

Iatrogenic oesophageal perforation due to tracheal or nasogastric intubation

Edward A. Norman MD, Mitchel Sosis MD PH D

Oesophageal perforation, due to a difficult endotracheal or nasogastric intubation occurred in a 49-year-old female. Perforation of the oesophagus is a rare complication of intubation of the trachea or oesophagus. Endotracheal intubation alone is most often blamed for iatrogenic oesophageal trauma following surgery. The incidence of iatrogenic oesophageal trauma is similar after nasogastric or endotracheal intubation. Iatrogenic oesophageal perforation occurs principally over the cricopharyngeus muscle on the posterior wall of the oesophagus. Here the oesophagus is thin and is markedly narrowed. Contamination of the perioesophageal space with gastric contents leads to diffuse cellulitis and infection. Diagnosis is made by evidence of cervical subcutaneous emphysema, cervical pain, dysphagia, temperature elevation and leukocytosis. Plain roentgenograms of the neck and a contrast media swallow will confirm the diagnosis. Treatment consists of massive antibiotic therapy followed by surgical repair and drainage of the area. Mortality ranges from 10–15 per cent with early diagnosis to 50 per cent if surgery is delayed.

Key words

COMPLICATIONS: oesophageal perforation, iatrogenic rupture of the oesophagus; ANAESTHETIC TECHNIQUES: tracheal intubation, gastric intubation.

From the Department of Anaesthesiology, Saint Barnabas Medical Center, Livingston, New Jersey.

Address correspondence to: Dr. Edward A. Norman, Saint Barnabas Medical Center, Old Short Hills Road, Livingston, New Jersey 07039, U.S.A.

Perforation of the oesophagus is a rare complication of intubation of the trachea and oesophagus¹⁻⁶ and specifically an infrequently reported complication of difficult endotracheal intubation.^{7,8} Anaesthetists and intensivists frequently intubate the trachea and occasionally insert feeding tubes, oesophageal dilators and nasogastric tubes. Such intervention may cause trauma to soft tissue structures. We present a case of oesophageal perforation, which followed difficult endotracheal intubation and difficult nasogastric tube placement.

Case report

A 49-year-old female was scheduled for diagnostic laparotomy. The patient had a small mouth which she was unable to open greater than 2 cm.

Anaesthesia was induced with 250 mg thiopentone IV, followed by 80 mg succinylcholine to facilitate intubation. The intubation of the trachea was difficult. Several attempts were made with #3 Miller and #3 Macintosh laryngoscopy blades. Ventilation was maintained using a mask and 100 per cent O₂, between the attempted intubations. Correct tracheal placement was achieved with a 7 mm internal diameter, Murphy eye, cuffed, "lo-pro" endotracheal tube (American Hospital Supply, McGraw Park, Ill.). The oesophagus was accidentally intubated at least once. A Satin-slip™, #14 French, Intubating Stylet (NCC Division Mallinckrodt, Inc., Argyle, N.Y.) was used but did not extend beyond the tip of the endotracheal tube. The surgeons requested that a nasogastric tube be placed. A well lubricated #18 French Levine tube would not advance easily, even with a gloved hand guiding it through the pharynx. To verify placement by auscultation, 50 cc of air was passed into the tube. Air entered the stomach with slight resistance. The tube was taped in position. The surgeon was asked to palpate the stomach to verify correct tube



FIGURE 1 Plain chest x-ray revealing widening of the superior mediastinum.

placement, but multiple adhesions prevented this. After an uneventful bilateral salpingo-oophorectomy the patient was extubated. A new naso-gastric tube was inserted in the recovery room because the tube inserted in the operating room was reported to be kinked and not draining well. A moderate amount of blood was noted on the tube's removal. Insertion was again difficult but the new tube drained gastric contents. After two hours the patient was discharged to the ward.

During the first anaesthesia postoperative visit, the patient stated she had mild discomfort in her throat and neck. This was attributed to pharyngeal irritation from both the endotracheal tube and the nasogastric tube. The nasogastric tube was still in place. There were no further complaints and the patient was reassured that the discomfort would diminish. On postoperative day three the patient received throat lozenges for the pharyngeal and cervical discomfort.

Four days following surgery the naso-gastric tube was removed. The tube had functioned well. It was used exclusively for gastric drainage, never alimentation. There was continued cervical pain but this was interpreted as continued discomfort from the nasogastric tube. On postoperative day five, "bronchospasm" was noted. On auscultation bilateral wheezing was heard. Leukocytosis was not present at this time or at any time during the hospital course. A chest x-ray revealed "... widening of the superior mediastinum with anterior displacement of the

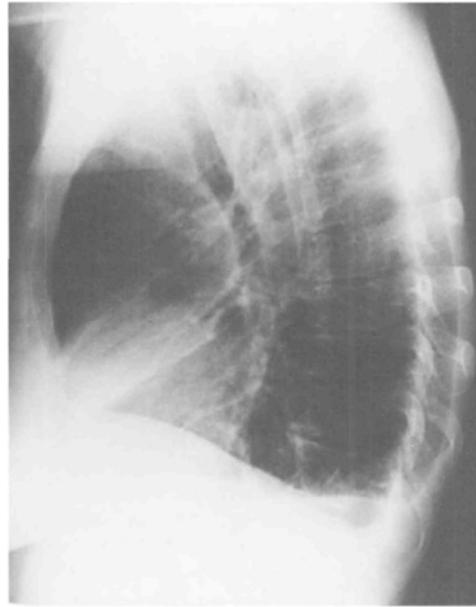


FIGURE 2 Lateral chest x-ray revealing anterior displacement of the trachea.

trachea" (Figures 1 and 2). On the sixth postoperative day dysphagia was reported. The following day a gastrograffin swallow showed "complete oesophageal obstruction at the level of the carina with collection of contrast between the trachea and oesophagus consistent with oesophageal perforation and mediastinitis" (Figure 3). Soft tissue x-rays of the neck suggested the perforation occurred at the level of the pyriform sinus.

An open cervical oesophageal exploration was performed and no perforation was found. A diagnosis of a false passage or thoracic oesophageal perforation was entertained. The patient was started on peripheral intravenous hyperalimentation and antibiotics. At the patient's request she was transferred to another institution. Conservative therapy was continued. One week later, she underwent thoractomy for mediastinal drainage and was subsequently able to advance to a regular diet. The discharge diagnosis was thoracic oesophageal perforation.

Discussion

It has been reported that difficult endotracheal

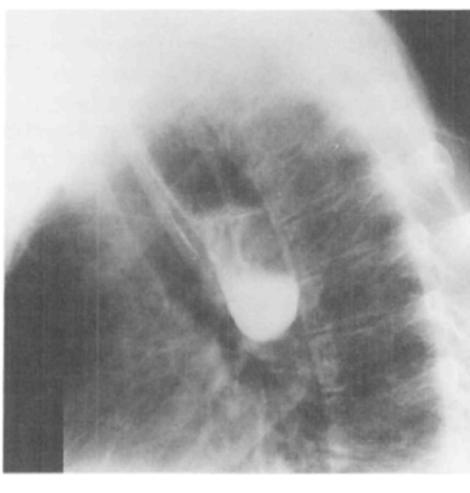


FIGURE 3 Gastrograffin swallowing showing complete oesophageal obstruction at the level of the carina with collection of contrast between the trachea and oesophagus consistent with oesophageal perforation and mediastinitis.

intubation may cause perforation or haematoma of the posterior pharynx or oesophagus. The anaesthetist or intensivists may also cause trauma to this region by passage of various tubes and dilators. Most commercially available nasogastric tubes are constructed of pliable synthetic materials. Therefore, their soft and flexible nature is generally considered to safeguard against trauma to the upper gastrointestinal tract.⁹ The incidence of oesophageal perforation is nearly equal for nasogastric intubation and difficult endotracheal intubation.^{3-5,7,10}

In one review of all causes of oesophageal perforation, 72 per cent occurred from various iatrogenic causes. Sixty per cent were located primarily in the cervical oesophagus, followed by the midthoracic (30 per cent) and distal oesophagus (ten per cent). Cervical oesophageal perforation, secondary to instrumentation of any kind, is located principally over the cricopharyngeus muscle on the posterior wall.¹⁰ Here the oesophagus is thin walled, owing to the absence of longitudinal muscle fibres² and has marked narrowing of the lumen at the introitus.¹¹ In our patient the contrast collected between the oesophagus and trachea indicating an anterior oesophageal perforation. Soft tissue x-rays of the neck suggested the perforation occurred at the

level of the pyriform sinus. The ensuing cervical exploration did not localize an oesophageal tear. The perforation probably did not penetrate the oesophageal wall completely, creating a false passage; or the perforation was in the thoracic oesophagus.

Arthritic changes in the cervical vertebrae increase the risk of perforation due to compression of the oesophagus against the bony vertebral body. While performing dilation procedures, the highest rate of perforation is associated with pneumatic dilation, next with metal olives and lowest with mercury bougies.¹⁰ Additionally, a broad or short neck, poor dentition, trismus, and micrognathia contribute to a difficult and perhaps a traumatic intubation. Our patient did present with a small mouth, with a limited opening.

The consequences of these perforations are due to the contamination of the perioesophageal space with corrosive digestive fluids, food and bacteria, which leads to a diffuse cellulitis with localized or extensive infection. Suppuration first appears in the perioesophageal space. This space extends from the cranial vault to the diaphragm.² Since mediastinal pressure is below atmospheric pressure during normal breathing, a tear of the oesophagus or upper pharynx can cause suctioning of luminal contents directly into the mediastinal space. The tissue here is poorly vascularized and highly susceptible to infection, especially with anaerobic bacteria. Further inoculation may occur if mask ventilation is practiced after the perforation, but before endotracheal intubation is performed,¹¹ as occurred in our patient's case. Early diagnosis of an oesophageal or pharyngeal perforation is made by evidence of cervical subcutaneous emphysema, cervical pain, dysphagia and temperature elevation. Leukocytosis is usually present. These signs and symptoms may occur immediately or be delayed for several days. Our patient had only cervical pain and dysphagia. These findings indicate the need for a plain roentgenogram of the neck and thorax. They would demonstrate cervical or cervico-mediastinal emphysema, widening of the upper mediastinum and possible pleural extravasation or a pneumothorax.

The plain chest x-ray in our case demonstrated mediastinal widening (Figure 1). A water soluble contrast medium swallow will show extravasation of contrast material. Our contrast study revealed oesophageal obstruction as well as extravasation

(Figure 3). Oesophagoscopy may not visualize a tear and was not instituted by our gastroenterologist. If perforation has been overlooked, acute mediastinitis may develop presenting as sepsis, shock, electrolyte imbalance or respiratory distress.²

The differential diagnosis most commonly includes angina, perforated peptic ulcer, and spontaneous pneumothorax; other diagnostic possibilities include pancreatitis, cholangitis, dissecting aortic aneurysm and pulmonary embolism.¹⁰

Treatment for cervical oesophageal perforation begins with massive antibiotic therapy followed by repair and drainage of the perforation via the cervical or thoracic approach.² A rare case may be treated conservatively if the cavity is well drained back into the oesophagus, symptoms are minimal and there is no sepsis.¹⁰ Initial therapy for our patient was a cervical exploration. No evidence of perforation was found. The diagnosis of a false passage of thoracic oesophageal perforation was considered and conservative therapy was instituted. Eventually a thoracotomy was performed for mediastinal drainage.

Mortality depends on the site of perforation and prompt diagnosis. The results of treatment of cervical oesophageal exploration are excellent with early cervical exploration.¹¹ Survival following perforation of the thoracic oesophagus ranges from 10–15 per cent in patients treated in less than 24 hours with surgery to 50 per cent for patients with delayed surgical therapy.^{12–14} Our patient fits into the second group.

An autopsy study of the hypopharynx and cervical oesophagus of 103 patients who were subjected to intubation and/or endoscopy during their final period of hospitalization, shows that this injury is commonly missed. Sixty per cent demonstrated evidence of mucosal ulceration, haemorrhage or perforation, but only 20 per cent of these iatrogenic injuries were recognized clinically. Nasogastric tubes were inserted in 34 of 103 cases (33 per cent) and resulted in mucosal damage and postcricoid ulcers in nine patients (26 per cent) in whom the tubes were retained for an average of five days.^{9,15,16}

Prevention of oesophageal perforation is not always possible. Preparation for difficult endotracheal or nasotracheal intubations is a necessity for the patient with a previous history of difficult intubation, neck tumours or the anatomical anomaly

mentioned above. Awake fiberoptic endotracheal intubation is the ideal method in this situation.¹⁵ If endoscopy equipment is not available, then meticulous preparation, including the exaggerated sniffing position and cricoid displacement, in order to obtain a better view of the vocal cords, is necessary. If a stylet is used it must not protrude beyond the tip of the endotracheal tube.

Naso-gastric intubation is facilitated by a well lubricated tube, guidance of the tube into the oesophagus with the index finger in the pharynx and gentle pressure, avoiding excess force. Placement of the nasogastric tube in our case was difficult and excess force may have been used for insertion, either in the operating room or the recovery room. Thus, the practitioner must always bear in mind that the routine passage of a naso-gastric tube, dilator or endotracheal tube is not without risk. Both can lead to life threatening oesophageal perforation, with acute mediastinitis.

In conclusion, we have presented a case of traumatic endotracheal intubation and difficult nasogastric intubation which led to oesophageal perforation. It is not clear if the oesophageal perforation was caused by endotracheal or nasogastric intubation. However, endotracheal intubation alone is most often blamed for iatrogenic oesophageal trauma following surgery. Statistics show that the incidence of iatrogenic trauma is equal after nasogastric or endotracheal intubation. This patient was at a much higher risk of oesophageal perforation, due to the difficulties encountered in placement of both the endotracheal and naso-gastric tubes.

Acknowledgments

The authors wish to thank Debra M. Norman and Idrees Ahmad, M.D. for editing and Mary Jane Gruppuso for typing the manuscript; and acknowledge the support of Norman J. Zeig, M.D.

References

- 1 O'Neill JE, Giffin JP, Cottrell JE. Pharyngeal and esophageal perforation following endotracheal intubation. *Anesthesiology* 1984; 60: 487–8.
- 2 Dubost C, Kaswin D, Duranteau A, Jehonna C, Kaswin R. Esophageal perforation during attempted endotracheal intubation. *J Thor Cardiovasc Surg* 1979; 78: 44–51.

- 3 Groves LK. Instrumental perforation of the esophagus. What is conservative management? *J Thor Cardiovasc Surg* 1966; 52: 1-10.
- 4 Wishern WA. Perforation of the esophagus. *Am J Surg* 1970; 119: 534-6.
- 5 Zittel RX, Boden T. Erkennung and behandlung iatrogenen oesophagus-perforationen. *Med Klin* 1966; 61: 1111-3.
- 6 Wolff AP, Kuhm FA, Ogura JH. Pharyngeal-esophageal perforations associated with rapid oral endotracheal intubation. *Ann Otol* 1972; 81: 258-61.
- 7 Pembleton WE, Brooks JW. Esophageal perforation of unusual etiology. *Anesthesiology* 1976; 45: 680-1.
- 8 Hirsch M, Abramowitz HB, Shaira S, Varki Y. Hypopharyngeal injury as a result of attempted endotracheal intubation. *Radiology* 1978; 128: 37-9.
- 9 Ghahremani GG, Turner MA, Port RB. Iatrogenic intubation of the upper gastrointestinal tract in adults. *Gastrointest Radiol* 1980; 5: 1-10.
- 10 Payne WS, Ellis RH. Esophagus and diaphragmatic hernias. In: *Principles of Surgery*. Schwartz S1, Shires GT, Spencer FC, Storer EH (eds.). New York: McGraw-Hill. 1974 pp. 1103-7.
- 11 Skinner DB. Perforation of the esophagus. In: *Textbook of Surgery*. Sagiston DC (ed.). Philadelphia: WB Saunders 1977: 814-8.
- 12 Akakura I, Nakamura Y, Kakegaga T, Nakayaman R, Watanabe H, Yamashita. Surgery of carcinoma of the esophagus with preoperative radiation. *Chest* 1970; 57: 47-57.
- 13 Carter R, Brewer L. Achalasia and esophageal carcinoma. Studies in early diagnosis for improved surgical management. *Am J Surg* 1975; 130: 114-20.
- 14 Jannssen J, Valembos P. Iatrogenic perforation of the esophagus. In: *Diseases of the Esophagus*. Vantrappeng, Hellemons J. (eds.). New York: Springer. 1974: 682-8.
- 15 Wolf AP, Kessler S. Iatrogenic injury to the hypopharynx and cervical esophagus. An autopsy study. *Ann Otol* 1973; 82: 778-83.
- 16 Vijayalakshmi P, Stehling L, Zauder H. *Fiberoptic endoscopy in anesthesia*. Chicago: Year Book Medical Publications, 1983.

Résumé

Les auteurs présentent un cas clinique de perforation œsophagienne dû à une intubation endotrachéale ou nasogastrique difficile. La perforation de l'œsophage est une complication rare de l'intubation de la trachée et de l'œsophage. L'intubation endotrachéale seule est considérée le plus souvent comme responsable du traumatisme œsophagien après la chirurgie. Les statistiques démontrent que l'incidence du traumatisme œsophagien iatrogénique est égale après l'intubation nasogastrique que l'intubation endotrachéale. La perforation œsophagienne iatrogénique survient principalement au dessus du muscle cricopharyngé au niveau de la paroi postérieure. A cet endroit l'œsophage est mince et rétréci. La contamination de l'espace périœsophagien avec le contenu gastrique aboutit à une cellulite diffuse et à l'infection. Le diagnostic est fait par la présence de l'emphysème sous-cutané cervical, douleur cervicale, dysphagie, élévation de la température et leucocytose. Un rayon x du cou et une gorgée barytée confirment le diagnostic. Le traitement consiste en une antibiothérapie massive suivie d'une réparation chirurgicale et drainage de la région. La mortalité s'étend de dix à 15 pour cent avec un diagnostic précoce et à 50 pour cent si la chirurgie est retardée.