

**INTERCOSTAL ARTERY EMBOLIZATION IN BLUNT TRAUMA - A CASE REPORT
AND REVIEW OF THE LITERATURE****James Lucocq, Robert Sinnerton and Dr. Darren J. Porter***

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ABSTRACT

Haemothorax is a common complication in blunt thoracic trauma that is associated with rib fractures. Patients with a haemothorax are at risk of developing a retained collection in the pleural cavity and haemodynamic compromise. Complete drainage of the haemothorax and definitive haemostasis is required to prevent the development of sequelae. In this study, we report a case of an intercostal artery haemorrhage from blunt trauma that was successfully embolised with Transcatheter Artery Embolization (TAE) and review the literature on management of a haemothorax.

KEYWORDS: Blunt Trauma, Intercostal Artery, Massive Haemothorax, Trans-catheter Artery Embolization.**INTRODUCTION**

Percutaneous arteriography was first performed by Seldinger in 1953 which enabled the use of minimally-invasive angiography.^[2] Selective catheterisation and embolization using angiography was performed in 1972 when it was utilised to control obturator artery haemorrhage from pubic rami fractures.^[3] Transcatheter Artery Embolization (TAE) can be used to embolise thoracic vessels and is an alternative to surgical intervention in the management of haemothorax and active intrathoracic haemorrhage.

A haemothorax develops in 16% percent of blunt traumatic injuries with associated rib fractures.^[4] Intercostal artery injury from blunt trauma is not uncommon and can lead to massive life-threatening haemothorax and hypovolaemic shock.^[5] A retained thoracic collection can lead to complications such as lung entrapment from clot formation, fibrothorax, empyema and pneumonia. The rate of developing empyema and pneumonia from a retained haemothorax is 26.8% and 19.5% respectively.^[1]

Initial management of a haemothorax with a chest drain, respiratory support, analgesia and fluid resuscitation can be insufficient. Haemodynamic instability or a retained haemothorax that has not resolved with initial management requires further management.^[6] Haemostasis can be achieved with exploratory thoracotomy, Video-Assisted Thoracoscopic Surgery (VATS) or TAE. TAE has a primary technical success rate of 87.5% and complication rates are low.^[6] It is a reliable and safe therapeutic technique that is particularly

useful in controlling haemorrhage from an identified bleeding vessel. TAE is an effective alternative to failed surgical interventions and in patients who are poor surgical candidates.^[6]

In this case report we report a case of a haemothorax from intercostal artery haemorrhage that was successfully embolised by TAE and review the literature on the management of haemothorax following blunt trauma.

CASE REPORT

A 62year old male was admitted with a blunt injury to his left anterior thorax that was sustained from a 3-metre fall. On admission his blood pressure was 92/57 mmHg, heart rate was 130 bpm, oxygenation saturations were 92% on high flow oxygen and he had a metabolic acidosis (ph 7.28). He had a background of chronic obstructive pulmonary disease, alcoholism and oesophageal cancer that was treated with radiotherapy and chemotherapy. Examination showed a flail segment of his left chest wall. Urgent chest x-ray showed left lateral 5-10th rib fractures and an extensive left pneumothorax. A tube thoracostomy was performed in the emergency department. A Computed Tomography (CT) scan confirmed the pneumothorax with mediastinal shift, multiple left-sided comminuted rib fractures, extensive surgical emphysema and pulmonary contusions. There was no initial haemothorax or evidence of any intra-thoracic bleed. The chest drain was abutting lung parenchyma and not positioned in the pleural cavity. It was removed and re-inserted in the left apex with no complications.

The patient was transferred to the surgical high-dependency unit. Intravenous broad-spectrum antibiotics, tranexamic acid and packed red cells (PRCs) were administered. Despite persistent hypotension and anaemia (Hb 65 g/L), a CT angiogram was performed and did not demonstrate an intra-thoracic bleed. The left pneumothorax was noted to have reduced in size. Forty-eight hours after presentation the patient had haemoserous fluid output from his chest drain (>300mls/hr), was increasingly hypoxic (saturations 85% on high-flow) and agitated. An emergency CT of his thorax, abdomen and pelvis with contrast demonstrated haemorrhage from the left 7th intercostal artery, massive left haemothorax and complete left lung collapse (Figure 1).

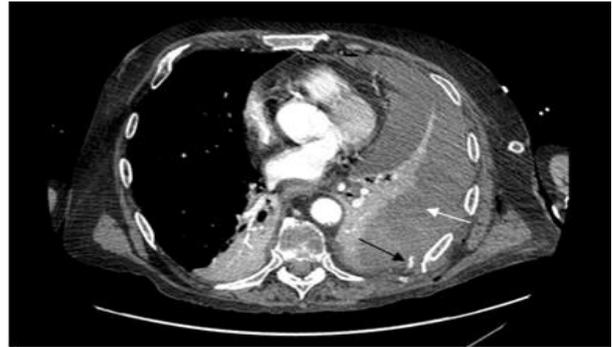


Figure 1: Computed Tomography with contrast (arterial-phase) scan demonstrating extravasation from the left 7th intercostal artery (black arrow) and massive haemothorax (white arrow).

The patient had a left basal chest drain inserted under general anaesthetic and had PRCs and fresh-frozen plasma transfusions for anaemia (77 g/L) and coagulopathy respectively. Selective angiography and Transcatheter Artery Embolization (TAE) of the left 7th intercostal artery was performed and successfully controlled the bleeding (Figure 2). Thereafter he was transferred to the intensive care unit (ICU) for lung protective ventilation and inotropic support with noradrenaline.

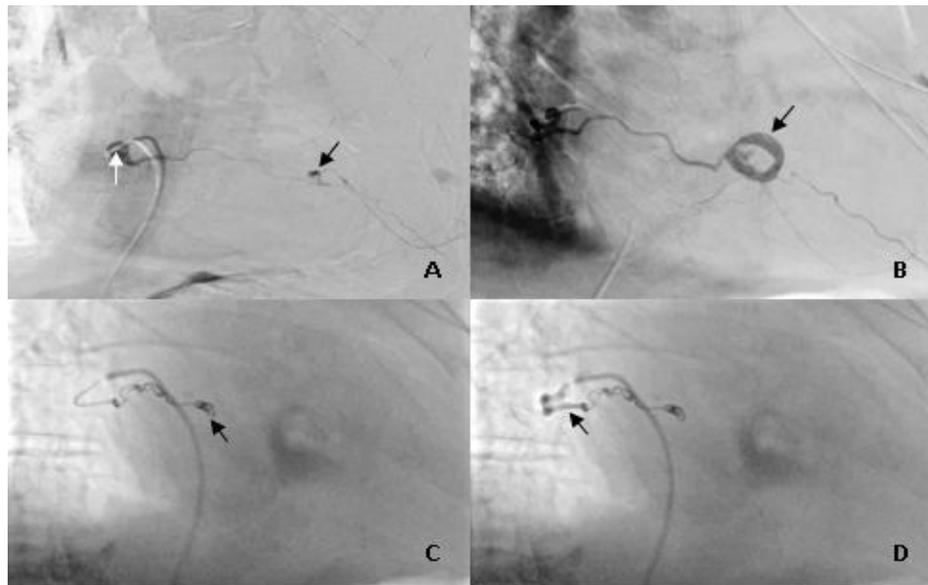


Figure 2: Trans catheter Artery Embolization (TAE) of the 7th left intercostal artery (A - selective catheterisation of the origin of the left 7th intercostal artery using a cobra catheter (white arrow) with blushing at the site of injury (black arrow); B - extravasation into surrounding tissues during injection of contrast (black arrow); C - deployed micro-coils (black arrow); D - reflux of contrast (black arrow) with no further extravasation.

After embolization the chest drain output reduced (<100ml/24hr) and the serum haemoglobin stabilised. The opacification of the left lung field on chest radiograph improved indicating resolution of the haemothorax (Figure 3).



Figure 3: Chest radiograph demonstrating resolution of the left massive haemothorax.

DISCUSSION

Seldinger first performed percutaneous arteriography in 1953. Selective catheterisation and embolization using angiography was first conducted in 1972 on the obturator artery.^[3] Developments in interventional radiology has permitted the use of Transcatheter Artery Embolization (TAE) to embolise thoracic vessels. It is an alternative to surgical interventions such as VATS and thoracotomy in the management of haemothorax and active haemorrhage.

Haemothorax arising from intercostal artery injury from rib fractures is not uncommon and can lead to massive haemothorax and hypovolaemic shock.^[5] If the thoracic collection is not managed appropriately it can lead to complications such as lung entrapment from clot formation, fibrothorax, empyema and pneumonia.

Initial management with a chest drain should be performed to drain the haemothorax. Drain output detects active bleeding and decompresses the thoracic space. The chest drain should be inserted in the 6th intercostal space to permit sufficient drainage. Its position within the pleural cavity and the eventual resolution of the haemothorax can be confirmed on chest radiograph. Antibiotic prophylaxis should be initiated from the time of chest drain insertion for at least 24 hours to reduce complications of pneumonia and empyema.^[7] If the drain output persistently exceeds 200ml/hour or if there is haemodynamic instability a computed tomography (CT) scan would be indicated to quantify the size of the haemothorax.^[8] CT interprets the need for surgical intervention more appropriately than chest radiograph and the administration of contrast can localise the bleeding vessel.^[9]

Persistent blood loss greater than 200ml/hour, a retained haemothorax or haemodynamic instability are indications for immediate surgical management.^[10] Video-Assisted Thoracoscopic Surgery to restore haemostasis and evacuate the haemothorax is indicated for significant

blood loss when the patient is haemodynamically stable. Early surgical intervention with VATS (<3 days) could improve outcomes and reduce infective complication rates.^[11] The use of VATS for a retained haemothorax reduces hospital stay as compared with patients who have an additional chest drain inserted.^[12] In the case of haemodynamic instability or a massive haemothorax (>1500ml), thoracotomy is indicated. This allows for direct visualisation of the thoracic cavity for complete evacuation and to control bleeding.^[10]

The indications for Transcatheter Artery Embolization (TAE) over surgical intervention are not conclusive from the literature review. TAE achieves primary technical success for intercostal arteries in 87.5% of cases and has a low complication rate. The mortality of blunt trauma patients with intercostal artery injuries post-embolization is 9.1%.^[6] Selective angiography can locate the source of bleeding more successfully than exploratory thoracotomy and has achieved haemostasis in cases where exploratory thoracotomy has failed.^[11] Patients with significant comorbidities avoid the high-risk of surgical intervention. If TAE is unsuccessful or if the patient becomes unstable, surgical management is advised. Unlike surgical intervention, TAE cannot remove retained clots and patients may be at risk of the long-term sequelae of retained haemothorax.

There are two reported cases in the literature of spinal cord ischaemia as a complication of TAE in intercostal artery embolization.^[13,14] Misplacement of the mother-catheter and release of embolic material can embolise the radicular arteries and compromised spinal cord perfusion. The use of a microcatheter has improved the accuracy of catheter placement and reduced the likelihood of this complication.

TAE can fail to control bleeding because of collateral vessel supply. Collateral pathways from adjacent intercostals arteries or the musculophrenic artery need to be identified. Small vessels can be overlooked during angiography and monitoring for further haemorrhage after embolization is advised. TAE should be performed by an experienced interventional radiologist to reduce the complication rate.^[6]

CONCLUSION

Haemothorax is a common complication of rib fractures in blunt trauma patients. There is a high risk of further complications in these patients and evacuation of a retained haemothorax and haemostasis is required. Transcatheter arterial embolization is an effective and safe procedure and has a low complication rate. It should be considered when the source of bleeding is identified and in haemodynamically stable patients.

Grant
None.

CONFLICTS OF INTEREST

We the authors of this case report have no conflicts of interest to declare.

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