

A Case of Difficult Ventilation

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Abstract

Difficult ventilation is a problem related to airway management which is a frequent and significant problem encountered during anesthesia. The main causes of difficult ventilation include disturbances in anesthetic gas flow, obstructions in the breathing-circulation system, decreased pulmonary compliance, severe acute bronchospasm, tension pneumothorax and endobronchial mass lesions. Secretions, cuff herniation, faults in manufactured airway equipment and kinking of the tube might also cause obstructions in the breathing-circulation systems. This report presents a case of difficult ventilation following intubation due to an endotracheal tube defect.

Keywords: Difficult ventilation; Defective endotracheal tube; Airway equipment

Introduction

We present a case of difficult ventilation that developed due to endotracheal tube manufacturing defects from our clinic. We want to attract attention to the fact that airway problems can be prevented by detailed examination of the cuff and connector, in addition to tube morphology, before intubation.

Case

A 64-year-old male patient underwent surgery for an elective colostomy closure. In his anesthetic history, he had uncomplicated general anesthesia for a low anterior resection operation due to rectal cancer. It was revealed that he had a 20-year history of diabetes mellitus and regulated his blood glucose levels. Upon physical examination, a scar lesion at the port site was observed in the right subclavian vein. The respiratory system examination and chest X-ray were normal. Standard monitoring and intravenous cannulation were performed. Following pre-oxygenation, 8 mg/Kg Pentothal, 1 mg/Kg lidocaine, 0.6 mg/Kg rocuronium bromide and 0.125 µg/kg remifentanyl were administered, and intubation was performed with cuffed endotracheal tube no. 8 (single use). No difficulties occurred during mask ventilation and intubation. The ventilator settings were adjusted to a tidal volume of 8 ml/Kg and respiratory frequency of 12/min.

It was observed that respiratory movements were absent. Based on the assumption that the anesthesia machine had failed, the patient was ventilated with a balloon valve mask. The anesthesia machine, soda lime and all the circuits were rapidly checked. Upon auscultation, the respiratory sounds were equal but deeply auscultated. It was observed that ventilation was possible with a mechanical ventilator with 100 cc. End-tidal CO₂ was in an obstructive pattern. It was observed that the peak airway pressure was 80 cm H₂O after intubation. During preparation for re-intubation, oxygenation with 100% O₂ was performed by manual ventilation. During aspiration, it was observed

that the aspiration catheter could not be advanced within the tube. A transparent membrane remnant obstructing more than 50% of the lumen was noticed. The remnant was due to a manufacturing defect in the connector of the intubation tube (Figure 1). Decreased ventilation was observed in concurrent posterior-anterior chest radiography (Figure 2), and respiratory acidosis was observed in blood gas analysis (pH: 7.22, PaCO₂: 63.8). The connector of the endotracheal tube was changed. The patient's respiratory parameters recovered. Anesthesia was successfully terminated.

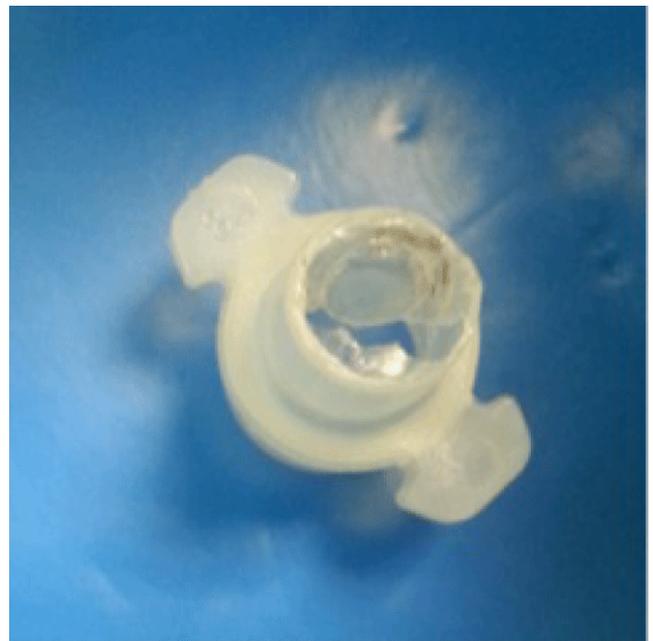


Figure 1: Manufacturing defect in the connector of the intubation tube.

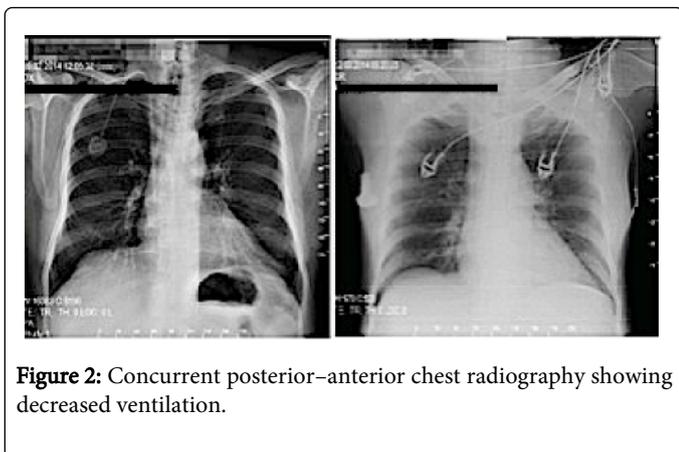


Figure 2: Concurrent posterior–anterior chest radiography showing decreased ventilation.

Discussion

The main causes of difficult ventilation include disturbances in anesthetic gas flow, obstructions in the breathing-circulation system, decreased pulmonary compliance, severe acute bronchospasm, tension pneumothorax and endobronchial mass lesions [1]. Secretions, cuff herniation, faults in manufactured airway equipment and kinking of the tube might also cause obstructions in the breathing-circulation systems [2]. Partial or total endotracheal obstruction can progress to respiratory distress, hypoxemia and death. Symptoms of an occluded tube include increased ventilator pressure values, low saturation and cardiovascular changes [3]. As well, very low tidal volumes, difficult ventilation, sudden increases in ventilator pressures and the inability to advance the aspiratory catheter can present as clinical characteristics. Although many causes, such as insufficient anesthesia depth, tension pneumothorax, decreased pulmonary compliance, acute severe bronchospasm, endobronchial mass lesions, chest wall rigidity, tube malposition, secretions and kinks in the breathing circuit or tube, are present in differential diagnoses of acute increases in airway pressure, cases of an obstruction developing due to defective tube are not rare [4].

Structural defects can be present in any part of the endotracheal tube and can cause difficult ventilation. Cuff defects can cause cuff herniation and intraluminal tracheal obstruction [1,5], while elliptical defects in the tube wall can cause endotracheal tube kinking [6] and air leakage [7]. Plastic films and meniscus can cause near-total airway obstruction [8]. In the literature, there is also a reported case of airway obstruction that developed due to a small opening at the center of the plastic film surrounding the distal end of the endotracheal tube [9]. During aspiration, detachment of the membrane in the connector can lead to foreign body aspiration [10].

In the current case, the membrane in the connector could be observed during aspiration of the tube. The decrease in tidal volume prompted primary control of the anesthesia machine as there had been no problem during intubation and mask ventilation. The absence of

any problem with the mechanical ventilator and the high pressure with the balloon valve mask led to the belief that there was an obstruction in the tube. To exclude the presence of a mucus plug, aspiration was performed, revealing the manufacturing defect. Routine control of the tube cuff before intubation, along with control of the connectors, could prevent such an error [11].

Many endotracheal tube defects that were not differentiated in routine preoperative examination have been reported. In this case although endotracheal tube was checked, because of the transparent intraluminal membrane, defect couldn't be recognized before intubation. ETT defect was detected after the aspiration catheter insertion. The membrane was clear white before intubation. We noticed the membrane that allows the air flow into lungs but it doesn't allow gas output. As a standard procedure for every patient undergoing planned endotracheal intubation, it is recommended to control the endotracheal tube and all anesthesia equipment twice before use as if it wasn't checked that could cause intraoperative problems and endanger patient safety [7].

In conclusion, we believe that, external and intraluminal control of the tubes before use can be vital for patients. In addition to preoperative control, it is essential and important to control ETs and also anesthesia equipment in the manufacturing phase to enforce quality standards as it might lead to severe complications.

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