CASE REPORT

Traumatic haemopneumothorax and 'whole-body' subcutaneous emphysema: successful use of a small-bore chest drain

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SUMMARY

A 56-year-old man presented having had two falls at home. He had a background of multiple sclerosis. After his second fall, during which he had fallen onto the toilet injuring his right chest, he was brought into the emergency department reporting pleuritic chest discomfort. Immediately evident was extensive swelling from his forehead to his thighs, which on palpation was found to be subcutaneous emphysema. A chest X-ray showed a large right-sided pneumothorax for which a chest drain was inserted. A CT revealed extensive surgical emphysema, pneumomediastinum, pneumoperitoneum and gas within the spinal canal. It also showed right-sided rib fractures and associated haemothorax. He was managed conservatively with a 12-French (F), small-bore, chest drain and made a complete recovery without complication. This case challenges the widely held, but poorly evidenced, opinion that traumatic haemopneumothorax needs to be managed with a large-bore surgical chest drain.

BACKGROUND

Subcutaneous, or surgical, emphysema occurs when air or gas becomes trapped within the soft tissues. It is usually not dangerous in itself but can point towards serious underlying pathology. Typically, subcutaneous emphysema results from a lung injury—it therefore is most commonly found around the thorax, axillary and neck areas. Other aetiologies include post-laparoscopic¹ or maxillofacial surgery,² bowel perforation,³ facial bone fractures⁴ and even barotrauma associated with diving.⁵

When associated with chest wall trauma, subcutaneous emphysema usually represents some degree of lung laceration, normally with rib fracture. While simple pneumothoraces can easily be managed with small-bore chest drains, traumatic pneumothoraces are usually associated with haemothorax and therefore conventionally managed with large-bore more invasive surgical chest drains. This case is interesting due to the extensive nature of the patient's subcutaneous emphysema, but also highlights questions regarding the optimal management of haemopneumothoraces.

CASE PRESENTATION

A 56-year-old man with multiple sclerosis (MS) presented to the emergency department with sharp chest pain after falling twice that day. He fell secondary to long-standing leg weakness, and during

one fall in the bathroom, he hit his chest on the toilet.

He took no regular medications, was a smoker and drank alcohol occasionally. He lived with his mother, who was his primary carer, and normally was able to independently get out of the house to attend the local MS society. He walked with a stick.

On initial assessment in the emergency department, he reported bilateral sharp chest pains that were worse on deep breathing. He also had a non-productive cough and hypophonia. He denied feeling short of breath. On examination the most striking feature was marked swelling from his forehead down to his lower thighs, he was unable to open his eyes due to the amount of swelling. On palpation, this was found to represent extensive subcutaneous emphysema.

There was reduced air entry throughout the right side with normal vesicular breath sounds on the left. The trachea was central. He was maximally tender over the lower right rib cage. His abdomen was soft and non-tender.

He appeared confused and his neurological examination revealed weakness in right hip flexion, with no initial concerns about head, neck or spinal injury.

A portable chest X-ray showed a right-sided pneumothorax with extensive subcutaneous and mediastinal emphysema. There was also free air beneath the right hemi-diaphragm (figure 1). There was no mediastinal shift, but a fracture in the seventh rib was visible on the right side. Arterial

Figure 1 Initial portable chest X-ray showing a right-sided pneumothorax and rib fractures, extensive surgical emphysema and free air beneath the right hemidiaphragm.

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blood gas sampling, taken on air, showed a reduced PaO₂ (8.2 kPa).

An intercostal chest drain was indicated to relieve the pneumothorax, and after consideration of the risks and benefits, a 12-F Portex Seldinger chest drain was inserted. On insertion, a loud and prolonged decompression hiss was heard, suggesting that the right thorax was under some degree of tension. No fluid or blood was drained. There was an immediate improvement in the patient's pain, and the drain was swinging and bubbling. Five minutes after the chest drain was inserted, the patient deteriorated, developing stridor and desaturating to 76%. His condition improved after 10 min of high flow oxygen, and a repeat portable chest X-ray showed reinflation of the right lung (figure 2).

Blood tests showed raised white cell count of 15, and mildly raised C reactive protein of 13.

Owing to the extent of his injuries, possible confusion, leg weakness, mediastinal air and abdominal free air, a CT of his head, neck, chest, abdomen and pelvis was performed. Brain, skull, neck and airway imaging revealed no acute pathology (figure 3). Rib fractures in the 6th to the 12th ribs were demonstrated but with no flail chest. A moderate right-sided haemothorax was evident along with atelectatic changes at the right base. The right-sided chest drain was positioned

appropriately with no residual pneumothorax. There was marked subcutaneous emphysema from head to thighs with pneumomediastinum (figure 4), pneumoperitoneum (figure 5) and gas within the spinal canal. A small mediastinal haematoma was present but with normal mediastinal vasculature and no clear source. The appearances of the abdominal viscera were normal. Finally, there was a fracture of the right transverse process of the L3 vertebra.

OUTCOME AND FOLLOW-UP

The patient was admitted under the surgical team. His case was discussed with the local cardiothoracic and neurosurgical teams who advised conservative management. His drain was placed on suction and around 1 L of blood-stained fluid was drained. His subcutaneous emphysema resolved over the next 3 days and the drain was removed on day 5. His 12-F chest drain proved sufficient and did not need to be changed to a large-bore tube.

He engaged well with the physiotherapists and was discharged 6 days after admission—he did, although, decline the recommended physiotherapist follow-up at home. His normal neurology team will follow him up in due course.

A repeat of his chest film several months after discharge showed complete resolution of his pneumothorax subcutaneous emphysema (figure 6).

Figure 2 Chest X-ray showing the right-sided 12-F drain in situ and a re-expanded right lung.

Figure 4 CT scan of the mid-thorax showing pneumomediastinum.

Figure 3 CT scan of the upper thorax and lung apices showing extensive subcutaneous emphysema.

Figure 5 CT scan of the upper abdomen showing pneumoperitoneum.

Figure 6 Follow-up chest X-ray showing resolved subcutaneous emphysema.

DISCUSSION

Subcutaneous emphysema as a result of a pneumothorax is perhaps the most common aetiology seen in the emergency department. On the wards, it is much more likely to be iatrogenic, being well-described post-laparoscopic and maxillofacial surgery.^{1 2} More worryingly, when associated with overlying skin cellulitis or swelling, a diagnosis of necrotising fasciitis must be considered and quickly addressed. In the setting of trauma, it is important to remember that not only can pneumothoraces result in subcutaneous emphysema but so too can rupture of other gas containing viscera such as the oesophagus and bronchial tree.^{6 7}

In this case, a history of trauma and chest wall tenderness pointed towards a diagnosis of rib fracture(s) and resultant underlying pneumothorax. In such circumstances, where a haemothorax is likely or evident, most guidelines would advocate the use of a large-bore surgical chest drain (28–30 F).⁸ Indeed, our hospital normally would follow the South West London and Surrey Trauma Network protocol that advocates a 32-F or 36-F surgical drain.⁹ The argument for the use of large-bore drains is that they are theoretically less likely to clot off and are better in terms of assessing continuing blood loss.¹⁰ However, there is little evidence to support large-bore drains' superiority over small-bore drains. In fact, several studies suggest that smaller drains, as small as 10–14 F,¹¹ may be as effective as larger drains in resolving traumatic haemothoraces, without significant differences in terms of the amount drained or length of time the drain remains in situ.^{11–15} Small-bore drains may also be better tolerated by the patient.¹⁶ With the knowledge that there is no clear evidence pointing either way, the fact that the patient had presented with what appeared to be predominantly a large pneumothorax, and the anticipated technical difficulties in placing a surgical chest drain through several inches of subcutaneous emphysema, a small-bore Seldinger technique chest drain was chosen for this patient.

The current evidence for the superiority of small-bore chest drains over larger-bore drains for traumatic haemopneumothoraces is weak. However, the available literature suggests that outside of the major intrathoracic haemorrhage scenario (which almost certainly does warrant large-bore surgical drains), small-bore chest drains may be non-inferior. A non-inferiority, randomised, controlled trial is required to properly address this question. If small-bore chest drains were found to be non-inferior, then doctors could be reassured that the best course of

management is the one with which the team have most experience.

In summary, this patient suffered a traumatic haemopneumothorax and presented with 'whole-body' subcutaneous emphysema. Although there is a lack of good quality evidence to guide the optimum management of traumatic haemopneumothorax, here we present a case successfully managed with a small-bore drainage tube that was very well tolerated by the patient.

Learning points

- ▶ Subcutaneous emphysema after trauma must trigger a careful assessment for lung and airway trauma.
- ▶ Most guidelines recommend large-bore chest drains for the treatment of a haemothorax; however, little high-quality evidence exists to advocate this more invasive practice.
- ▶ Here, we present a case in which a small-bore chest drain was successfully used in the treatment of a traumatic haemopneumothorax.

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