



# Traumatic Extrapleural Haematoma Incidence, Diagnosis and Management: A mini review

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## Abstract

Traumatic Extrapleural Haematoma (EH) is a rare clinical entity describing traumatic bleeding occurring within the thoracic cavity, but outside the parietal pleura. It needs to be differentiated from intrapleural bleeding, commonly known as a haemothorax, which is the more typical location for bleeding after chest wall trauma. The management principles are different and the trauma clinician needs to be vigilant in making an early accurate diagnosis. As intercostal catheters sit within the intrapleural space, suitably placed catheters will struggle to adequately evacuate EHs. Accordingly, early consideration needs to be made for surgical evacuation. The EHs do not occur commonly making it difficult for prospective studies and the current literature largely consists of case reports and series. This narrative review aims to look at this work to provide guidance on the best manner to diagnose and manage this rare injury pattern.

**Keywords:** Trauma, Traumatic Extrapleural, haemothorax.

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## Introduction

Chest trauma is a significant burden on the health system and has been described as the third most common cause of mortality in polytrauma patients, after head injury and abdominal injury.<sup>1</sup> The bony thoracic cage and associated soft tissue structures provide robust protection against traumatic injury. However, when these barriers are breached, the complex interplay of force and thoracic anatomy makes an array of injuries possible. A rare entity is an EH which describes bleeding between the endothoracic fascia and the parietal pleura. It is typically due to bleeding intercostal vessels, but has also been observed with injured internal thoracic vessels, vertebral vessels, periosteal bleeds from fractures or a ruptured thoracic aorta. An EH can sometimes be the only initial indication on plain film imaging for more sinister pathology.<sup>2,3</sup> If the parietal pleura is breached, then the bleeding will pool within the intrapleural space between the parietal and visceral pleura. This is the more classical presentation for chest-wall bleeding, termed haemothorax. Since a haemothorax can also be due to parenchymal lung bleeding when the visceral pleura is breached, correct identification of an EH isolates bleeding from the chest wall rather than from the lung parenchyma. Furthermore, as intercostal chest drains sit within the intrapleural space, a suitably placed chest drain will not evacuate an EH. Actually, EHs are a rare injury with much of the current literature available consisting of case series and reports, with only two

retrospective reviews. This review aims to present literature to provide an approach for the diagnosis and management of this difficult clinical entity.

## Epidemiology

The EHs are an uncommon entity. Across a 10 year period, Rashid et al. found 34 patients having an EH, from a total of 477 chest injuries, giving an incidence of 7.1%.<sup>4</sup> Among the patients, 33 cases were due to blunt trauma, the majority being from Motor Vehicle Crashes (MVC) and falls. Penetrating trauma accounted for 1 case. Chung et al. examined 13 cases of extrapleural haematoma across a 2 year period.<sup>5</sup> Eleven had a traumatic aetiology, all being from blunt force. In both series, rib fractures were the most commonly associated injury.

## Clinical features

It is difficult to differentiate between a haemothorax and EH by clinical features alone. An EH is more likely to occur in a blunt mechanism as penetrating injuries are likely to injure the parietal pleura as well, resulting in a haemothorax. On auscultation, reduced breath sounds may be localised to the peripheral chest wall overlying the EH, however this subtle feature may be difficult to appreciate in the acute trauma setting. The resulting physiology will determine the urgency for any therapeutic interventions.

## Imaging

The Chest X-Ray (CXR) will not provide a definitive diagnosis for an EH, but can show a number of suspicious features. The typical feature on CXR is a 'D' shaped peripheral haziness along the chest wall – with the base of the 'D' lying against chest wall and the loop facing into the thorax. This shadow will not be gravity dependent as compared to a haemothorax, but this is not usually feasible to test in the acute trauma setting as many patients present with spinal precautions. Unless the EH involves the base of the chest wall, it will not obliterate the costophrenic angle, which would otherwise be seen with a haemothorax. A lateral projection will identify an EH on the anterior or posterior wall; whereas a frontal projection will show a lateral EH. [Table 1](#) summarises the plain film CXR differences between an EH and a haemothorax.

Although a CXR can suggest an EH, gold-standard diagnosis relies on Computed Tomography (CT) of the chest. The CT will show internal displacement of the extrapleural fat by an intrathoracic peripheral fluid collection, the so called 'extrapleural fat sign'; this anatomy being confirmed on forensic studies.<sup>6</sup> If done with arterial phase contrast, any source of active bleeding can also be found.<sup>7</sup> However, a clotted haemothorax, any history of pleural disease or history of thoracic surgery does make the imaging diagnosis

difficult.<sup>8</sup> These entities can all produce regional haemothoraces mimicking an EH, however they will all lack the extrapleural fat sign. Chung et al. described that on CT, EHs can take two distinct patterns: biconvex or non-convex.<sup>5</sup> Biconvex haematomas form an oval or round shape similar to the appearance of an intracranial extradural haemorrhage, whilst non-convex haematomas have lobulated margins that conform to the shape of the inner chest wall. Their cohort of 13 EHs had five being biconvex and eight being non-convex, with the biconvex haematomas tending to have larger volumes.<sup>5</sup> Considering the fact that most trauma centres will employ a CT of the chest with any significant chest trauma mechanism, less emphasis is placed on picking up the subtle signs on CXR. However, they remain clinically important particularly if CT is not available or if the patient is in extremis. A large EH can be difficult to distinguish from a large haemothorax, even on CT – however, the distinction is vital as an intercostal catheter will have difficulty evacuating an extrapleural haematoma, with numerous case reports describing this issue.<sup>9-14</sup>

Ultrasound has been suggested to determine if a penetrating wound has breached the pleura or not, but remains to be determined if it could distinguish whether a traumatic thoracic haemorrhage lies extrapleural or intrapleural in the acute setting.<sup>15</sup>

**Table 1.** Distinguishing features on plain film imaging between a haemothorax and an EH. These are useful as a guide only, with definitive diagnosis made on computed tomography.

	Haemothorax (Intrapleural)	Extrapleural Haematoma
Relationship with Gravity	Gravity dependent	Localised, not gravity dependent
Costophrenic Angle	Blunting of costophrenic angle	Costophrenic angle spared, unless low sitting EH
Appearance and Shape	Meniscal shape on erect imaging; haze/veiling on supine imaging	Peripheral shadow, 'D' shape on erect and supine imaging

## Approach to treatment

The optimal strategy for managing EHs can be difficult to decide upon and is based upon the clinical status of the patient. For the patient who is actively bleeding, the trauma team needs to quickly determine which patient will need an open resuscitative thoracotomy, versus those who can be managed with angio-embolisation. Those who are not actively bleeding and are remaining haemodynamically stable may also ultimately require an open thoracotomy, however other strategies are available in this setting including a non-operative close observation approach, intercostal catheter or Video-Assisted Thoracoscopic Surgery (VATS).

### Actively bleeding patients

#### - Open Resuscitative Thoracotomy

A patient who is peri-arrest from his/her chest injuries will require an open resuscitative thoracotomy and it becomes less important to localise the bleeding as intrapleural or

extrapleural on imaging.<sup>16</sup> This technique provides the best exposure to assess and manage injuries involving the chest wall, lungs and mediastinum. However, this is uncommonly described for EHs, likely because the parietal pleura and endothoracic fascia provide a well contained tamponading effect when bleeding occurs within this potential space. If the parietal pleura does rupture, these patients can indeed become haemodynamically unstable very quickly.<sup>17</sup>

#### - Angio-embolisation

This is a minimally invasive technique to provide haemorrhagic control from arterial bleeding. Patients who are actively bleeding should be considered for angio-embolisation if the ongoing physiology allows. This however does carry the risk of embolisation to the anterior spinal artery with resulting paraplegia.<sup>4,18</sup> Gorospe et al. describe a case where a patient with unstable haemodynamics was managed successfully with angio-embolisation, avoiding surgical intervention, concluding that angio-embolisation should be the method of choice in those with active arterial

bleeds.<sup>7</sup> However, angio-embolisation is not always successful and other authors have described failed angio-embolisation conditions, ultimately requiring surgical control.<sup>19,20</sup> Actually, it can be stated that angio-embolisation will not provide haemorrhage control from venous bleeds.

### Haemodynamically Stable Patients

#### - Expectant Management vs. Open Thoracotomy

In patients who are presented with normal physiology and no active bleeding, the trauma clinicians need to determine which patients should have their EH evacuated and which ones can be managed expectantly. Both Rashid et al. and Chung et al. along with a number of case reports describe that most EHs can be managed non-operatively in those patients with no concerning physiology. Guiding principles include any concerning respiratory function and the haematoma size. Among the 34 patients in Rashid et al.'s cohort, 33 were managed non-operatively, with one requiring open thoracotomy due to a huge EH causing circulatory and ventilatory disturbances. Four of the 13 patients from Chung et al.'s cohort required operative intervention – two for respiratory compromise, one for ongoing bleeding and one for ongoing chest pain. This last patient initially underwent VATS, before conversion to open thoracotomy. These four patients all had biconvex shaped haematomas and the authors discuss how the shape of these haematomas likely reflects higher pressure due to arterial bleeding explaining their larger size. This is also reflected by many case reports describing the need for surgical evacuation showing CT images of biconvex EHs.<sup>10-12,19-22</sup> Chung et al. further recommend that small biconvex haematomas should be closely observed to exclude rapid enlargement from arterial bleeding. Non-convex haematomas however have not caused sufficient pressure to completely dissect the endothoracic fascia and hence bleeding in these settings is likely to originate from venous or periosteal sites. None of the patients in Chung et al.'s study who had a nonconvex haematoma required surgical intervention. This is not to say venous bleeds cannot cause issues. Goh et al. have described an intercostal vein bleed creating a massive EH causing haemodynamic instability requiring open thoracotomy.<sup>23</sup> Also, Khalil et al. have described a case where thoracotomy was needed from an internal thoracic vein bleed.<sup>24</sup>

#### - Close-observation

Clinicians need to be wary of patients who are at risk of bleeding (e.g. anticoagulants, liver disease, bleeding diathesis), particularly if the initial CXR shows the presence of rib fractures. Despite either a small EH or no-initial bleeding on initial imaging, it is not unusual for these patients to present a delayed haemorrhage requiring operative intervention.<sup>9,12,19,22,25,26</sup>

#### - Intercostal Catheter

Unlike haemothoraces, there have been numerous reports of difficulties in intercostal catheter placement for EH. As such trauma teams should exert caution if this is considered as the method to evacuate the haematoma, using imaging guidance where possible.<sup>7,10,27</sup> If an intercostal catheter is inserted, this may allow administration of a thrombolytic agent to treat a clotted EH.<sup>27</sup>

#### - Video Assisted Thoracoscopic Surgery (VATS)

Rashid et al. had concluded that VATS had no role in the management of traumatic EH in their initial paper.<sup>4</sup> This is further supported by the fact that the one patient who initially underwent VATS in Chung et al.'s cohort, required conversion to open thoracotomy.<sup>5</sup> However, since these studies and case reports have been able to successfully describe the evacuation of the extrapleural space through VATS whilst also obtaining haemorrhage control from bleeding intercostal vessels.<sup>9,10,20,25</sup> Pirzirenli et al. have stated that if tube thoracostomy fails to adequately drain an EH, consequently VATS should be the first surgical preference.<sup>10</sup> Narsule et al. describe a patient who was actively bleeding but failed embolisation, however was subsequently successfully managed with VATS.<sup>20</sup> As all the minimally invasive mentioned techniques continually improve, these need to be considered for those patients who are haemodynamically stable.

### Conclusion

Traumatic EH remains a difficult injury to diagnose. This is due to its rarity and subtle signs on plain films. However correct diagnosis is required as bleeding within this space is not easily amendable via an intercostal catheter. Contrast-enhanced (CT) of the chest is the imaging modality of choice for definitive diagnosis. The tamponading effect of the parietal pleura pressed against the endothoracic fascia likely limits bleeding in this space resulting in the low incidence of haemodynamic instability for these patients. The management for these patients depends on the clinical state of the patient and the size of the haematoma. Those with ongoing bleeding can either be managed through angio-embolisation or with open thoracotomy as determined by the clinical urgency. If the chest does indeed need to be evacuated from the haematoma, thoracoscopic utilities may provide a minimally invasive solution for the stable patient, however most patients can be managed non-operatively with the haematoma resolving over time. Considering the rarity of this presentation, it will be difficult to construct suitably powered prospective studies, so trauma centres need to take special care in maintaining their trauma registries so ongoing retrospective analyses can continue to occur.

## Conflict of Interest Disclosures

The authors declare they have no conflicts of interest.

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