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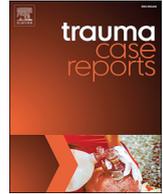
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## Case Report

## Delayed cardiac tamponade following blunt chest trauma due to disruption of fourth costal cartilage with posterior dislocation

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## ABSTRACT

Cardiac tamponade is a recognised sequelae of non-penetrating and penetrating chest trauma. Delayed cardiac tamponade has been described following blunt chest trauma. We present a 29 year-old gentleman who had initially presented to peripheral district general hospital following direct blunt chest wall trauma. His initial trauma CT demonstrated a small mediastinal haematoma and large left haemopneumothorax and disruption/dislocation of the costal cartilage. He initially underwent a thorascopic procedure uneventfully. He then had worsening chest radiograph appearances with enlarging cardiac contours. Transthoracic echocardiography confirmed cardiac tamponade. He underwent creation of a pericardial window and excision of the protruding fourth costal cartilage.

## Introduction

Cardiac tamponade is a recognised sequelae of non-penetrating and penetrating chest trauma. However, blunt chest trauma rarely leads to cardiac tamponade hence the management is often guided by development of symptoms and findings on imaging [1]. There are several case reports which mention the development of cardiac tamponade following minor and more significant chest wall trauma with usual onset of symptoms 4–6 weeks following the injury [1,2]. Cardiac tamponade following blunt chest trauma can be attributable to multiple causes and the diagnosis is confirmed from the fluid that is aspirated/drained. Serous fluid often indicative of a reactive process from resultant myocarditis/pericarditis or as a post-cardiac injury syndrome. Haemorrhagic fluid is indicative of direct cardiac injury. The mechanism in the development of haemorrhagic cardiac tamponade following blunt chest wall trauma can be related to a shear-stress acceleration/deceleration injury resulting in an avulsion/traction type injury to the heart. Furthermore, cardiac tamponade can occur as a late sequelae of myocardial contusion and through the laceration of the right ventricle [3]. The clinical presentation of these patients can have a wide degree of variance from initially patients who have distracting injuries as part of their poly-trauma or patients who are initially asymptomatic due to no pericardial collection but developing progressive dyspnoea and symptoms of heart failure as the pericardial tamponade evolves. Transthoracic echocardiography confirms the diagnosis following initial identification of a pericardial collection on computer tomography or magnetic resonance imaging. We describe an unusual case of delayed cardiac tamponade following blunt chest wall trauma due to the mechanism of right ventricular injury secondary to left costal cartilage disruption causing three weeks after the index injury.

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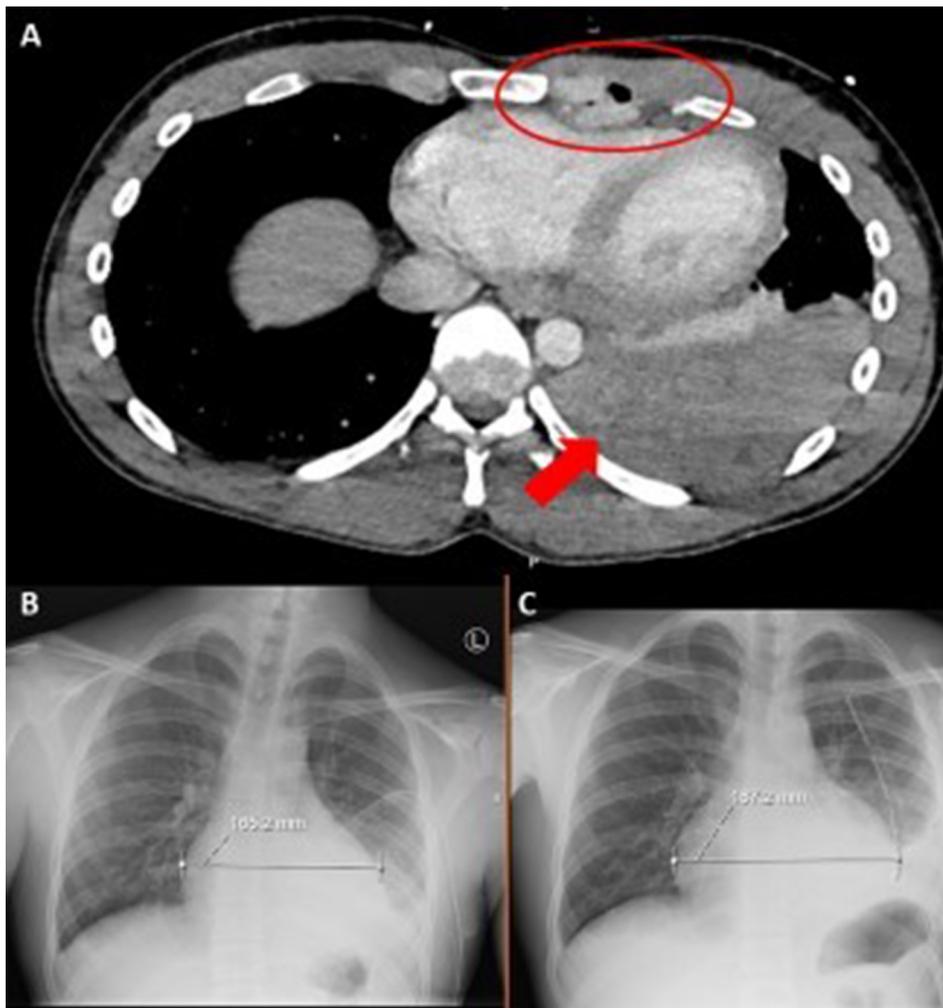
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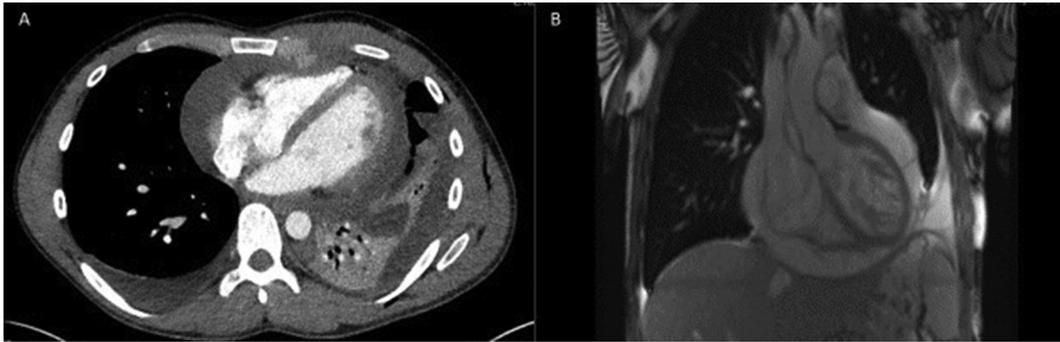


**Fig. 1.** Panel A - CT scan demonstrating, a. large left haemothorax (arrow), and b. left fourth rib fracture and disruption/dislocation of the costal cartilage medially (circled). Panels B and C - chest radiographs taken one week apart showing sizable increase in cardiac contours; A. on admission, B. one week post admission.

### Case discussion

We present a 29 year-old gentleman who had initially presented to peripheral district general hospital following direct blunt chest wall trauma. He had fallen 9 ft off a zip wire and landed onto his left chest against a tree stump. He had no significant co-morbidities. On primary survey and trauma imaging he was noted to have a large left haemothorax but was haemodynamically stable. His initial trauma CT demonstrated a small mediastinal haematoma, large left haemo-pneumothorax, left fourth rib fracture and disruption/dislocation of the costal cartilage medially; there was no contrast extravasation or apparent injury to the left internal thoracic artery (LITA) despite its close proximity (see Fig. 1a and Fig. 1b). There was no great vessel injury, pericardial collection or sternal fracture identified on initial imaging. He had a left intercostal drain placed and this drained two litres of dark haemorrhagic fluid consistent with a massive left haemothorax. He required blood transfusion of five units of packed red cells to increase his haemoglobin level to 134 g/l and four units of fresh frozen plasma. Following stabilisation the patient was transferred to our institution for further definitive care. He underwent a left-sided video-assisted thoracoscopic procedure with drainage of the haemothorax and washout of the left hemithorax. Operative findings were that of 500mls of clot in the left costophrenic angle but no bleeding point or evidence of pericardial collection or lung injury identified and the LITA seemed intact. Moreover the fourth costal cartilage disruption was not immediately evident and there was no obvious retropulsion of the segment seen.

Following the initial procedure the patient remained in hospital for a few days and seemed relatively well. However, over the course of the next week the patient seemed to become progressively dyspnoeic with worsening chest radiograph appearances with enlarging cardiac contours (see Fig. 2). He underwent subsequent CT imaging which confirmed the presence of a large pericardial effusion maximally measuring 3.8 cm and small bilateral effusions (see Fig. 3). Subsequently an MRI scan was performed to assess for any underlying cardiac disease such as cardiomyopathy or any evidence of traumatic cardiac injury such as myocardial contusion



**Fig. 2.** Panel A - Repeat CT imaging which confirmed the presence of an enlarging pericardial effusion and bilateral pleural effusions. Panel B - MRI scan demonstrating the pericardial effusion.

which was also excluded, but again confirmed the presence of a large pericardial effusion measuring 3.4 cm causing septal bounce and rippling of the right atrial and right ventricular wall which could be suggestive of early tamponade (see fig. 4). Transthoracic echocardiography confirmed a moderate pericardial effusion maximally measuring 2.4 cm around the LV causing diastolic septal bounce and bowing of the free right ventricular wall. Due to the findings mentioned above he was taken back to theatre for drainage of the pericardial collection and creation of a pericardial window through a minimally invasive left subcostal incision. Operative findings confirmed cardiac tamponade with a starting central venous pressure of 16 falling to 9 upon release of the collection of old haemorrhagic fluid and clot and there were dense adhesions which were carefully dissected off the pericardium and loculations broken down. The fourth costal cartilage had been displaced posteriorly and likely to have caused pericardial irritation and myocardial contusion. This costal cartilage was shaved off and excised to prevent further injury. He progressed satisfactorily post-operatively and was discharged a week later following a normal transthoracic echocardiography scan.

## Discussion

Cardiac tamponade is a life-threatening sequelae of thoracic trauma. Its occurrence following blunt chest trauma has been well-described previously and even as a delayed presentation presenting a few weeks later following the initial injury [3,4]. This case exemplifies the high index of suspicion required for associated cardiac injuries in apparent chest wall trauma with particular attention to injuries that cause medial disruption of the costal cartilage with likelihood of posterior displacement. Consequentially, pericardial and right ventricular injury can occur leading to delayed cardiac tamponade as this has occurred following the index injury and initial presentation. Prompt recognition and treatment mandates a successful prognosis with no long-term complications. Treatment can be multi-modal with interventional and invasive surgical options available but therapy should achieve resolution of cardiac tamponade and address the cause and in this case the fourth costal cartilage from which the injury was attributable was duly excised. In summary, delayed cardiac tamponade can occur as a consequence from blunt chest wall trauma and needs a high index of suspicion for early recognition of delayed cardiac injury.

## Contributions

SM, AJP: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Validation; Visualization; Roles/Writing - original draft; Writing - review & editing.

SM, AJP designed and constructed the manuscript.

AO, KM: Data curation; Formal analysis; Investigation; Methodology.

LS and LB supervised the project and provided constructive critique to the manuscript.

## Declaration of competing interest

None to declare.

## Acknowledgements

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