Endotracheal Tube Obstruction: A Manufacturing Defect

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Various manufacturing defects of endotracheal tubes are encountered in anaesthesia practice. One of the important defects of an endotracheal tube is that a partial or complete obstruction can be potentially life-threatening. Manufacturing defects may not be ascertainable by routine inspection. In this case report, we report a partial airway obstruction caused by a plastic membrane in the connector of an endotracheal tube as a manufacturing defect.

Key Words: Endotracheal tube, manufacturing defects, obstruction

Introduction

Endotracheal tube (ET) is of vital importance for assuring airway control. In patients having undergone endotracheal intubation, a difficulty in ventilation can be experienced in association with the defects of ET (1). Some manufacturing defects cannot be noticed even though visual inspection is performed before using ET (2). Airway obstruction can result from structural defects associated with ET as well as mucus, blood and development of a kink in the ET tube (3). When a difficulty in ventilation is detected in a patient ventilated with ET, differential diagnosis should be performed rapidly for bronchospasm, pneumothorax, chest wall rigidity and equipment-related defects. An obstruction that would develop in ET can be life-threatening for the patient. Therefore, the presence of any obstruction in the tube should be investigated before using it. In this case report, a partial airway obstruction caused by a manufacturing defect in the connector of ET was presented in a patient who underwent endotracheal intubation with an ET having a 7.0 mm internal diameter (ID) cuff.

Case Presentation

Written consent form was obtained before preparing this case report. A 38-year-old female patient (weight 70 kg) with ASA IV E due to having been shot in the abdomen was urgently taken into laparotomy operation. Invasive intra-arterial blood pressure monitoring was conducted in addition to routine monitoring. Baseline values were measured as 105/70 mmHg for blood pressure, 110/min for pulse and 94% for SpO₂. In anaesthesia induction, 40 mg 2% lidocaine, 100 mg propofol and 100 µg fentanyl were administered intravenously (iv). Neuromuscular blockade was performed using 40 mg iv administered atracurium. Endotracheal intubation was performed orally with an ET having a 7.0 mm ID cuff, and the tube was positioned at the distance at which equal bilateral breath sounds were heard (approximately 20 cm). The patient's breath sounds were bilaterally equal but decreased. The patient was attached to a ventilator at the volume-controlled mode, with the tidal volume of 500 mL and the frequency of 12/min. The patient was ventilated with 50% oxygen and 2% sevoflurane. The patient's peak airway pressure was 40 cmH₂O, arterial blood pressure was 70/40 mmHg and heart rate was 120/min. End-tidal carbon dioxide pressure (ETCO₂) was measured to be 50 mmHg. In the following measurements, progressively increased ETCO₂ was observed. Anaesthesia maintenance of the patient, who was undergoing erythrocyte replacement and fluid therapy, was provided with intermittent bolus ketamine. It was detected that expired volume decreased to 220 mL and SpO₂ to 90%. The patient had to be ventilated manually. In the meantime, ventilation was provided in difficult periods of breathing. Owing to the peak airway pressure of 42 cmH₂O, increased ETCO₂ and difficult ventilation, possible causes of airway obstruction were examined considering differential diagnoses. The patient was suspected to have pneumotho-

Figure 1. Membrane narrowing the lumen of ETT connector
ETT: endotracheal tube

rax because of a history of being shot. However, radiography could not be performed under surgical conditions. To aspirate possible secretions, an attempt was made to advance an aspiration catheter into the ET. Because this was impossible, it was decided to change the ET. The presence of a plastic membrane which narrowed the lumen of the connector of the tube approximately 70% and which was resulted from a manufacturing defect was subsequently found (Figure 1). The old connector was replaced with the new one and ventilation was continued. After this change, the peak airway pressure was 20 cm H₂O, ETCO₂ was 35 mmHg and SpO₂ was 95%.

Discussion

Difficulty in ventilation during anaesthesia practice can develop because of various reasons, including a problem in providing anaesthetic gas, obstruction in the respiratory cycle, weak pulmonary compliance (extrinsic or intrinsic), oesophageal intubation, acute bronchospasm, blood pressure pneumothorax and endobronchial mass (4). In this case report, we aimed to discuss manufacturing defects of ET that can lead to difficulty in ventilation and their results.

Various manufacturing defects have been defined for ETs. It was reported that tube cuff herniation, intraluminal obstruction (5, 6), elliptical defects of the tube wall that cause air leak (7), development of kink in the endotracheal tube (8) and intraluminal plastic membrane (9) lead to severe airway obstruction.

There are many case reports presenting airway obstruction that develops because of manufacturing defects in the ETs (1, 4, 10-13). In our case, increased peak airway pressure after intubation, the value of SpO₂ beginning to decrease, ETCO₂ beginning to increase and low level of expired air suggested the possibility of an obstruction or secretion in the tube. The plastic membrane in the tube connector was noticed when an attempt was made to advance the catheter for the aspiration procedure and it did not pass through the connector into the lumen of tube. It was subsequently replaced with a new connector.

This case and other cases in the literature suggest that airway control, which is vital for patients, should be performed very carefully and punctiliously. This shows that ETs, which are very important in airway control, should be controlled prudently from the manufacturing phase to the practice phase.

Conclusion

It is essential to control ETs in the manufacturing phase. External and intraluminal control of the tubes before use can be vital for patients. Moreover, follow-up monitorization, including auscultation of breath sounds, airway pressures and SpO₂ value with intubation, is important for early detection of problems. When airway obstruction is suspected, differential diagnosis for mechanical and pathological causes should be urgently performed to solve the problem rapidly.

Informed Consent: Written informed consent was obtained from patient who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept - R.B., Y.A., Z.N.A., N.G.; Design - R.B., Y.A., Z.N.A., N.G.; Supervision - R.B., Y.A., Z.N.A., N.G.; Funding - Y.A., R.B., Z.N.A.; Materials - Y.A., Z.N.A., R.B.; Data Collection and/or Processing - R.B., Y.A., Z.N.A.; Analysis and/or Interpretation - Y.A., R.B.; Literature Review - R.B., Y.A., Z.N.A.; Writer - R.B., Y.A.; Critical Review - R.B., Y.A., Z.N.A.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support.

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