Pneumothorax after nasogastric tube insertion

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Nasogastric tubes are not without complications and it is important to know how to deal with them appropriately.

Introduction

Nasogastric tubes are often inserted in intensive care settings, the emergency department and hospital wards. Common indications for nasogastric tubes are gastric decompression to palliate bowel obstruction, preventing aspiration in intubated patients and for the delivery of enteral nutrition or medication. A case of pneumothorax following nasogastric tube insertion in a 63-year-old neurosurgical patient is presented with an overview of the literature related to nasogastric tube complications.

Case report

A 63-year-old man was transferred to Addenbrookes Hospital in Cambridge from France in July 2009 where he sustained a high speed road traffic accident resulting in an overturned vehicle on the highway. When paramedics arrived he was incarcerated with an initial Glasgow Coma Score of 6, anisocoria (right mydriasis) with significant scalp and facial wounds, tachycardia with an initial blood pressure of 60/30. Cervical spine control was established and 3 L of crystalloid fluid infused. During transfer to the Centre Hospitalier Universitaire de Rouen the right mydriasis regressed and the systolic blood pressure stabilized around 90 mmHg. In the Accident and Emergency department (A&E) the patient was intubated and sedated.

A full-body computed tomography (CT) scan showed:

- Brain: right fronto-parietal subdural hematoma (10 mm), right fronto-temporal brain contusion, right hemispheric sub-arachnoid haemorrhage and perimesencephalic haemorrhage, multiple fractures of the temporal, parietal bones and facial bones;
- Spine: fracture of C5 and L4;
- Chest: fracture of the sternum with a retrosternal haematoma, contusions of the two pulmonary apices, fracture of the first and second right ribs and the left fifth rib;
- Maxillo-facial: bilateral othematoma;
- Limbs: right elbow dislocation and left humerus fracture.

Past medical history included untreated hypertension. The patient was stabilized. The brain injuries were treated conservatively. Standard management for the other injuries was instituted, including reduction of the elbow dislocation and a nail-plate osteosynthesis of the left humerus. Subsequent clinical course was favourable and the patient came off inotropes. After 31 days the patient was breathing spontaneously through his tracheostomy and had a normal blood pressure and urine output. His nutritional status was good.

The patient was subsequently repatriated to a neurosurgery ward at Addenbrookes Hospital in the UK where his conservative management continued. The patient was initially eating and drinking but was unable to increase his intake to the required levels needed for his nutritional requirements. A nasogastric tube was passed for the purposes of feeding under the guidance of the nutrition team. No aspirate was obtained and an...
X-ray showed the nasogastric tube extending into the right main bronchus and lower lobe (Figure 1). The nasogastric tube was re-positioned but was found to be in the right lower lobe again (Figure 2).

On the same evening the patient began to desaturate to 88% on air, became tachypnoeic, complained of pleuritic chest pain and became confused. On auscultation there was decreased air entry over the right lung. The patient was given high flow oxygen (15 L/min) with sats rising to 94% and routine blood tests were sent. An ECG showed sinus tachycardia with an arterial blood gas showing a pH of 7.399, pCO₂ of 5.19, pO₂ of 28.45, HCO₃⁻ of 23.5, base excess of –1.1 and a lactate of 1.5. A chest X-ray showed a right pneumothorax (Figure 3). A 20G chest tube was promptly inserted under aseptic conditions and local anaesthetic into the right fifth intercostals space and anterior axillary line. A repeat chest X-ray showed re-inflation of the lung and confirmed the chest drain’s position in the pleural space (Figure 4). The patient made a full recovery from the above event.

**Discussion**

Nasogastric tubes have an enduring place in our diagnostic and therapeutic armamentarium and its insertion is one of the more common invasive procedures in secondary care settings.¹ They can, however, be challenging to insert, misplaced² and uncomfortable³ and carry tracheobroncho-pleural,⁴ intravascular penetration⁵ and enteral⁶ complications as well as inadvertent intracranial
entry. The incidence of malplacement of nasogastric tubes into the airways ranges from 0.3% to 15%, and is more common after chest trauma or mechanical ventilation. This may be because of the need for adequate coordination of swallowing.

When nasogastric tubes are placed and an aspirate with a pH <5 is not obtained, then a chest radiograph, regarded as the gold standard to verify correct tube placement should be requested. However, interpreting supine chest X-rays in critically-ill patients may be difficult. A malpositioned feeding tube into the left lower lung may be misinterpreted as being in the stomach. In 1989, Roubenoff and Ravich proposed a two-step protocol for nasogastric tube insertion. In this procedure, the feeding tube is initially advanced blindly to 30 cm and the position is verified by chest radiograph. After radiographic confirmation of the tube position in the oesophagus, the tube is further inserted to its adequate length and a second radiograph is taken to check the final position. Marderstein et al. applied this protocol at their institution and found that the rate of nasogastric tube induced pneumothorax decreased from 0.38% to 0.09%. While this improves patient safety, it has several drawbacks: a time-consuming protocol, exposing the patient to two X-rays and cost-effectiveness. It is no surprise that this protocol has not gained widespread uptake but could be reserved for those with a history of tube malposition and complications.

Even common indications for nasogastric tubes are now coming into dispute. Long-term placement of a nasogastric tube is associated with ulceration and infection, known as the nasogastric tube syndrome. As with any nasogastric tube complication, the first priority is establishment of a safe airway and removal of the tube whenever possible. In the context of the nasogastric tube syndrome, antibiotic therapy and anti-reflux therapy should also be considered.

As in the case we present, Mardenstein et al. found that repeated malposition in the same patient was surprisingly common, with 32% of patients who had one intrabronchial misplacement ultimately having nasogastric tubes wrongly placed multiple times. In 1978, Fremstad and Martin reported the lethal complication of intracranial passage when a nasogastric tube was inserted in a patient with a basal skull fracture. Advanced Trauma Life Support (ATLS) guidelines now advise against insertion of nasopharyngeal airways or nasogastric tubes in these circumstances. However, Fremji and Mullet in 1997 reported a case of inadvertent intracranial insertion of an nasogastric tube in a non-trauma setting with subsequent death. Wang et al. reported a case of inadvertent nasogastric tube insertion into the right lower lobe bronchus of a 79-year-old patient with advanced chronic obstructive pulmonary disease (COPD), despite the patient having a cuffed tracheostomy tube in situ, resulting in pneumonia and septic shock. Postaci et al. reported a case of vocal cord paralysis from recurrent laryngeal nerve injury following nasogastric tube insertion. They advised avoiding forced manipulations.

When nasogastric tubes are placed for nutritional and medicinal purposes a pharmacist or other knowledgeable healthcare provider should be consulted for information regarding product availability, bioavailability, compatibility and potential for drug–nutrient interactions. This case confirms the importance of confirming correct placement. It illustrates the potentially life-threatening sequelae of improper nasogastric tube placement, the importance of vigilance and a high index of suspicion from ward staff.

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