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ANAESTHESIA
Case Report

One-Lung Ventilation in a Patient with a Fresh Tracheostomy – A Case Report

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Abstract

Background: Double-lumen endotracheal tube is still the most common device used in one-lung ventilation, yet bronchial blockade technology is increasing offering sometimes, more advantages than double lumen tubes. This report aims to present a case of a fresh tracheostomized patient requiring one-lung ventilation.

Case report: 57-year-old man admitted for cervicotomy and left thoracotomy. Was in septic shock due to cervical, mediastinal and pleural abscesses. He was sedated, intubated (6,5ID) and ventilated. Although he is intubated, his airway was recognized as being potentially difficult.

After drainage of cervical abscesses, the tracheostomy was performed. For one-lung ventilation a wire guided endobronchial blocker (Arndt Blocker) was electively placed through the cannula of the fresh tracheostomy. The patient was submitted to one lung ventilation for 5 hours. Some episodes of hypoxemia required intermittent two lungs ventilation under 100% Fi_{02}. The surgery lasted eight hours and at the end of the procedure bronchial blocker was removed from the stoma site without intercurrences.

Discussion: In tracheostomized patients we must consider if it is a fresh or a chronic tracheostomy. In a fresh stoma the method to achieve lung isolation is limited because the airway could be immediately lost on decannulation. During the past decades modifications on bronchial blockers have been reported to make possible their use in patients with tracheostomies.In this situation, placing a bronchial blocker through the tracheostomy cannula proved to be easy and safe with minimal disturbance to the tracheostomy site.

Keywords: *Arndt blocker; bronchial blocker; one lung ventilation; fresh tracheostomy*

Abbreviations: One-lung ventilation: OLV; tidal volume: VT; respiratory rate: RR; positive end-expiratory pressure: PEEP; bronchial blocker: BB; Intensive Care Unit: UCI: double-lumen bronchial tube: DLT; single lumen tracheal tube: SLT.

Introduction

This report involves a case of successful one-lung ventilation (OLV) during 5 hours using an Arndt Blocker (Cook Medical inc, Bloomington, Indiana) electively placed through the cannula of a fresh tracheostomy. The patient was in septic shock due to cervical, mediastinal and pleural abscesses.

In a fresh stoma the method to achieve lung isolation is limited because the airway could be immediately lost on decannulation. Various techniques have been described and, during the past decades modifications on bronchial blockers have been reported to make possible their use in patients with tracheostomies [1].

In this particular situation, placing a bronchial blocker under direct visualization with a flexible bronchoscope passed through the tracheostomy cannula proved to be easy, safe, and a simple way to provide single-lung ventilation. This technique allowed ventilation during the positioning of the bronchial blocker with minimal disturbance to the tracheostomy site. This type of airway management is unusual and there is limited information in literature.

Case Report

A 57 year-old man was admitted into the emergency department with the diagnosis of septic shock due to cervical, mediastinal and pleural abscesses. He had cardiovascular, respiratory, neurological and renal impairment. He was sedated, intubated (6,5ID), ventilated and managedwith sympaticomimeticdrugs. His medical history included hypertension and alcoholism. Hispreoperative physical status was ASA 4.

The patient was proposed for cervicotomy and thereafter, left thoracotomy, in the same procedure. Although he is intubated, his airway was recognized as being potentially difficult. All the operating suites were geared to deal with an anticipated difficult airway. A careful examination of the patient ensues was made; the operating room had been prepared with difficult airway supplies and staff working was familiarized with the algorithmic approach that would be preformed.

Sevoflurane, a mixture of oxygen and air and a fentanyl infusion were used to convert into general anesthesia. Volume-controlled ventilation, including an 8 ml/kg tidal volume (V_T) of predicted body weight under 40% Fi_{02}, a 12-cycles/min respiratory rate (RR), and a 5 cm H_2O positive end-expiratory pressure (PEEP), was used. Placement of standard monitoring ASA II, an arterial line and a femoral venous catheter were performed. A baseline arterial blood gas measurement with two-lung anesthesia, with a fraction of inspired oxygen of 40%, showed: pH - 7.236; PaCO2 -46.2; Pa_{02} – 139; HCO3 - 19.2; lactates - 3.10; hemoglobin - 9.9 mg/dl.

Incision and drainage of the pharyngeal abscesses were performed and a surgical traqueostomy cannula was inserted for left thoracotomy, the anesthetic team decided to perform lung exclusion using a bronchial blocker (BB), the Arndt blocker through the traqueostomy cannula. BB was placed using a lubricated bronchofiberoscope (4 mm). The balloon on the blocker was placed in left main bronchus to allowed left lung isolation. Volume-controlled ventilation included a 6 ml/kg V_T of predicted body weight under 70% Fi_{02}, a 17 cycles/min RR, and a 5 cm H_2O PEEP, was used to maintain oxygen saturation and PaC_{02} stable. Arterial blood gas measurement with one-lung anesthesia, with a fraction of inspired oxygen of 70%, showed: pH - 7.218; PaCO2 -54.2; PaO2 - 142; HCO3 - 18.2; lactates - 3.50.

The patient was submitted to OLV for 5 hours. During this period some episodes of hypoxemia required intermittent two lungs ventilation under 100% Fi_{02}.

The surgery lasted eight hours and at the end of the procedure BB was removed from the stoma site. Postoperative care was made in an Intensive Care Unit (ICU) on ventilatory support. The patient stayed in the ICU for 3 months and during that period several times had surgical interventions for mediastinitis treatment because of empyema and cervical abscesses. All of these surgeries took place after the first month.

Nosocomial infections caused by *Candida albicans*, Enterococcus faecalis, *Escherichia* coli were diagnosed and treated. After 90 days in ICU stay severe nosocomial pneumonia caused by a MRSA was diagnosed leading to death 6 days later.

Discussion

Anesthesiologists often have to isolate and selectively ventilate a single lung. Intentional collapse of the lung on the operative side is needed to improve surgical access to most thoracic procedures.Lung isolation techniques are primarily designed to facilitate OLV in patients undergoing cardiac, thoracic, mediastinal, vascular, esophageal or orthopedic procedures involving the chest cavity. Lung isolation is also used to protect the lung from soiling by the contralateral lung, or can be used to provide differential patterns of ventilation in cases of unilateral reperfusion injury as well as in unilateral lung trauma. [2]

Lung isolation can be achieved by three different methods: (1) placement of a double-lumen bronchial tube (DLT), (2) use of a single-lumen tracheal tube (SLT) in conjunction with a bronchial blocker; or (3) insertion of a endobronquial single lumen tube into a mainstream bronchus. [3] DLT is still the most common device used in OLV lung techniques although bronchial blockade technology is improving and in some specific situations offers more advantages than DLT.Alternatives to achieve OLV in tracheostomized patients include:

a. Insertion of a SLT followed by an independent bronchial blocker passed coaxially;
b. The use of a disposable cuffed tracheostomy cannula with an independent bronchial blocker passed coaxially;
c. Replacement of the tracheostomy cannula with a specially designed short DLT such as the Naruke DLT, made for use in a tracheostomized patients;
d. Placement of a small DLT through the tracheostomy stoma;
e. Oral access to the airway for standard placement of a DLT or blocker (occasionally an option in patients on prolonged mechanical ventilation for respiratory failure or postoperative complications.) [3]

Before placing any lung isolation devices through a tracheostomy stoma it is important to consider if it is a fresh or a chronic stoma. When there is a fresh stoma the airway can be lost immediately on decannulation so it is recommended that the change of the cannula should be avoided during the first 48-72 hours. In the present case, the contingency airway plan was to use a bronchial blocker tube through the tracheostomy cannula.

Bronchial blockers are inflatable devices that are passed alongside or through a single-lumen tracheal tube to selectively occlude a bronchial orifice. They have an inner channel that allows suctioning of secretions from the collapsed lung or oxygen insufflation if oxygenation proves to be difficult. The bronchial blocker must be advanced, positioned, and inflated under direct visualization via a flexible bronchoscope. The placement must be reconfirmed when the patient is placed in the lateral position.

There are several different bronchial blockers available to facilitate lung separation. These devices are used independently with a conventional SLT; the Arndt wire-guided endobronchial blocker (Cook Critical Care, Bloomington, IN), the Cohen tip-deflecting endobronchial blocker (Cook Critical Care, Bloomington, In), the Fuji, Uniblocker (Vitaid, Lewinston, NY) and the EZ blocker™ Endobronchial Blocker [4]. Modified uses of the Arndt and Uniblocker with confirmation by flexible fiberoptic bronchoscopy have been successful through existing stoma sites. [1,6,7]

The Arndt blockers are newer, introduced in 1999 (Ref), and dislodgment and complications also limit its use. Literature reports [5,8] that the Arndt blocker have more malpositions than Uniblockers. It is recommended that if the Arndt blocker is used, it should be deflated and advanced 1cm before lateral positioning to avoid dislodgement. Reconfirmation of tube placement by fiberoptic bronchoscopy after any patient position change is prudent. Actually, regardless of the one-lung airway device used, immediate use of fibrotic bronchoscope is required for confirmation of placement of all types of tubes.

The axial lumen of the Arndt blocker, as well as the Uniblocker, permits use of CPAP in non-dependent lung, to reverse hypoxemia during OLV. During general anesthesia, 90% of the patients develop atelectasis in the dependent portions of the lung. [9] In addition; a higher Fi_{02} causes the oxygen to move at a faster rate from the alveolus into the capillary. Intraoperative considerations for the use of CPAP to the nondependent lung during one-lung anesthesia may include limiting absorption atelectasis, reversal of hypoxemia, and improving postoperative pulmonary function.The great advantage of the Arndt blocker is that it has a special multiport adapter that allows simultaneous ventilation and bronchoscopy whilst providing an effective seal and locking device for the catheter and so do the Uniblocker. [6]

It has been reported that failure to achieve lung separation because of abnormal anatomy or lack of a seal within the bronchus. Inclusion of the bronchial blocker or the distal wire loop of an Arndt blocker into the stapling line has been reported during a right upper lobectomy and required surgical reexploration after unsuccessful removal of the bronchial blocker after extubation. [1]

Another potentially dangerous complication with all bronchial blockers is that the inflated balloon may move and lodge above the carina or be accidentally inflated in the trachea. This leads to inability to ventilate, hypoxia, and potentially cardio respiratory arrest unless quickly recognized and the blocker deflated. There is a report of a sheared balloon of the Arndt blocker that occurred when the blocker was removed through the multiport blocker side port. It is advised that when an independent bronchial blocker is not in use it needs to be removed with the multiport blocker side port. [1]

It is imperative that preoperative alternative airway plans be carefully considered. In summary the optimal method of lung isolation will depend on a number of factors, including the patient's airway anatomy, the indication for lung isolation, the available equipment, and the training of the anesthesiologist.

Conclusion

Placing a bronchial blocker through the tracheostomy cannula and positioning it under direct visualization with a flexible bronchoscope passed through the tracheostomy tube proved to be an easy, safe, and simple way to provide single lung ventilation, in this situation. Furthermore, this technique allowed for ventilation during positioning of the bronchial blocker with minimal disturbance to the tracheostomy site.

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Conflict of interest

The authors declare no conflicts of interest.

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