Impending Complete Airway Obstruction from a Reinforced Orotracheal Tube: a Case Report

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Abstract- Reinforced tubes are commonly used to minimize the opportunity of upper airway obstruction in patients at risk. There are a few reports of the airway obstruction resulted from kinked reinforced tubes. This report describes the obstruction of a reinforced tube in an adult patient who underwent tonsillectomy. Under general anesthesia; an armoured endotracheal tube was inserted into the trachea uneventfully. A few minutes after starting the surgery, the anesthesia machine detected a high airway pressure and an increased $ETCO_2$ (end-tidal CO_2) up to 50 mmHg. Further evaluation showed spiral wire damage resulted from Mouth Gag device that led to airway obstruction. Early anticipation of the complications leads to proper management of such critical and life threatening complications and prevention of hypoxia, hypercapnia, pneumothorax, and pulmonary edema. Based on our experience using an armoured endotracheal tube in tonsillectomy does not guarantee a safe airway and intensive monitoring is necessary.

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Keywords: Airway obstruction; Armoured tube; Boyle-Davis Mouth Gag; Tonsillectomy

Introduction

Spiral embedded tubes, known as armoured or reinforced tubes are designed to minimize the probability of obstruction or compression of the endotracheal tube during the surgery. These tubes are preferred for "head and neck" surgeries, neurosurgical operations and surgical non-supine positions (1,2). Despite the mentioned advantages, some problems have been reported with spiral endotracheal tubes (3-5). A Boyle–Davis Mouth Gag device is used to keep the mouth open for adequate exposure and to stabilize the tracheal tube during tonsillectomy (6). This report describes an unexpected obstruction of a reinforced tube in an adult patient who underwent tonsillectomy.

Case Report

A 28-year-old, 179 cm tall, 81 kg man, ASA class I (American Society of Anesthesiologists physical status classification) was scheduled for tonsillectomy under general anesthesia. After insertion of an intravenous cannula, routine monitoring including NIBP (Non-invasive Blood Pressure), ECG (Electrocardiogram), pulse oximetry and capnography were established. After preoxygenation, the patient received midazolam 2 mg and fentanyl 100 µg as premedication. General anesthesia was induced with intravenous sodium thiopental 400 mg and atracurium 50 mg. After laryngoscopy Cormack-Lehane grade, 3 was seen and an 8 mm internal diameter cuffed reinforced endotracheal tube was inserted using BURP (Backward Upward Rightward Pressure) maneuver and a bended stylet. It was hard but done on the first try. After securing the tube, controlled ventilation was established (tidal volume 750 ml and Frequency 12/min). Anesthesia was maintained with Nitrous Oxide-Oxygen (60%-40%) and Isoflurane (1.2%). A Boyle–Davis Mouth Gag device was inserted into the mouth and was fixed to provide an appropriate exposure during the surgery. A few minutes after starting the surgery, the anesthesia machine detected a high airway pressure and the $ETCO_2$ was increased up to 50 mmHg. Regarding decreased respiratory sounds, controlled ventilation was changed to manual with O_2 100%. Airway pressure was too high. Oxygen saturation decreased to 90%. The surgeon was asked to stop the surgery and open the mouth gag to relieve the obstruction probably resulted from Davis

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Gag device. There was still high resistance. We doubted the tube obstruction by a mucous plug and tried to remove it by suction, but the suction catheter was stuck in the midway. Therefore, we suspected the tube kink and observed that spiral wire of the tube was crushed between Davis Gag and patient's incisors. We decided to exchange the endotracheal tube immediately. Regarding the difficulty of re-intubation, we tried to use the exchange tube (size x) but it did not pass. Therefore, the kinked tube was removed, and laryngoscopy was done.

The first try to intubate the patient was failed because the field was filled with blood and secretions. Immediately, a video laryngoscope was used, and fortunately, intubation was successful after the secretions were suctioned. The tube was fixed properly, and normal ventilation was established. Hydrocortisone 100 mg IV was given to prevent airway edema. After assurance that the patient was stable, surgery continued uneventfully.

Observation of the tracheal tube after removal showed complete deformation and obstruction resulted from an entangled and compressed tube between the teeth and Davis Gag (Figure 1).

Figure 1. Image of the damaged tube: Pay special attention to the spiral wire damage resulted from Mouth Gag device that led to airway obstruction.

Discussion

The probability of angulation and bending of conventional endotracheal tubes has been accompanied by serious complications and threatening patient safety. Armoured tubes have an embedded coil (usually stainless steel) that minimizes the possibility of kinking and angulation and provides more patient safety.

These advantages have made them the tube of choice in most head and neck and neurosurgical operations and surgical non-supine positions (1,2).

Despite the mentioned characteristics of armoured tubes, some complications have been reported in the literature (7-9). Insertion of an armoured tube needs a stylet. Sometimes obstruction occurs secondary to the lubricants used to pass the stylet (4). Problems resulted from cuff herniation, and eccentric cuff inflation have been described previously as well (5). Several authors have reported the possibility of bubble formation along the tube walls when the tubes are repeatedly sterilized. This may enhance the risk of airway obstruction especially when N_20 is used (9). Tube-bite, usually with the incisors is a major complication, which results in deformity of the embedded wires and irreversible obstruction of the tube. This may happen when the patient experiences light anesthesia or during recovery from anesthesia (1,3,7,8). Obstruction due to the foreign body, mucus plug and blood has also been reported. Obstruction of such tubes also has happened after prone positioning. According to our knowledge, obstruction of reinforced tubes has not been reported before in tonsillectomy and surgeries using a Boyle-Davis mouth gag device.

Early anticipation of the complications mentioned above leads to proper management of such critical and life threatening complications and prevention of hypoxia, hypercapnia, pneumothorax, negative pressure pulmonary edema, and airway injuries. Based on our experience and previous reports using an armored endotracheal tube in tonsillectomy, does not guarantee a safe airway and intensive monitoring is necessary.

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