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Case Report

Delayed subclavian artery rupture secondary to a traumatic first rib fracture

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Introduction

Traumatic first rib fractures are an indicator of severe trauma and are associated with significant morbidity and mortality. In particular, first rib fractures are associated with laceration of the subclavian vessels usually at the time of initial injury. We present the first successful surgical repair in the literature of a delayed subclavian artery rupture secondary to a first rib fracture. Herein, we will also discuss the implications for the management of patients with these injuries who present to the Emergency Department.

Case presentation

A 48-year-old male with known epilepsy was an unrestrained front seat passenger in a car which collided at high speed with a wall. Following initial resuscitation and a rapid primary survey he was transferred to the Computed Tomography (CT) scanner for a complete trauma series with contrast to include the head, neck, chest, abdomen and pelvis. The CT scan demonstrated facial injuries, a small right apical pneumothorax with lung contusion and bilateral rib fractures. The first through to the sixth ribs were fractured anteriorly on the right and the third through to the sixth ribs were fractured on the left. There were no flail segments, haemothorax or evidence of major vessel injury (Fig. 1a). The initial haemoglobin was 157 g/l. The patient was admitted to the intensive care unit for close observation. The following morning, approximately, 34 h after initial presentation to the hospital, the patient had a seizure and suddenly deteriorated. He became severely agitated, clammy, hypotensive and eventually unresponsive. He was intubated, ventilated and required significant fluid resuscitation and vasopressor support. A portable CXR showed a complete white out of the right hemithorax (Fig. 1b). A CT head was performed which excluded significant intracranial pathology. Over the next hour the patient remained unstable and the haemoglobin dropped to 50 g/l. A chest drain was inserted which drained 2.7 l of fresh blood within seconds. The patient was transferred to theatre immediately in a peri-arrest situation. A rapid right thoracotomy was performed and an active arterial bleeding point was identified at the apex of the thoracic cavity. Initially, the bleeding point was immediately packed as the patient was clearly haemodynamically unstable and the haemorrhage severe, the source of bleeding at this point was arterial and presumed to be from the second segment of the subclavian artery. The bleeding was eventually controlled with multiple pledgeted 3-0 prolene sutures and a haemostatic patch made from collagen was applied on the bleeding surface to help induce haemostasis. The post-operative course was uneventful and the patient went on to make a full recovery.

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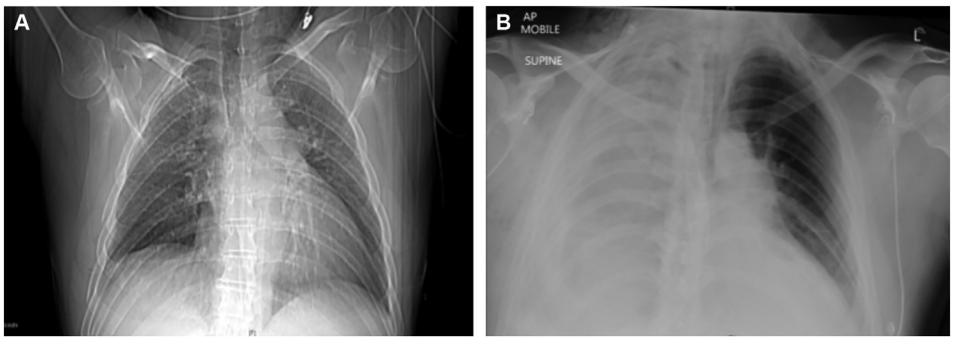

Fig. 1. a) Initial scout view on trauma CT scan showing bilateral rib fractures but no significant haemothorax or pneumothorax, b) portable chest x-ray taken 34 h after presentation showing complete right sided white out.

Comment

First rib fractures have long been recognised as a hallmark of severe trauma. (1) Due to its position and surrounding anatomical structures, a fracture in this area is usually indicative that the mechanism of injury involved significant force. There are a number of historical reports in the literature of subclavian artery injury directly associated with first-rib fractures [1, 2]. Gupta et al. performed a retrospective review of 730 patients with first rib fractures and concluded that patients who meet the following criteria should have an angiogram of the aortic arch and subclavian artery on admission i) mediastinal widening on chest x-ray ii) unequal pulse or blood pressure discrepancy between upper limbs iii) a posteriorly displaced fracture or anterior fracture in the subclavian groove and iv) brachial plexus injury or evidence or an expanding haematoma [3].

Although subclavian artery injury secondary to first rib fracture is well recognised, delayed rupture of the subclavian artery is extremely rare and has only been reported once before by Yonezawa et al. [4]. In similar circumstances to the case presented here, the patient suddenly deteriorated 35 h after initial presentation and although angiography was used to identify the source of bleeding and resuscitative and emergency thoracotomy performed, unfortunately the patient did not survive.

There are a number approaches to repairing an injury of the subclavian artery. The traditional method of repair of the right subclavian artery has been an open surgical repair which requires an extensive incision in order to gain both proximal and distal control of the vessel. Gaining proximal control most often requires a median sternotomy in order to access the innominate and the proximal segment of the right subclavian artery. Distal control is usually achieved by an extended supraclavicular incision. The proximal left subclavian artery can be accessed via a high anterolateral thoracotomy, however, clavicular resection may be needed in this case to optimise exposure. Unfortunately, these extensive incisions are time consuming and require a prolonged period of rehabilitation meaning that the morbidity associated with these incisions is high [5].

Carrick et al. discussed the modern management of traumatic subclavian artery injuries. They proposed an algorithm for treatment whereby patients who were haemodynamically unstable had an open repair and those that were more stable underwent angiography and then endovascular repair. Endovascular repair with the use of a covered stent graft is a less invasive method of repair and allows the area of injury to be accessed from a remote site which is preferable if there is an area of surrounding traumatised tissue. Endovascular approaches are particularly useful when there is a high risk of ischaemia to the limb or cerebral infarction [6].

Conclusions

Delayed subclavian artery injury in patients with first rib fractures is a life threatening injury. In this case it is likely that the seizure caused a shear injury to the subclavian artery secondary to movement of the fractured first rib. Therefore, in patients with a first rib fracture and no initial evidence of neurovascular injury we strongly recommend reconstruction of CT imaging (performed retrospectively in this case, Fig. 2) or angiography to assess the likelihood of subsequent vascular injury. Information should be obtained regarding, the degree of displacement of the fracture, shape of the edges of the fracture line and relationship to the subclavian vessels. This information would be useful in planning either elective or emergency intervention if necessary. Both cases of delayed subclavian artery rupture in the literature have occurred within the first 36 h of injury. We therefore strongly recommend observation in a critical care environment for at least 36 h in patients with first rib fracture.

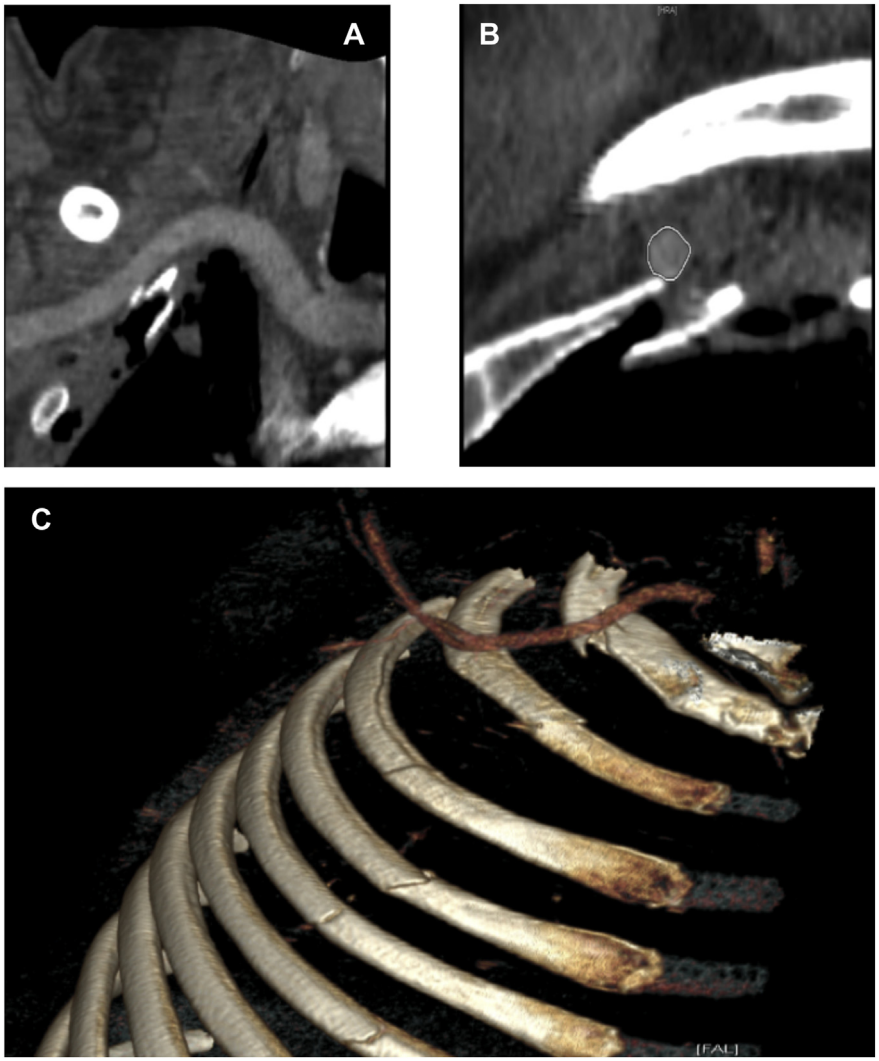

Fig. 2. Reconstructions of the initial trauma CT scan a) showing the course of subclavian artery over first rib, b) a cross-sectional CT image showing point of communication between the subclavian artery (circled) and first rib bony fragment, c) 3D reconstruction showing the course of the subclavian artery in relation to first rib fracture.

Conflict of interest

None declared.

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