SIMULTANEOUS TRANSTRACHEAL VENTILATION AND RETROGRADE TRACHEAL INTUBATION IN A CANNOT INTUBATE-CANNOT VENTILATE SITUATION

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Abstract

A case of recurrent laryngeal cancer where the patient was in a cannot-intubate, cannot-ventilate (CICV) situation, and refused to have a tracheotomy despite a doctor’s recommendation. No family members were available at that moment to give consent for a tracheotomy. We performed a temporizing measure to achieve emergency ventilation and a second cricothyroidotomy for retrograde intubation. Retrograde intubation is not one of standard method for securing an airway. However, when the airway could not be secured and emergent tracheostomy was not available, this method was considered as a “last resort” option.

Key Words: Cricothyroidotomy, Retrograde intubation, Difficult intubation

Introduction

The cannot intubate-cannot ventilate (CICV) situation is probably the most stressful condition faced by anesthesiologists because hypoxic brain injuries and cardiac arrest are real possible in this scenario. Thus, a correctly performed cricothyroidotomy is a potential lifesaving procedure in a CICV situation. Retrograde intubation is not one of standard method for securing an airway. However, when an emergent tracheostomy was not available for CICV patient, or an airway cannot be secured, this method can be considered as a “last resort” option. This article details the technique involved in approaching a temporizing measure to achieve emergency ventilation and a second ary cricothyroidotomy for retrograde intubation, which seems to be less invasive.

Case Presentation

A 42-year-old man with laryngeal cancer was admitted because of progressive shortness of breath along with blood-tinged sputum. The patient suffered from moderately differentiated squamous cell carcinoma of the larynx, stage IVa, cT4aN0M0. Previous treatment included chemotherapy and chemoradiotherapy. Positron Emission Tomography (PET) showed an abnormal hypermetabolic focus located in the right vocal fold extending through the thyroid cartilage (Fig. 1). Laryngoscopic examination showed a granular
surface over the anterior aspect of the subglottis and limited movement in the bilateral edematous vocal folds. Non-invasive treatment was given to the patient. Initially, a tracheostomy was suggested due to the impending airway obstruction, but the patient refused because of cosmetic reasons.

On the fifteenth day after admission, the patient suddenly gasped and gradually lost consciousness. Preliminary airway management including bag-valve mask ventilation, oropharyngeal and nasopharyngeal airways were attempted but none of the methods worked effectively. Anesthesiologists and an otorhinolaryngologist were called to the ward. Since the patient had refused a tracheostomy and no family members were available to give consent for the procedure, temporary access for ventilation was quickly established by a cricothyroidotomy with a 16# catheter. A 10 cc syringe (needle and plunger were removed) was connected to the hub of a catheter with a 7.0-mm-inner-diameter ETT with an inflated balloon inside the syringe. Bag-valve ventilation with 100% oxygen was maintained. The oxygen source came from the centralized system through the wall outlets. The pulse oximeter oxygen saturation (SpO2) increased from 93% to 97% with 100% oxygen, and the heart rate increased from 110 bpm to 130 bpm.

Intensive care was warranted, but a more secure airway had to be established first. We tried nasal fibroscopic intubation; however, the procedure failed due to soft tissue edema and distorted anatomy. Hence, at the bedside, we decided to perform another cricothyroidotomy, and we introduced a guide wire in the cephalic direction through the second cricothyroidotomy. The wire was easily passed into the patient’s oropharynx and retrieved in his mouth. Also, a bougie was

Fig. 1. Space-occupied soft tissue lesion over larynx.
Simultaneous transtracheal ventilation and retrograde intubation was performed with a 6.0 mm ID tracheal tube successfully placed during simultaneous ventilation in the first cricothyroidotomy. Bilateral breath sounds were auscultated and chest rise was observed. The patient’s SpO2 increased to 98%. The patient gradually regained consciousness after being adequately ventilated and oxygenated.

The otorhinolaryngologist had another thorough discussion with the patient and he finally agreed to receive a subthyroid tracheostomy.

During the general ward stay, the tumor was debunked and the airway was reconstructed. The patient was discharged without any problems and followed up at our out-patient department.

Discussion

This case report describes the emergency management of a patient with a known difficult airway using retrograde tracheal intubation via cricothyroidotomy. The cannot intubate, cannot ventilate (CICV) situation is probably the most stressful condition faced by anesthesiologists because of possible hypoxic brain injuries and cardiac arrest. Thus, a correctly performed cricothyroidotomy is a potential lifesaving procedure in a CICV situation.1-3

According to the Difficult Airway Algorithm of the American Society of Anesthesiologists4, when ventilation is inadequate and intubation is unsuccessful, we should call for help and then perform emergency non-invasive airway access (rigid bronchoscope, esophageal-tracheal combitube ventilation, or transtracheal jet ventilation) or invasive airway access (surgical or percutaneous tracheostomy or cricothyroidotomy).

One aspect that requires further discussion in this report is the patient’s refusal and the consequences of such a refusal which were communicated to the patient. The patient had a laryngeal tumor, and the common surgical option for this condition is a laryngectomy which is really a form of tracheostomy. Either way, a direct consequence of refusal is inevitable death. In this scenario, the patient refused surgical tracheostomy for cosmetic reasons and instead accepted inevitable death. Therefore, we did not view a cricothyroidotomy as a violation of the patient’s wishes, considering that a cricothyroidotomy is a temporary life saving procedure and has relatively few cosmetic complications.

Cricothyroidotomy, is easier, quicker, and safer to perform than subthyroid tracheostomy because the surrounding tissues have fewer major nerves or blood vessels, and it is the most widely advocated surgical technique for emergency tracheostomy.4-7 A randomized prospective trial comparing bedside surgical cricothyroidotomy and subthyroid tracheostomy revealed a 30% incidence of related complications and 5% were classified as major events.8 Cricothyroidotomy can be performed using a needle, cannula or surgical technique. Severe subglottic stenosis is a potential threat of surgical cricothyroidotomy.8,9,10 Whereas the needle method is associated with problems related to ventilation, such as hypercapnia, barotraumas, subcutaneous emphysema, and obstruction of the cannula because of kinking, it does however have the advantages of being a simple procedure, requires minimal practice, takes a relatively short time to perform, does not require complicated equipment, and causes fewer major complications.11-17 Mild bleeding is the most frequent immediate complication that is always resolved by proper local packing.8

The needle cricothyroidotomy is performed by inserting a catheter (12-, 14- or 16-G) through the cricothyroid membrane and then connecting it to a jet-type ventilator (Sanders) or bag-valve ventilation to ventilate the lungs with a high volume of O2-air mixture. The most common ventilation settings in an adult patient are: oxygen concentration: 30% to 100%; driving pressure: 0.8 to 4 bars; and ventilation frequency: 150 cycles per minute. It has been suggested that the duration of ventilation using needle cricothyroidotomy is less than 30 minutes and best assessed by watching the rise and fall of the chest wall.18 Carbon dioxide retention limits the duration of the technique’s usefulness. Usually oxygen saturation improves rapidly;
however, patients who cannot frequently expire fully can develop increased intrathoracic pressure which may be related to cannula obstruction due to kinking, less cardiac output, or barotraumas. Subsequent pneumothorax is also a risk and may in turn lead to mediastinal or subcutaneous air accumulation. If the jet stream is not aimed into the trachea, subcutaneous emphysema and gastric dilation may occur.\(^4\,\,6\,\,19\)

Several possible setups have been suggested for attaching bag-valve ventilation to a needle cricothyroidotomy catheter.\(^20\) We should always consider availability, cost, speed of assembly, and mechanical flexibility (easier stabilization, especially in conditions of pre-hospital emergency care and transport). Thus, we designed another device with a #5.0 Fr. catheter connected to a three way stopcock (Fig. 2) which can be connected to the hub of the catheter with a side hole for carbon dioxide release which relieves intrathoracic pressure. After successful ventilation, invasive airway access including surgical or percutaneous tracheostomy or cricothyroidotomy is recommended. However, the permanent incision scar always upsets patients. Retrograde transtracheal intubation may be appropriate for temporary airway management in this situation.

Butler and Cirillo first described retrograde intubation 50 years ago for intraoperative placement of an oral endotracheal tube using a pre-existing tracheostomy.\(^21\) The risks of retrograde intubation using a bougie include: creating a false passage with the bougie, vocal cord injury, retropharyngeal hematoma, and damage to supraglottic and oropharyngeal structures.\(^22\)

When an emergent tracheostomy is refused by a patient, like this case, or an airway is not secured, simultaneous retrograde intubation and needle cricothyroidotomy for ventilation can be considered as a “last resort” option.

Fig. 2. A cut-off end of 5.0 mm-inner-diameter endotracheal tube connected with a three way stopcock.
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References

15. Patel RG. Percutaneous transtracheal jet ventilation: a safe, quick, and temporary way to provide oxygenation and ventilation when conventional methods are unsuccessful. Chest 1999;116:1689-1694.
18. Advanced trauma life support for doctor eight edition; page 52
病患遭遇無法換氣及無法插管時，同步實施氣管穿刺以及逆向插管

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摘要

個案報告：一位喉癌復發患者因呼吸短促住院，但他拒做氣切手術並持續接受非侵入性治療，然入院後第 15 天時，因急性呼吸道阻塞而失去意識，面罩式換氣以及口鼻呼吸管路均無法提供適當換氣，考量到病患之前拒行氣管切開手術，當時又無家屬在旁可決定氣切，因此我們先執行了環甲膜穿刺術，暫時的維持了他的血氧飽和度，並透過另一環甲膜穿刺完成了逆向插管。

討論：當病患遭遇無法換氣及無法插管時，對於麻醉醫師來說是最具壓力的緊急狀況，腦部缺氧以及心跳驟停是可能的合併症，尤其是當病患之前拒絕氣管切開術時，此時即時的實施環甲膜穿刺術將會是救命的重要步驟，本篇文章就此項技術作一說明，並同步實施了逆向插管的技術，這應該是這一類病患可以參考的作法。

關鍵詞：環甲膜穿刺， 逆向插管，困難插管

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