Tension pneumothorax after accidental aspiration

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Abstract - Case: A patient was presented after aspirating food. After drinking copious amounts of alcohol, she had fainted immediately after the first bite of her dinner. Bystanders started basic life support immediately. However, proper oxygenation remained very problematic until her presentation at our emergency department, where she was intubated and ventilated. She developed a left-sided tension pneumothorax immediately thereafter. Rib fractures, as a possible cause of a pneumothorax after cardiopulmonary resuscitation, were not apparent on the chest radiograph. After chest-tube insertion, oxygenation remained problematic. A chilli pepper was bronchoscopically removed from the left main bronchus. Thereafter, her oxygenation improved.

Conclusion: Aspiration may present with sudden collapse without much coughing. Although rib fractures, sustained during cardiopulmonary resuscitation, may be the most frequent cause, other mechanisms may underlie a pneumothorax after accidental aspiration. We believe that in this case a chilli pepper caused a valve mechanism to develop, leading to hyperinflation and consequently a tension pneumothorax.

Keywords - respiratory aspiration, pneumothorax, airway obstruction.

Abbreviations:
ARDS: acute respiratory distress syndrome
COPD: Chronic obstructive pulmonary disease
FiO₂: inspiratory oxygen fraction
HCO₃⁻: bicarbonate
PaCO₂: arterial carbon dioxide tension
PaO₂: arterial oxygen tension
PEEP: positive end expiratory pressure
pH: acidity
SaO₂: arterial oxygen saturation

Case
A 70-year-old woman was brought to the emergency department after aspirating food. She was a healthy lady with a long history of hypertension which was treated with candesartan. She took lorazepam 0.5 mg three times daily, and was a non-smoker. The evening of her admission, she had been drinking large amounts of alcohol. Almost immediately after the first bite of her dinner, she collapsed and fell quietly from her chair. Bystanders started basic life support immediately. Upon arrival of a paramedic team, the patient was unconscious without apparent breathing effort. A pulse was palpable and her electrocardiogram revealed supraventricular tachycardia. During the attempt to intubate her, copious amounts of food were removed. Although intubation was unsuccessful, the airway seemed to have been cleared and the patient resumed breathing. During this manoeuvre, the patient temporarily became bradycardic, with loss of output, which responded to intravenous atropine. The patient maintained a poor arterial oxygen saturation (SaO₂) 50% as determined by pulsoximetry.

On arrival at the emergency department, the patient had a heart rate of 130 beats per minute, a blood pressure of 120/60 mmHg, and she was hypoxaemic with an SaO₂ of 47%. Breathing sounds were present on the left side of the chest, but absent on the right side. An arterial blood gas (pH 7.18, PaCO₂ 70 mmHg, PaO₂ 34 mmHg, and HCO₃⁻ 25.8 mmol/l) confirmed severe hypoxaemia and acute respiratory acidosis. After more chunks of food had been removed, she was intubated, and ventilated with tidal volumes of 400 ml, with non-remarkable airway pressures (volume-controlled ventilation using 15 cmH₂O above 5 cmH₂O positive end expiratory pressure with a mean airway pressure of 15 cmH₂O, approximately). Her SaO₂ soon rose to 90% while being ventilated with an inspiratory oxygen fraction (FiO₂) of 100%. Now breathing sounds could be heard over the left and right apical areas, but not over the right mid- and basal areas of the chest. Within five minutes of starting mechanical ventilation, pulse pressure, blood pressure and oxygenation fell, while a chest radiograph was being taken. A left-sided tension pneumothorax was diagnosed and successfully released by chest tube insertion, followed by restoration of normal circulation and improved ventilation. Subsequently, the chest radiograph showed a tension pneumothorax (Figure 1). A second chest radiograph taken 30 minutes after the first, showed restored mediastinal anatomy and proper lung inflation on the left, atelectasis of the right lower lobe, causing elevation of the right hemidiaphragm. The tube...
was correctly positioned and rib fractures were not apparent. Although toxicology screening was positive for alcohol, the alcohol concentration in her blood was not measured.

Upon arrival on the intensive care, oxygenation diminished to a SaO$_2$ of 84% while ventilating with a FiO$_2$ of 100%. Regarding the clinical picture, we expected food chunks to be obstructing the greater airways, and therefore, bronchoscopy was performed immediately. A chilli pepper (Figure 2) was removed from the proximal left main bronchus, with its tail pointing upwards. Other food chunks were removed from both sides. A bleeding lesion was seen on a lower left bronchus.

After this intervention oxygenation improved dramatically. The FiO$_2$ was reduced progressively without affecting SaO$_2$. The patient maintained cardiorespiratory stability, while she was kept hypothermic for 24h in order to protect the brain from ischaemic injury. She was still showing mild cognitive impairment on the fourth day after admission, when she was successfully extubated. Her recovery was uneventful and complete.

Discussion

The café coronary, or fast eating syndrome are terms for accidental occlusion of the airway during a meal. This is often facilitated by alcohol ingestion, medication, or disease [1]. The incidence of fatal food aspiration varies from 0.1-2 cases per 100,000, with most incidents occurring in the elderly population [1]. The cause of death may result from simple obstruction. However, regarding the frequently observed rapidity with which fatal episodes occur, without obvious evidence of choking, it has been suggested that a vagal reflex causing bradycardia, or even cardiac arrest, may contribute [1]. These observations and hypothesis fit our patient as well.

Aspirated material most frequently ends up in the right bronchial tree, secondary to the bronchial anatomy. Our patient was no different; the breathing sounds on the right were most, and continuously, diminished. In addition, chest radiography showed atelectasis and an elevated diaphragm. The impaired oxygenation may thus, in part, be explained by shunting due to atelectasis.

Interestingly, a tension pneumothorax developed immediately after mechanical ventilation started. Although cardiopulmonary resuscitation may cause a pneumothorax in 1.3-3% [2] secondary to rib fractures, rib fractures were not apparent on the chest radiograph. Two senior radiologists reviewed the chest radiographs and found no clues to indicate rib fractures. Furthermore, after regaining awareness, during physical examination the patient did not report chest pain indicative of rib fractures. Therefore, a rib fracture seems an unlikely explanation. Alternatively, mechanical ventilation may cause a pneumothorax. However, ventilator-induced pneumothorax depends on the number of ventilator days, underlying diseases such as ARDS and COPD, and the use of PEEP [3], which were all minimal or absent in this case. Although there is no doubt our patient had very inhomogeneous lungs, she did not endure exceptional ventilator pressures. Finally, with food obstructing the left main bronchus, as was found during bronchoscopy, manual hyperinflation during bagging in the first phase of resuscitation would have resulted in a right sided pneumothorax.

A (tension) pneumothorax after foreign body inhalation in spontaneously breathing children [4-6] has been reported. The presumed mechanism is the foreign body acting as a ball valve, allowing air to pass during inspiration when bronchi dilate, but obstructing air flow during expiration when bronchi narrow [6]. Alternatively, a foreign body may work its way to the periphery and breach the pleura [5]. The authors of this report propose that this pneumothorax, complicating an accidental aspiration, is secondary to a valve mechanism. The chilli pepper found in the proximal left main bronchus may have acted as a valve secondary to its shape and position, allowing inspiration and expiration.

![Figure 1. Chest x-ray showing a left-sided tension pneumothorax with mediastinal displacement to the right.](image1)

![Figure 2. Part of the chilli pepper occluding the right main bronchus and partially occluding the left main bronchus resulting in a ball-valve mechanism.](image2)
obstructing expiration.

In adults, a pneumothorax secondary to a foreign body acting as a ball valve has rarely been described. However, a ball valve mechanism in an endotracheal tube causing a tension pneumothorax [7] and hyperinflation of a lung over a mucous plug [8] have been reported previously. In the latter case, a pneumothorax was prevented by swift removal of the plug using fibre optic bronchoscopy.

In short, we reported an accidental aspiration complicated by a tension pneumothorax. This pneumothorax was probably secondary to a food chunk acting as a valve mechanism. Two lessons may be learned from this case. First, choking may present with little coughing, instead sudden collapse may be the first sign. Second, aspiration may be accompanied by a valve mechanism leading to local over-inflation of the lung, with the potential risk of a (tension) pneumothorax.

References

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