

Non-penetrating chest blows and sudden death in the young

S Thakore, M Johnston, E Rogena, Z Peng, D Sadler

Abstract

Sudden death in the young after low energy anterior chest wall impact is an under-recognised phenomenon in this country. Review of the literature yields several American references to commotio cordis, mainly in the context of sporting events. Two cases are reported of sudden death in young men as a result of blunt impact anterior chest wall trauma. It is suggested that these cases draw attention to a lethal condition of which many practitioners are unaware.

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Keywords: chest blows; sudden death

Case report 1

The deceased was a 15 year old boy who collapsed to the ground immediately after being struck centrally in the chest with a 500 g stone, thrown from a distance of 8 to 10 feet during a gang fight. Upon collapse he was said to have suffered a fit and was carried bodily a short distance by friends and laid on the ground. There was no basic life support until ambulance paramedics arrived, five minutes after receiving the emergency call.

The cardiac rhythm at the scene was pulseless electrical activity, which degenerated to ventricular fibrillation resistant to electrical cardioversion. Appropriate advanced life support continued and he arrived at the accident and emergency (A&E) department 27 minutes after the emergency call. His pupils were fixed and dilated and he had an agonal rhythm, interrupted by runs of ventricular tachycardia and episodes of ventricular fibrillation. Right needle thoracocentesis was performed because of reduced air entry on auscultation but no air was aspirated. Internal jugular and femoral venous lines were inserted and a crystalloid bolus was infused. Ventricular fibrillation developed, but electrical cardioversion proved unsuccessful. His rhythm degenerated into asystole and resuscitation attempts were stopped.

NECROPSY FINDINGS

There were signs of medical intervention in the form of needle puncture marks in the cubital fossae, right lower neck, right groin and right upper anterior chest, and defibrillator paddle marks on the anterior chest wall. There were minor abrasions to both anterior knees, the fingers of the right hand and the left eyebrow, cheek, and chin. There was no significant externally apparent injury to the anterior chest wall. There was minor bruising over the left pectoralis major muscle. Internal examination revealed moderate bruising of the lingula and patchy subpleural bruising on the posterior

right and left lower lung lobes. There was a 15 mm long and 8 mm deep laceration within the left ventricular myocardium at the apex. There was no natural disease and toxicological analyses were negative. Death was attributed to blunt force chest trauma.

Case report 2

A 19 year old man was playing in goal in a five a side football game when he was struck in the central chest by a leather football, kicked with considerable force from a range of only a few yards. Although initially in obvious discomfort and "winded", he continued to stand in goal for an estimated 5–10 minutes before crying out and collapsing. Bystander cardiopulmonary resuscitation was started promptly by a doctor participating in a neighbouring game. Ambulance paramedics performed advanced life support, including repeated administration of epinephrine and attempts at electrical cardioversion. On arrival in the A&E department approximately 70 minutes after the collapse he was in asystole. Further attempts at resuscitation, including pericardiocentesis and external pacing, were performed but unfortunately failed to achieve return of spontaneous circulation.

NECROPSY FINDINGS

There were signs of medical intervention in the form of electrode pads, endotracheal intubation and a needle puncture mark in the left cubital fossa. Marked upper anterior mediastinal bruising was present in relation to right subclavian cannulation. There was 350 ml of blood within the pericardial sac and a small puncture mark over the lower sternum entering the right ventricular apex, representing the attempt at pericardiocentesis. There was no other myocardial abnormality and no injury to the chest wall. There was no natural disease but toxicological analyses were not performed. Death was attributed to blunt force chest trauma resulting from being struck on the chest by the football.

Discussion

We suggest that the above cases illustrate death attributable to primary arrhythmia occurring after blunt chest trauma. This is often described as commotio cordis, which typically occurs in the absence of structural cardiac damage. Collapse is usually near instantaneous, but there can be a period of activity following impact, usually only of a few seconds duration.^{1–3}

Most previous reports are concentrated in American literature and occur mainly in baseball and ice hockey, where projectile impacts to the precordium are frequent.^{1–3} Such projectiles cause a focused impact of short duration

Accident and
Emergency
Department, Ninewells
Hospital, Dundee,
DD1 9SY, Scotland
S Thakore
M Johnston

Department of
Forensic Medicine,
University of Dundee,
Dundee
E Rogena
Z Peng
D Sadler

Correspondence to:
Mr Johnston

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with virtually no rebound, allowing almost complete transfer of kinetic energy to the chest wall.³ Commotio cordis has not been reported in the game of cricket, Britain's nearest sporting equivalent. Maron *et al*⁴ have described four cases of commotio cordis occurring in relation to criminal activity.

An experimental model for commotio cordis suggests that the impact of projectiles on the chest wall of pigs during the period of cardiac repolarisation, prior to the peak of the T wave, typically induced ventricular fibrillation.⁵ This situation probably corresponds to the typical presentation reported in most fatalities, causing immediate collapse and cardiac arrest. In contrast, impact during the QRS complex is more likely to induce complete heart block, ST segment elevation or left bundle branch block.⁵ Other reported ECG abnormalities include sinoatrial nodal dysfunction, atrial fibrillation, right bundle branch block and ventricular extrasystoles.^{6,7}

In the first case, the sequence of events after impact were typical of commotio cordis. However, it is unusual in that it occurred in a homicidal manner, with an object that is heavier than usual, thrown over a shorter distance and at lower velocity. In this case there was evidence of structural cardiac damage. The apical endocardial laceration may be attributable to the hydraulic ram effect of ventricular compression, causing blood to be forced into the blind-ending apex of the left ventricle. This could have been attributable either to impact by the stone itself or may represent resuscitation artefact.⁸

Our second reported case differed significantly from the usual presentation of commotio cordis in that collapse occurred several minutes after chest impact. Blood was found in the pericardial sac at necropsy suggesting a slowly developing cardiac tamponade may have been

responsible for death. The attempt at pericardiocentesis produced no blood, suggesting that there was no sizeable collection of blood at the time of resuscitation. This reflects the difficulty in determining whether the pericardial haemorrhage resulted from an injury at the time of trauma or by attempts at pericardiocentesis. We considered it possible that chest impact, presumably during the QRS complex, produced one of the above electrical abnormalities that then degenerated into a malignant arrhythmia with cardiac arrest after some minutes.

The severity of impact required to cause death after a blow to the chest is often unremarkable and careful enquiry should be made for a history of chest wall impact after cardiac arrest or sudden death in the young. We further suggest that the classic impression of instantaneous collapse may not be true in every case.

Contributors

Shobhan Thakore, Emily Rogena, Zhang Peng, David Sadler and Michael Johnston collected the clinical data on the two cases and wrote the paper. David Sadler and Michael Johnston act as guarantors of the paper.

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Extracorporeal rewarming in a severely hypothermic patient using venovenous haemofiltration in the accident and emergency department

K Spooner, A Hassani

Abstract

Severe hypothermia is a medical emergency and requires active and occasionally rapid core rewarming to prevent cardiac arrhythmias and death. In the accident and emergency department rewarming is often limited to warmed intravenous fluids, heated blankets, gastric and bladder lavage. Extracorporeal methods, which rewarm core blood directly, for example haemodialysis and cardiopulmonary bypass, require expertise and equipment not always found in a district

general hospital. Venovenous haemofiltration is now commonly found in district general hospitals around the country and can be used safely for core rewarming. A case is reported of a severely hypothermic elderly patient successfully rewarmed using venovenous haemofiltration, in an accident and emergency department, when other conventional methods had failed.

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Anaesthetic
Department,
Broomfield Hospital,
Chelmsford, Essex
CM1 7ET, UK

Correspondence to:
Dr Hassani, Consultant
Anaesthetist

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