

Blunt traumatic rupture of the pericardium with cardiac herniation

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ABSTRACT

Traumatic rupture of the pericardium with cardiac herniation is rare. Clinicians are often unfamiliar with the clinical and radiological manifestations of the injury, and the diagnosis is frequently missed preoperatively. This case report describes a patient with multiple trauma following a fall from a height, who developed this injury. The diagnosis was not made preoperatively despite suggestive clinical, electrocardiographic and radiological findings. Clinicians need to be aware of the presentation of this potentially fatal injury so that the diagnosis can be made and treatment instituted at an earlier stage. Pericardial rupture with cardiac herniation presents as cardiogenic shock, mimicking cardiac tamponade.

Key words: trauma, herniation, pericardium, cardiac, pericardial rupture

RÉSUMÉ

La rupture traumatique du péricarde avec hernie cardiaque est rare. Les cliniciens méconnaissent souvent les manifestations cliniques et radiologiques de cette affection, et par conséquent il arrive fréquemment que le diagnostic approprié ne soit pas établi avant une intervention chirurgicale. Ce rapport de cas décrit un patient présentant de multiples traumatismes à la suite de chute d'une hauteur, chez qui cette rupture est survenue. Le diagnostic n'a pas été fait avant l'intervention chirurgicale, malgré les indications cliniques, électrocardiographiques et radiologiques de cet état. Les cliniciens doivent connaître la présentation de ce traumatisme qui peut être mortel afin de pouvoir en faire le diagnostic et d'instituer le traitement au plus tôt. La rupture péricardique avec hernie cardiaque se présente comme un choc cardiogénique et simule la tamponnade cardiaque.

Introduction

Blunt traumatic rupture of the pericardium is uncommon, with an estimated incidence of 0.4%–2% in blunt trauma.^{1–3} Cardiac herniation through the pericardial defect is the main complication, with a mortality rate of 67%–75%.^{2,4,5}

Pericardial rupture occurs in high velocity deceleration

injuries, most commonly motor vehicle accidents and less commonly after falls from a height.^{1,4,5} It is usually not an isolated injury and is difficult to diagnose in the acute multiple trauma setting.^{1,3,6,7} Rupture usually occurs in the left pleuropericardium but can also occur in the diaphragmatic portion of the pericardium, the right pleuropericardium or the superior mediastinal pericardium.^{1,8}

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Pericardial rupture without cardiac herniation is usually not diagnosed initially and is found incidentally either in the course of surgery for associated injuries or at a later date.^{1,6} Cardiac herniation through the pericardial defect may occur at any time after the initial injury and has been reported to occur up to 5 years post injury.⁴ If cardiac herniation occurs, a previously stable patient may develop sudden cardiogenic shock with signs and symptoms mimicking cardiac tamponade.⁸ Timely diagnosis can avert disaster because surgical management is relatively simple and effective.

Case report

A 38-year-old woman suffering major depression with psychotic features absconded from the psychiatry ward and was later found outside the hospital grounds, having jumped from a 9-metre-high balcony. The patient was found approximately 2 hours after she jumped and was brought immediately to the emergency department (ED). She was tachypneic, with a respiratory rate of 24 breaths/min; she had a systolic blood pressure of 80 mm Hg, a heart rate of 115 beats/min, and a Glasgow Coma Scale score of 14. She was complaining of chest and back pain. She was managed by a trauma team (ED consultant, trauma surgeon, trauma fellow, ED trainee, RMO [resident medical officer] and 2 registered

nurses) in accordance with Advanced Trauma Life Support (ATLS) principles.

On cardiac auscultation an unusual crunching and splashing murmur was noted in both systole and diastole. At the time this was thought to be Hamman's sign, a crunching noise that is associated with each heart beat in patients with pneumomediastinum.⁹ In retrospect, it was a "bruit de moulin," which is described as the splashing or waterwheel murmur of hemopneumopericardium and is created by the heart beating in a pericardium filled with both air and blood.^{1,4,6}

The patient's blood pressure normalized with 2 litres of crystalloid and 4 units of packed red blood cells. Initial supine chest x-ray revealed a mid-thoracic spine fracture, a left-sided hemopneumothorax and subtle pneumopericardium and pneumomediastinum (Fig. 1).

A left chest tube was inserted and chest x-ray was repeated (Fig. 2). This showed an enlarged cardiac shadow shifted to the left with an unusual contour, prominence at the site of the pulmonary artery, a prominent pneumopericardium and pneumomediastinum and a left-sided pleural effusion. These findings are consistent with cardiac herniation through a pericardial defect, although the diagnosis was not made at this point.



Fig. 1. Initial supine chest x-ray revealed a mid-thoracic spine fracture, a left-sided hemopneumothorax and subtle pneumopericardium and pneumomediastinum



Fig. 2. Results of 2nd chest x-ray, taken after a left chest tube was inserted. This showed an enlarged cardiac shadow shifted to the left with an unusual contour, prominence at the site of the pulmonary artery, a prominent pneumopericardium and pneumomediastinum and a left-sided pleural effusion.

An electrocardiogram (ECG) at this time showed changes consistent with inferior myocardial ischaemia. ST-segment elevation of 1 mm was present in leads II, III and aVF, and <1 mm ST depression was present in leads V2 and V3. This was attributed to blunt myocardial injury. Focussed abdominal sonography in trauma (FAST scan) was performed in the resuscitation room. The presence of pericardial and mediastinal air significantly degraded the cardiac and pericardial views, but the scan excluded free intraperitoneal fluid. Orthopedic injuries included an unstable 7th thoracic vertebral burst fracture without cord injury, an open proximal left humerus fracture, a left olecranon fracture, left sacral and superior and inferior pubic rami fractures.

After initial assessment and stabilization she underwent abdominal and thoracic CT scanning. Thoracic CT scan confirmed pneumopericardium, pneumomediastinum and mediastinal shift to the left, as well as posterior mediastinal hematoma, bilateral hemothoraces and pulmonary contusions. There was no evidence of thoracic aortic injury. Cardiac herniation through a pericardial defect was not considered. Abdominal CT scan showed a liver laceration.

The patient was then transferred to the intensive care unit (ICU). There it was noted that her apex beat was very prominent and displaced to the left. Formal transthoracic echocardiogram (TTE) and then transesophageal echocardiogram (TEE) were performed. The TTE revealed intrapericardial clot. The TEE showed moderately impaired right ventricular systolic function consistent with myocardial contusion. Neither revealed the pericardial rupture with cardiac herniation. On day 3 of admission the ECG showed generalized T-wave inversion. Her troponin I peaked at 9.20 µg/L (normal value <0.1 µg/L). The patient remained hemodynamically stable throughout her ICU admission.

On day 3 the patient went to the operating room for a T7 subtotal vertebrectomy and reconstruction with decompression of the spinal canal. The approach was through a left thoracotomy. In view of the intrapericardial clot and probable cardiac injuries this was undertaken by the cardiothoracic surgeons in conjunction with spinal surgeons. At operation a left pericardial rupture with cardiac herniation was evident. The laceration was longitudinal and anterior to the phrenic nerve. The heart was reduced, and the rent in the pericardium repaired with a synthetic graft (Gore-tex®). From a cardiac point of view the patient had an unremarkable postoperative recovery. She was transferred to the hospital's spinal rehabilitation unit on day 17 and went home on day 47.

Discussion

Although cardiac herniation through a pericardial defect is an unusual occurrence it should be suspected in certain circumstances. High velocity deceleration injuries, particularly motor vehicle accidents or falls from a height, are characteristic. There are usually associated thoracic injuries.¹

Herniation of the heart through a pericardial tear may be delayed.⁴ Changing the patient's position — for example, rolling them on to their side for a rectal examination or sitting them up — may cause the heart to herniate through the pericardial defect. If the fit is tight, with the pericardial defect being 8–12 cm, the patient may develop signs consistent with cardiac tamponade, particularly hypotension and raised jugular venous pressure.^{1,4–6} If the defect is larger, the patient may not show clinical deterioration. A prominent and displaced apex beat resulting from direct contact of the heart with the chest wall is a feature. Occasionally a splashing murmur known as a “bruit de moulin” can be heard.⁶

ECG changes may show axis deviation associated with luxation and rotation of the heart. The ECG often reveals ischemic features because coronary arteries can be compressed by the constricting pericardial band.^{1,6,7} Radiological manifestations of pericardial rupture without cardiac herniation are subtle and non-specific, with the combination of a hemopneumothorax and a pneumopericardium being suggestive of pericardial injury.^{1,5} If the heart herniates through the pericardial defect results of the chest x-ray are usually abnormal. Findings include an enlarged cardiac shadow shifted to the side of herniation, a notched cardiac silhouette caused by a constricting band around the heart, prominence of the pulmonary artery, pneumopericardium and a left-sided pleural effusion.^{1,5,7}

Diagnosis has also been described using CT scan, transthoracic and transesophageal echocardiography although no imaging technique is entirely reliable. An empty pericardium, a pericardial defect, cardiac shift and pneumopericardium are all consistent with the diagnosis.^{1,3,6,10} No single radiological investigation described is entirely reliable; however, the literature supports the view that a chest x-ray is the single best screening test when pericardial rupture with cardiac herniation is suspected.⁵ Video-assisted thoracoscopic surgery and creation of a surgical pericardial window are invasive diagnostic tools that have been used very successfully.^{5,7} Once the condition is diagnosed, management is straightforward. Treatment is surgical. Options include primary repair of the pericardial defect, repair using a synthetic graft or complete pericardiectomy.

Conclusion

Although rare, pericardial rupture and cardiac herniation is one of the readily treatable causes of cardiogenic shock in blunt trauma.^{3,4,8} For this reason clinicians need to be familiar with its characteristic presentation and maintain a high index of suspicion for this injury.

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