


Case Report

Undiagnosed tracheomalacia accompanied with accidental expiratory central airway collapse after tracheal intubation

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Background: A patient with undiagnosed tracheomalacia undergoing surgery experienced accidental expiratory central airway collapse after tracheal intubation. Here, we aimed to diagnose tracheomalacia from the preoperative data.

Case Presentation: A 73-year-old man, scheduled for abdominal surgery, had a clinical history of chronic obstructive pulmonary disease. Preoperative chest computed tomography revealed a lateral narrowing of the tracheal shape. After tracheal intubation, we could not manually ventilate the inflated lung. Emergent bronchoscopy findings, including severe expiratory tracheal collapse, indicated a diagnosis of tracheomalacia. We could fully ventilate the patient by moving the endotracheal tube near the tracheal carina and finally changing it to a double-lumen tube. Airway collapse did not occur under spontaneous breathing.

Conclusion: Accidental expiratory central airway collapse could occur in patients with undiagnosed tracheomalacia during surgery. A diagnosis of tracheomalacia should be presumed from a deformed trachea on preoperative imaging and history of chronic obstructive pulmonary disease.

Key words: Chronic obstructive pulmonary disease, deformed trachea, emergent bronchoscopy, expiratory central airway collapse, tracheomalacia

INTRODUCTION

VENTILATION FAILURE IS a life-threatening issue throughout mechanical ventilatory support and it is essential to manage this issue during acute medicine. Degenerative tracheobronchial conditions, including tracheomalacia (TM), have been found to be associated with expiratory central airway collapse (ECAC).¹ Although ECAC can cause an intraoperative event involving sudden respiratory distress, it is an unusual occurrence in our daily anesthetic practice.²

We encountered a case of accidental ECAC after tracheal intubation in a patient with undiagnosed TM accompanied by chronic obstructive pulmonary disease (COPD). Although the preoperative data, including a chest radiograph

and chest computed tomography (CT) image, showed a deformed trachea, even the respiratory specialist did not presume that the patient might have TM before the induction of general anesthesia. Therefore, in this report, we aimed to identify the presence of TM from the preoperative data and to describe the management of accidental ECAC after tracheal intubation.

CASE PRESENTATION

A 73-year-old man was scheduled for high anterior resection for rectal cancer. He presented with wheezing but no stridor. He had a clinical history of COPD and underwent video-assisted thoracic surgery for lung squamous cell carcinoma 10 years ago. He was taking an anticoagulant for atrial fibrillation. His medical history included liver cirrhosis (Child A). He was also a current smoker. A preoperative chest radiograph revealed an intrathoracic narrowing of his trachea (Fig. 1), and a lateral narrowing of the tracheal shape was found on chest CT imaging (Fig. 2). A respiratory function test revealed mixed ventilatory defects with a forced expiratory volume in 1 s of 50.8% and vital capacity

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of 56.8%. A low maximal forced expiratory flow of 23.1% was detected, although a biphasic morphology, notched expiratory loop, or expiratory oscillation was not shown in the flow–volume curve (Fig. 3).

Before inducing general anesthesia, an epidural catheter was inserted into the thoracic (T)11–T12 intervertebral space for postoperative analgesia. Anesthesia was induced with an intravenous infusion of propofol, and a neuromuscular blockade was achieved with a bolus injection of rocuronium. The trachea was intubated with an endotracheal tube with 8 mm internal diameter. After intubation, a left radial artery catheter was inserted.

An alarm indicating high airway pressure was triggered on the respirator 7 min after intubation during volume-controlled ventilation in the Trendelenburg position. Subsequently, we attempted to manually ventilate the patient. However, we were not able to ventilate his inflated lung but were able to ventilate the deflated one. Emergent bronchoscopy findings, including severe expiratory tracheal collapse, were indicative of a diagnosis of TM. We were able to fully ventilate the patient by advancing the endotracheal tube under fiberoptic guidance until it was near the tracheal carina, and we finally changed it to a double-lumen tube. The value of percutaneous oxygen saturation was over 99% during the event.

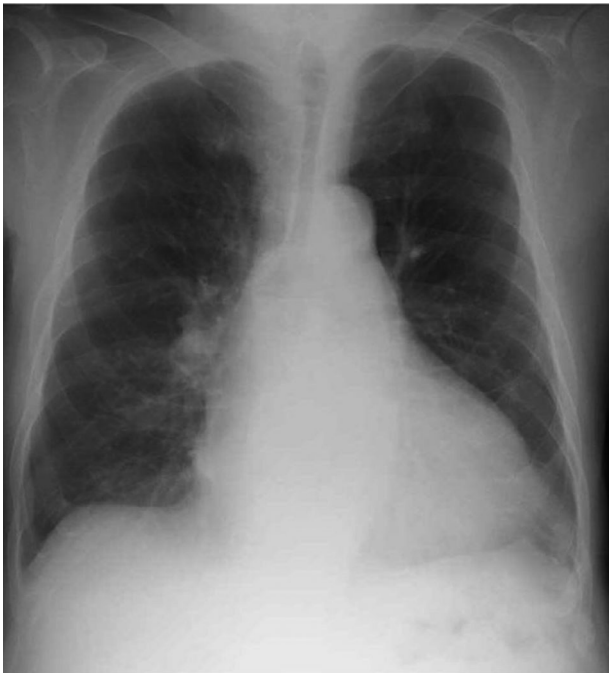


Fig. 1. Preoperative chest radiograph of a 73-year-old man with tracheomalacia, showing an intrathoracic narrowing of his trachea.

Thereafter, the scheduled surgery was carried out without any further issues, including high airway pressure or hypoxemia. Airway collapse did not occur under spontaneous breathing; therefore, the patient could be extubated safely. He did not show any postoperative respiratory issues in the intensive care unit. Subsequently, he was diagnosed with TM accompanied by COPD and was discharged with a normal postoperative course.

DISCUSSION

TRACHEOMALACIA IS CHARACTERIZED by a structural weakness of the tracheal cartilage, which induces excessive collapsibility of the trachea. The two etiologies of this disease include congenital defects and acquired conditions affecting the tracheal cartilage. Congenital TM is characterized by the immaturity of the cartilaginous rings and tends to coexist with tracheoesophageal fistula or esophageal atresia. Up to 75% of children with tracheoesophageal fistula have been found to present with a deficiency of tracheal cartilage.³ Inflammatory processes, such as tracheobronchitis and recurrent polychondritis, and chronic lung conditions, such as bronchiectasis, could cause acquired TM. Furthermore, COPD could weaken the structure of the airway and cause tracheal collapse. Other conditions, such as prolonged intubation, pulmonary resection, chest trauma, or the presence of foreign bodies or neoplastic pathologies in the respiratory tract, could also cause TM. Moreover, vascular aneurysms, thyroid goiters, and intrathoracic neoplastic diseases, which cause an external compression on the airway, could lead to TM.⁴ In most cases, the tracheal shape associated with TM is characterized by an expiratory bulging of the posterior membranous wall and is called the crescent type of TM, whereas preoperative chest CT imaging in our case showed a lateral narrowing of the tracheal shape, which is the so-called saber-sheath type of TM.

Bronchoscopic visualization of dynamic airway collapse is considered the diagnostic gold standard for TM.⁵ Dynamic multidetector CT is also useful in the diagnosis of TM.⁶ Tracheomalacia is diagnosed if there is more than 50% expiratory reduction in a cross-sectional area of the tracheal lumen, but data from healthy volunteers have revealed that this threshold increases the rate of false-positive diagnoses of TM.⁷ Further research is required for defining the specific threshold that should be used during a CT evaluation in order to accurately predict clinically significant ECAC. The use of dynamic magnetic resonance imaging in the diagnosis of TM provides significant data with no radiation exposure for the patient.⁸ Airway malacia has been reported in 53% of COPD patients undergoing dynamic

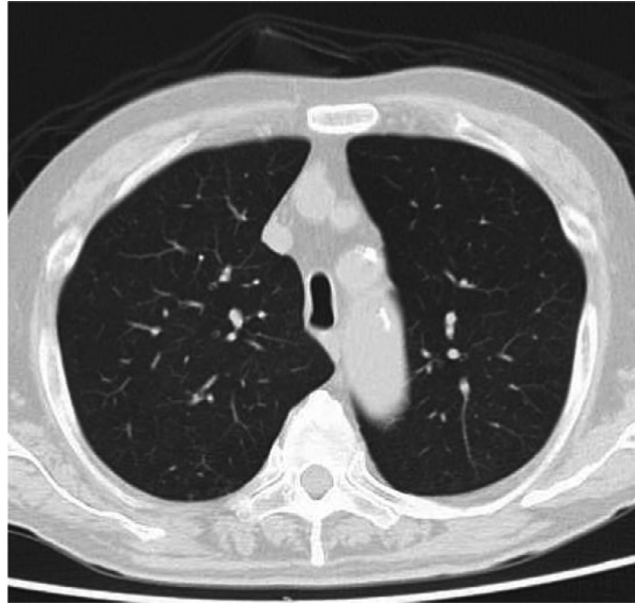


Fig. 2. Preoperative chest computed tomography image of a 73-year-old man with tracheomalacia, showing a lateral narrowing of the tracheal shape.

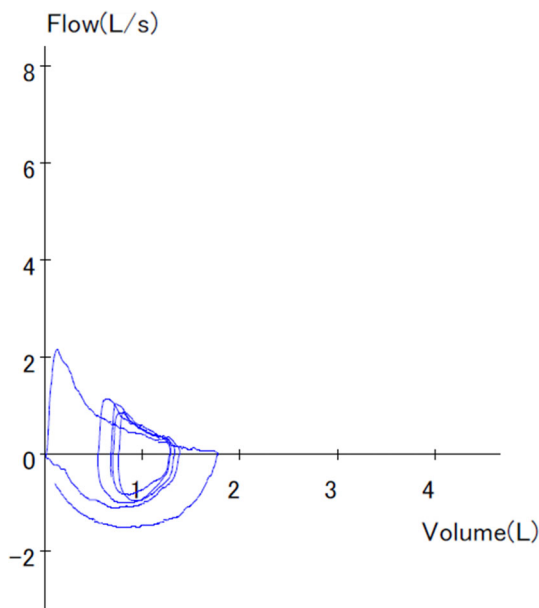


Fig. 3. Preoperative flow–volume curve of the respiratory function of a 73-year-old man with tracheomalacia.

multidetector CT.⁹ We did not presume that this case involved TM, although the preoperative data indicated a history of COPD and imaging data revealed a deformed trachea. If we were able to diagnose the patient with TM, we

would have been able to predict that central airway collapse could occur during mechanical ventilation and, therefore, could have prepared for the management of airway difficulties.

When unexpected ventilation failure occurs during general anesthesia, it is necessary to consider the possibility of respiratory diseases, such as asthma, or of any condition that could lead to airway obstruction and to immediately check for endotracheal tube or circuit occlusion and machine malfunction. If none of the abovementioned causes are found, emergent fiberoptic bronchoscopy could aid in detecting ECAC. To resume ventilation, we advanced the endotracheal tube past the collapsed segment of the airway under fiberoptic bronchoscope guidance. Other recommendable options would be reverting to spontaneous ventilation, changing the position of the patient to the reverse Trendelenburg or sitting position, pneumatic stenting, jet ventilation, helium–oxygen treatment, and extracorporeal membrane oxygenation in extreme cases.¹ The anesthesia induction plan for patients diagnosed with TM through a preoperative assessment would be dependent on the severity of the collapse and type of surgery.

CONCLUSIONS

IN SUMMARY, CENTRAL airway collapse was detected in a patient with undiagnosed TM undergoing elective

surgery. In such cases, the presence of TM should be presumed based on preoperative imaging findings indicative of a deformed trachea and a history of COPD.

DISCLOSURE

Approval of the research protocol: N/A.

Informed consent: Verbal and written informed consent was obtained from the patient.

Registry and registration no. of the study/trial: N/A.

Animal studies: N/A.

Conflict of interest: None.

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