

Gastric Perforation, a Rare Consequence of Unintentional Esophageal Intubation



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Citation Faghih Soleimani M, Yamini A, Amiri E, Khosronejad S. Gastric Perforation, a Rare Consequence of Unintentional Esophageal Intubation. Case Reports in Clinical Practice. 2023; 8(4): 171-175.

Running Title Gastric Perforation Following Intubation



Article info:

Received: June 19, 2023

Revised: July 26, 2023

Accepted: August 16, 2023

Keywords:

Intubation; Complication; Esophageal intubation; Gastric perforation

ABSTRACT

Accidental esophageal intubation is a preventable human error that complicates airway management and continues to occur despite advances in medical devices. Perforation of the stomach has been associated with esophageal intubation in several case reports.

This report presents a case of an elderly woman suspected of having COVID-19-related pneumonia. She was intubated due to respiratory dysfunction. In the initial few minutes, the patient became desaturated, leading to a second intubation. An hour later, the patient's abdomen was distended, and the chest computed tomography (CT) showed a massive pneumoperitoneum. During laparotomy, a 6 cm long rupture was found in the lesser curvature, which was attributed to accidental esophageal intubation.

To avoid such a fatal condition, it is imperative for physicians to ensure the correct positioning of the endotracheal tube. To achieve this goal, further investigation into readily available and highly sensitive techniques is recommended.

Introduction

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astric perforation is a life-threatening surgical emergency in which the entire thickness of the stomach is damaged. This creates a connection between the gastric lumen and the peritoneal space. Leakage of stomach contents into the peritoneal cavity can lead to peritonitis, and if left

untreated, sepsis or even death can occur [1]. The most common symptoms include acute abdominal pain and distension, which can be accompanied by nausea, vomiting, anorexia, respiratory distress, or fever [2]. Gastric perforation commonly occurs secondary to peptic ulcer disease, malignancy, trauma, foreign bodies, caustic agents, or even spontaneously in the neonatal period [2]. Iatrogenic etiologies are also involved, with endoscopies being

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the main cause [3], but several uncommon scenarios have been recorded. Some reports have documented gastric perforation after mouth-to-mouth ventilation [4], bag-mask ventilation [5], cardiopulmonary resuscitation (CPR) [6], non-invasive positive pressure ventilation (NIPPV) [7], and failed intubation [8]. In the following, a patient with gastric perforation after incidental esophageal intubation is discussed.

Case presentation

An 81-year-old woman with a history of Diabetes Mellitus, Ischemic Heart Disease, Hypertension, Chronic Kidney Disease, and with no history of gastrointestinal disease was admitted to the emergency department with dyspnea, nausea, vomiting, and altered mental status. Upon arrival, the patient was febrile (T: 38.5C), consciousness was declined (GCS score: 7), and blood oxygen saturation was 50%, so intubation was planned. Within the first few minutes after the procedure, the emergency medicine specialist realized that the patient was not ventilated well and O₂ saturation tended to drop. Inadvertent esophageal intubation was detected, so an immediate correction was performed. Due to the patient's unstable situation, she wasn't sent to the CT scan unit. An hour after intubation, the patient's abdomen was significantly distended and the nasogastric tube (NG tube) contained approximately 200 cc bloody discharge. At this time, a general surgery consultation was requested and the patient was sent to take chest and brain CT scans. The brain CT scan showed no acute pathological defect but a large amount of free air was discovered in the abdominal

CT scan (Fig. 1.a).

Consolidation was also observed in the lower lobes of both lungs indicative of pneumonia (Fig. 1.b) which was related to COVID-19, confirmed later by PCR. After a general surgery consultation, an emergency exploratory laparotomy was decided and antibiotic therapy with ceftriaxon and metronidazole was started. During the surgery, a substantial amount of air was released and a large hematoma was discovered on the lesser curvature; upon further exploration, a 6 cm long perforation was found beneath the hematoma (Fig. 2). No other pathologies like ulcers were detected in the site. The perforation was repaired with nylon sutures in two layers and an omental patch was applied. After confirming that the bleeding has stopped, the Nelaton and Corrugated surgical drains were placed in the lesser curvature. Then continuous infusion of pantoprazole (8mg/h) and heparin was started and the patient was taken to the intensive care unit (ICU).

Follow up and outcome

Feeding gavage was started on the ninth post-operative day, which was well-tolerated, and surgical drains were removed on the 11th day. The patient remained ventilator-dependent, and her consciousness level didn't change. On day 65, the patient developed ventricular tachycardia (VT) and received cardioversion. Two days later, bradycardia and a sudden drop in blood pressure occurred and despite resuscitation, the patient expired after 67 days of ICU admission.

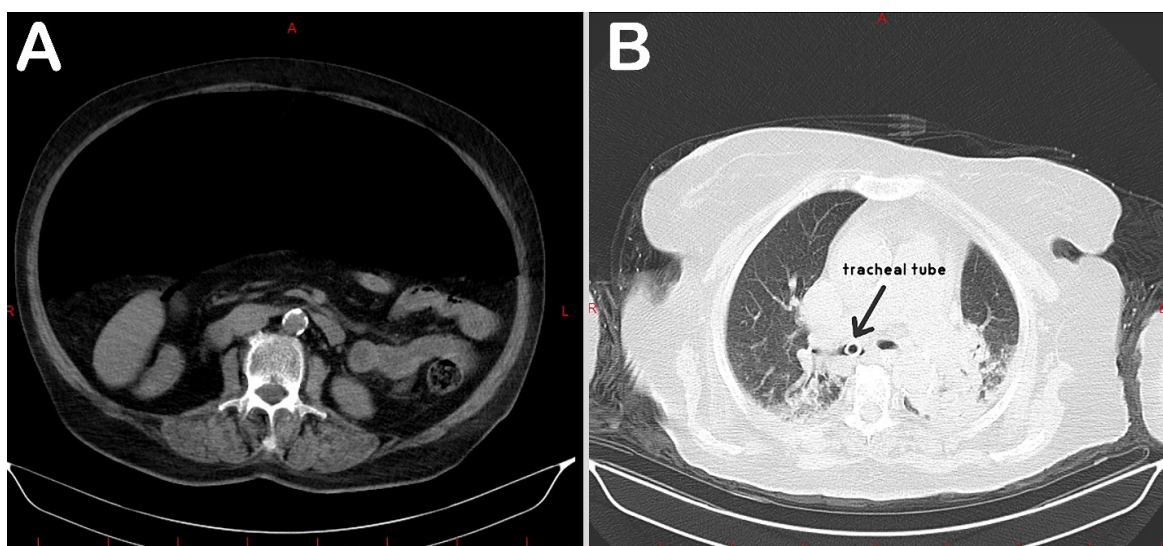


Fig. 1. chest CT scan; A) a large amount of free air in the abdomen indicative of massive pneumoperitoneum. B) consolidation of lower lobes of both lungs, also chest tube had been fixed in the right bronchi leading to the atelectasia of the left lung which was pulled out about 2 cm

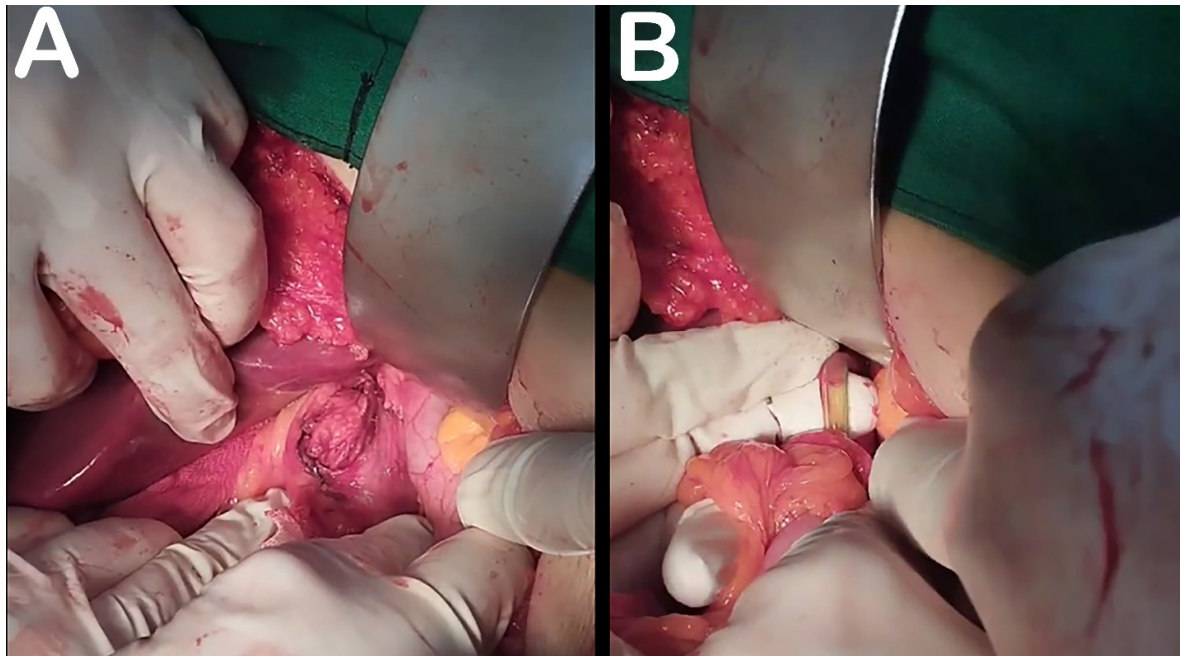


Fig. 2. the perforation cite; A) intraoperative image of a 6 cm long perforation in the lesser curvature. B) The nasogastric tube (NGT) is observed through the perforation site

Discussion

Endotracheal intubation is an essential airway management technique for critically ill patients. Endotracheal intubation can be challenging and result in complications, of which esophageal intubation is among the most serious. The incidence rate of this complication ranges from 6% to 16% and can be life-threatening if not detected early [9-11].

A rare consequence of esophageal intubation is gastric perforation. The patient was found to have a 6 cm long gastric perforation after accidental esophageal intubation. Similar to previous case reports, perforation had occurred in the lesser curvature, probably due to less elasticity, fewer mucosal folds, and immobility by the hepatogastric ligament [8, 12-19].

Gastric perforation is easily diagnosed with an abdominal or upright chest radiograph but the modality of choice is CT scan with more than 90% accuracy [20].

An NG tube also helps with the diagnosis when there is bloody gastric aspiration or failure to resolve distention after its insertion. This condition requires immediate resuscitation, emergent surgical repair, and broad-spectrum antibiotics. The mechanism of perforation could be explained by excessive

insufflation of the stomach. As the stomach distends, the gastroesophageal angle changes, preventing the gas from escaping into the esophagus [6].

Also, gastric distention may cause mucosal ischemia by reducing blood supply, increasing the risk of mucosal injury [21].

Perforation of the gastric wall requires a pressure of 120 to 150 mmHg, which is not unlikely considering the stomach's 4 L volume [22].

Such high pressures could have occurred in CPR-induced perforations, which have been repeatedly reported [6].

The patient didn't receive CPR, so bag-mask ventilation during sedation and esophageal intubation are the only possible causes. As the Ambu-bagging period before intubation was short and with low airflow, while ventilation with an esophageal tube lasted several minutes, the second one is considered more probable. To prevent such a catastrophic event, physicians should ascertain that the endotracheal tube is correctly positioned. Video laryngoscopy can decrease the rate of esophageal intubation but in the prehospital setting, it may worsen the intubation outcomes [23].

Other confirmatory methods include chest wall

auscultation, bronchoscopy, chest radiography, end-tidal carbon dioxide (ETCO₂), bedside tracheal ultrasonography, and capnography, each one with several limitations [24]. More studies are necessary for establishing an easily available, inexpensive, and accurate method of verifying endotracheal tube placement. Physicians should also be aware of cognitive factors associated with delayed diagnosis of esophageal intubation [25].

Conclusion

Gastric perforation is recognized as a fatal complication of esophageal intubation. It is imperative for physicians to consider this in the event of a distended abdomen and oxygen desaturation in a patient with difficult intubation.

List of abbreviation

Computed tomography (CT), cardiopulmonary resuscitation (CPR), non-invasive positive pressure ventilation (NIPPV), temprature (T), glasgow coma scale (GCS), nasogastric tube (NG tube), polymerase chain reaction (PCR), intensive care unit (ICU), ventricular tachycardia (VT), end-tidal carbon dioxide (ETCO₂).

Ethical Considerations

Compliance with ethical guidelines

There were no ethical considerations to be considered in this article.

Ethical approval

Ethical approval was obtained from the Ethics Committee of Hamadan University of Medical Sciences under the code: IR.UMSHA.REC.1402.361.

Funding

No funding was received to assist with the preparation of this manuscript.

Conflict of Interests

The authors have no conflict of interest to declare.

Consent

Verbal consent was taken from the patient's next of kin.

References

- [1] Hahn CD, Choi YU, Lee D, Frizzi JD. Pneumoperitoneum due to gastric perforation after cardiopulmonary resuscitation: case report. *Am J Crit Care*. 2008;17(4):388, 6-7. <https://doi.org/10.4037/ajcc2008.17.4.388>
- [2] Sigmon DF, Tuma F, Kamel BG, Cassaro S. Gastric Perforation. StatPearls. Treasure Island (FL) ineligible companies. Disclosure: Faiz Tuma declares no relevant financial relationships with ineligible companies. Disclosure: Bishoy Kamel declares no relevant financial relationships with ineligible companies. Disclosure: Sebastiano Cassaro declares no relevant financial relationships with ineligible companies. Treasure Island (FL): StatPearls Publishing LLC.; 2023.
- [3] Kang DH, Ryu DG, Choi CW, Kim HW, Park SB, Kim SJ, et al. Clinical outcomes of iatrogenic upper gastrointestinal endoscopic perforation: a 10-year study. *BMC Gastroenterol*. 2019;19(1):218. <https://doi.org/10.1186/s12876-019-1139-1>
- [4] Wolff AT, Hohenstein C. Gastric perforation after mouth-to-mouth ventilation: a case report. *Eur J Anaesthesiol*. 2015;32(2):138-9. <https://doi.org/10.1097/EJA.000000000000143>
- [5] Bednarz S, Filipovic M, Schoch O, Mauermann E. Gastric rupture after bag-mask-ventilation. *Respir Med Case Rep*. 2015;16:1-2. <https://doi.org/10.1016/j.rmcr.2015.05.014>
- [6] Spoormans I, Van Hoorenbeeck K, Balliu L, Jorens PG. Gastric perforation after cardiopulmonary resuscitation: review of the literature. *Resuscitation*. 2010;81(3):272-80. <https://doi.org/10.1016/j.resuscitation.2009.11.023>
- [7] Nishimura T, Shirai K, Nakao A, Kotani J. Gastric Perforation Because of Non-Invasive Positive-Pressure Ventilation: Review of Complications. *Surg Infect Case Rep*. 2016;1:41-3. <https://doi.org/10.1089/crsi.2016.29008.tn>
- [8] Suwanwongse K, Shabarek N. Gastric Perforation: A Rare Accident from Intubation. *Cureus*. 2020;12(1):e6684. <https://doi.org/10.7759/cureus.6684>
- [9] Katz SH, Falk JL. Misplaced endotracheal tubes by paramedics in an urban emergency medical services system. *Ann Emerg Med*. 2001;37(1):32-7. <https://doi.org/10.1067/mem.2001.112098>
- [10] Jones JH, Murphy MP, Dickson RL, Somerville GG, Brizendine EJ. Emergency physician-verified out-of-hospital intubation: miss rates by paramedics. *Acad Emerg Med*. 2004;11(6):707-9. <https://doi.org/10.1111/j.1553-2712.2004.tb00730.x>
- [11] Wirtz DD, Ortiz C, Newman DH, Zhitomirsky I. Unrecognized misplacement of endotracheal tubes by ground prehospital providers. *Prehosp Emerg Care*. 2007;11(2):213-8. <https://doi.org/10.1080/10903120701205935>
- [12] Schvadron E, Moses Y, Weissberg D. Gastric rupture complicating inadvertent intubation of the esophagus. *Can J Surg*. 1996;39(6):487-9.
- [13] Song JK, Stern EJ, Beaty CD. Gastric perforation: a complication of inadvertent esophageal intubation. *1995;164(6):1386-1387*. <https://doi.org/10.2214/ajr.164.6.7754878>

- [14] Hershey MD, Hannenberg AA. Gastric Distention and Rupture from Oxygen Insufflation during Fiberoptic Intubation. *Anesthesiology*. 1996;85(6):1479-80. <https://doi.org/10.1097/00000542-199612000-00030>
- [15] Gilbert TB. Gastric Rupture after Inadvertent Esophageal Intubation with a Jet Ventilation Catheter. *Anesthesiology*. 1998;88(2):537-8. <https://doi.org/10.1097/00000542-199802000-00037>
- [16] Chen PN, Shih CK, Li YH, Cheng WC, Hsu HT, Cheng KI. Gastric perforation after accidental esophageal intubation in a patient with deep neck infection. *Acta Anaesthesiol Taiwan*. 2014;52(3):143-5. <https://doi.org/10.1016/j.aat.2014.06.001>
- [17] Marcucci V, Bhattacharyya R, Yee S, Zuberi J, Ingram M. Gastric Perforation with Omental Patch Repair: A Rare Complication of Pulmonary Resuscitation in COVID-19 Pneumonia. *Case Rep Surg*. 2020;2020:8850739. <https://doi.org/10.1155/2020/8850739>
- [18] Akinci O, Akinci Ö. Gastric perforation: An unusual complication after esophageal intubation. *Ulus Travma Acil Cerrahi Derg*. 2022;28(7):1035-7. <https://doi.org/10.14744/tjtes.2022.08395>
- [19] Lelcuk S, Leibovitch I, Kaplan O, Rozin RR. Stomach rupture caused by false intubation of the esophagus. *Isr J Med Sci*. 1990;26(3):167-8.
- [20] Kim HC, Yang DM, Kim SW, Park SJ. Gastrointestinal tract perforation: evaluation of MDCT according to perforation site and elapsed time. *Eur Radiol*. 2014;24(6):1386-93. <https://doi.org/10.1007/s00330-014-3115-z>
- [21] Tang SJ, Daram SR, Wu R, Bhajee F. Pathogenesis, diagnosis, and management of gastric ischemia. *Clin Gastroenterol Hepatol*. 2014;12(2):246-52.e1. <https://doi.org/10.1016/j.cgh.2013.07.025>
- [22] Smally AJ, Ross MJ, Huot CP. Gastric rupture following bag- valve-mask ventilation. *J Emerg Med*. 2002;22(1):27-9. [https://doi.org/10.1016/S0736-4679\(01\)00433-4](https://doi.org/10.1016/S0736-4679(01)00433-4)
- [23] Jiang J, Ma D, Li B, Yue Y, Xue F. Video laryngoscopy does not improve the intubation outcomes in emergency and critical patients - a systematic review and meta-analysis of randomized controlled trials. *Crit Care*. 2017;21(1):288. <https://doi.org/10.1186/s13054-017-1885-9>
- [24] Baker PA, O'Sullivan EP, Aziz MF. Unrecognised oesophageal intubation: time for action. *Br J Anaesth*. 2022;129(6):836-40. <https://doi.org/10.1016/j.bja.2022.08.027>
- [25] Honardar MR, Posner KL, Domino KB. Delayed Detection of Esophageal Intubation in Anesthesia Malpractice Claims: Brief Report of a Case Series. *Anesth Analg*. 2017;125(6):1948-51. <https://doi.org/10.1213/ANE.0000000000001795>