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Manuel High-Frequency-Ventilation during Sleeve Pneumonectomy

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Authors' contributions

This work was carried out in collaboration between all authors. Author EDB designed the study, wrote the protocol and wrote the first draft of the manuscript. Authors GO and EDB managed the analyses of the study. Authors SB and MED managed the literature searches. All authors read and approved the final manuscript.

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Case Report

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ABSTRACT

Aims: Sleeve pneumonectomy is an operation that requires careful perioperative management of anesthesia.
Presentation of Case: A case diagnosed with a mass in the right main bronchus was presented in this article. He was a 53 year old man who underwent right sleeve pneumonectomy with carinal resection and subsequent anastomosis of trachea to the left main bronchus. During the anastomosis, ventilation was provided via a Nelaton catheter by using high frequency ventilation manually. Patient was extubated smoothly in the operating room, and was discharged without any complications at the end of 1st week.
Discussion and Conclusion: In case of unexpected findings during thoracic surgery non-conventional ventilation techniques (manual HFV-like mode) using available materials can lead to satisfactorily results.

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1. INTRODUCTION

Tumors involving the most proximal portions of the mainstem bronchus and the carina may require a sleeve pneumonectomy. These are most commonly performed for right-sided tumors and can usually be performed without cardiopulmonary bypass via a right thoracotomy [1]. Sleeve pneumonectomy is an operation that requires careful perioperative management of anesthesia and is a continually evolving science and art. Management of one lung anesthesia, hypoxemia, postoperative pain are the major problems. Ventilation during trachea-bronchial anastomosis is the most important part of the operation. A long single lumen tube can be advanced across into the left mainstem bronchus during the period of tracheo-bronchial anastomosis. High-frequency positive-pressure ventilation (HFPPV) has also been used for this procedure [1].

In this report, we describe a 53 year old man who underwent right sleeve pneumonectomy with carinal resection and subsequent anastomosis of trachea to the left main bronchus.

2. PRESENTATION OF CASE

A 53-year-old man diagnosed with a mass in the right main bronchus was planned for sleeve resection by the thoracic surgeons. Informed consent was obtained from the patient. His preoperative mass image is shown in Fig. 1. Patient reported a 60-pack-year history of smoking. Before arrival to the operating room, patient was premedicated with midazolam. After routine anesthesia monitoring (Electrocardiogram, heart rate, non-invasive blood pressure, peripheral oxygen saturation (SPO_2)) and anesthetic induction, a rigid bronchoscopy was performed for understanding whether the tumor invased the carina or not.

Rigid bronchoscopy revealed involvement of the carina. Right sleeve pneumonectomy with carinal resection and anastomosis of the left main bronchus to the trachea were planned. Patient was intubated with double lumen 37 Fr tube and provided with central venous route via right internal jugular vein. After arterial catheterization, patient was given a left lateral decubitus position. Thoracic cavity was approached with right posterolateral thoracotomy. Tracheal and hilar dissections were performed. Trachea was transected over the orifice of the right main bronchus while left main bronchus was transected right under the carina. Patient was passed on ventilation with sterile intubation tube (6.5 mm) inserted through surgical site into the left main bronchus. It appeared that the intermediate bronchus did not have enough elasticity, possibly due to prior chemotherapy and mediastinoscopy, precluding direct anastomosis to trachea, without considerable tension. Therefore, it was decided to perform sleeve pneumonectomy Right lung was excised together with carina. Anastomosis of the left main bronchus to the trachea was initiated from posterior semicircumference. The tube inserted in the left main bronchus was removed. Double lumen tube was not selected because of its larger diameter and fear of producing damage to the anastomotic line during manipulations therefore with help of tube exchanger double lumen tube was removed exchanged by a 6 mm intubation tube. However, as operation went on, it was seen that the new tube was not reaching beyond the anastomotic site as mentioned by the surgical team. In order to ventilate patient during anastomosis it was decided to insert a 14 Fr Nelaton catheter into the left main bronchus through the current tracheal tube under the guidance of surgical team. After the Nelaton catheter was inserted, a connector of the 7.5 mm tracheal tube was placed to the tip of the catheter for providing oxygen connection. Ventilation was provided manually with low tidal volume using 100% oxygen and high tidal frequency (nearly 100 per minute) during the anastomosis. Patient's oxygen saturation did not fall under 85% and was monitored with frequent blood gas analyses every ten minutes. After completion of anastomosis Nelaton catheter was removed leaving behind 6 mm tracheal tube. After closure of thoracotomy incision intercostal nerve block was done along with 100 mg tramadol infusion, 50 mg of IV meperidine and 1000 mg of iv paracetamol. Patient was placed in supine position (with chin sutured to manubrium sterni) with neck in flexion and was given a reverse with 2 mg/kg of Sugammadex. The patient was extubated after complete responsiveness was achieved. Patient was transferred to intensive care unit (ICU) and after uneventful follow-up was transferred to normal ward. Patient was discharged without any complications at the end of 1^{st} week. The CT image at the postoperative 10^{th} month is seen in Fig. 2.

Fig. 1. Preoperative CT image of the mass

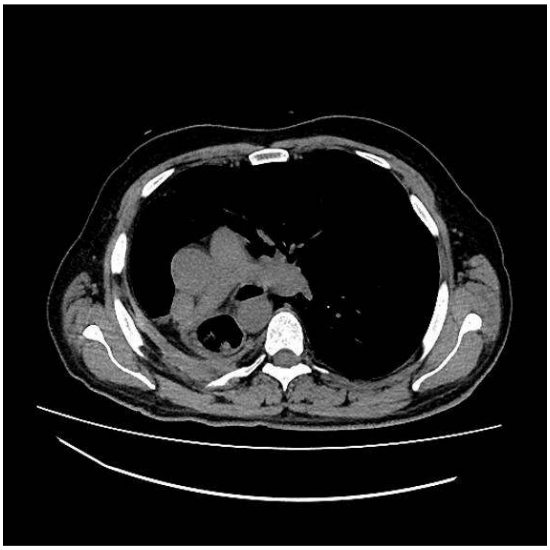

Fig. 2. CT image 10 months postoperatively

3. DISCUSSION

The aim of this report is to describe anesthesia managements in a patient undergoing sleeve pneumonectomy.

Tracheal sleeve pneumonectomy (TSP) was first performed by Gibbon in 1959 to overcome the technical limitations of resection in the case of tumors originating from the carina and tracheobronchial angle [2]. Other sporadic attempts were carried out by various surgeons with different techniques and reported in literature during the following years [3,4]. One of the main technical problems concerning tracheobronchial anastomoses is caused by the ventilation technique used.

Alternative methods of oxygenation may be required during thoracic surgery when hypoxemia occurs. These methods include intermittant oxygen insufflation or continuous positive airway pressure (CPAP) ventilation to the non-dependent and positive end expiratory pressure (PEEP) to the dependent lung. Altough high frequency jet ventilation (HFV) is not routine procedure, it provides safe respiratory management and good surgical field exposure during surgery [5-7]. High frequency ventilation requires catheters with small diameters, very small tidal volumes, high flow rates may facilitate surgical performance in large airways. In a recent study that evaluated tracheal sleeve pneumonectomies, double lumen tube was preferred for one lung ventilation. The tube was pulled back into the trachea during carinal resection and HFV was performed [8]. In our hospital high frequency ventilation machine was not available. In our case, the double lumen tube was not appropriate because it obstructed the surgical site during carinal resection through right thoracotomy. Consequently we preferred to insert endotracheal tube with a tube exchanger aid, then a nelaton catheter (14 French) was inserted through the endotracheal tube. Then high frequency ventilation was provided manually with highest possible approximation to mechanically performed HFV. Anastomosis of trachea to the left main bronchus was achieved without any adverse event.

Post-thoracotomy pain relief also plays important role as adequate pain management avoids prolonged intubation and ICU stay in such patients. There are various sensory afferents that transmit nociceptive stimuli after thoracotomy, such as intercostals nerves (T4-T6), vagus nerve, phrenic nerve and ipsilateral shoulder (brachial plexus) [1]. Analgesia should be multimodal to block all of these various pain efferents. In our case, multimodal analgesia was used and we think that excellent postoperative analgesia has a big role in early extubation.

4. CONCLUSION

In case of unexpected findings during thoracic surgery non-conventional ventilation techniques (manual HFV-like mode) using available materials can lead to satisfactorily results.

CONSENT

As per international standard or university standard written patient consent has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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