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Case Report

Ventilation-induced gastric rupture after extubation in the ICU: a case report

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Abstract: Background: Gastric rupture is a rare yet potentially fatal complication that has been reported during cardiopulmonary resuscitation (CPR). This is generally attributed to acute gastric overdistension caused by chest compressions combined with positive-pressure ventilation. Ventilation-induced gastric rupture after planned extubation in the intensive care unit (ICU) is rare. Case presentation: An 80-year-old man developed acute gastric rupture shortly after planned ICU extubation following lumbar spinal surgery. Quantitative neuromuscular monitoring was not performed prior to extubation. Four minutes after extubation, repeated bag-mask ventilation and laryngeal mask airway-assisted ventilation were administered prior to successful reintubation. Progressive abdominal distension was observed during rescue ventilation. Imaging demonstrated massive pneumoperitoneum, while emergency surgery identified a 5-cm longitudinal perforation along the lesser curvature of the stomach without evidence of ischemic discoloration. No CPR was conducted. The patient required prolonged mechanical ventilation and died 2 months later from progressive nosocomial pneumonia. Conclusions: Repeated positive-pressure ventilation after ICU extubation may result in gastric rupture even in the absence of CPR. Awareness of progressive abdominal distension, objective neuromuscular assessments before extubation and careful control of inspiratory pressure may improve airway safety in high-risk patients.

Keywords: Gastric rupture, positive-pressure ventilation, bag-mask ventilation, extubation, airway obstruction, intensive care unit

Introduction

Gastric rupture is a rare but potentially fatal complication that has been mainly reported in association with cardiopulmonary resuscitation (CPR) [1]. In such cases, chest compressions combined with positive-pressure ventilation may cause acute gastric insufflation and abrupt intragastric pressure elevation [1, 2]. Gastric rupture in the absence of cardiac arrest has also been described following emergency bag-mask ventilation, particularly in situations involving impaired airway patency or poorly controlled inspiratory pressures [3-6]. However, gastric rupture after planned extubation in a monitored intensive care unit (ICU) has rarely been reported. We report a case of ventilation-induced gastric rupture after planned ICU extubation, emphasizing early recognition, pressure-limited rescue ventilation and standardized airway management in high-risk patients.

Case presentation

An 80-year-old man was admitted with fever, bilateral lower-extremity weakness and gait disturbance after posterior lumbar interbody fusion at L4-5. Imaging suggested loosening of the previous instrumentation with severe lumbar spinal stenosis. Emergency decompression and fusion were planned. His medical history was significant for hypertension, diabetes mellitus, end-stage renal disease on hemodialysis, atrial fibrillation and Child-Pugh class B liver cirrhosis.

General anesthesia was induced using etomidate 10 mg and rocuronium 50 mg. Tracheal intubation was uneventful with a Cormack-Lehane grade I view and anesthesia was maintained with sevoflurane. The surgery lasted for 4 h and 30 min. Rocuronium was administered intermittently (total dose of 100 mg) and the

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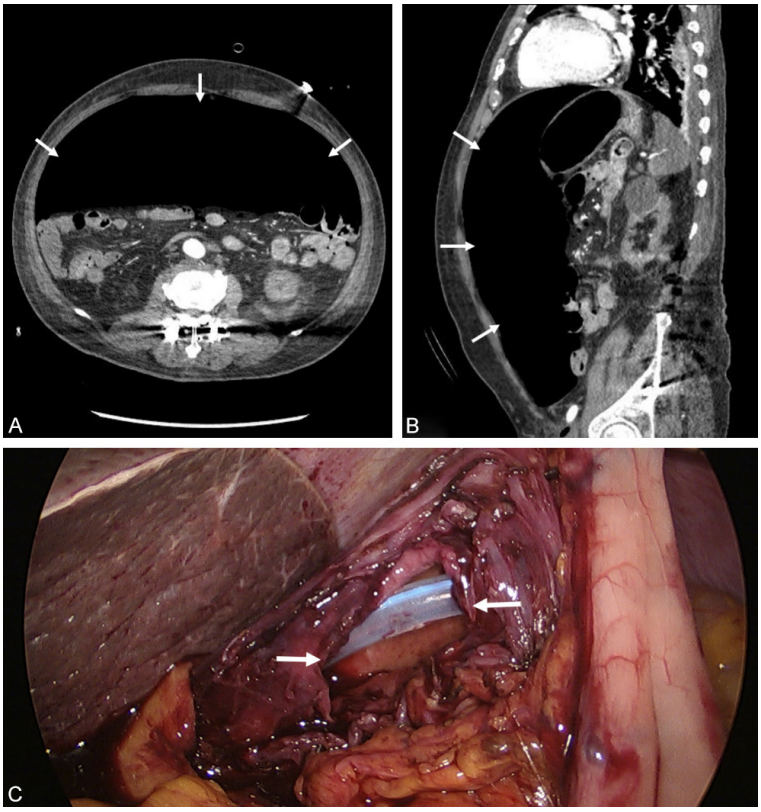

Figure 1. Radiologic and intraoperative findings of gastric rupture. (A) Axial abdominal computed tomography showing massive free intraperitoneal air. (B) Sagittal computed tomography image showing extensive pneumoperitoneum. (C) Laparoscopic image showing a longitudinal perforation along the lesser curvature of the stomach extending toward the esophagogastric junction. White arrows indicate free air in (A) and (B) and the perforation margins in (C).

final dose was administered 55 min before the end of surgery. The patient was transferred to the ICU with the tracheal tube in place.

Thirty minutes after ICU arrival, a spontaneous respiratory effort was observed and glycopyrrolate 0.4 mg and pyridostigmine 15 mg were administered approximately 90 min after the final rocuronium dose. After a 17-min T-piece trial with oxygen at 5 L/min, oxygen saturation remained at 98% and the respiratory rate was 16/min. Quantitative neuromuscular monitoring was not conducted prior to extubation. Extubation was performed and oxygen was supplied via a face mask. No immediate stridor was documented.

Four minutes after extubation, cyanosis developed and oxygen saturation abruptly decreased to 40%. Bag-mask ventilation was initiated and four endotracheal intubation attempts by non-anesthesiology residents were recorded within approximately 3 min before the anesthesiology team arrived. During this period, oxygen saturation remained at 37-56% and progressive abdominal distension became evident. Seven minutes after extubation, a size 4 laryngeal mask airway was inserted and positive pressure ventilation was continued. End-tidal carbon dioxide, airway pressure and intragastric pressure monitoring were not documented. CPR was not performed.

Eleven minutes after extubation, the anesthesiology team successfully performed the endotracheal intubation. Chest radiography performed 29 min after extubation detected free intraperitoneal air and abdominal computed tomography confirmed massive pneumoperitoneum (**Figure 1A**, **1B**). A nasogastric tube was inserted for decompression. Arterial blood gas analysis at 31 min revealed a pH of 7.263, arterial partial pressure of carbon dioxide ($PaCO_2$) of 51.5 mmHg and lactate of 1.0 mmol/L. Emergency laparoscopic exploration performed 4 h and 19 min after extubation revealed a 5-cm longitudinal perforation along the lesser curvature of the stomach extending toward the esophagogastric junction without ischemic discoloration or necrosis (**Figure 1C**). Primary closure was performed with omentopexy. The clinical course of peri-extubation is summarized in **Figure 2**.

After gastric repair, bilateral lower extremity weakness improved; however, prolonged mechanical ventilation and critical care were required. Oral intake was attempted 2 weeks later but was complicated by delayed gastric emptying. The patient subsequently developed nosocomial pneumonia and died 2 months later from progressive pneumonia.

Discussion

Gastric rupture is most commonly reported during CPR, where chest compressions combined

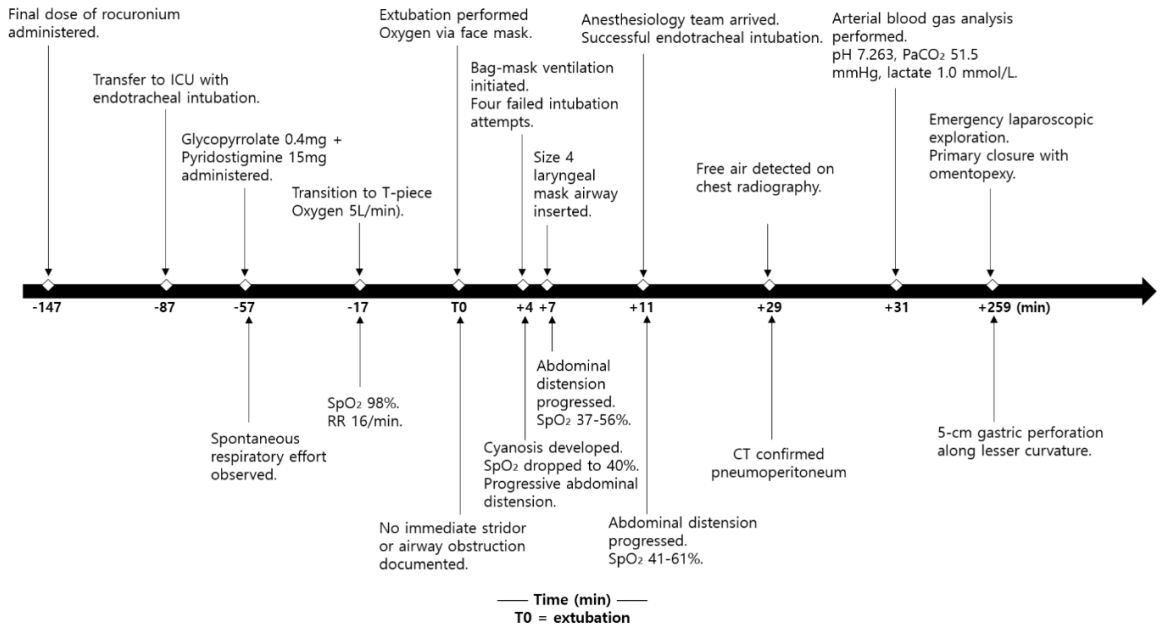

Figure 2. Timeline of peri-extubation clinical events. Timeline showing the sequence of clinical events from the final rocuronium administration to emergency laparoscopic exploration. T0 indicates the time of extubation. Progressive abdominal distension developed during rescue ventilation, followed by radiologic detection of pneumoperitoneum and surgical confirmation of gastric perforation. ICU, intensive care unit; T-piece, T-shaped breathing circuit; SpO_2, peripheral oxygen saturation; CT, computed tomography; $PaCO_2$, arterial partial pressure of carbon dioxide.

with positive-pressure ventilation may lead to acute gastric insufflation [1, 2]. Non-arrest cases have been described after emergency bag-mask ventilation, particularly when airway patency is impaired or inspiratory pressure is uncontrolled [3-6]. Conversely, this rupture occurred after planned ICU extubation during urgent in-hospital rescue ventilation, expanding the spectrum of ventilation-induced gastric rupture beyond emergency and resuscitation settings.

In this case, the temporal sequence supports a pressure-mediated mechanism. When inspiratory pressure exceeds the lower esophageal sphincter pressure, gas may enter the stomach, particularly when the upper airway patency is incomplete [2, 6]. Repeated gastric insufflation can rapidly increase the intragastric pressure and wall tension [1, 2, 6]. The lesser curvature may be vulnerable to rupture because it is relatively fixed and less distensible [1, 7]. This patient developed progressive abdominal distension during bag-mask and laryngeal mask ventilation, followed by massive pneumoperitoneum and a longitudinal lesser-curvature perforation without ischemia, elevated lactate, or preceding CPR, supporting an acute pressure-related rupture.

In this patient, advanced age, end-stage renal disease, liver cirrhosis, possible residual neuromuscular blockade, uncertain airway patency, repeated airway manipulation and limited airway pressure monitoring may have heightened the risk of gastric insufflation and subsequent rupture. Because quantitative neuromuscular monitoring was not performed before extubation, residual neuromuscular blockade may have led to reduced upper airway muscle tone or inadequate ventilation [8, 9]. In this patient with end-stage renal disease, delayed rocuronium recovery was possible because renal failure may prolong the effect of rocuronium [10]. Repeated intubation attempts before the arrival of the anesthesiology team and unavailability of end-tidal carbon dioxide, airway pressure, or intragastric pressure monitoring also limited the assessment of ventilation safety, underscoring the need for standardized rescue airway protocols.

Preventive measures include quantitative neuromuscular monitoring before extubation [8, 9]. During rescue ventilation, pressure-limited bag-mask ventilation, early recognition of abdominal distension and prompt gastric decompression when feasible should be emphasized to decrease gastric insufflation risk [3-6]. Early

involvement of experienced airway personnel and use of capnography or airway pressure monitoring may improve ventilation safety.

Although not the direct cause of death, the gastric rupture in this patient led to emergency surgery, prolonged mechanical ventilation and poor nutritional recovery, increasing susceptibility to nosocomial pneumonia and contributing to death 2 months later. Here we describe a single retrospectively reviewed case in which objective airway or gastric pressure measurements were unavailable. Emergency airway management was not standardized and no structured long-term prognostic assessment was conducted. Therefore, ventilation-induced gastric rupture should be considered during post-extubation rescue ventilation when progressive abdominal distension develops.

Disclosure of conflict of interest

None.

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References

[1] Spoormans I, Van Hoorenbeeck K, Balliu L and Jorens PG. Gastric perforation after cardiopulmonary resuscitation: review of the literature. Resuscitation 2010; 81: 272-280.

[2] Savary D, Drennan IR, Badat B, Grieco DL, Piraino T, Lesimple A, Charbonney E, Fritz C, Delisle S, Ouellet P, Mercat A, Bronchti G, Brochard L and Richard JC; CAVIAR group. Gastric insufflation during cardiopulmonary resuscitation: a study in human cadavers. Resuscitation 2020; 146: 111-117.

[3] Smally AJ, Ross MJ and Huot CP. Gastric rupture following bag-valve-mask ventilation. J Emerg Med 2002; 22: 27-29.

[4] Bednarz S, Filipovic M, Schoch O and Mauermann E. Gastric rupture after bag-mask-ventilation. Respir Med Case Rep 2015; 16: 1-2.

[5] Vemuru SR, Stettler GR, Betz ME and Ferrigno L. Gastric perforation secondary to bag-valve mask ventilation following opioid overdose. Am Surg 2022; 88: 1354-1356.

[6] Cajander P, Edmark L, Ahlstrand R, Magnuson A and de Leon A. Effect of positive end-expiratory pressure on gastric insufflation during induction of anaesthesia when using pressure-controlled ventilation via a face mask: a randomised controlled trial. Eur J Anaesthesiol 2019; 36: 625-632.

[7] Johnson S, McCracken J and Baidoun F. Tension pneumoperitoneum after bystander cardiopulmonary resuscitation: a case report. Int J Surg Case Rep 2018; 42: 227-232.

[8] Murphy GS, Szokol JW, Marymont JH, Greenberg SB, Avram MJ and Vender JS. Residual neuromuscular blockade and critical respiratory events in the postanesthesia care unit. Anesth Analg 2008; 107: 130-137.

[9] Herbstreit F, Peters J and Eikermann M. Impaired upper airway integrity by residual neuromuscular blockade: increased airway collapsibility and blunted genioglossus muscle activity in response to negative pharyngeal pressure. Anesthesiology 2009; 110: 1253-1260.

[10] Robertson EN, Driessen JJ and Booij LH. Pharmacokinetics and pharmacodynamics of rocuronium in patients with and without renal failure. Eur J Anaesthesiol 2005; 22: 4-10.