

Bronchopulmonary Complications of Nasogastric tube Placement

Jens Schreiber^{*1}, Thomas Hachenberg², Sebastian Föllner¹ and Sandra Riedel¹

¹Department of Pneumology, Otto-von-Guericke-University Magdeburg, University Hospital

²Department of Anaesthesiology and Intensive Care Medicine Magdeburg, Germany

Abstract: *Importance:* Nasogastric tube (NGT) placement can cause severe thoracic and non-thoracic complications, which can cause severe morbidity and mortality. The knowledge of predisposing factors is crucial for prevention of these complications. *Design:* We report on three different cases of severe complication of NGT placement, which have not yet been described. *Results:* In the first case, intrathoracic malposition of a NGT in a sliding gastric hiatus herniation and repeated insufflations of air for localization control resulted in compression and laceration of the lungs with massive pulmonary hemorrhage. In the second, there was a perforation of both the esophagus and the membranous part of the trachea from the gullet site by a guidewire-containing NGT. In the third case, severe pleuropulmonary complications occurred after short-term intrabronchial malposition. *Conclusions:* These cases are intended to encourage vigilance to reasons and the clinical course of thoracic complications of NGT placement. Predisposing factors and preventive measures are discussed.

Keywords: Nasogastric tubes, complications, esophageal injury, pulmonary haemorrhage.

INTRODUCTION

Nasogastric tube (NGT) placement is a frequently used procedure. As this procedure is usually easy to perform and rarely leads to complications if performed carefully, the overall risk of complications, potentially severe and life threatening, may be underestimated. Minor complications may include nosebleeds or sinusitis. However more severe complications may occur as erosion of the nose, esophageal or tracheobronchial perforation, laryngeal edema with asphyxia ("NGT-syndrome"), pulmonary aspiration, pneumothorax or intracranial placement of the NGT as a formidable extrathoracic complication in patients with cranial fractures.

The anatomy of the upper respiratory and digestive tracts abets bronchopulmonary complications of NGT placements. Close proximity of the larynx and the upper esophageal sphincter may lead to malposition of the NGT especially in patients with reduced consciousness and protective reflexes. Furthermore the close proximity of the esophagus and the very thin membranous part of the trachea may predispose to perforations.

We report on 3 cases of severe bronchopulmonary complications after NGT placement, occurring during the last 15 years in a large University hospital with approximately 3.000 procedures per year. All took place in patients with altered consciousness and we

want to highlight predisposing factors for these complications.

CASE REPORTS

Patient 1: A 79-year-old female patient was hospitalized for severe stroke due to right middle cerebral artery infarction. Consciousness was severely impaired. A 15 CH NGT without guidewire was placed without obvious problems. There was no tracheobronchial misplacement of the tube. Its correct position in the stomach was verified by insufflations of air and epigastric auscultation. Due to uncertainty in the auscultatory findings, this procedure was repeated several times. There was no chest X-ray, neither before the NGT-placement, nor for confirmation of its position. Suddenly the patient's condition deteriorated dramatically and massive haemoptysis occurred. Chest X-ray showed intrathoracically a massively dilated stomach with compression of the lungs (Figure 1a).

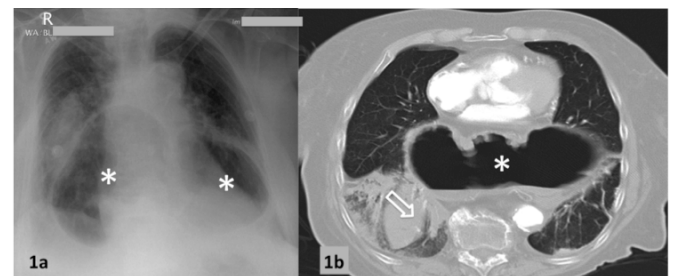


Figure 1. a. Chest X-ray showing intrathoracically a massively dilated herniation of the stomach (*). **b.** Thoracic CT showing a massively dilated sliding herniation of the stomach (*) with compression of the lungs and laceration of the right lung (arrow).

*Address correspondence to this author at the University Hospital Magdeburg, Dept. Pulmonology, Leipziger Str. 44, 39120 Magdeburg, Germany; Tel: 49-391-67-15421; Fax: 49-391-67-13356; E-mail: jens.schreiber@med.ovgu.de

Thoracic CT confirmed an extremely dilated, air-filled structure, corresponding to an inflated sliding hiatus herniation with displacement of a part of the stomach into the thorax. Furthermore CT revealed compression and laceration of lung parenchyma as the cause of haemoptysis. Bronchoscopy was performed to remove blood and clots and to ensure haemostasis. The air from the stomach was extracted by suction. The patient's condition stabilized.

Patient 2: Another female patient, 62 years old, was treated at the stroke unit because of severe ischemic apoplexy. In this patient as well, consciousness was seriously impaired. A 15CH polyurethane-NGT with a guidewire was placed without obvious problems. Shortly after this procedure the patient developed massive subcutaneous emphysema. Thoracic CT confirmed extensive subcutaneous and mediastinal emphysema and showed dislocation of the NGT in the tracheal lumen (Figure 2a). Additionally, CT showed distinct consolidation of lung parenchyma in both lower lobes as well as minute bilateral pleural effusion (Figure 2b). Fiberoptic bronchoscopy confirmed perforation of the esophagus and the membranous wall of the trachea with the NGT extending into the trachea. There was minimal bleeding. The NGT was removed and the defect was temporarily covered with an esophageal stent. There was no predisposing pathology of the esophagus and beside moderate COPD no illness of the respiratory system, which might have predisposed to this complication. The esophago-tracheal defect healed, the subcutaneous emphysema resolved spontaneously, the pulmonary infiltrates were treated with antibiotics and the patient recovered from this severe complication.

Patient 3: In another 68-year-old male patient, who was also artificially ventilated, malposition of a 15 CH - NGT with a guidewire in the right lower lobe occurred (Figure 3a). In this case there was no obvious perforation of the visceral pleura and the error was noticed and corrected about 2 hours afterwards. There was no nutrition fluid in the pleural space at the time of removal of the NGT, which was confirmed by ultrasound. Nevertheless the patient's course was complicated by an ipsilateral pleural empyema and pneumothorax (Figure 3b). The pleural empyema required a large bore chest tube. The results of the microbiologic examinations of the pleural effusion as well as the bronchial secretions were negative. The patient recovered from this complication.

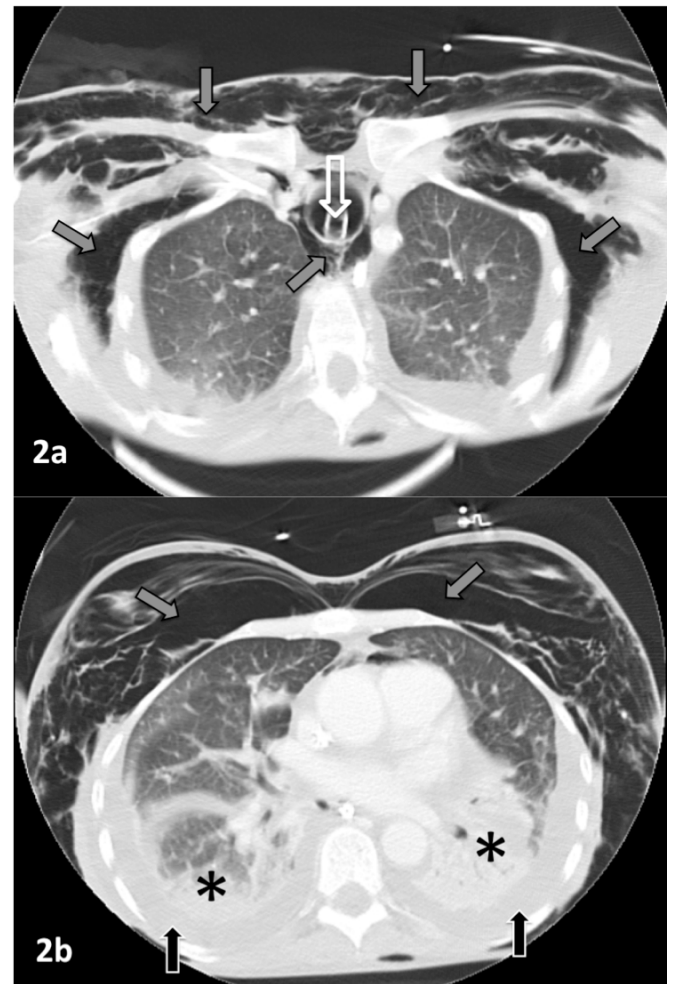


Figure 2. a. Thoracic CT showing extensive subcutaneous and mediastinal emphysema (grey arrows) and the NGT in the tracheal lumen (empty arrow). **b.** Thoracic CT showing subcutaneous emphysema (grey arrows), consolidation of lung parenchyma in both lower lobes (*) and minute pleural effusions (black arrows).



Figure 3. a. Chest X-ray showing malposition of a NGT in the right lower lobe (arrows) and pulmonary infiltrates (*). **b.** Thoracic CT showing pneumothorax (white asterisks), pleural effusion (black asterisks) and a chest tube (arrow).

DISCUSSION

Fine bore NGT have been used during the past decades and their placement is easily to perform and

usually safe. Nevertheless there are several thoracic and extra-thoracic complications as mentioned above – sometimes severe and life threatening. In one prospective series of 740 NGT insertions there was a 2% incidence of tracheopulmonary complications with a mortality of 0.3%, with pneumothoraces being the most frequent complication [1]. Other thoracic complications of NGT placement include erroneous bronchial placement, leading to atelectasis, pneumonia and lung abscess. Bronchial misplacement may be particularly significant in postoperative cases with bronchial sutures or anastomoses [2, 3]. Furthermore bronchial perforation with pleural cavity penetration resulting in pneumothorax, enteral feed hydrothorax and empyema may occur. Knotting of the NGT, requiring thoroscopic withdrawal of the tube, may complicate penetration into the pleural space. Bronchial perforation may cause pulmonary hemorrhage [4-7]. Massive bleeding has been reported after perforation of large blood vessels [8,9].

In our first patient, massive, life threatening pulmonary hemorrhage occurred as a result of hyperinflation of a sliding hiatus herniation with compression and laceration of the lung. Such a complication has not yet been published. This case shows that partial gastric herniation into the thorax bears a relevant additional risk. This case also shows that verification of the correct position of the NGT by insufflation of air is unsafe, bears an additional risk and may cause severe damage when performed improperly. This case demonstrates, that in unconscious patients, chest X-ray should be performed before the placement. In case of thoracic stomach endoscopic placement would have been mandatory. Radiographical confirmation of the correct position of the NGT is indispensable.

The second case indicates that tracheal perforation may occur not only as a result of tracheobronchial misplacement, but also via the healthy esophagus and the membranous part of the trachea resulting in massive mediastinal and subcutaneous emphysema. We suspect that the usage of a guidewire-containing NGT has abetted this complication. To the best of our knowledge, this complication has not yet been published. Though an isolated perforation of the esophagus has already been described in a patient with an anatomic variation [10], our case shows that an anomaly is not a prerequisite for esophageal perforation. Our patient recovered, although fatal mediastinal complications have been reported in the

literature after nasopharyngeal perforation with a NGT [11].

Our third case illustrates that pneumothorax and pleural empyema may complicate a short-duration bronchial malposition of a NGT without obvious perforation of the pleura. We speculate, that local alteration and inflammation of subpleural lung parenchyma in a patient with severe emphysema might have been contributed to this complication. Furthermore, this case illustrates that the NGT, especially stylet-stiffened fine bore tubes, may pass low-pressure tracheal cuffs, therefore intubation or the presence of a tracheal cannula does not protect against tracheobronchial malposition of a NGT.

These three complications, although not lethal, substantially added morbidity and prolonged hospital stay of the patients. Taken together with other thoracic and non-thoracic complications described in the literature we wish to revive awareness that NGT placement bears a relevant risk and the risk factors should be taken into account.

It has been reported several times and is confirmed by our cases, that perforations were not noticed during the insertion, even by experienced and careful physicians. The ease of placement therefore does not exclude complications.

In all our patients, consciousness was impaired either because of stroke or due to sedation during ventilatory support. Therefore an effective cough reflex and normal expression of pain are suppressed. Anatomic variants, in our case a gastric herniation, may predispose to complications. In this case the complication occurred as a result of the verification procedure for the correct position. It should be pointed out that the easy placement of the tube, the absence of coughing, and a positive epigastric auscultation are not always reliable confirmatory signs of correct tube placement. Up to 20% false positive gastric confirmation by auscultation has been reported [12]. Even measurement of the pH in the aspirate may be misleading in cases of patients treated with anti-ascidic drugs or when infected pleural or bronchial secretions have a low pH and also the “bubble sign”, i.e. bubbling under water as a sign of bronchial placement is not certain either [5].

Air insufflations in a NGT can cause devastating worsening in cases of intrapleural or intravascular

position of the tube and, as in our case if located in a herniation, especially when repeated several times.

Additional methods have been proposed to control the correct position of the tube: measurement of bilirubin in the aspirate, capnography and endoscopy [13-15]. In everyday practice these methods did not find broad acceptance and X-ray remains the gold standard to verify the correct placement.

Therefore we want to emphasize the importance of never forcing the tube during placement to prevent perforation of the esophagus and adjacent organs and never using the tube till X-ray confirmation has been performed. In unconscious patients chest X-ray should be performed additionally before NGT-placement to exclude anatomical abnormalities. This course of action should be documented in a SOP of the hospital.

CONFLICTS OF INTERESTS

All authors declare, that there are no conflicts of interests, regarding this manuscript.

REFERENCES

- [1] Rassias AJ, Ball PA, Corwin HL. A prospective study of tracheopulmonary complications associated with the placement of narrow-bore enteral feeding tubes. *Critical Care* 1998; 2(1): 25-28. <http://dx.doi.org/10.1186/cc120>
- [2] Granier I, Leone M, Garcia E, et al. Nasogastric tube: intratracheal malposition and entrapment in a bronchial suture. *Ann Fr Anesth Reanim* 1998; 17(10): 1232-1234. [http://dx.doi.org/10.1016/S0750-7658\(99\)80029-X](http://dx.doi.org/10.1016/S0750-7658(99)80029-X)
- [3] Kolbitsch C, Pomaroli A, Lorenz L, et al. Pneumothorax following nasogastric feeding tube insertion in a trachostomised patient after bilateral lung transplantation. *Int Care Med* 1997; 23(4): 440-442. <http://dx.doi.org/10.1007/s001340050354>
- [4] Thomas B, Cummin D, Falcone RE. Accidental pneumothorax from a nasogastric tube. *N Engl J Med*. 1996; 335 (17): 1325. <http://dx.doi.org/10.1056/NEJM199610243351717>
- [5] Pillai JB; Vegas A; Brister S. Thoracic complications of nasogastric tube: review of safe practice. *Interact Cardiovasc Thorac Surg* 2005; 4(5): 429-433. <http://dx.doi.org/10.1510/icvts.2005.109488>
- [6] Korkola SJ, Stansfield W, Belley G, et al. Thoracoscopic extraction of a Dobhoff feeding tube knotted in the pleural space. *J Am Coll Surg* 2001; 193(6): 704-705. [http://dx.doi.org/10.1016/S1072-7515\(01\)01082-1](http://dx.doi.org/10.1016/S1072-7515(01)01082-1)
- [7] Roubenoff R, Ravich WJ. Pneumothorax due to nasogastric feeding tubes. Report of four cases, review of the literature, and recommendations for prevention. *Arch Intern Med* 1989; 149(1): 184-188. <http://dx.doi.org/10.1001/archinte.1989.00390010156022>
- [8] Merchant FJ, Nichols RL, Bombeck CT. Unusual complication of nasogastric esophageal intubation – erosion into an aberrant right subclavian artery. *J Cardiovasc Surg* 1977; 18(2): 147-150.
- [9] Duthorn L, Schulte Steinberg H, Hauer H, et al. Accidental intravascular placement of a feeding tube. *Anesthesiology* 1998; 89(1): 251-253. <http://dx.doi.org/10.1097/00000542-199807000-00031>
- [10] DeDominicis F, Rezik R, Merlusca G, et al. Esophageal perforation during nasogastric tube insertion in a patient with right-sided aortic arch and thoracic aorta. Pathophysiology and surgical limitations. *J Chir (Paris)* 2009; 146(5): 499-502
- [11] Ronen O, Uri N. A case of nasogastric tube perforation of the nasopharynx causing a fatal mediastinal complication. *Ear Nose Throat J* 2009; 88(9): 17-18.
- [12] Benya B, Langer S, Morbarhan S. Flexible nasogastric feeding tub tip immediately after placement. *J Parenter Enteral Nutr* 1990; 14(1): 108-109. <http://dx.doi.org/10.1177/0148607190014001108>
- [13] Metheny NA, Smith L, Stewart BJ: Development of a reliable and valid bedside test for bilirubin and its utility for improving prediction of feeding tube location. *Nurs Res* 2000; 49(6): 302-309. <http://dx.doi.org/10.1097/00006199-200011000-00002>
- [14] Araujo-Preza CE, Melhado ME, Gutierrez FJ. Use of capnometry to verify feeding tube placement. *Crit Care Med* 2002; 30(10): 2255-2259. <http://dx.doi.org/10.1097/00003246-200210000-00013>
- [15] O'Keefe SJD, Foody W, Gill S. Transnasal endoscopic placement of feeding tubes in the intensive care unit. *J Parenter Enteral Nutr* 2003; 27(5): 349-354. <http://dx.doi.org/10.1177/0148607103027005349>