

Case Report

A Penetrating Heart Injury Resulting in Ventricular Septal Defect

LOIZOS ANTONIADES, PETROS M. PETROU, CHRISTOS EFTYCHIOU, EVAGORAS NICOLAIDES

Department of Cardiology, Nicosia General Hospital, Cyprus

Key words: Cardiac trauma, left-to-right shunt, echocardiography.

Penetrating heart injuries can be lethal. Here we report a case of self-inflicted cardiac injury with glass fragments by a psychiatric patient. The patient presented with cardiogenic shock and was initially treated surgically for a large pneumothorax and cardiac tamponade. A few days later she presented with dyspnoea and hypotension. An echo-Doppler study was performed and an acquired post-traumatic ventricular septal defect (VSD) with left-to-right shunt was diagnosed. The patient was transferred to theatre where the defect was successfully repaired. Post-traumatic VSD is a rare complication of penetrating heart injuries and has a tendency to present late. Follow up of such cases is recommended with repeat echocardiography.

Manuscript received:
March 24, 2009;
Accepted:
October 6, 2009.

Address:
Petros M. Petrou

7 Lesvou St., Flat 304
Aglantzia 2103
Nicosia, Cyprus
e-mail: petrosp@doctors.net.uk

Penetrating cardiac injury is a life-threatening condition that usually requires emergency surgical intervention. It represents one of the commonest causes of death due to urban violence.¹ The clinical presentation depends on various factors, such as the time elapsed between injury and initiation of resuscitation, the mechanism and extent of injury, the amount of blood loss, the site of the cardiac lesion, the presence of cardiac tamponade and other associated injuries. Echocardiography is the most useful diagnostic technique, with high specificity and sensitivity rates.¹ We report a case of a patient with a self-inflicted chest injury that resulted in acquired ventricular septal defect (VSD) and a pseudoaneurysm of the left ventricle, which was repaired surgically.

Case presentation

A 59-year-old female psychiatric patient was initially admitted to the General Surgical Department after a self-inflicted glass injury in a suicide attempt. On examination she had 4 penetrating injuries of

the left hemithorax, with pulsating pieces of glass noted within one of the injuries. She was found to be in cardiogenic shock with a systolic blood pressure of 50 mmHg and a thready pulse. The ECG showed sinus rhythm, right bundle branch block, left axis deviation, low voltage and lack of R wave progression in leads V₁ to V₅ (Figure 1). The chest X-ray showed a left sided haemothorax.

The patient was taken to theatre urgently and a left thoracotomy was performed. A massive haemothorax was diagnosed and drained and a fragment of glass was found to be embedded in the heart. The pericardial sac was filled with blood. A pericardiotomy was performed with removal of blood clots and the foreign body.

The patient had an initially unremarkable postoperative course. Even though a left sided parasternal systolic murmur was noted, she returned to the psychiatric ward 10 days later. A few days later the patient was re-admitted with recurrence of dyspnoea and hypotension. A left sided haemothorax was diagnosed again. Pre-operative transthoracic and transoesophageal echocardiography was performed.

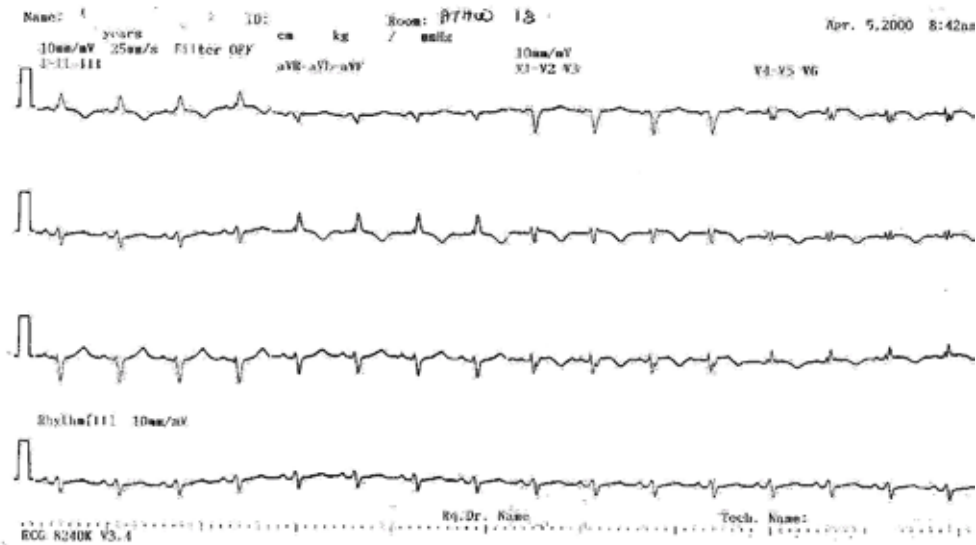


Figure 1. ECG showing sinus rhythm, right bundle branch block, left axis deviation, low voltage and lack of R-wave progression.

This revealed a large (2 cm) post-traumatic VSD in the distal-apical portion of the septum (Figure 2) with the presence of a pseudoaneurysm in the apical area. A left-to-right shunt was clearly demonstrated by colour flow Doppler (Figure 3).

She was transferred to theatre where the pseudoaneurysm was resected and the VSD repaired. Subsequent intraoperative transoesophageal echocardiography showed an intact ventricular septum (Figure 4) with no evidence of communication on colour Doppler (Figure 5).

The patient was discharged 10 days later with no further postoperative complications.

Discussion

Penetrating cardiac injuries are one of the commonest causes of death due to urban violence.¹ Cardiac injury occurs in about 20-30% of cases of major chest trauma.² In the majority of cases penetrating heart injuries are fatal. About 20% arrive in hospital alive³ and urgent management is necessary. Up to 70% of these patients survive to hospital discharge.³ Patients with no signs of life on admission may have a mortality rate up to 94%.

Factors that determine survival are rapid diagnosis and immediate treatment. The survival rate is re-



Figure 2. Transoesophageal echocardiographic study showing the ventricular septal defect.



Figure 3. Transoesophageal echocardiographic study with colour Doppler, showing communication between the two ventricles.



Figure 4. Transoesophageal echocardiographic study showing the ventricular septum after repair, with no evidence of a defect.

lated to the extent and mechanism of injury, the need for emergency operation and the presence of complex cardiac lesions. The presence of cardiac tamponade, right ventricular injury, single chamber injury and sole injury have been found to be associated with improved survival.⁴ When the left ventricle and the coronary arteries are injured mortality rates as high as 40% have been reported.⁵

The right and left ventricle are the most commonly involved chambers in penetrating cardiac injuries. Cardiac tamponade and VSD are the most frequent complications of cardiac injury. In cases of penetrating chest injury, the suspicion of intracardiac injury is usually raised by persistent haemodynamic instability or the incidental discovery of a cardiac murmur. Echocardiography has an important role in the assessment of patients with acute penetrating chest trauma. It can provide both the diagnosis and the anatomical details necessary for the surgical approach. Transthoracic echocardiography is the most useful imaging modality in confirming the presence of haemopericardium.⁶ The nature of the pericardial wound is very important. If the pericardium remains open and the extravasated blood can pass freely into the pleural cavities or mediastinum, then cardiac tamponade will not develop, at least initially, and the presenting signs and symptoms will be those of a haemothorax. If the pericardium does not permit free drainage, tamponade may occur within minutes or hours.

Post-traumatic VSD is a delayed complication of penetrating heart injury. It has been postulated that the reason for the delay is muscular spasm or blood



Figure 5. Transoesophageal echocardiographic study with colour Doppler, showing no evidence of communication between the two ventricles.

clot sealing the defect. A protocol suggested by Rozicky et al⁷ suggests performing echocardiography and proceeding to surgery if a haemopericardium is confirmed. A pericardial window or follow-up echocardiography is suggested in the case of equivocal initial echocardiographic results and a new echocardiographic examination is recommended before discharge if the initial results are negative. This echocardiographic protocol is very important, since VSD is the commonest delayed complication of penetrating heart injuries. There are several case reports of delayed VSD presentation where initial echocardiography was normal but subsequent examinations revealed the pathology.⁸ Because of this it is prudent to plan follow-up electrocardiography and echocardiography as well as cardiac catheterisation in symptomatic patients.⁹

It is possible for a small traumatic VSD to close spontaneously.¹⁰ Even though surgical correction is to date the preferred treatment, transcatheter closure of VSDs after surgery^{10,11} and after myocardial infarction¹² has been described. Such repair of VSDs arising from penetrating trauma has also been successful¹³ and needs to be studied further in view of the obvious benefits from a transcatheter technique compared to open heart surgery.

In conclusion, penetrating injuries to the heart can be potentially lethal. A number of variables can help to determine their prognosis pre- and postoperatively. Cardiac tamponade and VSD are the most frequent complications. Although cardiac tamponade, when suspected, is easily recognised, a post-traumatic VSD may become clinically detectable only at a lat-

er stage and can escape the initial examination. Even if conservative management is planned initially, it is crucial to plan follow up because of the occurrence of delayed complications such as VSD.

References

1. Asensio JA, Murray J, Demetriades D, et al. Penetrating cardiac injuries: a prospective study of variables predicting outcomes. *J Am Coll Surg*. 1998; 186: 24-34.
2. Argento G, Fiorilli R, Del Prete G. [A rare case of a post-traumatic intraventricular defect]. *Ital Heart J Suppl*. 2002; 3: 352-354.
3. Naughton MJ, Brissie RM, Bessey PQ, McEachern MM, Donald JM, Laws HL. Demography of penetrating cardiac trauma. *Ann Surg*. 1989; 209: 676-681.
4. Campbell NC, Thomson SR, Muckart DJ, Meumenn CM, Van Middelkoop I, Botha JB. Review of 1198 cases of penetrating cardiac trauma. *Br J Surg*. 1997; 84: 1737-1740.
5. Johnson SB, Nielsen JL, Sako EY, Calhoon JH, Trinkle JK, Miller OL. Penetrating intrapericardial wounds: clinical experience with a surgical protocol. *Ann Thorac Surg*. 1995; 60: 117-120.
6. Barden BE, Kent RB 3rd. Multiple penetrating injuries to the heart diagnosed by ultrasonography. *South Med J*. 2001; 94: 644-645.
7. Rozycki GS, Feliciano DV, Ochsner MG, et al. The role of ultrasound in patients with possible penetrating cardiac wounds: a prospective multicenter study. *J Trauma*. 1999; 46: 543-551.
8. Vecht JA, Ibrahim MF, Chukwuemeka AO, James PR, Venn GE. Delayed presentation of traumatic ventricular septal defect and mitral leaflet perforation. *Emerg Med J*. 2005; 22: 521-522.
9. Mittal V, McAleese P, Young S, Cohen M. Penetrating cardiac injuries. *Am Surg*. 1999; 65: 444-448.
10. Ilija R, Goldfarb B, Wanderman KL, Gueron M. Spontaneous closure of a traumatic ventricular septal defect after blunt trauma documented by serial echocardiography. *J Am Soc Echocardiogr*. 1992; 5: 203-205.
11. Lock JE, Block PC, McKay RG, Baim DS, Keane JF. Transcatheter closure of ventricular septal defects. *Circulation*. 1988; 78: 361-368.
12. Burrell CJ, Zacharkiw LA, deGiovanni JV. Percutaneous device closure of post-infarction ventricular septal defect with aneurysm. *Heart*. 2004; 90: 731.
13. Berry C, Hillis WS, Knight WB. Transcatheter closure of a ventricular septal defect resulting from knife stabbing using the Amplatzer muscular VSD occluder. *Catheter Cardiovasc Interv*. 2006; 68: 153-156.