We describe a patient who sustained a widely displaced, high-energy, mid-shaft clavicular fracture in association with brachial plexus damage. The distal fragment was subsequently found to have penetrated the thoracic cavity. We describe the treatment of this rare injury with a successful outcome.

Mid-shaft clavicular fractures are among the most common fractures encountered. The majority heal uneventfully with conservative treatment, and most patients make a complete recovery with no functional limitations. Several configurations of the bony injury may be associated with a poor outcome. Open fractures, ipsilateral scapular or humeral fractures, marked displacement (>2 cm), neurovascular compromise and excessive shortening (>2 cm) are considered indications for primary open reduction and internal fixation.1-8 Potentially fatal vascular disruption and brachial plexus lesions are not uncommon, particularly with high-energy injuries.7 However, we believe thoracic penetration by the fracture fragments has not been previously described.

Case report
An 18-year-old man presented to the resuscitation room having been extricated from a motor vehicle accident. He was a restrained front-seat passenger in a car which had struck a wooden fence. Part of the fence penetrated the vehicle through the front windscreen, striking a glancing blow to his left upper quadrant. He remained conscious throughout, sustaining an isolated, closed, mid-shaft fracture of the left clavicle, with superficial overlying abrasions. Initial radiographs confirmed the fracture and demonstrated marked but not exceptional displacement of the fragments (Fig. 1). On clinical examination there was incomplete sensory disturbance in the C5/6 dermatomes. There was also an incomplete motor deficit compatible with injury to the posterior cord of the brachial plexus. All pulses were present and of good volume.

We were concerned about possible subclinical vascular injury which might be revealed intra-operatively during exploration of the brachial plexus. A CT angiogram was performed to examine the subclavian artery and demonstrate the fracture configuration in relation to the brachial plexus and major vessels. The distal fracture fragment appeared to lie in an anterosuperior to posteroinferior alignment with respect to the artery, which itself appeared intact. The CT scan also showed that the distal bony fragment penetrated the chest wall deeply through the second interspace by 5 cm (Fig. 2). The pleura appeared to be tented over the fragment and there was no evidence of a hae-mopneumothorax.

After induction, with the patient breathing spontaneously, a prophylactic chest drain was inserted before intubation. The patient was placed in the semi-recumbent position and the fracture was explored. The distal fragment had dissected through the interval between the subclavian artery posteriorly and the subclavian vein anteriorly, penetrating the chest between the second and third ribs. The artery was intact. The vein had sustained an avulsion of a minor tributary. This was closed with 6/0 monofilament suture. The brachial plexus in the zone of injury was contused but in continuity.

The fragment was firmly lodged within the chest and soft-tissue tension precluded easy extraction. Care was necessary to avoid vascular injury; the clavicle was further divided in situ, thereby creating a three-part segmental fracture to allow easy removal of the intrathoracic fragment. Potential vascular tamponade by the fragment was not identified. The fracture was then fixed using a standard, contoured, AO reconstruction plate. The chest drain was removed 48 hours after operation and the patient made an unremarkable recovery.
Neurovascular compromise is not uncommon after clavicular fracture and represents an indication for primary open reduction and internal fixation. Vascular compromise is not always immediately apparent. Indeed, vascular injury can be present even in the presence of a normal distal circulation. A high index of suspicion is therefore required.

Thoracic penetration is a previously unreported pattern of injury. It must be approached as any other penetrating wound to the chest. Pneumothorax may be present on initial presentation or occur as a potentially fatal tension pneumothorax after commencing positive pressure ventilation. Insertion of a chest drain is mandatory before ventilation.

In high-velocity injuries, considerable energy is expended at the time of fracture, displacing fragments and deforming soft tissues to such an extent that direct reduction may not be possible. In our case the delicate location of the fragment between the subclavian artery and vein made removal particularly difficult. Osteotomy in situ made extraction simple and safe and did not complicate the subsequent reconstruction. Injury to the subclavian vessels would have been apparent on extraction of the fragment. Injury to the intercostal vessels, or the lung parenchyma may not be apparent immediately but would present secondarily as a haemo- or pneumothorax. This further justifies prophylactic chest drain insertion, allowing early detection of these complications.

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

References