Blunt thoracic trauma

Nathan Burnside

Kieran McManus

Abstract

The restructuring of emergency healthcare services has led to more blunt thoracic trauma being treated by a multidisciplinary team, including general, orthopaedic and trauma surgeons, often without immediate access to a thoracic surgeon. Having a critical mass of injured patients in a central location, it has been possible to bring expertise from other areas of intensive care, radiology and surgery and apply new technology and techniques to the trauma patient. We now see the regular use of endovascular stenting and embolization reducing the need for urgent surgery on unstable patients and the increasing use of extracorporeal membranous oxygenation (ECMO) to salvage patients with acute respiratory distress syndrome. A more liberal use of video-assisted thoracic surgery (thoracoscopic) decortication and chest wall fixation both reduce ICU requirements and shorten hospital stay. It is hoped that these improvements in the hospital management of chest injuries will not only improve survival, but that the reduction in the late sequelae of chronic pain and loss of stamina will translate into improved return-to-work rates.

Keywords Blunt injury; thoracic; trauma

Introduction

Blunt trauma tends not to happen on heavily congested city streets. It occurs in the form of farm injuries or road traffic crashes (RTC) out in rural areas, or as work-related mishaps on industrial estates. Between them these three categories account for nearly 60% of major injuries. Rarely do these patients need acute surgery performed by a specialist thoracic surgeon, but instead will need initial stabilization with basic thoracic surgical procedures, timely institution of supportive measures, and, when appropriate, safe transfer to a cardiothoracic unit.

Though most patients with major injuries will be managed in trauma centres, the general surgeon in local units will still need to recognize and treat evolving chest injuries that may have been missed or underestimated by pre-hospital care teams. In this article we aim to outline the basic management of blunt chest trauma for surgeons working in hospitals receiving acute trauma who may not have immediate access to a specialist cardiothoracic unit.

Initial assessment

All trauma cases should be treated as multiple trauma until proven otherwise. Primary assessment and management should follow the standard ATLS™ principles, starting with control of the **A**irway. While it is obvious that a chest injury may affect **B**reathing, the major effect of a tension pneumothorax and haemothorax is on **C**irculation. A chest drain will be both diagnostic and therapeutic. Unlike penetrating injuries, most blunt chest injuries do not need immediate resuscitative surgery, but it is wrong to assume that they do not require surgical intervention at all. This presumption can result in the potential benefit of a specialist thoracic opinion being ignored, and many injuries being undertreated.

Secondary survey

When assessing chest injuries, the mechanism of trauma (Table 1) may be more relevant in terms of immediate injury and eventual outcome than the radiological images. The details of the accident are key to establishing the specific injuries that arise in connection with particular trauma situations and can often predict the late sequelae (Table 2). In abdominal injuries, ultrasound is more accurate than clinical examination alone but it has been slower to catch on as an 'instant' assessment tool in the chest. Haemothorax and haemopericardium can be quantified and treated with ultrasound-guided drainage, and even small pneumothoraces can be detected by the absence of a normal visceral pleural movement shadow. Despite this, chest X-ray (CXR) and CT scan remain the main imaging techniques in chest injuries.

CT scan or chest X-ray: that is the question?

There are a number of recurring themes in all reviews of chest injuries – that chest injuries are frequently missed, virtually always underestimated and full diagnosis is often delayed. Chest X-ray, the investigation on which we rely most, is notoriously unreliable in imaging chest injuries. It will underestimate rib fractures, flail segments, cardiac and pulmonary contusions, effusions less than 500 ml, and can completely miss an anterior pneumothorax in a supine patient. Modern high-speed CT scanners take only a few seconds to complete a whole body scan and some A & E departments already have CT scanners on

Mechanism of trauma predicts the severity of injury

Road traffic crash (RTC)

- Speed of vehicle or cumulative speed of vehicles
- Ejection from vehicle
- Seatbelt, including damage to belt or anchoring points
- Airbag deployment (failure to deploy suggests lesser force of impact)
- Contact with steering wheel
- Condition of the vehicle, seat damage and distribution of collision damage
- Associated fatalities
- Need for and time taken for extraction from vehicle

Fall from height

- Height of fall
- Objects struck (banisters, scaffold)
- Surface of landing (concrete, bricks, hay)
- Part of body impacted (e.g. shoulder crush)
- Reason for fall (industrial, alcohol, epilepsy)

Industrial accident

- Type of impact
- Height, speed and type of object impacting
- Crush asphyxia
- Chemical or smoke inhalation

Table 1

Nathan Burnside *MB BCh BAO MRCS is a Registrar in Cardiothoracic Surgery at The Royal Victoria Hospital, Belfast, Northern Ireland, UK. Conflicts of interest: none declared.*

Kieran McManus *BMedSc MB BS FRCS(I) is a Consultant Thoracic Surgeon at The Royal Victoria Hospital, Belfast, Northern Ireland, UK. Conflicts of interest: none declared.*

Specific trauma mode, injuries and sequelae to expect

Mode	Injury	Sequelae
Anterior oblique:	Fractured sternum	Bone pain improves 6–8 weeks
'Head-on' RTC	Sternomanubrial junction or chondrosternal dislocation	Joint pain (chondritis) or subluxation persists
Seatbelt	Costal cartilage fracture and subluxation as the body folds over the seatbelt	Exertion applying traction on pectoral or rectus muscles aggravates inflamed cartilages ('Costochondritis')
Steering wheel	Costal margin fracture	Left anterior chest wall pain mistaken for ischaemic heart disease or breast pathology
	Costovertebral joint/ligament injury	Thoracic back pain
	Cardiac contusion	If not immediately fatal, usually insignificant but may exacerbate chronic cardiac failure
	Aortic injury	Graft stenosis, neurological
		Stent erosion/endoleak/infection
Anterior diffuse:	More diffuse injuries	More diffuse cartilage pain but less severe in intensity
Airbag RTC	Survive high energy impact	Restricted scapulothoracic shoulder movements
Shoulder crush	Fractured scapula	Intercostal neuralgia long term
Motorbike RTC	Posterior rib fractures including neck of rib or costovertebral	Drooped shoulder
Fall	Associated clavicular fracture, acromio-clavicular joint or sternoclavicular joint	Brachial plexus pain or thoracic outlet syndrome
Industrial		Volume loss of chest cavity
Lateral impact:	Multiple rib fractures	Exertional breathlessness
Bicycle	Costochondral subluxation	Loss of stamina
'T-Bone' RTC	Pulmonary contusion	Intercostal neuralgia
Fall against elbow	Haemothorax/pneumothorax	'Costochondritis'
	Diaphragm injury	Most heal completely though pneumatocele may occur
	Spleen or liver injury	Fibrothorax, diaphragm tethering
		Chest drain site neuralgia
		Tethered or paralysed
		Post-splenectomy syndrome
Rear impact:	Costovertebral	Back pain
'Rear-end'	Costal cartilage, masked by more severe 'whiplash' neck pain	Anterior chest wall pain 'that all the doctors ignored'
Double impact	Single rib fracture	Minimal
Focussed Injury	Simple pneumothorax	
Single elbow at football	Pulmonary contusion	
Seatbelt against mobile phone in breast pocket in RTC	Rarely Commotio cordis	
Car door handle		
'Rubber bullet'		
Neck	Bilateral clavicle fracture	Thoracic outlet syndrome
Flexion	Sternal fracture	Sternomanubrial pain
Motorbike helmet	1st rib fractures	Paralysis
Elderly fall	Posterior sternoclavicular subluxation with tracheal compression	
	Neck injury and central cord syndrome	
	Oesophageal injury against osteophytes	

RTC, road traffic collision

Table 2

robotic arms that can perform a scan before the clinical examination is complete. NCEPOD 2007 stated that 'routine use of "top to toe" scanning is recommended in the adult trauma patient if no indication for immediate intervention exists'. A more selective approach can safely reduce radiation exposure without compromising diagnostic accuracy[1] (Table 3).

CT is the mainstay of the assessment of the following intrathoracic organs.