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Non-surgical repair of ventricular septal rupture after acute myocardial infarction

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ABSTRACT

Background: Ventricular septal rupture (VSR) following myocardial infarction is a rare complication with high mortality. Although transcatheter closure has emerged as a less invasive method of VSR closure, the optimal timing and technique remain unclear.
Methods: This is a single-center, retrospective, cohort study. Eleven patients that underwent transcatheter closure of post-AMI VSR from 2006 to 2013 at the Second Xiangya Hospital were included in this study. The clinical, procedural, and outcome data were analyzed.
Results: VSR occurred in 4 patients at anterior, 4 at posterior, and 3 at apical ventricular septum. Atrial Septal Defect occluder was used in 2 patients, muscular Ventricular Septal Defect occluder was used in 6 patients, and Patent Ductus Arteriosus occluder was used in 3 patients. The median time between VSR diagnosis and transcatheter closure was 18 days (range, 13–30 days). The median size of the VSR was 12 mm (range, 8–17 mm). The occlusion device was deployed successfully in 10 of 11 patients. Three patients died between zero and seven days after the procedure (30-day mortality, 27.3%). Eight patients survived during a follow-up of 150–1960 days. A follow-up TTE showed no residual shunt in three patients and a trivial or small residual shunt in five patients.
Conclusion: Transcatheter closure of post-AMI VSR using Atrial Septal Defect, Ventricular Septal Defect, and Patent Ductus Arteriosus occluders is feasible and effective. If the clinical conditions permit, intervention can be delayed to the late phase (>2–3 weeks) after VSR diagnosis.

1. Introduction

Ventricular septal rupture (VSR) is a rare and severe mechanical complication of acute myocardial infarction (AMI) frequently leading to cardiogenic shock. Since the introduction of myocardial reperfusion therapies including thrombolytic therapy in the 1970s and primary percutaneous coronary intervention in the early 2000s, the incidence of post-infarction VSR has been reduced to 0.25–0.7% from 1–2% [1,2]. Treatment of VSR without surgical intervention results in an approximate in-hospital mortality of 90%. Even after the first description of surgical closure of post-infarction VSR in 1957 [3], the mortality rates remained high in the range of 20–87% [4,5]. Due to the high mortality from surgical repair, transcatheter closure (TCC) of VSR was introduced as a less invasive method providing a definitive single treatment, a bridge to subsequent surgical correction, or a procedure for the closure of residual defects after surgical repair in selected cases [6–8]. To date, there is a limited amount of clinical experience on TCC of post-AMI VSR as a result of the lowered incidence of the disease. Indeed, the limited published information regarding TCC of VSR mainly comes from case reports and studies of small case series. A standard procedure has not been established for TCC of VSR and there is little consensus on many treatment-related issues such as timing of intervention, perioperative therapeutic management of patients, device selection and residual shunt management. More clinical experience needs to be accumulated from different centers before a consensus can be reached on these issues.

In this study, we report the outcomes of non-surgical closure of post- in 11 patients. Three types of closure devices were used for repair of ruptures at three different anatomical locations; specifically, the Atrial Septal Defect occluder (ASDo), Patent Ductus Arteriosus occluder (PDAo), and muscular Ventricular Septal Defect occluder (VSDo).

2. Material and methods

2.1. Patients

Twenty-eight patients were diagnosed with VSR after AMI from September 2006 to December 2013 at the Second Xiangya Hospital. Among the 28 patients, only 11 patients underwent TCC of VSR and are included in this study. VSR was diagnosed by transthoracic echocardiography

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(TTE). Surgical repair was not attempted until 4 weeks after VSR, and transcatheter procedure was performed 2–4 weeks after VSR. Intra-aortic balloon pump (IABP) was used in case of hemodynamic instability. The transcatheter procedure was performed immediately if hemodynamics continually worsened after using IABP. Demographic, clinical, echocardiographic, and angiographic data were collected. This study was approved by the Ethics Committee of the Second Xiangya Hospital.

2.2. Procedure

Catheterization and VSR closure were performed in 10 patients under local anesthesia and in one patient under general anesthesia, due to irritability under TTE and fluoroscopic guidance. All patients received a single dose of cefazolin (1.0 g) for peri-interventional antibiotic prophylaxis and a single dose of heparin (60 U/kg body weight) intravenously. Invasive hemodynamic measurements, including direct measurement of the left ventricular end-diastolic pressure (LVEDP), mean pulmonary artery pressure (mPAP), and calculation of pulmonary to systemic flow ratio (Qp:Qs) measured by oximetry were obtained for every patient before VSR closure. Vascular access was generally obtained using the right femoral artery and right internal jugular (RIJ) vein. An initial left ventricle (LV) angiogram was performed to establish landmarks for guiding the procedure (Fig. 1A). A Judkins R4 or brachial (Terumo Corporation, Tokyo, Japan) catheter was advanced into the LV cavity and manipulated into the mouth of the VSD, through

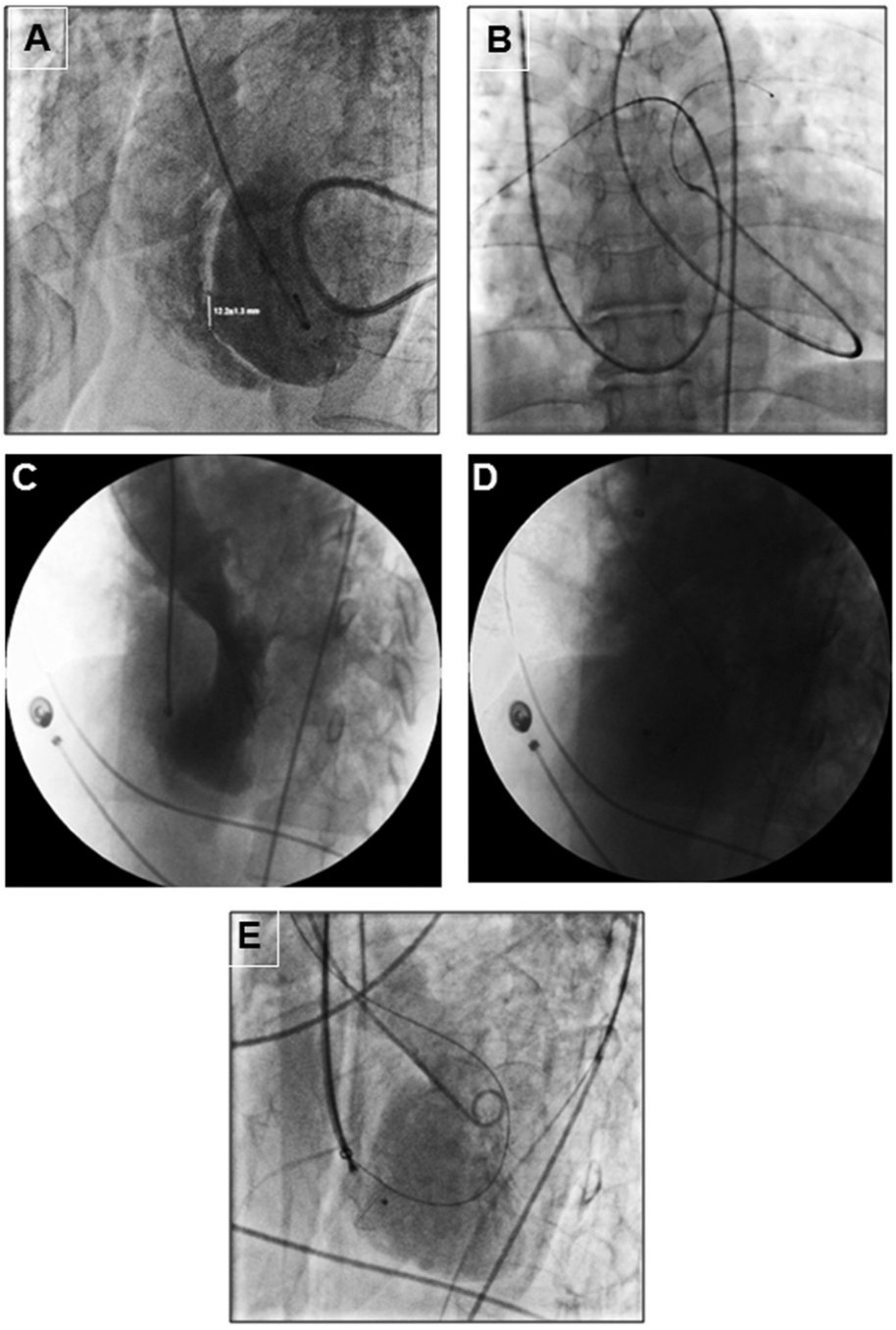

Fig. 1. Angiographic imaging. A) LV angiogram showing the location and size of the VSR. B) A catheter is advanced across the VSR into the pulmonary artery (PA), while another catheter is advanced from the RIJ vein into the PA. C) LV angiogram demonstrating the location of the occluder and residual shunt. D) The released occluder. E) PDAo was used. By keeping the guidewire in the catheter, the need for an arterial–venous loop can be reduced.