CASE REPORT

Fatal blunt cardiac injury: are there any subtle indicators?

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SUMMARY

A 29-year-old man had a head-on collision with an oncoming truck while riding a bike. He sustained a fracture of the left first rib, fracture of the left talar neck with ankle dislocation and fracture dislocation of the right wrist. The patient was haemodynamically stable and underwent an emergency open reduction and internal fixation of the fractured talar neck to prevent further vascular compromise of the lower limb. Postoperatively, the patient deteriorated haemodynamically with persistent tachycardia and respiratory distress and died after 3 days despite ventilator support. The postmortem examination revealed a contused heart with dissection of the coronary arteries. Our case demonstrates that a first rib fracture may be associated with severe thoracic and cardiac injuries which may be masked by less severe but more obvious skeletal injuries.

BACKGROUND

Blunt cardiac injury may present with subtle signs in a patient with polytrauma. There are no specific diagnostic guidelines for the condition.

CASE PRESENTATION

A 29-year-old man had a head-on collision with an oncoming truck while riding a bike. He sustained trauma to the head, face, chest, left ankle and right wrist. He presented to us 10 h post-trauma, after being initially treated at another hospital. On presentation, he was conscious, oriented with a Glasgow Coma Scale (GCS) of 15/15. His pulse rate was 132 bpm, blood pressure 110/70 mm Hg and respiratory rate 22/min. He was afebrile and maintained oxygen saturation (SpO₂) on room air.

The secondary survey performed after the primary survey revealed a swelling and deformity of the left ankle with an absent posterior tibial pulse. He also had a swelling and deformity of the right wrist with no neurovascular compromise. There was periorbital ecchymosis on the right side with a restricted mouth opening.

INVESTIGATIONS

A CT scan of the brain and face did not show any intracranial abnormalities. However, there were fractures of the right zygomatic arch, maxillary antrum, lateral orbital wall and the mandible. The chest X-ray posteroanterior (PA) view showed an isolated fracture of the left first rib with no evidence of pneumothorax ([figure 1](#)). Radiographs of the left ankle showed a Hawkins' type 3 talar

fracture dislocation with extrusion of the talar head out of the ankle mortise ([figure 2](#)). Radiographs of the right wrist showed volar Barton's type fracture of the distal radius. Blood investigations showed a haemoglobin percentage of 12.3 g/dL and the total white cell count count was 16 540/mm³ with 87% neutrophils. The blood sugar, renal function tests, liver function tests, clotting profile and serum electrolytes were within normal limits. ECG was within normal limits except for sinus tachycardia.

TREATMENT

The patient was planned for an emergency open reduction and internal fixation of the fracture dislocation of the talus as there was impending vascular compromise of the lower limb. Immediately before the surgery, the pulse rate was 130/min and the patient was haemodynamically stable. The surgery was performed in a supine position, under spinal anaesthesia and without a tourniquet. The duration of surgery was 2 h and the estimated blood loss was about 300 mL. Towards the end of surgery, the patient developed acute respiratory distress and was shifted to the intensive care unit (ICU). At this point, the pulse rate was 160 bpm, blood pressure was 110/70 mm Hg, respiratory rate was 40/min and oxygen saturation was 60%. Clinically, the air entry was equal on both sides, but there were basal crepitations on both sides.

Figure 1 Posteroanterior chest radiograph taken at the time of presentation showing fracture of the left first rib with no pneumothorax.

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Figure 2 Anteroposterior and lateral radiographs of the left ankle showing a Hawkins type 3 talar neck fracture with a medial malleolus fracture.

Arterial blood gas analysis revealed pH 7.3, pO_2 45.4 mm Hg, pCO_2 27 mm Hg, HCO_3^- 15.9 mmol/L and base excess of -10.6 mmol/L. At this stage, the differential diagnoses of the pneumothorax, aspiration pneumonia and pulmonary embolism were considered. A chest X-ray was obtained and it showed signs of pulmonary oedema (figure 3A). Complete blood counts, a renal function test and a bleeding profile were performed and were within normal limits.

Despite positive pressure ventilation (PPV), the oxygen saturation failed to improve beyond 80%, and hence the patient was intubated and put on mechanical ventilator (SIMV mode). The oxygen saturation improved to 90% after a few hours, but tachycardia was persistent despite the patient being haemodynamically stable and maintaining good urine output. In view of persistent tachycardia, a cardiac cause for the respiratory distress was considered. ECG showed ST depression and T wave inversion in V3–V6 leads (figure 4). A transthoracic two-dimensional echocardiogram was performed. Regional wall motion abnormalities (RWMA) were noted in the basal, midseptum and inferoposterolateral walls with an ejection fraction of 40%. The heart, including the great vessels, was structurally normal. The levels of cardiac enzymes (CK-MB and troponin I) were markedly elevated. The patient was anticoagulated with an intravenous infusion of unfractionated Heparin 5000 i.u. 12th hourly and metoprolol 25 mg was given intravenously 12th hourly to control the heart rate. Ventilator support was continued for two more days, but the patient did not show any further improvement and the tachycardia was persistent. On the third postoperative day, the patient developed sudden cardiac arrest from which he could not be revived.

The postmortem examination showed a contusion at the root of the right atrioventricular sulcus and root of the great vessels, interatrial septum and left atrium (figure 5A,B). Dissection was noted in the aorta just above the coronary sinus and also in the left coronary artery. The left ventricular wall showed an infarct with an adherent clot over the anterior wall of the left ventricle.

DISCUSSION

Non-penetrating trauma to the heart or blunt cardiac injury is a well-established pathological entity which is difficult to diagnose, as there are no telltale clinical signs for its identification.^{1,2} Frequently, the symptoms are non-specific and there are no specific tests to detect myocardial contusion.¹ Furthermore, the cardiac injury can be easily masked by other more obvious injuries which may be less serious. The spectrum of the condition varies from no symptoms to varying degrees of decrease in cardiac function.³ The reported incidence of the condition in the literature varies from 8% to 71% due to the variability of the diagnostic criteria used in the studies.⁴

Blunt myocardial contusion usually occurs due to high-velocity road traffic accidents involving rapid deceleration or due to the direct impact of the steering wheel on the chest.¹ Other mechanisms include sports injuries, blast injuries or fall from a great height.^{1,3,5} Although cardiac contusion is said to have good prognosis, the condition can be associated with pump failure, dysrhythmias, valvular rupture and coronary artery dissection commonly involving the left descending coronary artery.^{4,6} The cause of death in our patient was acute myocardial infarction secondary to the dissection of the left descending coronary artery.

Figure 3 (A) Supine anteroposterior chest X-ray, taken immediately after surgery, showing signs of pulmonary oedema. (B) Supine anteroposterior chest X-ray, taken on the first postoperative day, showing minimal bilateral spread out pleural effusion. (C) Supine anteroposterior chest radiograph, taken on the second postoperative day, showing mild cardiomegaly of left ventricle (LV) configuration with pulmonary oedema.

Figure 4 ECG, taken on the second postoperative day, showing ST elevation and T wave inversion in anterior chest leads, suggestive of cardiac ischaemia.

First rib fracture is said to be a harbinger of major trauma as it is a deep-seated structure and is not as easily fractured as other ribs.⁷⁻⁹ Richardson *et al* noted cardiac injuries in eight cases in their series of 55 patients with first rib fractures.⁷ Of these, six patients had blunt cardiac injury. They reported an overall mortality rate of 36.3% with first rib fractures and its sequelae, highlighting the importance of the injury.

Vogler *et al*¹⁰ reported a case of a 28-year-old man presenting with a non-penetrating injury to the chest who went on to develop ventricular tachycardia. The patient was successfully treated with direct cardioversion. They concluded that patients

with blunt cardiac injury with associated injuries need intensive monitoring to look out for life-threatening complications.

Traumatic coronary artery dissection is a rare but serious complication of blunt cardiac injury. Most of the cases involve the left descending coronary artery,¹¹⁻¹³ though there are a few reports of the right coronary artery being involved.¹⁴ Compression of the artery between the sternum and the heart leads to shear forces causing intimal tear. Coronary occlusion and myocardial infarction can result from intraluminal thrombosis or obstruction from the dissection flap.¹³ In our case, the patient may have developed coronary artery dissection immediately after trauma, but it may not

Figure 5 Postmortem specimen of the heart showing contusion at the root of great vessels (A, black arrow) and at the right atrioventricular sulcus (B, yellow circle).

have been so severe as to cause immediate coronary occlusion. Intraluminal thrombosis may have set in after some time, leading to myocardial infarction.

Our case demonstrates that a serious condition like blunt cardiac injury can present innocuously without any telltale clinical signs. Traumatic coronary artery dissection, though rare, is a devastating complication of blunt cardiac injury. Subtle signs like 1st rib fracture and persistent tachycardia should make one suspect serious injury to the heart.

Learning points

- ▶ Blunt cardiac injury can present with subtle signs like persistent tachycardia, first rib fracture and signs of cardiac ischaemia in ECG.
- ▶ Blunt cardiac injury may go undetected in the presence of other less severe but more obvious skeletal injuries.
- ▶ Myocardial contusion is difficult to diagnose as there are no specific diagnostic tests.

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