MISPLACEMENT OF NASOGASTRIC TUBES AND OESOPHAEGAL MONITORING DEVICES

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SUMMARY

Accidental invasion of the trachea past an inflated cuff may occur more easily when endotracheal tubes with soft, low pressure cuffs are used. A new, simple and safe technique for blind oesophageal intubation is outlined. Two cases of accidental invasion of the trachea by oesophageal tubes are described.

There is a risk of nasogastric tubes and oesophageal monitoring devices being misplaced into the trachea in unconscious patients. In our hospital this has occurred with apparent increasing frequency in the intensive care units. Nasogastric tubes are misplaced most commonly (case 1) but an oesophageal stethoscope (case 2), an electrocardiogram lead and a temperature probe have also been found in the tracheobronchial tree. We suspect that the ease with which a nasogastric tube may pass the inflated cuff of an endotracheal tube is still not widely appreciated—"a Ryle's tube may be in the trachea without either the patient or the anaesthetist being aware of it" (Lee and Atkinson, 1973). Published reports of accidental entry of oesophageal devices into the trachea (Johnstone and Lief, 1972; Zwagwil and Metzerott, 1973) or other sites (Seebacher, Nozik and Mathieu, 1975) are few.

CASE REPORTS

Case 1

The trachea of a 53-yr-old male, who was undergoing repair of an abdominal wound dehiscence, was intubated with a red rubber cuffed orotracheal Magill tube. At the end of the surgical procedure a nasogastric tube was passed blindly and connected to continuous suction. Artificial ventilation was continued in the intensive care unit with a Bennett PR 2 Ventilator on assist-control mode. The patient became restless, with a respiratory frequency greater than 20 b.p.m., and developed sinus tachycardia. Arterial blood-gas analysis showed persistent hypoxaemia despite high inspired oxygen concentrations. Ventilation was then controlled, following the injection of pancuronium i.v. with an Emerson Ventilator set at a rate of 12 b.p.m. and a tidal volume of 600 ml. However, no visible chest expansion occurred on this setting, and peak inflation pressures were very low. To achieve a measured expiratory tidal volume of 600 ml, an increase in the machine setting to 1800 ml was needed. No leakage past the inflated cuff of the endotracheal tube was detected. At this time, condensation of water vapour synchronous with ventilation was noted in the nasogastric tube and suction container. Submerging the external end of the nasogastric tube under water produced vigorous bubbling. Re-examination of the post-operative chest x-ray revealed that the nasogastric tube had entered the trachea and right lower lobe bronchus (fig. 1). After removal of the nasogastric tube from the trachea, there was no disparity between the measured expiratory tidal volume and the machine setting, and the patient's clinical condition improved.

Case 2

A 50-yr-old female undergoing mitral valve replacement was found to have persistent right lower lobe collapse before closure of the chest, and high peak inflation pressures. Direct examination of the lung by the surgeon revealed no obvious cause. Bronchoscopy with a fibroptic bronchoscope, through the tracheal tube, revealed that an oesophageal stethoscope had entered the trachea past the inflated cuff of the plastic endotracheal tube and had virtually occluded the right lower lobe bronchus. Leakage of gas past the cuff was barely audible but there was much background noise in the operating room. Removal of the stethoscope resulted in immediate re-expansion of the collapsed lobe, a
FIG. 1. Chest x-ray showing a nasogastric tube (A) passing the inflated cuff (Δ) of the tracheal tube and extending into the trachea, right main-stem bronchus and right lower hemithorax. There is mediastinal shift to the right, elevation of the right diaphragm and extensive infiltration throughout the entire right lung field, consistent with collapse. (There is no radiological evidence of an intrathoracic hiatus hernia which might otherwise explain the supradiaphragmatic position of the nasogastric tube.)

reduction of peak inflation pressures to normal and disappearance of the leak.

DISCUSSION

In most other cases known to us, misplacement of a nasogastric tube into the trachea was first detected on examination of the routine postoperative chest x-ray (fig. 2). However, on occasions this was missed or misinterpreted as an external e.c.g. lead (fig. 3). Our two case reports demonstrate that misplacement may present in several ways:

- Unexplained hypoxaemia or hypercarbia
- Atelectasis
- Difficulty in maintaining tidal volume on mechanical ventilation
- Reduction in peak inflation pressure if leakage occurs

Increase in peak inflation pressure
Audible leakage past the inflated cuff of the tracheal tube
Condensation in the nasogastric tube synchronous with ventilation
Failure to aspirate gastric secretions.

We have noted that other oesophageal devices, such as oesophageal electrocardiogram leads and temperature probes, may be misplaced in the same way. A false low temperature recorded from an oesophageal temperature probe lying in the trachea is a result of the cooling effect of inspired gases. Conversely, warmed inspired gases may produce a false high reading in the hypothermic patient. A slow response to warming or cooling as detected by an oesophageal temperature probe also suggests misplacement.

On only one occasion (case 1) have we seen invasion of the trachea occurring in the presence of a red rubber tube with a high pressure cuff. The increasing use of the newer plastic endotracheal tubes with low pressure cuffs may well increase the frequency of accidental insertion into the trachea of the various devices described.

FIG. 2. Chest x-ray showing a nasogastric tube (A) lying in the trachea and right main-stem bronchus and extending into the right lower lobe. The right hemidiaphragm is elevated, indicating collapse of the right lower lobe.
A variety of “simple”, “safe” or “reliable” methods has been used to overcome the difficulty of passing a nasogastric tube in the unconscious patient. These include stiffening the tube by chilling and by using a Fogerty catheter (Rosenberg, 1975) or guitar string (Matsuki and Zsigmond, 1972; Wedley, 1972) as a stylet. Some methods involve introducing the nasogastric tube via a lubricated nasopharyngeal airway or a nasotracheal tube with its tip lying in the pharynx (Hunter, 1973; Mirakhur, 1973; Kamat, 1975). However, this carries the same hazard as stiffening with an improvised stylet: the likelihood of the tip being introduced into the trachea as easily as into the oesophagus. Blowing into the tube is likely to distend the stomach (Smith, 1973), and relying on the surgeon to palpate the tube in the lower oesophagus or stomach may not be foolproof (Saha, 1974).

One solution to these problems might be oesophageal intubation in the awake patient before anaesthesia, but the need for multiple oesophageal devices, in cardiac surgery for example, makes this impracticable and disturbing for the patient. Also, the risk of vomiting and regurgitation during induction is increased. Therefore, the following plan is recommended for multiple oesophageal intubations during anaesthesia.

1. Place the orotracheal tube with the cuff 1–2 cm beyond the cords, inflate the soft cuff to a pressure just sufficient to prevent leakage at peak inflation pressure, and check that both lungs are ventilated adequately by listening with a stethoscope in both axillae.

2. Insert the oro-oesophageal stethoscope using, if necessary, two fingers in the mouth to guide the tube into the oesophagus (anterior displacement of the mandible will open the pharyngo-oesophageal junction). If the tube is advanced while listening, the usual heart and breath sounds will be loudest when the tip of the catheter is in the oesophagus behind the heart. It is important to listen for airway leaks, since inadvertent invasion of the trachea will permit air to escape around the cuff. Do not try to seal the leak by adding more air to the cuff; this will delay detection of the misplacement. Instead, withdraw the oesophageal stethoscope to a position above the larynx and reinsert. If necessary, check its position by direct laryngoscopy.

3. Insert a well-lubricated nasogastric tube, preferably a wide-bore sump tube (Rosenberg,
On advancing to 20–25 cm, slight resistance will be appreciated as the larynx is encountered. The tube should be withdrawn 1 cm and the larynx displaced anteriorly by elevation of the jaw. Advance the tube into the oesophagus and stomach. Place the free end of the nasogastric tube next to the ear and listen for air escaping during positive pressure ventilation. An outrush of air during inspiration suggests that the tube is in the trachea or bronchus. Do not apply suction to the tube or inject water until this test has been performed as alveolar hypoventilation and atelectasis may result.

(4) The same tests of leakage around the cuff are applied when inserting an oesophageal electrocardiogram lead and temperature probe. The temperature in the oesophagus of a premedicated surgical patient is normally 36–36.5 °C. Lower readings suggest that the probe is lying in the trachea or coiled in the pharynx. If there is doubt about correct positioning, direct laryngoscopy must be used, especially if the cuff on the tracheal tube has been temporarily deflated to aid advancement.

(5) If time and circumstances allow, a chest x-ray before operation and after insertion of all lines and tubes provides the best safety check of positioning. For those patients who continue to receive mechanical ventilation with oesophageal devices still in place, an early postoperative chest film is essential.

This plan relies only on simple clinical “bed-side” tests to position these devices correctly and detect misplacement into the trachea. After 6 months’ experience of the plan in our hospital there have been no further misplacements in more than 80 general anaesthetics for open-heart surgery.

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REFERENCES


**RESUME**

Il peut se produire plus facilement une invasion accidentelle de la trachée lorsqu’on passe un manchon gonflé que lorsqu’on utilise des tubes endotrachéaux à manchons mous, à basse pression. On expose dans cet article une nouvelle technique, simple et sure, pour l’intubation oesophagienne effectuée sans visibilité. On décrit dans cet article deux cas d’invasion accidentelle de la trachée par des tubes oesophagiens.

**FAŁSCHE ANBRINGUNG VON NASOGASTRISCHEN RÖHREN UND GERÄTEN ZUR ÜBERPRÜFUNG DER SPEISEROHRE**

**ZUSAMMENFASSUNG**


**ERREUR DE MISE EN PLACE DES TUBES NASOGASTRIQUES ET DISPOSITIFS DE SURVEILLANCE DE L’ÖESOPHAGE**

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**FALSCHES ANBRINGEN VON NASOGastesch RÖHREN UND GERÄTEN ZUR ÜBERPRÜFUNG DER SPEISEROHRE**

**ZUSAMMENFASSUNG**


**DESALOJAMIENTO DE TUBOS NASOGASTRICOS Y DISPOSITIVOS PARA OBSERVACION DEL ESOFAGO**

**SUMARIO**

La invasión accidental de la tráquea puede ocurrir más fácilmente a lo largo de un brazal neumático inflado cuando se utilizan tubos endotraqueales blandos, de baja presión. Se expone una técnica nueva, sencilla y segura, para la intubación esofágica ciega. Se describen dos casos de invasión accidental de la tráquea con tubos esofágicos.