A Case of Broken Heart from Blunt Trauma

K K Poh, H C Tan, B L Chia, Y T Lim

ABSTRACT

A young man with blunt chest trauma presented acutely in shock as a result of cardiac rupture causing acute bloody tamponade. We discuss the clinical presentation, the importance of rapid and accurate diagnosis and management of such cases.

Keywords: cardiac rupture, tamponade, blunt cardiac trauma

Singapore Med J 2002 Vol 43(8):423-425

CASE REPORT

A 20-year-old man working in a construction site presented with severe back pain when he was pinned between a heavy metal rod and a vehicle. At presentation to the Emergency Room, he was noted to be confused and violent. His haemodynamics was unstable with blood pressure of 80/46 mmHg and pulse rate of 110 beats per minute. His extremities were clammy with marked peripheral hypoperfusion. Bruise marks were observed on his upper back and front of his chest. Significantly, his jugular venous pressure was elevated; his face was plethoric and cyanotic; and neck veins were distended. Cardiovascular examination revealed that his dual heart sounds were muffled. No cardiac murmur was auscultated. His breath sounds in both lungs were normal. Systemic examination was otherwise normal except for mild tenderness over his upper abdomen and over his upper back. His resting 12-lead electrocardiogram showed widespread concave upward ST-segment elevation (Fig. 1). Chest radiograph revealed a widened mediastinum (Fig. 2) with slight cardiomegaly. Haematological investigations revealed that his hemoglobin was 13.4 g/dl, cardiac enzyme markers of creatinine kinase (CK) was 1017 U/L and CK-MB fraction was 74 U/L.

Emergency bedside echocardiogram was performed. A large pericardial effusion, measuring 30mm in width was detected. Blood clots were present (Fig. 3a, b). There was early diastolic collapse of the right ventricular outflow tract. The diagnosis of acute haemorrhagic cardiac tamponade secondary to crush injury was made.

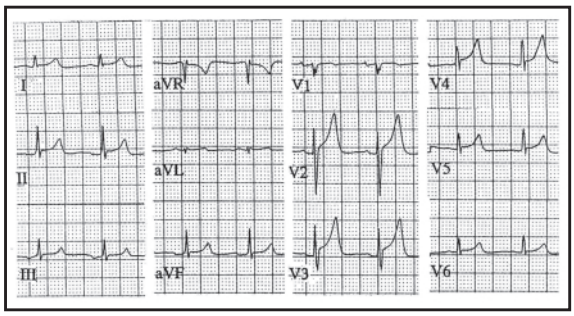

Fig. 1 Resting electrocardiogram showing concave ST-segment elevation in the anteroseptal leads indicative of transmural myocardial injury.

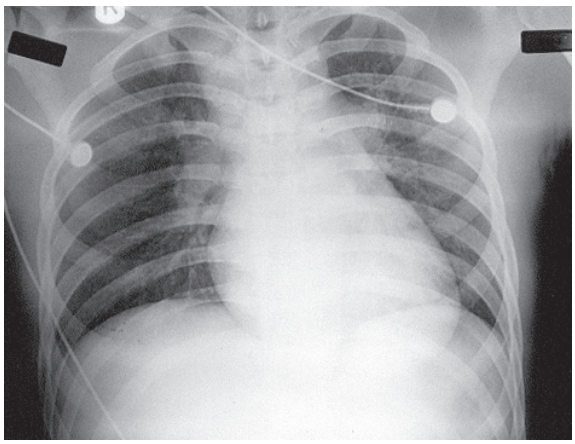

Fig. 2 Chest radiograph shows a widened mediastinum and globular cardiomegaly on presentation.

Intravenous infusion of 0.9% normal saline was commenced and the patient was transferred to the operating theatre immediately. At surgery, the pericardium was noted to be tensed and filled with venous blood. A total of two litres of blood were drained from the pericardial cavity. There was a tear seen at the junction of the right atrium with the superior venous cava. Repair of the right-sided injury was effected with direct suture. Arterial blood was seen to be welling up from behind the heart. The left atrium was also ruptured and the right superior pulmonary vein torn. Repair had to be performed under cardiopulmonary bypass. The

Cardiac Department
National University Hospital
5 Lower Kent Ridge Road
Singapore 119074

K K Poh, MMBChir (Camb), MMed (Int Med), MRCP (UK)
Registrar

H C Tan, MMed (Int Med), MRCP (UK), FACC
Consultant

B L Chia, MBBS, FRACP, FACC
Senior Consultant

Y T Lim, MMed (Int Med), FRCP, FACC
Associate Professor of Medicine, Chief

Correspondence to:
Dr Poh Kian Keong
Tel: (65) 6772 5260
Fax: (65) 6872 2998
Email: pohkk@singnet.com.sg

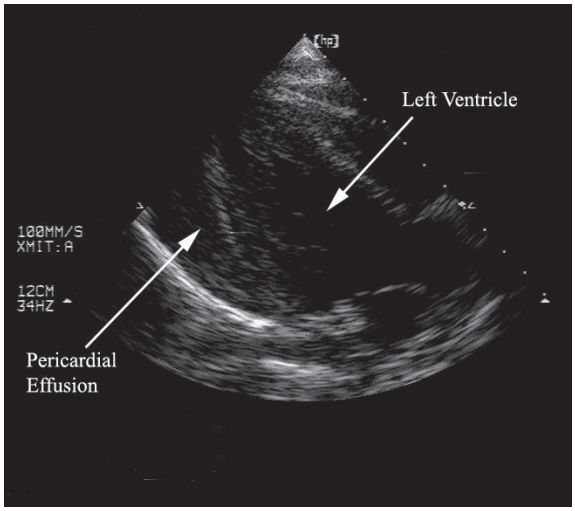

Fig. 3a Bedside echocardiogram shows a large pericardial effusion.

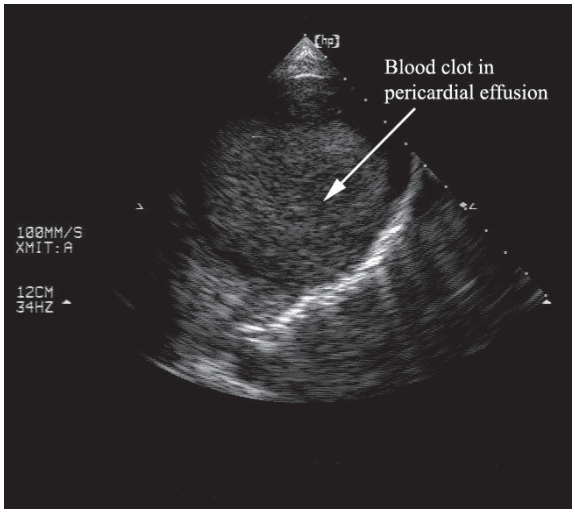

Fig. 3b Bedside echocardiogram shows a blood clot in the pericardial effusion.

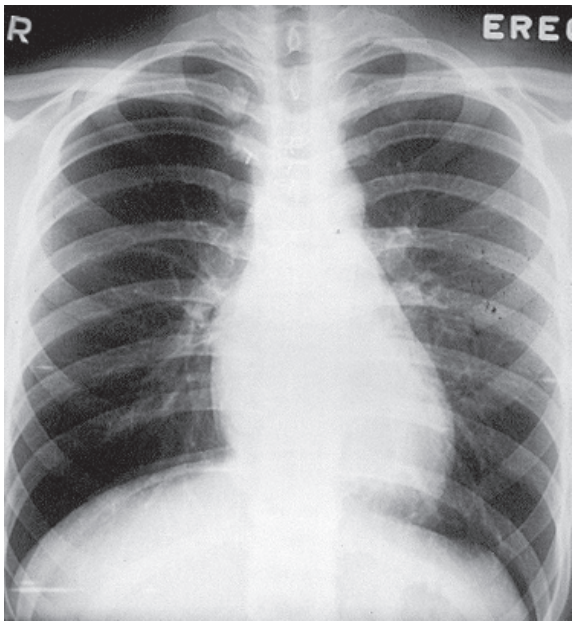

Fig. 4 Chest radiograph post-surgical repair shows a normal heart size.

procedure lasted for four hours and required intra-operative transfusion of six units of blood products in addition to another 6.5 litres of colloids and crystalloids. A re-exploratory surgery was also later carried out for profuse bloody drainage from the chest tube. No significant bleeding source was found apart from general ooze secondary to coagulopathy. The patient was stabilised and extubated the following day. The rest of his post-operative convalescence was uneventful and he was discharged 10 days later (Fig. 4 Post-surgery chest radiograph).

DISCUSSION

The actual incidence of cardiac injury following blunt chest trauma is not well documented. It most commonly follows road traffic accidents, followed by direct blows to the chest, falls from heights, sporting and industrial injuries. The commonest form of cardiac injury is myocardial contusion, which occurs in up to 27% of patients suffering from blunt chest trauma[1]. Myocardial contusion is often times minor with no significant sequelae. However, the most serious consequence of cardiac injury is myocardial or wall rupture. The sites of traumatic rupture in order of frequency, as noted in a large autopsy series, are: right ventricle, left ventricle, right atrium, interventricular septum, left atrium and interatrial septum[2]. Cardiac tamponade commonly results from rupture occurring at the junction of right atrium and venae cavae where the heart is relatively fixed within the thorax. Injuries to the pericardium, coronary arteries, valves and aorta have also been documented in the literature[3].

Clinical examination is unreliable, as the absence of signs of direct trauma to the chest wall does not exclude significant internal injury. However, a heightened index of suspicion must be maintained in the appropriate clinical settings. One should constantly be on the lookout for signs of cardiac tamponade such as elevation of venous pressure and the Beck's triad of systemic arterial hypotension, pulsus paradoxus and impalpable cardiac pulsations. Notably, these signs may be absent even in patients with echocardiographic evidence of cardiac tamponade[4]. It may also be mimicked by other clinical conditions such as right ventricular contusion[5].

In our patient, the diagnosis was made on careful and quick clinical examination despite patient's main complaint of severe back pain. His resting 12-lead electrocardiogram (ECG) showed ST-segment elevation, which was indicative of transmural myocardial injury. The chest radiograph showed enlargement of the right cardiac shadow, which in retrospect was from collection of blood at the site of the torn superior vena cava.

Common non-invasive tests such as chest radiograph and electrocardiogram are not specific for cardiac trauma. The 12-lead ECG changes are poorly diagnostic of pericardial effusion and cardiac tamponade[6]. There may be low ECG voltages and electrical alternans which suggest cardiac tamponade. Non-specific ST-T waves abnormalities, ECG changes of acute pericarditis and Q waves may also be present in the setting of blunt cardiac trauma. The cardiac markers are also not specific as they merely indicate cardiac necrosis but not the mechanism of injury. False positive elevation of biochemical markers such as creatine kinase may occur with severe skeletal muscle injury.

Transthoracic echocardiography is paramount in the accurate diagnosis of cardiac tamponade, which was the case here. The presence of echo-free space surrounding the heart between the parietal and visceral pericardium confirms echocardiographic pericardial effusion. Diastolic collapse of the right ventricle (RV) signifies that the pericardial pressure exceeds intracavitory diastolic RV pressure. Late diastolic right atrial collapse can also be seen and is highly sensitive for tamponade. During cardiac tamponade, tricuspid and pulmonary flow velocities measured by Doppler echocardiography increase markedly with inspiration whereas mitral and aortic valve flow velocities decrease significantly. There are also changes in the pattern of venous flow and exaggerated respiratory variations of the venous flow velocities. When the pericardial effusion is massive, the heart swings freely within the pericardial sac and acquires a pendular, rotary motion. However, it may be difficult to obtain good imaging pictures in 13-28% of blunt chest trauma cases[7]. In addition, concomitant aortic injuries are difficult to assess with the transthoracic technique. Transoesophageal echocardiography may be an alternative technique of choice and offers safe, rapid and high quality images of the heart and aorta in the majority of trauma patients[1,8]. Other diagnostic tools such as magnetic resonance imaging (MRI) and spiral computed tomographic scan may be employed but their access may be limited and time-consuming.

The treatment of choice for cardiac trauma with tamponade is exploratory surgery with a view to repair the torn vessels and chambers. Pericardiocentesis is not advisable as it may remove the "tamponade" effect of the collected blood on the traumatised cardiac chambers causing circulatory collapse. Definitive treatment involves surgical exposure through a thoracotomy or median sternotomy with relief of tamponade and correction of aberrant physiology. Left anterolateral thoracotomy allows access to the pericardium and heart and exposure for aortic cross-clamping if necessary. On the other hand, median sternotomy approach allows excellent exposure to the anterior structures of the heart. The choice of approach depends on suspected chambers involved. Various techniques employed to control bleeding include the use of digital pressure, Foley balloon catheter or skin stapler. Ultimately, surgical repair should only be performed by experienced operators.

CONCLUSION

There is a high mortality risk associated with cardiac trauma and resultant tamponade. A high index of suspicion for myocardial or aortic injury should be constantly applied and early diagnosis is key to patient's survival. Clinical diagnosis should be supported by transthoracic or transoesophageal echocardiography, and surgical repair effected soonest possible.

REFERENCES

1. Weiss RL, Brier JA, O Connor W, Ross S, Brathwaite CM. The usefulness of transesophageal echocardiography in diagnosing cardiac contusions. Chest 1996; 109:73-7.
2. Pamley LF, Manion WC, Mattingly TW. Nonpenetrating traumatic injury of the heart. Circulation 1958; 18:371-96.
3. Banning AP, Pillai R. Non-penetrating cardiac and aortic trauma. Heart 1997; 78:226-9.
4. Fowler NO. Cardiac Tamponade: A clinical or an echocardiographic diagnosis? Circulation 1993; 87:1738-41.
5. Goldberg SP, Karalis DG, Ross Jr JJ. Severe right ventricular contusion mimicking cardiac tamponade: the value of transoesophageal echocardiography in blunt chest trauma. Ann Emerg Med 1999; 22:745-7.
6. Eisenberg MJ, Romeral ML, Heidenreich PA, Schiller NB, Evans Jr GT. The diagnosis of pericardial effusion and cardiac tamponade by 12-lead ECG - a technology assessment. Chest 1996; 110:318-24.
7. Karalis DG, Victor MF, Davis GA, McAllister MPJ, Covalesky VA, Ross Jr JJ, et al. The role of echocardiography in blunt chest trauma: A transthoracic and transoesophageal echocardiographic study. J Trauma 1994; 36:53-8.
8. Chirillo F, Totis O, Cavarzerani A, Bruni A, Farnia A, Sarpellon M, et al. Usefulness of transthoracic and transoesophageal echocardiography in recognition and management of cardiovascular injuries after blunt chest trauma. Heart 1996; 75:301-6.