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Case Report

Difficult tracheal extubation due to endotracheal tube malfunction: A challenge during the COVID-19 pandemic

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الملخص

نزع الأنبوب الرغامي هو إجراء طبي يولد الهباء الجوي. يعتبر نزع الأنبوب الصعب من القصبة الهوائية من المضاعفات الخطيرة التي تزيد من خطر انتشار الهباء التنفسي وانتشار العوامل الممرضة، خاصة أثناء جائحة كوفيد-١٩. يحتمل أن تكون إدارة صعوبة نزع الأنبوب أكثر صعوبة أثناء الجائحة. نقدم تقريرا عن حالتين من حالات نزع الأنبوب الصعبة بسبب عطل في كفة الأنبوب الرغامي أثناء جائحة كوفيد-١٩. تم استخدام مناورات خاصة في مجرى الهواء وتدابير مكافحة العدوى لإدارة المعضلة غير المتوقعة بنجاح. تسلط سلسلة الحالات هذه الضوء على خطر انتقال فيروس كوفيد-١٩ في بيئة نزع الأنبوب الصعبة. يصف هذا التقرير الإدارة الوقائية والتفاعلية للمعضلة النادرة المتمثلة في صعوبة نزع الأنبوب.

الكلمات المفتاحية: كوفيد-١٩؛ إجراء طبي يولد الهباء الجوي؛ نزع أنبوب القصبة الهوائية؛ مجرى الهواء الصعب؛ إجراءات مكافحة العدوى

Abstract

Tracheal extubation is an aerosol-generating medical procedure. Difficult tracheal extubation is a serious complication that increases the risk of respiratory aerosol and pathogen spread, especially during the COVID-19 pandemic. The management of difficult extubation is potentially even more challenging during the pandemic. We report two cases of difficult extubation due to endotracheal tube cuff malfunction during the COVID-19 pandemic. Special airway maneuvers and infection control measures were employed to successfully manage the unexpected dilemma. This case series highlights the risk of COVID-19 virus transmission during difficult extubation. This report describes the preventive and reactive management of difficult extubation.

Keywords: Aerosol-generating medical procedure; COVID-19; Difficult airway; Infection control measures; Tracheal extubation

Introduction

Tracheal extubation is an aerosol-generating medical procedure (AGMP) that has caused more concerns during the coronavirus disease (COVID-19) pandemic.[1,2] Difficult tracheal extubation is defined as failed or incomplete attempts of purposeful removal of a patient's endotracheal tube (ETT).

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It is a rare and risky perioperative or critical care complication. It has increased safety implications during a respiratory pandemic. Difficult extubation may be related to mechanical problems, such as ETT malfunction, transfixation by surgical or pharyngeal device, and complications of head or neck surgery. It may be related to technical issues such as inadequate management of the ETT device, difficult tracheal intubation, inappropriate airway management, patient's posture, and patient's comorbidities. Difficult extubation is usually unexpected, multifactorial, and challenging to manage.[3] The management of this delicate AGMP problem has been both more challenging and important. There is no study on difficult tracheal extubation during a respiratory pandemic. This is a case series and review of this rare clinical dilemma during the COVID-19 pandemic.

Case reports

An adult female underwent urgent laparoscopic oophorectomy during the COVID-19 pandemic. The patient had a low risk of COVID-19 infection. The anaesthesiologist and the assistant used personal protective equipment (PPE) comprising goggles, N95 facemask, gloves, and gown. General anaesthesia was induced in a modified rapid sequence fashion using intravenous propofol and rocuronium and was maintained with propofol infusion, rocuronium boluses, and titrated hydromorphone doses. Direct Macintosh laryngoscopy and ETT insertion were uneventful. The patient was intubated using a size-7 Shiley™ tracheal tube with a high-volume, low-pressure, thin-walled, and flexible cuff (Covidien, Mexico). The ETT was properly checked preoperatively and was not defective. Two grams of intravenous magnesium were administered routinely. The patient was in the head-down position for 90 min of uneventful surgery. At anaesthesia emergence and full reversal of neuromuscular blockade, tracheal extubation was difficult, the ETT was stuck, and the patient became agitated. Anaesthesia was re-established with propofol. The anaesthesiologist and the assistant added face shield as PPE. Videolaryngoscopy showed that the ETT cuff failed to deflate adequately, with a distal semi-circumferential cuff herniation flap catching on the glottis. Lidocaine was sprayed on the glottis and ETT cuff. Subsequent ETT circumrotation enabled tracheal extubation. Adequate pharyngeal and tracheal suctioning was performed before extubation. Tracheal extubation was performed with simultaneous continuous endotracheal suctioning. The patient's postoperative course was uneventful and she was discharged home after 4 h. No airway complication at 24 h was reported.

An adult male had urgent laparoscopic cholecystectomy during the COVID-19 pandemic. The patient also had a low risk of COVID-19 infection. The anaesthesiologist and the assistant used PPE comprising goggles, N95 facemask, gloves, and gown. Modified rapid sequence general anaesthesia was induced with intravenous propofol and cisatracurium and was maintained with propofol infusion, titrated cisatracurium doses, and fentanyl boluses. Direct Macintosh laryngoscopy and endotracheal intubation were uneventful. The patient was intubated using a size-8 Shiley™ tracheal tube with a high-volume, low-pressure, thin-walled, and flexible cuff (Medtronic, Canada). Preoperatively, the ETT was checked properly and had no defect. The patient was in the head-up position for 60 min of uneventful surgery. At anaesthesia emergence and full reversal of neuromuscular blockade, attempted ETT cuff deflation and extubation failed. The ETT cuff pilot tube was damaged. Anaesthesia was deepened using propofol and fentanyl. Intravenous lidocaine 100mg was administered. The anaesthesiologist and the assistant added face shield as PPE. Videolaryngoscopy confirmed that the ETT cuff remained inflated despite deflation attempts. Lidocaine was sprayed on the glottis. The ETT was retracted to the glottis, Magill forceps was used to break and deflate the cuff, and the patient was extubated. Adequate pharyngeal and tracheal suctioning was performed before extubation. Tracheal extubation was performed with simultaneous continuous endotracheal suctioning. The patient's postoperative course was uneventful and he was then discharged home after 5 h. No complication at 24 h was reported.

Discussion

Difficult tracheal extubation may be caused by mechanical or technical issues such as ETT malfunction, adhesion to tracheal mucosa, entanglement with a nasogastric tube, or transfixation by surgical material. Difficult tracheal extubation in the two cases in this report was due to ETT cuff malfunction; however, this is an unusual incident especially if the ETT is properly checked before tracheal intubation. Difficult extubation may result from difficult endotracheal intubation and occasionally complicates forceful or difficult intubation because of oversized or defective ETTs. Problematic extubation may be due to the patient's pathophysiology, posture, surgery, airway anomaly, secretions, adhesions, laryngospasm, coughing, biting, or agitation.[4]

The risk of difficult or failed extubation may be minimized by adequate perioperative management of the ETT and appropriate intraoperative management of the patient's airway. Before intubation, it is important to properly check the ETT for defects and test the ETT cuff pressure using a manometer. Preoperative assessment of the patient's airway must be comprehensive, and this should guide the approach to endotracheal intubation. The process of endotracheal intubation should be smooth and atraumatic to avoid damage to the ETT and patient's airway. Inadvertent damage to the ETT cuff is a known cause of difficult extubation and in this case series the cause of the problem in both patients. It is important to check and optimize the ETT cuff pressure using a manometer after intubation, during airway or respiratory events, at certain intervals during a prolonged surgery, and after changing the patient's posture.

Difficult extubation is usually unexpected and some inexperienced anesthesiologists may be surprised by this rare event, especially if the initial tracheal intubation was easy.[3] Unexpected difficult extubation may be more dangerous because it occurs when danger awareness is reduced, attention decreases, or the airway cart is further away.[3] Management necessitates increasing the depth of anaesthesia or sedation to abolish laryngospasm and enable essential airway examination via laryngoscopy or laryngo-bronchoscopy. Laryngospasm and coughing should be minimized by intravenous magnesium and/or lidocaine.[5,6] Topical lidocaine is also beneficial. Tracheal

extubation must be performed under visualisation and may require manipulation of the ETT or cuff deflation using a blunt device such as Magills forceps. Difficult extubation may be complicated by cough, hoarseness, sore throat, airway oedema, or mild respiratory distress.

Tracheal extubation can produce detectable aerosol at 15-fold higher spread than intubation, especially during coughs.[1] Despite high air exchange rates, extubation may potentially spread COVID-19 or other respiratory viruses in the operating and critical care units. This risk of AGMP viral spread must be minimized, especially during difficult extubation. Operating and critical care unit staff must wear full PPE, including face shields.[7,8] For COVID-19 patients, the recommendation for anaesthesia care includes modified rapid sequence induction and tracheal intubation with the aid of videolaryngoscope. Videolaryngoscopy is preferred to direct laryngoscopy to reduce the anesthesiologist's proximity to the patient's airway and aerosol source.[9] Coughing or airway complications should be minimized by timely adequate airway suctioning, good anaesthesia or sedation emergence technique, intravenous magnesium, and intravenous lidocaine.[4,5,6] The practice of tracheal extubation with simultaneous continuous endotracheal suctioning may reduce post-extubation airway secretions, coughing, aerosol generation, and viral spread. This practice may be potentially important during respiratory pandemics or other respiratory infections. As the COVID-19 pandemic is very concerning,[7,8] there must be concerted efforts to minimize the risk of difficult extubation in the operating and critical care units to potentially reduce AGMP viral spread and protect hospital staff and patients.

The utility of airway management isolation boxes has been trialled during the COVID-19 pandemic to reduce aerosol spread during tracheal intubation or extubation. However, there is no evidence for the effectiveness of these aerosol boxes or barrier enclosures during the airway management of COVID-19 patients.[10] These barrier systems are associated with complications such as interference with controlled air circulation, compromise of PPE integrity, false sense of security, aerosol accumulation, and secondary aerosolization upon barrier removal. Further research is required regarding the efficacy of these barrier systems.

Conclusion

Difficult tracheal extubation potentially increases the spread of COVID-19 or other respiratory viruses in the clinical setting. This interesting case series highlights the risk of transmission of the COVID-19 virus during difficult tracheal extubation and shows that anaesthesiologists should take precautions to avoid the risk of difficult tracheal extubation. Multi-faceted approaches must be used to minimize the risk of difficult extubation and AGMP viral spread in all clinical settings, especially during a respiratory pandemic to protect the medical staff and patients.

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Conflict of interest

The authors have no conflict of interest to declare.

Ethical approval

The authors confirm that this study had been prepared in accordance with COPE roles and regulations. Given the nature of the study, the IRB review was not required.

Authors' contributions

OAB, VOM, AUO, MBK, OJO, and BTO were involved in the conception and design of the study, data collection, data analysis and interpretation, writing of initial and final drafts, proofreading, and critical review and approval of the final article draft. All authors reviewed and approved the final manuscript. Authors are responsible for the content and similarity index of the manuscript.

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