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Airway Management of a Patient with Montgomery T-tube in situ undergoing Neurosurgery

Yongwei Su[1], Xiaoqiang Li[2*]
[1]*Department of Anesthesiology, West China Hospital, Sichuan University, Sichuan, China*

Corresponding Author: **Xiaoqiang Li**
Address: Department of Anesthesiology, West China Hospital, Sichuan University, Chengdu 610041, Sichuan, China; Tel: +18980601475; Email: 39006900@qq.com
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Abstract

This article stipulates the airway management in a patient requiring cranial debridement and cranioplasty with a Montgomery T-tube（MTT）in situ. Anesthetic techniques that have been previously described for surgeries with MTT in situ which can be managed by applying a laryngeal mask or intubating a trachea tube easily. The airway management of patients with an MTT in situ, requiring a supine position with the head rightly tilted and flexed, has not yet been addressed. In this article, we explored some possible approaches to cope with this arising problem. We present how we managed to intubate a double-lumen endotracheal tube onto the superior tracheal limb of the T-tube since the 5.0 mm ID tracheal tube (equivalent to a 6.9 mm ED) could not pass through the tube readily. This technique could possibly be considered for patients in similar clinical scenarios.

Keywords

Montgomery T-Tube, Double-Lumen Endotracheal Tube, Fibreoptic Scope, Airway Management

Abbreviations

MTT: Montgomery T-tube; DLT: Double-Lumen Endotracheal Tube

Introduction

MTT (Montgomery T-tube) was first described in the mid-1960s as a stent for the trachea following laryngotracheoplasty [1]. Patients with MTT in situ are less commonly scheduled for selective surgery, except for laser application to remove granulomatous tissues. As a result, many anesthetists may be unfamiliar with this device, and airway management for these types of patients under general anesthesia with controlled ventilation can be challenging. In this report, we focus on the airway management of a patient with MTT in situ who is undergoing left frontotemporal cranioplasty.

Case Presentation

A 39-year-old man weighing 86kg was scheduled for left frontotemporal cranioplasty to repair a skull defect. Six months prior, he had undergone left middle cerebral artery aneurysm clipping and frontotemporal decompressive craniectomy. Additionally, he had a tracheotomy performed due to expected prolonged intubation and ventilation, as well as possible cuff injury. Two months after being discharged from the hospital, he experienced gradual dyspnea, and fiberoptic scope revealed severe subglottic stenosis resulting from the tracheotomy. As a result, his otorhinolaryngologist arranged for

laryngotracheoplasty to repair the damage, and an MTT was placed as a stent to support his trachea.

Before his surgery, we examined his medical history in detail. We talked to the otorhinolaryngologist who placed his MTT. He told us that it was a Standard Safe T-Tube (Boston Medical Products, Inc.) that has an outer diameter of 11 mm (with an internal diameter of 8-9mm). We thought that by intubating a tracheal tube through the MTT and controlled ventilation would be the most appropriate airway management, for it to preserve tracheal construction from collapsing and re-stenosis resulting from MTT removal. It had been a month since his last bronchoscopy and we speculated that a shiley 5.5 mm ID oral/nasal tracheal tube (7.5mm ED) could pass through the intratracheal lumen easily. Being aware of the possible consequences of sputum crusting and subsequent difficulty of putting a tracheal tube through MTT during anesthesia induction, it had been established that it was necessary to arrange a fiberoptic scope before entering the operating theatre. We spoke to the otorhinolaryngologist who had performed the fiberoptic bronchoscopy. He advised that our proposal of intubating a 7.5mm ED tracheal tube should be avoided, because the MTT barely allows an ED 6mm fiberoscope to cross through smoothly.

We considered that a laryngeal mask airway with the anterior limb of the T-tube plugged could not work either, as it would result in failed oropharyngeal seal in surgery necessitating a supine position with the head right tilted and flexed. We ultimately tried to manage his airways by putting a cuffed double-lumen endotracheal tube upon the superior tracheal limb of the MTT (refer to **Fig-1**). A double-lumen endotracheal tube (DLT) is an endotracheal tube generally designed to isolate the lungs from each other anatomically. For

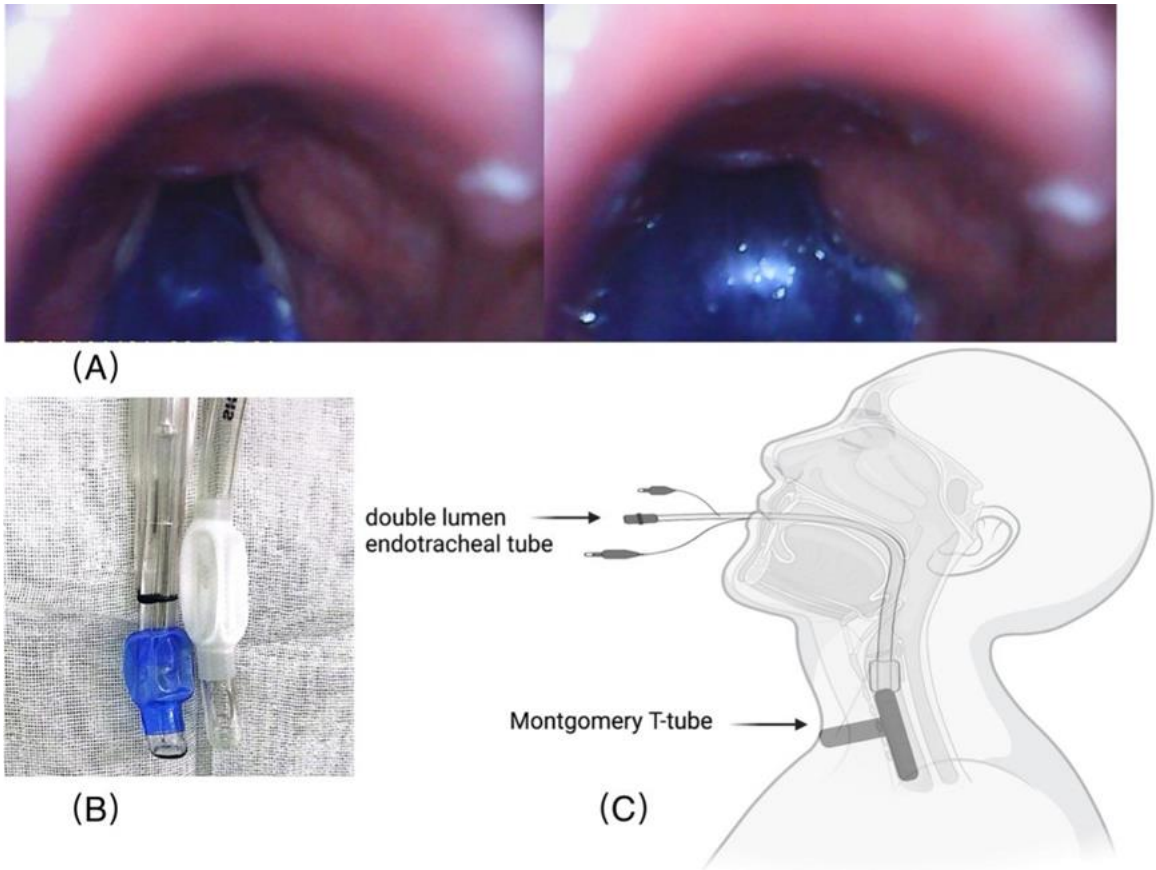

Fig-1: Key Steps of Controlling Airway with the Montgomery T-Tube in Situ

A: Visualizing the process of inserting a double-lumen endotracheal tube. B: The double-lumen endotracheal tube had a shorter cuff length and a shorter distance from cuff to tip of the tube, when compared with the single-lumen endotracheal tube. C: A size of 37 double-lumen endotracheal tube was inserted through the glottis and was placed onto the upper lumen of the MTT allowing positive pressure ventilation when the cuff was inflated.

this case, we noticed that DLT had a shorter cuff length and a shorter distance from the cuff to the tip of the tube. When it is compared with the single-lumen endotracheal tube (refer to **Fig-1**). Therefore, we presume a larger DLT cuff size could be placed on the superior tracheal limb of the MTT that would provide enough ventilation volume when the cuff is inflated.

We cleaned the airway of the extratracheal limb and plugged the stamo after a thorough suction. 100 mg of succinylcholine and 100 mg propofol were intravenously administrated after preoxygenation. After the disappearance of fasciculation, we intubated a size of 37 cuffed DLT through the glottis and placed it onto the upper lumen of the MTT successfully with a video laryngoscope (refer to **Fig-1**). The cuff was inflated and the anesthetic circuit connected. An inspiratory pressure of 22 cm H_2O achieved a 5 ml/kg of tidal volume after carefully positioning the patient. A senior otorhinolaryngologist held tightly on to the extratracheal lumen of the T-tube throughout the process until the patient was in place. Then, an administration of sufentanil (20 μg) and cisatracurium (16 mg) were given. Anesthesia was maintained with a mixture of sevoflurane, oxygen and air. The remainder of the procedure was uneventful.

The operation lasted for approximately 2 hours. Once the patient has fully recovered from anesthesia, extubation was performed with an assistant holding the anterior limb. There was no glottis damage and the patient was able to speak as per normal after surgery.

Discussion

MTT is an uncuffed silicon, which consists of superior, anterior, and inferior limbs. MTT is generally limited to a specialized type of surgery, which comes in tracheal sizes of 4.5–16 mm (as its external diameter) [2,3]. However, most of the anesthesiologists are unfamiliar with this T-tube because of its rarity in common surgery. Making it challenging and difficult to develop a feasible approach to managing a patient's airway. For instance, there is no standard fitting at the external opening of the anterior limb to attach an anesthetic circuit. Aside from this, there are too many size variants for MTT that even choosing an appropriate tracheal tube connector for attachment of an anesthetic circuit isn't that easy.

There is insufficient literature referring to anesthetic management of patients with MTT in situ. But rather, there are more published papers relating to anesthesia for T-tube insertion [4-6]. Most of the anesthetists, working outside specialist centers, are more likely to encounter the second situation than the first. As for anesthetic management of patients with MTT already in situ, otorhinolaryngologists advise that replacement of the MTT with a cuffed tracheostomy tube before induction should be considered only as a very last resort. When the risk of aspiration is low, it is suitable to use either inhalation technique [5] or IV induction. There are a number of methods being proposed for controlled ventilation after induction. One of which is a laryngeal mask airway (LMA) with the anterior limb of the T-tube plugged if the operative position is allowed. Moreover, orotracheal intubation guided by a direct laryngoscope or a bougie passing through the MTT proves to be practicable [3,7,8]. If ventilation via the extratracheal lumen is preferred, a Fogarty or Shiley embolectomy catheter may be introduced via the extratracheal lumen of the T-tube and passed upwards in the superior lumen. Balloon inflation then isolates the lower airway from the upper airway, permitting controlled ventilation [3]. When the risk of aspiration is high, awake fiberoptic intubation can be adopted [9].

To our knowledge, there are no case reports on the management of a patient like our own neurosurgery demanding a specific operative position with MTT in situ.

Authors' Contributions

YWS was responsible for obtaining the patient's informed consent and writing the first draft of the manuscript. She also participated in the anesthesia and care of the patient. XQL contributed to the literature review and wrote and edited the manuscript to its final submission. The authors have read and approved the final manuscript.

Ethics Approval Statement

The ethical considerations of this report have been diligently addressed, and patient personal data has

been respected. All relevant ethical guidelines and regulations have been followed to ensure patient privacy and confidentiality.

Patient Consent Statement

Written informed consent was obtained from the patients to publish this report, in accordance with the journal's patient consent policy. The patients were fully informed about the purpose and nature of the report, as well as the potential risks and benefits of publication. All efforts have been made to protect the rights and welfare of the patients involved in this report.

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Conflict of Interest

The authors have read and approved the final version of the manuscript. The authors have no conflicts of interest to declare.

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