



Case Report

Device closure of a traumatic VSD in a young man with a history of a stab wound to the chest



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ABSTRACT

The most commonly affected area of the heart in penetrating chest trauma is the right ventricle. The occurrence of a ventricular septal defect (VSD) after penetrating trauma to the left chest has an incidence of 1% to 5%. We describe a 27-year-old man with a history of the surgical repair of right ventricular free-wall rupture due to a stab wound to the chest and a posterior muscular VSD, which was diagnosed with transthoracic echocardiography postoperatively. We closed the VSD with a symmetric occluder successfully.

<Learning objective: Cardiac penetrating trauma is not always limited to the right ventricular free wall and may involve the cardiac valves, the heart septa, the coronary arteries, and the conduction system. Traumatic ventricular septal defect (VSDs) can be treated surgically or percutaneously with occluder devices. It appears that the device closure of this type of acquired VSD is a reasonable therapeutic choice, especially in patients with a history of recent cardiac surgery for the repair of right ventricular free wall rupture.>

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Introduction

Acquired ventricular septal defects (VSDs) are uncommon and can be due to myocardial infarction, chest trauma (either penetrating or blunt), and infective endocarditis [2]. The mechanism of traumatic VSDs is variable, with muscular VSDs being the most frequently reported type in the literature and case reports.

Case report

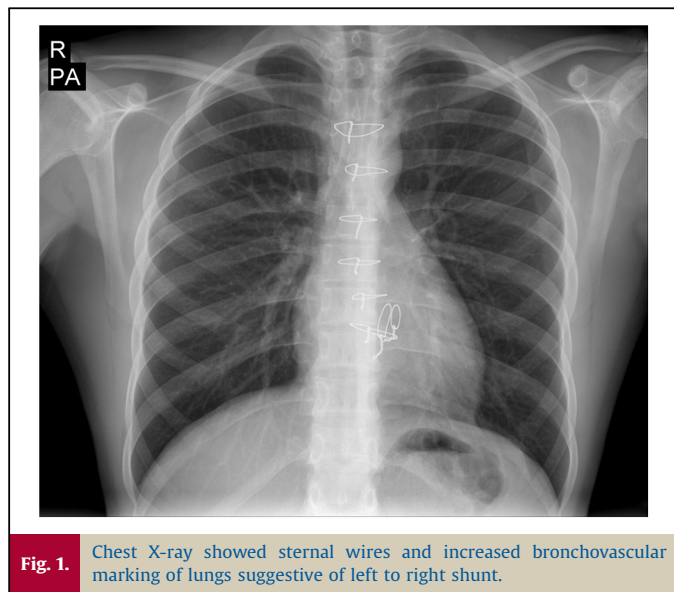
A 27-year-old man was referred to our hospital with a VSD caused by penetrating trauma to his anterior left chest. The patient presented with a cardiogenic shock and tamponade, so he was urgently transferred to the cardiac surgery room, where the ruptured free wall of the right ventricle was repaired. Postoperative transthoracic echocardiography (TTE) illustrated a small-to-moderate sized defect in the posterobasal part of the muscular interventricular septum, which was subsequently confirmed with transesophageal echocardiography (TEE).

On admission into our center, the patient had stable vital signs, harsh systolic murmurs of grade 3/6 on the mid-left sternal border, and clear lungs. Additionally, almost all his routine blood tests were within normal limits. Electrocardiography showed a normal sinus rhythm with a heart rate of 85 beats per minute, a normal axis, and a nonspecific inverted T wave in the right precordial leads. Chest X-ray revealed a normal cardio-thoracic ratio, sternal wires, and increased pulmonary vascular marking, in favor of a left-to-right shunt (Fig. 1).

TEE was repeated in our center, and it showed mild left ventricular (LV) enlargement, an LV ejection fraction of 55%, mild mitral regurgitation, mild tricuspid regurgitation, no pericardial effusion, and a small-to-moderate sized VSD in the posterobasal part of the muscular interventricular septum (6 mm) with a left-to-right shunt of 2 (Qp/Qs: 2) and an acceptable distance from the mitral valve and the coronary sinus, which appeared suitable for device closure (Fig. 2, Video 1). The patient was, therefore, scheduled for heart catheterization. Right- and left-heart catheterization demonstrated mild LV enlargement with a preserved systolic function, mild mitral regurgitation, a small mid muscular VSD with Qp/Qs of 1.7, and a mildly elevated pulmonary artery pressure of about 35/18 mmHg (Video 2). Selective coronary angiography was also done, and it revealed normal and patent

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epicardial coronary arteries. The VSD was wired and snared to the inferior vena cava and the right femoral vein before it was closed successfully with a symmetric muscular VSD occluder (size of 10 mm) with no significant residual shunt and no complication (Video 3).

Discussion

Penetrating heart trauma is almost life-threatening and often requires urgent surgical intervention. Approximately 60% to 80% of patients with penetrating cardiac wounds die prior to reaching a hospital. Penetrating injury can cause damage in more than one cardiac structure, which may be difficult to identify at the initial urgent operation [3]. VSDs occur in 1% to 5% of cases of penetrating chest trauma, although blunt trauma to the chest can also lead to VSDs [1]. The presentation varies from stable to critical hypotension, shock, and tamponade. The diagnosis of VSDs due to

stab-wound trauma may not be made at the first workup in the emergency department. Our patient presented with tamponade and shock. He was transferred to the cardiac surgery room urgently, and in postoperative TTE, the VSD was diagnosed in the posterior basal part of the interventricular septum. Apical VSDs with ragged walls are the most common traumatic VSDs [4]. VSD occurrence in the posterior basal part of the interventricular septum in our patient was unexpected given the patient's history of a stab wound to the anterior part of his chest and may raise the probability of a preexisting congenital VSD unrelated to the chest trauma, although VSDs can result from penetrating cardiac injury involving any part of the septum. The patient stated that he had had no abnormal finding on his medical checkup.

The treatment strategy for traumatic VSDs has been based on a combination of heart failure symptoms, hemodynamics, and defect size. A large VSD of more than 10 mm in diameter requires closure as soon as possible because of a high likelihood of the development of congestive heart failure [4]. However, in some patients such as those presenting with a low left-to-right shunt rate and mild congestive heart failure, the traditional approach has been to try medical treatment first, followed 2 to 3 weeks later by surgical repair when the myocardial tissue surrounding the VSD shows signs of the formation of a fibrous ring [5]. Our patient had no significant symptoms; nevertheless, hemodynamic study showed a significant left-to-right shunt (>1.5) one month after the stab wound to his chest and TTE demonstrated mild LV enlargement, prompting us to opt for VSD closure. Considering that the patient had undergone cardiac surgery one month earlier and that redo operation might add risk to his surgery, we made him a candidate for percutaneous closure.

The VSD was closed successfully with a symmetric muscular VSD device (size 10 mm) without significant residual shunt and fortunately, our patient passed a good and uneventful hospital course and was discharged on aspirin, clopidogrel, and metolazone.

Early diagnosis of complex heart injury and proper timing of therapeutic interventions (surgical and percutaneous) can prevent long-term sequelae such as infective endocarditis, LV enlargement, and heart failure [6]. What our case highlights is the probability of multiple injuries to the heart, which should be investigated carefully at the first evaluation, if it is feasible. This patient also

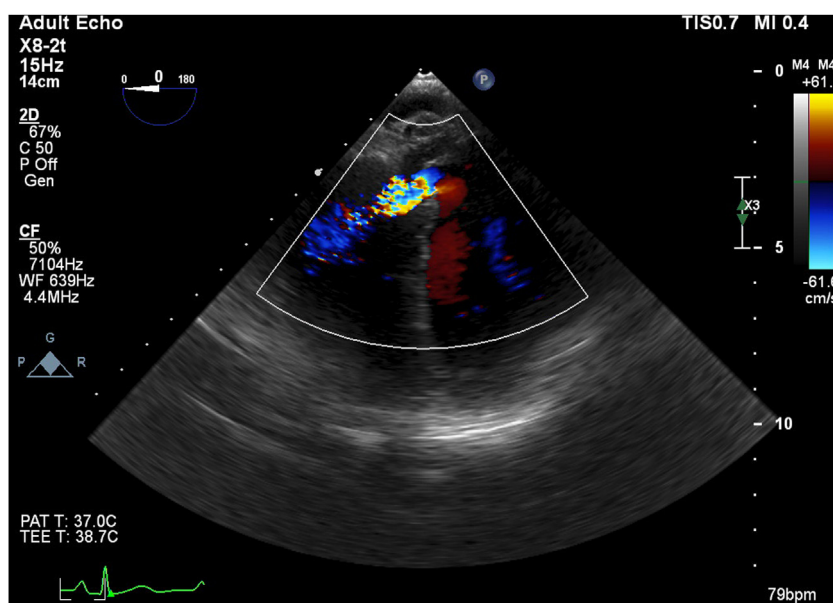


Fig. 2. Transesophageal echocardiography revealed small to moderate size muscular ventricular septal defect with left to right flow.

demonstrates that percutaneous closure can be a feasible and effective choice for the treatment of traumatic VSDs, especially in patients who have undergone recent sternotomy for the repair of other cardiac injuries and who may be placed at greater risk by reoperation.

Conflict of interest

The authors declare that there is no conflict of interest.

Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:<https://doi.org/10.1016/j.jccase.2020.03.002>.

References

- [1] Sugiyama G, Lau C, Tak V, Lee DC, Burack J. Traumatic ventricular septal defect. *Ann Cardiothorac Surg* 2011;91:908–10.
- [2] Rojas CA, Cruite DM, Chung JH. Traumatic ventricular septal defect: characterization with ECG-gated cardiac computed tomography angiography (CTA). *J Thorac Imaging* 2012;27:W174.
- [3] Topaloglu S, Aras D, Cagli K, Ergun K, Deveci B, Demir AD, Korkmaz S, Sabah I. Penetrating trauma to the mitral valve and ventricular septum. *Tex Heart Inst J* 2006;33:392.
- [4] Kasem M, Kanthimathinathan HK, Mehta C, Neal R, Stumper O. Transcatheter device closure of a traumatic ventricular septal defect. *Ann Pediatr Cardiol* 2014;7:41.
- [5] Pierli C, Iadanza A, Del Pasqua A, Sinicropi G. Unusual localisation of a ventricular septal defect following blunt chest trauma. *Heart* 2001;86:E6.
- [6] Harling L, Ashrafian H, Casula RP, Athanasiou T. Late surgical repair of a traumatic ventricular septal defect. *J Cardiothorac Surg* 2014;9:145.