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Severe gastric insufflation and consequent atelectasis caused by gas leakage using AIR-Q laryngeal mask airway: A case report

Zhao Y *et al.* Severe gastric insufflation and consequent atelectasis

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Abstract

BACKGROUND

The airways of patients undergoing awake craniotomy (AC) are considered “predicted difficult airways,” inclined to be managed with supraglottic airway devices (SADs) to lower the risk of coughing or gagging. However, the special requirements of AC in the head and neck position may deteriorate SADs’ seal performance, which increases the risks of ventilation failure, severe gastric insufflation, regurgitation, and aspiration.

CASE SUMMARY

A 41-year-old man scheduled for AC with the asleep-awake-asleep approach was anesthetized and ventilated with a size 3.5 AIR-Q intubating laryngeal mask airway (LMA). Air leak was noticed with adequate ventilation after head rotation for allowing scalp blockage. Twenty-five minutes later, the LMA was replaced by an endotracheal tube because of a change in the surgical plan. After surgery, the patient consistently showed low tidal volume and was diagnosed with gastric insufflation and atelectasis using computed tomography.

CONCLUSION

This case highlights head rotation may cause gas leakage, severe gastric insufflation, and consequent atelectasis during ventilation with an AIR-Q intubating laryngeal airway.

Key Words: Insufflation; Atelectasis; Laryngeal mask airway; Craniotomy; Case report

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Core Tip: AIR-Q intubating laryngeal airway is a feasible airway management method for predicted difficult airways and has been proven to involve fewer complications and a shorter ventilation duration than fiberoptic intubation. This case highlights that head rotation during ventilation with an AIR-Q intubating laryngeal airway may lead to gas leakage, severe gastric insufflation, and consequent atelectasis; this indicates that physicians should pay attention to patient position changes when using laryngeal mask airway.

INTRODUCTION

The use of supraglottic airway devices (SADs) has been proven to be a feasible airway management method for awake craniotomy (AC) to lower the risk of coughing or gagging during the transition to the awake state^[1]. Recently, a retrospective analysis of 30 cases of AC reported that patients receiving laryngeal mask airway (LMA) had fewer complications and a shorter ventilation duration than patients who underwent fiberoptic intubation^[2]. Considering the requirements of craniotomy and scalp blocks, head rotation and neck flexion may influence the performance of SADs including oropharyngeal leak pressure, ventilation, and fiberoptic view^[3,4]. Gastric insufflation and regurgitation were also reported by studies using SADs^[3,5,6]. There are no clinical data on gastric insufflation and regurgitation in AC, and the current reviews do not

provide suggestions to prevent these complications^[1,7,8]. Here, we report a case of severe gastric insufflation and consequent atelectasis caused by gas leakage using AIR-Q LMA during preparation for craniotomy.

CASE PRESENTATION

Chief complaints

A 41-year-old man was admitted for paroxysmal unconsciousness for 7 d.

History of present illness

¹Written informed consent was obtained from the patient for the publication of this report and any accompanying images. A 41-year-old man (weight, 65 kg; height, 168 cm) was diagnosed with postoperative recurrence of a right frontotemporal glioma and was scheduled for AC with the asleep-awake-asleep approach^[1] on July 24, 2020.

Preoperative medication included daily doses of phenobarbitone 120 mg and carbamazepine 600 mg. He did not receive premedication and fasted for longer than 8 h on the day of surgery. After attaching the monitors and securing peripheral venous access, pre-oxygenation was performed to reach an exhaled oxygen concentration > 90%. ²Anesthesia was induced with a bolus injection of propofol (2 mg/kg) and sufentanil (0.2 µg/kg). Bag-mask ventilation with the head-tilt-chin lift, jaw-thrust maneuver was applied and ³rated Grade 1 using Han's grading scale for mask ventilation^[9]. At EEG stage D, a size 3.5 AIR-Q intubating laryngeal airway (Cookgas® company) was promptly inserted following a standard insertion technique. The sealing pressure was optimized by inflating the cuff until the cessation of the air leak sound from the mouth^[10].

Large chest elevation amplitude, normal pulmonary auscultation, no epigastric audible sound, and standard end-tidal CO₂ (ETCO₂) curve were achieved. Volume-control ventilation was adopted with the following breath parameters: 500 mL/L O₂ gas flow 3 L/min, ⁴V_T 6 mL/kg, I:E 1:2, positive end-expiratory pressure (PEEP) = 0 cmH₂O, and peak inspiratory pressure (PIP) = 18 cmH₂O. The respiratory rate was

adjusted to maintain ETCO_2 between 35 and 40 mmHg. Sevoflurane inhalation and target-controlled infusion of remifentanyl were administered to maintain anesthesia. Scalp nerve block was performed using 20 mL ropivacaine 500 mg/L. To facilitate ultrasound-guided bilateral greater and lesser occipital nerve blocks, the patient's head was rotated approximately 45° to the left and right, respectively. Air leak sound from the mouth with obvious chest expansion and increased PIP (23 cmH₂O) was noticed and assessed as "adequate" ventilation using a three-point ventilation score^[11]. After approximately 25 min of administering the scalp block, the anesthesia provider was informed that the surgical plan would change to craniotomy under general anesthesia. After administering an induction dose of cisatracurium (0.15 mg/kg), the LMA was withdrawn, and an endotracheal tube (ID 7.5) was successfully inserted using a video laryngoscope at the first attempt. Ventilation parameters remained unchanged, except for PEEP 5 cmH₂O and PIP 22 cmH₂O. The length of surgery was 460 min. At the completion of the surgery, sevoflurane was stopped, and remifentanyl was adjusted to 2 µg/mL. Patient consciousness and spontaneous breathing were restored in 13 min. However, V_T was consistently low (160-200 mL) even after a standard lung recruitment maneuver (RM).

History of past illness

The patient had no history of any medical illness other than the diagnosis from the previous surgery.

Personal and family history

This patient is with no family history.

Physical examination

Breath sounds decreased bilaterally.

Laboratory examinations

Intraoperative PO₂ of arterial blood gas was between 214 and 225 mmHg.

Imaging examinations

A lung computed tomography (CT) scan was performed in the hybrid operating room. Before gastric decompression, gastric insufflation (Figure 1 A1, asterisk) and atelectasis with air bronchogram (Figure 1 B1, asterisk) were observed. In contrast, after gastric decompression and RM, the stomach was deflated (Figure 1 A2, asterisk), and the atelectatic lung tissue (Figure B2, asterisk) was re-aerated.

FINAL DIAGNOSIS

Abdominal and chest CT scans revealed severe gastric insufflation (Figure 1 A1), elevation of the bilateral diaphragm dome to the lower edge of the seventh thoracic vertebral body, and atelectasis of the bilateral lower lobes (Figure 1 B1).

TREATMENT

A nasogastric tube was promptly inserted, through which a large amount of gas was released. After another RM, V_T was restored to 300 mL. The second CT scan showed gastric deflation (Figure 1 A2), descent of the bilateral diaphragm dome to the lower edge of the ninth thoracic vertebral body, and a great reduction in the atelectasis region (Figure 1 B2).

OUTCOME AND FOLLOW-UP

The patient was transferred to the neurological intensive care unit, extubated after 48 h of synchronized intermittent mandatory ventilation without other pulmonary complications, and discharged from the hospital on the 7th postoperative day.

DISCUSSION

This is the first report to describe severe gastric insufflation and consequent atelectasis during mechanical ventilation with an AIR-Q LMA. Contrary to the endotracheal tube,

SADs enable effective ventilation with risks of gastric insufflation, consequent regurgitation, and pulmonary aspiration^[8]. These risks may increase upon changing the head and neck position, which is required for certain surgical and anesthetic procedures, such as AC and scalp block^[1]. Neck flexion decreases longitudinal tension in the anterior pharyngeal muscles and reduces the pharyngeal anteroposterior diameter, resulting in significant impairment of ventilation and alignment between the SAD and glottis with increased oropharyngeal leak pressure. Conversely, neck extension increases the pharyngeal anteroposterior diameter by elevating the laryngeal inlet and reduces oropharyngeal leak pressure without impairing ventilation. A systematic review and meta-analysis reported that SAD performance was not significantly affected by the rotation of the head and neck, and the intracuff pressure of LMAs was standardized at 60 cmH₂O (5.9 kPa)^[7]. In the present case, peak inspiratory pressure-guided intracuff pressure was applied to reduce postoperative pharyngolaryngeal complications^[12]. This technique might have led to a lower intracuff pressure and cuff volume and consequently impaired seal performance of LMA as the head and neck positions changed. However, higher intracuff pressure does not necessarily improve sealing performance. A recent study reported that an intracuff pressure of 20 cmH₂O reduced the incidence of gastric insufflation to 35%, compared with that of 60 cmH₂O (48%)^[6]. Moreover, gastric insufflation detected with ultrasonography^[6] is reported to be significantly more frequent than that with epigastric auscultation^[8]. Prolonged duration of surgery and mechanical ventilation lead to atelectasis and other pulmonary complications^[13]. However, the difference in the outcomes between the first RM and the RM after gastric decompression indicated that gastric insufflation was an important factor aggravating atelectasis. Furthermore, by continuously stretching the diaphragm for approximately 10 h, gastric insufflation might have led to diaphragmatic dysfunction, decreasing the patient's postoperative V_T^[14].

Because of immobilization of the patient's head and limited access of the anesthetist to the patient, airway management in AC should be treated as a predicted difficult

airway. Therefore, gastric insufflation with SAD ventilation, which may lead to regurgitation and aspiration, should be prevented, detected, and addressed early. An alternative solution may be ventilation with a SAD embedding a channel for orogastric tube placement, insertion of an orogastric tube, and careful titration of intracuff pressure for various head and neck positions during the asleep period. Further, the orogastric tube can be removed at the beginning of the transition to the awake period and reinserted if a SAD is replaced in the post-awake phase. If available, ultrasonography for early detection of gastric insufflation and measurement of gastric volume is significantly superior to epigastric auscultation. Moreover, ultrasonography may help monitor the development of atelectasis^[15] and diaphragm function^[16].

CONCLUSION

Our report suggests that head rotation may lead to gas leakage, severe gastric insufflation, and consequent atelectasis during ventilation with an AIR-Q intubating laryngeal airway.

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