

Pneumothorax after Insertion of Nasogastric Tube

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Abstract

A 65-year-old man was admitted to the Intensive Care Unit (ICU) for invasive mechanical ventilation after a significant intraventricular bleed. When his nasogastric tube (NGT) was accidentally removed, a new NGT was inserted blind. The pH of the thick green aspirate was under five and so enteral feeding was restarted. However, the patient subsequently deteriorated with rapidly worsening respiratory failure and invasive ventilation was required. An X-ray revealed misplacement of the NGT into the right lung with consolidation, pleural effusion, and pneumothorax. This highlights that indirect techniques to check NGT position (e.g., air insufflation and abdominal auscultation, aspirate appearance and pH) are unreliable. Even X-ray only detects misplacement after the event and mistakes have occurred because previous X-rays from the same patient have erroneously been reviewed. Only real-time visualization can prevent bronchopulmonary misplacement and the associated risks of pneumothorax and microbial contamination. The authors' current practice is therefore to use laryngoscopy, endoscopy, or fluoroscopy for insertion of all NGT in patients in ICU with impaired airway protective reflexes.

Keywords: Misplacement, nasogastric tube, pneumothorax

INTRODUCTION

Nasogastric tube (NGT) insertion is a common procedure that is often performed blindly in Intensive Care Unit (ICU) patients. However, misplacement into the lungs is common (0.3%–15%) and can cause life-threatening complications. We report a case that highlights the importance of insertion of NGT under direct vision in patients with impaired airway protective reflexes.

CASE REPORT

A 65-year-old man with diabetes mellitus, hypertension, and chronic kidney disease was admitted to the ICU for invasive mechanical ventilation after a significant intraventricular bleed. Ten days after admission the only organ support the patient required was 24% oxygen through a tracheostomy mask and enteral feeding through a NGT. He was transferred to the radiology suite for insertion of a peripherally inserted central catheter under fluoroscopic guidance. Unfortunately, the NGT came out during this procedure. A new NGT was inserted blindly on return to the ICU. The pH of the thick green aspirate was under five and so enteral feeding was restarted through the NGT.

Over the next 6 h, the patient deteriorated with rapidly worsening respiratory failure and invasive ventilation was required. A chest X-ray was performed [Figure 1]. This revealed misplacement of the NGT into the right lung with right lower zone consolidation, pleural effusion, and pneumothorax. Insertion of a chest drain demonstrated that the effusion contained NG feed. Computed tomography [Figure 2] demonstrated that the NGT had perforated the right lower lobe bronchus and that the tip of the NGT was in the pleural space. Feeding was stopped and the NGT was removed.

The patient's condition improved significantly after insertion of a chest drain. Videolaryngoscopy was used to insert a new NGT into the esophagus under direct vision. A chest X-ray confirmed correct placement of the NGT. Enteral feed was then started without any complication. Ventilatory support was weaned within 48 h and the patient was transferred to the ward with the tracheostomy *in situ* on 4 L/min oxygen administered through tracheostomy mask.

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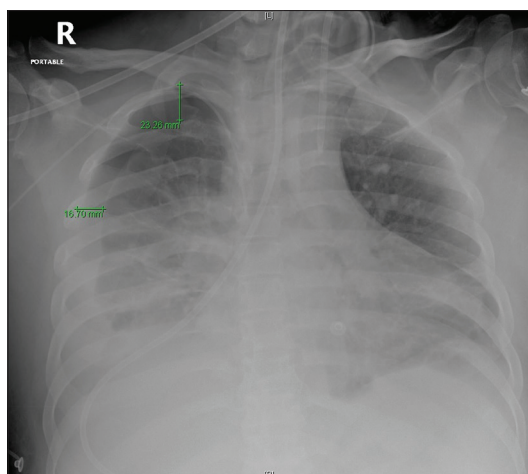


Figure 1: This chest X-ray demonstrates misplacement of the nasogastric tube into the right lung with right lower zone consolidation, pleural effusion, and pneumothorax

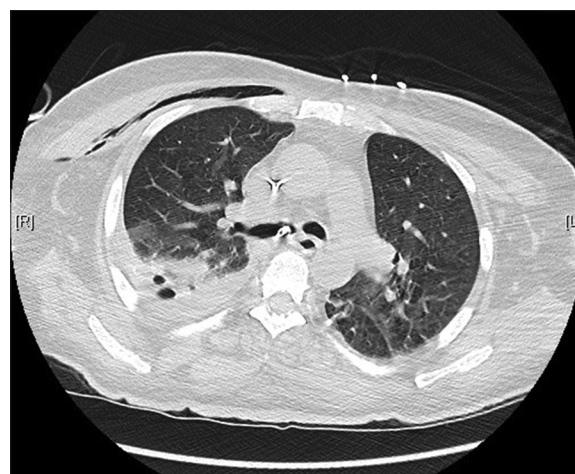


Figure 2: This computed tomography image performed after insertion of a chest drain reveals the nasogastric tube within the right main bronchus. It also demonstrates right lower zone consolidation and a pleural effusion

DISCUSSION

NGT insertion is frequently ordered with little thought and is routinely performed “blind” in the ICU. The use of a misplaced NGT is considered a “Never Event” in the United Kingdom’s National Health Service. However, misplacement into the lungs is surprisingly common (0.3%–15%).^[1,2] The significant complications which may then ensue include pneumonia, pneumothorax, respiratory failure, and even death.^[1,2] Misplacement is more common in mechanically ventilated patients.^[1,2] In one series, 60% of misplacements after blind NGT placement occurred in patients receiving mechanical ventilation.^[2] Risk factors include reduced level of consciousness, absence of a gag reflex, presence of an endotracheal tube, supine position, and head and neck surgery.^[2]

Auscultation of the abdomen while insufflating air and the appearance of the aspirate are often used to exclude NGT misplacement. That these techniques are completely unreliable has been highlighted and guidelines state that these tests should never be used.^[3] However, the same guidelines strongly advocate testing the pH of the aspirate from the NGT.^[3] This is because pH values under 5.5 are thought to confirm that the tip of the NGT is within the stomach. However, gastric pH is increased by continuous enteral feeding and medications that suppress gastric acid secretion.^[3,4] More dangerous, however, is the fact that although the pH of secretions in healthy lungs is 7.38–7.42^[3] infection decreases the pH of pleural fluid and bronchial secretions.^[5] Furthermore, inappropriately “flushing” the NGT before testing the pH falsely lowers the pH of the aspirate.^[3] Hence, bronchopulmonary NGT misplacement can be masked by reliance on these techniques alone.

The current gold standard investigation to confirm correct NGT placement is X-ray. The sensitivity of this investigation can be increased by the use of radiographic contrast. While this does provide definitive confirmation of the position of the

NGT it is expensive, time-consuming, and exposes patients to radiation.^[4] However, mistakes have occurred because previous X-rays in the same patient have erroneously been reviewed. Magnet-tracking systems enable real-time tracking of NGT progression. However, tracheal misplacement cannot be excluded while the tip of the NGT remains in the midline above the diaphragm.^[6]

Hence, these techniques only detect NGT misplacement after it has happened. Thus, although the risk of administering enteral feed into the lung can be reduced, the risks of pneumothorax, and microbial contamination of the lung remain unchanged.^[6] Only real-time visualization of placement of either a guide for NGT placement or the NGT itself can prevent bronchopulmonary misplacement.^[7-9] However, visualization of NGT placement with fluoroscopy, laryngoscopy, or endoscopy is technically challenging, expensive, and time-consuming.^[7-9]

A disposable NGT with a small camera at the distal end is now available (Kangaroo Feeding Tube with IRIS Technology; IRIS, Medtronic, USA).^[9] This allows anatomical landmarks (e.g., larynx, esophagus, folds of the gastric mucosa, and pylorus) to be seen during NGT placement.^[9] It also allows periodic reconfirmation that the NGT remains within the stomach by inspection of the gastric mucosa. A recent prospective, single-center, single-arm case series of ICU patients reported that the success rate of this technology was comparable to endoscopic placement of NGT.^[9] However, this technique is significantly less invasive, cheaper, and quicker than endoscopy.

The authors’ current practice for ICU patients with impaired airway protective reflexes is to insert all NGT under direct vision (i.e., with laryngoscopy, endoscopy, fluoroscopy, or NGT camera). Unless a NGT has been inserted under direct vision, an X-ray must be performed and reported (by an appropriately trained clinician) to show that the tip of the NGT is projected over the stomach before it can be used.^[4]

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Conflicts of interest

There are no conflicts of interest.

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