CASE REPORT

Tension pneumopericardium: A rare complication in penetrating chest trauma
A case report and review of the literature

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Accepted 30 January 2005

Introduction

A pneumopericardium is defined as air within the pericardial sac, and in trauma, this radiological sign is an indicator of a potential cardiac injury. A tension pneumopericardium (TPP) causing cardiac tamponade is an extremely rare condition seen in penetrating trauma. There is a reported mortality rate of 56%, thus rapid diagnosis of TPP and definitive surgical treatment is required.1

Case report

A 23-year-old man was assaulted and sustained multiple stab wounds to the neck, left flank, praecordium, and epigastrium. He presented with an acute abdomen and a right-sided haemothorax to a secondary level hospital. An intercostal drain was inserted and a laparotomy was performed revealing an injury to the transverse mesocolon. A subxyphoid pericardial window was performed which was negative for blood. On the fourth day post-operatively he developed respiratory distress and was transferred to the Trauma Unit at Groote Schuur Hospital.

On arrival he was fully conscious and alert, but very distressed and unable to lie supine comfortably. His vital signs were a pulse rate of 125 beats per minute, blood pressure of 133/50 mmHg, respiratory rate of 40 breaths per minute on 40% facemask oxygen, haemoglobin of 12 g/dL and a temperature of 38.3 °C. On examination he had distended neck veins, muffled heart sounds and a palpable pulsus paradoxus. The central venous pressure measured 22 cm of water. An electrocardiogram showed normal size QRS complexes with no ST segment elevation. His chest radiograph showed a large pneumopericardium (Fig. 1).

A diagnosis of tension pneumopericardium was made and he was taken to theatre for an emergency subxyphoid pericardial window and a re-look laparotomy. On incision of the pericardial sac, a high-pressure gush of air was expelled and his haemodynamic parameters normalised instantaneously. A pericardial drain was placed. The laparotomy revealed a previously undiagnosed left diaphragmatic wound communicating with the pericardium, which was repaired. He made an uneventful rapid post-operative recovery. He was discharged on day 6 and was well at his 2 week post-operative follow-up.
Discussion

Tension pneumopericardium has been described after blunt and penetrating trauma, in relation to fistulous tracts between the pericardium and adjacent infected or malignant organs, following invasive procedures (laparoscopy and endoscopy), with pyopneumopericardium, in relation to severe asthma and also in patients on intermittent positive pressure ventilation (IPPV). The IPPV-related cases are mostly premature neonates with severe respiratory distress syndrome but some adult cases have occurred during IPPV after high velocity traumatic injuries such as road traffic accidents. Of the 602 cases of pneumopericardium described in the literature, only 64 were a tension pneumopericardium and only 13 related to penetrating trauma.

The following theories have been proposed to explain the development of a TPP after trauma:

(i) A flap-valve effect with a tear in the pericardium.
(ii) A traumatic tracheopericardial fistula.
(iii) A knife tract through lung, mediastinum and pericardium in the presence of pleural adhesions.
(iv) Traumatic rupture of alveoli allows air to track through the mediastinal tissues and, as the intra-mediastinal pressure increases, air is forced into the pericardial sac through a traumatic tear.
(v) With IPPV, the high-pressure air leaks through a weakened area of the mediastinal wall, which is either traumatic or congenital.

Air in the pericardial sac was not recognised as a cause of tamponade until 1939. In contrast to blood, due to the distensibility of air, a much greater volume is required before it will lead to clinical symptoms. Adcock et al. studied the pneumopericardium in a patient with tuberculous polyserositis and noted that haemodynamic changes only began to be apparent when the intrapericardial pressures reached 145 mm of water (approximately 60 ml of air) and only when pressures reached 265 mm of water did signs of tamponade appear.

The classical signs of tamponade can be seen with tension pneumopericardium such as a raised jugular venous pressure (distended neck veins), hypotension, tachycardia, and tachypnoea. On examination a pulsus paradoxus, weakened peripheral pulses, muffled heart sounds and the classically described Mill Wheel murmur (Bruit de Moulin), which is caused by turbulent flow of air and fluid in the pericardial sac, may be present. In addition, Knottenbelt et al. described a case of TPP with a loud (5/6) pan-systolic murmur although there was no myocardial injury and the murmur resolved once the...
pericardium had been decompressed. In the presence of tamponade, the electrocardiogram often shows a diffuse low voltage picture. Finally, the dramatic pneumopericardium on the chest radiograph is the crux of the diagnosis, however the “small heart sign” in which the cardiothoracic ratio decreases as the heart is compressed and the “flattened heart” on computed tomography have also been described.

Cummings et al. are the only group to have studied mortality and a large proportion of their subjects were premature neonates on IPPV. However, in their TPP group the mortality rate was 56%, of whom 72% died as a direct result of the air tamponade and circulatory collapse.

The definitive treatment is via a subxyphoid pericardial window into the pericardium allowing the communicating tract to be visualised and repaired. Pericardiocentesis is not advocated. The outcome is good if prompt treatment is instigated.

References