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Delayed Perventricular Device Closure of Post-Infarction Ventricular Septal Defect Guided By Epicardial Echocardiography

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Abstract

Open surgical repair or percutaneous transcatheter closure of post-myocardial infarction ventricular septal defect (PIVSD) still has an in-hospital mortality of more than 40%. Transcatheter percutaneous repair of PIVSD is utilized in several clinical settings including acute stabilization as a bridge to surgery, correction of residual shunt after surgical repair, or as a primary modality of repair. Perventricular device closure (PVDC) of VSD under echocardiographic guidance is a hybrid approach successfully used in pediatric cardiac surgery. It was designed to combine the advantages of both approaches, allowing direct access to the defect without CPB but with guidance by transesophageal echocardiography (TEE) or transthoracic echocardiography (TTE). It is a safe and easily reproducible technique that is acceptable in patients of any age, and suitable for most anatomical localizations.

Keywords: Amplatzer Muscular VSD Occluder; VSD

Introduction

Open surgical repair or percutaneous transcatheter closure of post-myocardial infarction ventricular septal defect (PIVSD) still has an in-hospital mortality of more than 40% [1]. Transcatheter percutaneous repair of PIVSD is utilized in several clinical settings including acute stabilization as a bridge to surgery, correction of residual shunt after surgical repair, or as a primary modality of repair [2]. Its main advantage is the beating heart procedure. Yet it has some limitations, like the size, location of the defect, presence of more than one defect, sufficient rim margins, and adequate distance from valve apparatus. Surgical repair has no anatomical limitations but is associated with additional myocardial trauma related to ischemia time, opening of the ventricle chamber, and direct suturing of the patch. Perventricular device closure (PVDC) of VSD under echocardiographic guidance is a hybrid approach successfully used in pediatric cardiac surgery. It was designed to combine the advantages of both approaches, allowing direct access to the defect without CPB but with guidance by transesophageal echocardiography (TEE) or transthoracic echocardiography (TTE). It is a safe and easily reproducible technique that is acceptable in patients of any age, and suitable for most anatomical localizations [3]. PVDC simplifies VSD closure and, thus, eliminates the potential complications of cardiac catheterization and fluoroscopy as it is performed under echocardiographic guidance on the beating heart. Growing evidence shows that delayed PIVSD closure is associated with better survival rates in surgical and transcatheter cohorts [4]. According to Ronco et al. [5] systematic review VA-ECMO is the most commonly used advanced mechanical circulatory support (MCS)

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for hemodynamic support in PIVSD to stabilize patients until defect closure can be performed. Concomitant use of IABP or Impella pump may reduce this ECMO-associated LV loading and shunt effect. We would like to present the first Polish case of delayed PVDC of PIVSD guided by epicardial echo only in a patient supported with VA-ECMO and IABP. The VSD was closed via sternotomy and right ventricle puncture (RV) under transesophageal and epicardial echocardiography (TEE; E-Echo) guidance.

Case Report

A 65-year-old male was admitted to the cardiac surgery department due to cardiogenic shock in the course of post-infarction, hemodynamically significant VSD. The patient additionally suffered from type 2 diabetes, hypertension, and depressive episodes. A coronary angiography performed due to ST-segment elevation myocardial infarction a day earlier revealed occlusion of the right coronary artery, which was successfully revascularized with a drug-eluting stent. Echocardiography examination revealed a discontinuity of the interventricular septum - a rupture at the level of the interventricular septum (IVS) junction with the inferior wall of the left ventricle (LV) with a transverse dimension of 15 mm, a significant left-right shunt, and dyskinesis of the basal and akinesis of the mid and apical segments of the inferior LV wall. LV systolic dysfunction with ejection fraction of 40%, RV hypokinesis and systolic dysfunction were found MCS was started right after the patient's admission with peripheral veno-arterial extracorporeal membrane oxygenation (V-A ECMO) via transfemoral access and intra-aortic balloon pump (IABP) to unload the left ventricle. A gradual improvement in the patient's hemodynamic status was observed. After 11 days of the MCS the VSD closure was performed via sternotomy, followed by puncture of RV with the use of the Amplatzer Muscular VSD Occluder (Abbott) only under TEE and E-Echo guidance. Intraoperative echocardiography showed the optimal position of the occluder discs and a mild L-R leak through the waist of the clasp. The patient was extubated a day after surgery. Postoperatively, the patient required support with a small dose of dobutamine and norepinephrine. Short episodes of atrial fibrillation were successfully treated with amiodarone. MCS was discontinued on the 3rd (ECMO) and 6th (IABP) postoperative days. Postoperative echocardiography revealed a moderate left-to-right leak in the distal part of the amplatzer (for observation) and an increase in LVEF up to 45%. 14 days after the procedure, the patient in ambulatory condition was discharged to another hospital for rehabilitation. Follow-up TTE performed two months after the procedure revealed reduction of the leak to a mild, hemodynamically insignificant one. PVDC of the PIVSD with epicardial echocardiographic guidance seems to be a promising therapeutic option in the armamentarium of

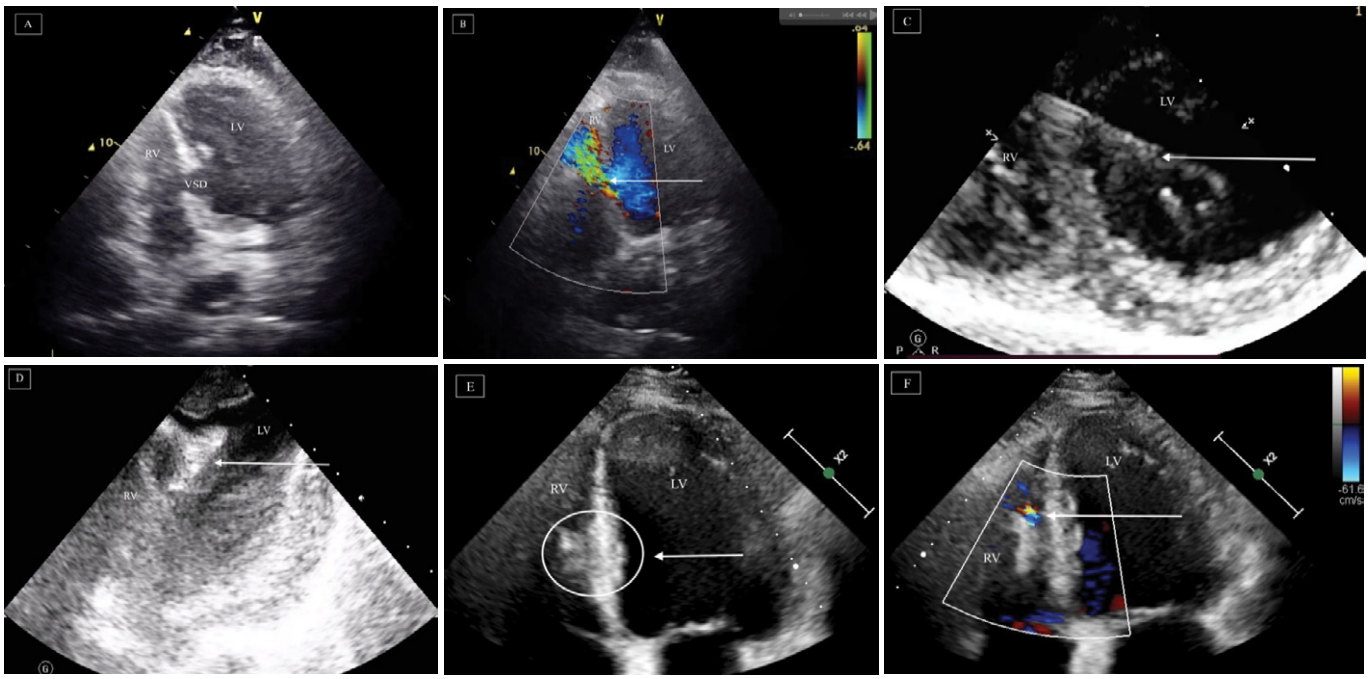

Figure 1: A. Ventricular septal defect; 2D TTE four-chamber view; B. Ventricular septal defect (arrow); 2D TTE, four-chamber view; color-Doppler; C. The guidewire in the right ventricle, necessary for the insertion of the Amplatzer (arrow); E-echo; D. Amplatzer disk in the left ventricle (arrow); E-echo; E. Amplatzer and its discs on both sides of the interventricular septum (arrow) ; 2D TTE, four-chamber view; F. Mild residual shunt through the ventricular septum at the location of the occluder implantation (arrow), 2D TTE, four-chamber view, color-Doppler

LA: left atrium; **LV:** left ventricle; **VSD:** ventricular septal defect; 2D TTE: Two-dimensional transthoracic echocardiography; E-ech: Epicardial echocardiography

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a heart team. It allows for precise closure of the VSD with minimal traumatization of the myocardium. In the event of failure, classic cardiac surgery can be performed during the same procedure.

Conflict of Interest: None declare.

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