Mistaken Endobronchial Placement of a Nasogastric Tube During Mandibular Fracture Surgery

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A 64-year-old male had an awake right nasal fiber-optic intubation with an endotracheal tube for open reduction and internal fixation of bilateral displaced mandibular fractures. After induction of anesthesia, an 18 Fr nasogastric tube (NGT) was inserted through the left nostril and was secured. The patient required high flow rates to deliver adequate tidal volumes with the ventilator. A chest x-ray done in the postanesthesia care unit revealed a malpositioned NGT in the left lower lobe bronchus, which was immediately removed. The patient was extubated on postoperative day 2. Various traditional methods, such as aspiration of gastric contents, auscultation of gastric insufflations, and chest x-ray are in use to detect or prevent the misplacement of an NGT. These methods can be unreliable or impractical. Use of capnography to detect an improperly placed NGT should be considered in the operating room as a simple, cost-effective method with high sensitivity to prevent possibly serious sequelae of an NGT placed within the bronchial tree.

Key words: Nasogastric tube; Misplacement; Oral surgery.

Placement of a nasogastric tube (NGT) preoperatively for decompression of the stomach is common practice to allow drainage of gastrointestinal contents in the case of bowel obstruction, or in other cases when the patient is at risk of aspiration for some other reason. This case report involves a patient who required aspiration precautions via NGT placement for mandibular surgery due to facial trauma; the NGT was later found to be misplaced in the left main stem bronchus as the misplacement was unrecognized intraoperatively. We discuss the necessity of preventing the possible intraoperative and postoperative complications of a misplaced NGT and simple measures to recognize misplacement in patients presenting for similar surgeries.

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CASE REPORT

A 64-year-old male, American Society of Anesthesiologists physical status IIIE, with history of pancreatic cancer, HIV (last CD4 count = 500) on highly active antiretroviral therapy, and depression and prior history of drug abuse on methadone, and who had previously undergone a Whipple procedure and an open reduction and internal fixation for a right hip fracture, presented to the emergency department with facial trauma and loss of consciousness after an assault to the face by assailants. He had blood pooling in his oral cavity, obvious deformity of the mandible with a laceration right of midline, and complete anesthesia of the lower lip bilaterally. Computed tomographic imaging studies were positive for bilateral displaced, comminuted, mandibular fracture (right, body; left, ramus), and negative for an

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acute intracranial process. Fractures involved right and left inferior alveolar canals, likely causing trauma to the inferior alveolar nerves. Patient was alert and oriented, and could speak with difficulty. He denied shortness of breath, pain in his cervical spine, and pain in his extremities.

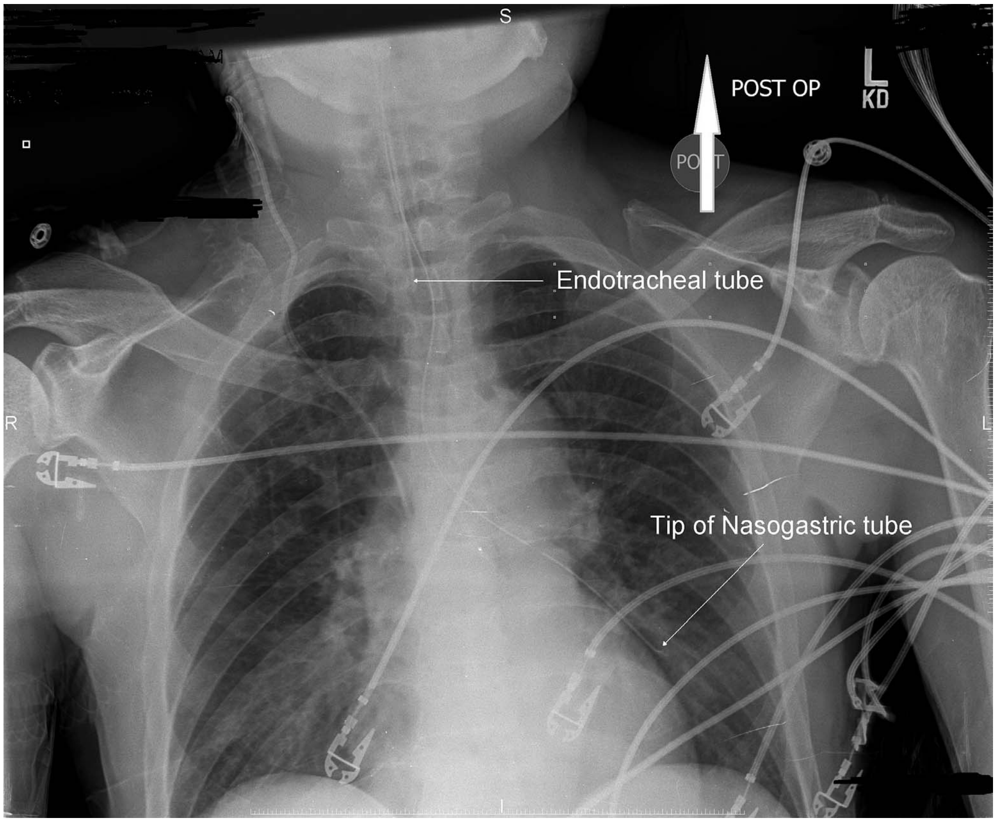
On preanesthetic evaluation we found a middle-aged, unkempt man in pain. He was 180 cm (5 ft, 11 in) and weighed 62 kg, with a body mass index of 20 kg/m^2. He had a heart rate of 68/min, blood pressure of 126/78 mm Hg, respirations of 14/min, oxygen saturation of 94% on room air, and a temperature of 37.3°C. On airway assessment, he was unable to open his mouth and was able to nonverbally communicate. Mallampati grade was not assessed because of the inability to open the mouth. The submandibular area was bruised and swollen. He was warm to the touch and his heart and lungs were clear to auscultation. Preoperative investigations revealed spondylosis of C3-C4 vertebra; a 12-lead electrocardiogram showed a normal sinus rhythm with a left anterior fascicular block. Urine was positive for opiates, cannabinoids, and methadone. An echocardiogram done a year prior to his presentation showed an ejection fraction of 60% with no evident regional wall motion abnormalities. Laboratory results revealed mild leukocytosis (white blood cell count = 12.7×10^9/L), anemia (hemoglobin = 12.5 g/dL) and a normal coagulation and chemistry profile. Patient was nil per os for more than 8 hours.

A general anesthetic was planned with an awake nasal fiber-optic intubation. An informed consent was obtained and the possibility of postoperative ventilation was discussed. Patient was scheduled for an open-reduction, intraoral fixation of bilateral mandibular fractures with titanium bone plates.

In the operating room, standard American Society of Anesthesiologists monitors were applied and an infusion of dexmedetomidine was started at 0.5 mcg/kg/min after an initial bolus of 1 mcg/kg. Glycopyrrolate 0.2 mg was given as an antisialagogue. Vital signs in the operating room were blood pressure = 150/96 mm Hg, pulse = 80/min, respirations = 14/min, and oxygen saturation of 94%. The patient also received inhaled nebulization with 4% lidocaine, and subsequently a transtracheal block for recurrent laryngeal nerve was performed with 2 mL of 4% lidocaine. The right nostril was dilated with nasopharyngeal airways lubricated with 2% lidocaine. A successful awake nasal fiber-optic intubation was performed and the patient was immediately induced after confirmation of the 7.0-mm endotracheal tube placement by both direct visualization with flexible bronchoscope and auscultation of breath sound. The endotracheal tube cuff was inflated with 5 mL of air. Fentanyl 150 mcg, propofol 200 mg, and rocuronium 50 mg were used as induction agents. Anesthesia was maintained with 2% sevoflurane. Postinduction vital signs were blood pressure = 108/60 mm Hg and pulse = 81/min. Initial ventilator settings were tidal volume = 500 mL, rate = 10/min with positive end-expiratory pressure of 5 cm H_2O, and a fraction of inspired oxygen of 1.0. A Foley catheter was inserted for urine output monitoring. A lubricated 18 Fr NGT was inserted through the left nostril without difficulty and was secured at 55 cm at the nostril. Clear secretions were suctioned and the proximal end of the NGT was closed and left undisturbed.

Fifteen minutes after induction patient became hypotensive with a blood pressure of 62/46 mm Hg. With hypotension not responding to 100-mcg boluses of phenylephrine and fluid bolus, the patient was started on a phenylephrine infusion titrated from 40 to 100 mcg/min. Because the patient's arms were tucked in by his side, no arterial line was attempted, and because a central line could not be obtained with the neck under surgical drapes, phenylephrine was infused through a peripheral 18 G intravenous line. In addition to the hypotension, it was noted that the ventilator was not able to deliver set tidal volumes. Further inflation of the endotracheal tube cuff with 3 mL of air and an increase in the flow from 2 to 3 L/min resulted in adequate ventilation. Also, at this point the ventilator settings were changed to deliver a tidal volume of 600 mL at a rate of 12 breaths/min as the end-tidal CO_2 was noted to be more than 40 mm Hg. The surgical procedure was uneventful and lasted 2 hours and 21 minutes.

At the end of the procedure a decision was made to keep the patient intubated in view of potential airway edema and vasopressor dependence. A left radial arterial line and a right internal jugular triple lumen catheter were inserted in the operating room after the surgical drapes were removed. During the surgery patient received a total of 4 L of crystalloids, estimated blood loss was 150 mL, and urine output was 220 mL. Patient was then transferred to the postanesthesia care unit, where a routine chest x-ray taken to confirm the tip of the triple lumen catheter revealed a malpositioned NGT in the left lower lobe bronchus (Figure), which was immediately removed. The endotracheal tube was noted to be at 5–6 cm above the carina, which was advanced 3 cm and secured to the patient's nose. Fortunately there was no evidence of a pneumothorax. The NGT was reinserted, and subsequent chest x-ray revealed properly placed NGT. The patient was later examined and found to be stable, following commands, with arterial blood gas measurements within normal limits: pH 7.40; P_{CO_2} 44 mm Hg, P_{O_2} = 135 mm Hg, oxygen saturation = 99%, HCO_3^- = 27.2 mmol/L, total CO_2 = 29 mm Hg, and fraction of inspired oxygen 1.0. The patient remained on



Malpositioned nasogastric tube in left lower lobe bronchus.

full ventilator support until he was extubated without incident 2 days later. He was discharged the following evening when his pain level was tolerable.

DISCUSSION

Various methods are in use to aid proper insertion of an NGT, including blind insertion with laryngeal manipulation, lateral neck pressure and forward head flexion, use of Magill forceps, esophageal guide-wire–assisted insertions, and insertions under direct visualization with pharyngoscopy.[1,2] Despite these techniques, Kirtania et al[1] reported a failure rate of 45–55% in proper NGT placement, suggesting that multiple attempts are routinely made to properly position an NGT. These above-mentioned maneuvers are not possible in a patient who presents for bilateral mandibular fracture repair, thus increasing the chances of misplacement.

Intraoperative hypotension along with increased peak airway pressures can suggest a tension pneumothorax. Fortunately, the hypotension in our patient was due to sepsis and general anesthetic. A misplaced NGT can certainly cause a pneumothorax, and this should be considered in the differential diagnosis of a patient with an unconfirmed placement of NGT.

The most frequent location of malpositioned NGTs is in the respiratory tract[3]; Sorokin and Gottlieb reported NGT placement in the left or right bronchus in 50 cases out of 2000 over 4 years, with 2 mortalities.[4] It is clear that the complications of a misplaced NGT can be serious in the case of endobronchial placement, with airway leakage, pulmonary edema, and death among the myriad possibilities.[3,5–7] Methods to detect a malpositioned tube should be undertaken to prevent these sequelae.[6]

Traditional practices to verify proper NGT placement include aspiration of gastric contents, auscultation of gastric insufflations, and chest x-ray. These methods are not completely reliable, with auscultation falling out of favor for its poor sensitivity.[3,5,8,9] Similarly, chest x-ray can be misinterpreted, with Hendry et al reporting 3 of 11 patients with unidentified malpositioned NGTs despite all having had radiography for verification of tube placement.[10] It still remains a very useful tool, but its use intraoperatively is cumbersome. Capnography is a convenient and practical alternative for verification of proper NGT placement.[11–14] Methods for adjoining a capnograph to an NGT vary, but most involve adapting other common supplies to create an airtight conduit between components. Some examples include using a disposable tracheostomy tube inner cannula with a 15-mm snap-lock connector to attach an NGT to a disposable capnograph[11] or using an endotracheal tube adapter, a 10-cm length of suction tubing, and a respiratory "Christmas tree" adapter with a reusable capnograph.[13]

Araujo-Preza et al[11] showed that capnography is both 100% sensitive and specific in detecting a misplaced NGT within the respiratory tract, having verified these results with conventional radiography. It should be noted that an important limitation to capnography is that it cannot determine whether the feeding ports of the NGT are below the diaphragm, and can therefore leave the patient at risk for aspiration if enteral feeds are started.[3] However, we strongly recommend adopting capnography as a common method of verification of NGT placement preoperatively, and most importantly intraoperatively in a case similar to ours, as not only would it be an ideal cost-effective way to minimize serious complications of NGT malpositioning, but it could also have prevented the unrecognized misplacement of the NGT in this particular case.

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