA, and SSG: Concept and design, data acquisition, interpretation, drafting, final approval, and agree to be accountable for all aspects of the work. MMS, MMS, and PH: Data acquisition, interpretation, drafting, final approval and agree to be accountable for all aspects of the work.

Conflict of interest: Authors declared no conflict of interest.

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