

Non-Intubated Video-Assisted Thoracoscopic Pulmonary Nodule: A Case Report

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Abstract

We present a case of VATS performed on a 72 years-old male patient with pulmonary nodule. She had a 35 year history of chronic obstructive pulmonary disease and smoking. In physical exam there was bilateral wheezing and preoperative pulmonary function tests revealed that; forced vital capacity (FVC): 2.03 (53%), forced expiratory volume in 1 second (FEV₁): 1.34 (45%), FEV₁/FVC: 66 (84%). Because the chest x-ray revealed pulmonary nodule thoracic epidural analgesia with adequate sedation was preferred over general anesthesia. Using combination of thoracic epidural anesthesia, intrathoracic vagal blockade, and appropriate sedation, non-intubated VATS procedure was easy and safe without adverse events in COPD patients.

Keywords: *Non-Intubated Epidural Anesthesia; Videothoracoscopy; Pulmonary Nodule*

Abbreviations

TEA: Thoracic Epidural Anesthesia; VATS: Video-Assisted Thoracoscopic Surgery; COPD: Chronic Obstructive Pulmonary Disease; FRC: Functional Residual Capacity; FEV₁: Forced Expiratory Volume in 1 Second; FVC: Forced Vital Capacity; VC: Vital Capacity; SpO₂: Peripheral Oxygen Saturation; PaO₂: Arterial Partial Pressure of Oxygen; PaCO₂: Arterial Partial Pressure of Carbon Dioxide; VAS: Visual Analog Scale

Introduction

Thoracoscopic surgery without tracheal intubation has been recently performed for management of resection of pulmonary nodules, solitary masses, lung volume reduction and during management of pneumothorax [1]. General anesthesia has many severe complications during preoperative and postoperative period especially related with respiratory functions and deterioration in cardiac performance. Therefore anesthesiologists preferred awake patient although it is more difficult to achieve [2].

Using combination of thoracic epidural anesthesia (TEA), intrathoracic vagal blockade, and appropriate sedation, nonintubated video-assisted thoracoscopic surgery (VATS) procedure was easy and safe without adverse events. This risk is of particular importance in the surgical treatment of lung nodules and mass combined with COPD because postoperative pulmonary complications occur more common in patients with COPD than in those without COPD. We presented a 72 year patient with a history of chronic obstructive pulmonary disease (COPD) who underwent VATS and TEA in an awake patient.

Case Presentation

A 72 years-old male patient, 169 cm tall and 76 kg weight with respiratory distress and pulmonary nodule with a 35 year history of COPD and smoking were scheduled for VATS after obtaining the approval of the informed consent from the patient. In physical exam there was bilateral wheezing and preoperative pulmonary function tests revealed that; forced expiratory volume in 1 second (FEV₁): 1.34 (45%), forced vital capacity (FVC): 2.03 (53%), FEV₁/FVC: 66 (84%). Chest computed tomography (CT) demonstrated a spiculated mass

of 7*8 mm in diameter in the posterior segment in the right upper lobe of the lung. The Charlson comorbidity index was used in the evaluation of this case and received 2 scores (pulmonary nodule, COPD). The weights range from 1 to 6 (0 if no comorbidity) and was used to estimate mortality [3].

For this reason the procedure was planned in an awake patient under TEA and adequate sedation.

Standard monitoring (electrocardiography, heart rate, non-invasive arterial blood pressure, and periferic oxygen saturation (SpO₂), was applied. We recorded the first measurements as the initial value. Arterial blood gas samples were collected perioperatively.

TEA was performed by insertion of an epidural catheter at the T₅₋₆ interspace with an 18G Tuohy needle with the saline loss of resistance technique in the sitting position. The dose was not repeated. From the thoracic epidural catheter a total of 35 mg of bupivacaine 0.5% with 50 µg of fentanyl was administered. Sensory level was tested every 5 minutes with cutaneous pinprick sensibility testing to achieve a sensory block between the T₂₋₈ dermatomes.

An incision through the chest wall on the operated side caused pulmonary collapse, leading to iatrogenic pneumothorax. The uniportal VATS wedge resection was performed for diagnosis of nodule in the right upper lobe. The patient was awake and under mild sedation for the entire procedure. Main problem in patients with COPD is dynamic hyperinflation, intercostal muscles weakness and coughing reflex because of manipulation of lung and traction of hilar structures and jeopardizing the surgical manipulation. Hyperinflation prevented with pressure on lung surface and the intrathoracic vagus nerve blockade was performed with 2 mL of 2% lidocaine to inhibit coughing for at least a 3 hour duration. One of the most important aims was to obtain the motor block of intercostal muscles while maintaining diaphragmatic respiration. An iatrogenic pneumothorax was created by thoracic incisions for thoracoscopy and the ipsilateral lung slowly collapsed.

During the thoroscopic procedure, the respiration rate of the patient was kept between 12 to 26/min under propofol infusion (10 to 50 µg/kg/min) and the sedation was stopped during wound closure. Sedation level was evaluated by Ramsay’s sedation scores which represent a scale from 1 to 6 including; 1-anxious and agitated, 2-co-operative, 3-responsive to commands only, 4-exhibiting brisk response to light glabellar tap, 5-exhibiting a sluggish response to light glabellar tap 6-unresponsive. The sedation level of the patient was monitored using the Ramsay sedation scale to keep the level between 4 and 5. Through a nasal probe, at least 2 L/min oxygen was continuously administered. If necessary, supplemental oxygen 10 L/min was provided to the patient if SpO₂ was below 90%.

During procedure pain intensity was evaluated using an 10-point Visual Analog Scale (VAS): 0-no pain, 10-very severe and worst possible pain. Pain intensity was asked before procedure and every fifteen minutes during procedure.

During the five minute test period, signs for bradycardia, hypotension were followed and if there is no deterioration in hemodynamical data (hypoventilation (< 8 breaths/minute), apnea (not breathing for 30 seconds), airway obstruction, hypotension (a 25% reduction from baseline mean arterial pressure value), arrhythmia, bradycardia (< 45 beats/min) was followed. The hemodynamic data including arterial pressure, heart rate, SpO₂, respiratory rate values did not differ before and after the iatrogenic pneumothorax. The preoperative and intraoperative values of hemodynamic parameters and arterial blood gas values are presented in table 1.

	Preoperative	Intraoperative
Mean arterial pressure (mmHg)	101	97
Heart rate (beats/min)	96	89
Peripheral oxygen saturation	92	92
pH	7.38	7.39
paCO ₂ (mmHg)	40.8	39.3
paO ₂ (mmHg)	60.1	61.2

Table 1: Hemodynamic parameters preoperative and intraoperative.

PaO₂: Arterial Partial Pressure of Oxygen; *PaCO₂*: Arterial Partial Pressure of Carbon Dioxide

After the procedure, the patient was asked to breathe deeply and cough to reexpand the collapsed lung. At the completion of the procedure, the patient was monitored for a further minimum period of 30 minutes on site. The patient was discharged from the recovery room after meeting Modified Aldrete discharge criteria of 9.

The epidural catheter was pulled back 4 hours after surgery. Additional analgesics included use of morphine at a dose of 2 mg every 2 hours for a total dose of 6 mg in 24 hours. Chest radiography was performed immediately postoperation or the next morning. If there is no air leak, the chest tube is removed. A complete re-expansion was detected by a chest roentgenogram. There were no complications and patient was discharged home on postoperative day 3.



Figure 1: Chest radiograph shows a nodule in the right upper lung and emphysema.

Discussion

In this case report we showed that VATS procedure is feasible and safe for an awake patient with a history of COPD and right sided pleural effusions. A deterioration in the respiratory function was the main concern in this case presentation with a preoperative $FEV_1 < 60\%$ because of increased risk of pulmonary complications related with induction of general anesthesia and one-lung ventilation in a patient with history of COPD and a preoperative FEV_1 of 45%. In COPD patients, the lower the FEV_1 , the higher the risk of mortality in thoracotomy surgeries and pulmonary complications are frequent when FRC decreases to 60% of the preoperative value postoperatively and mainly postoperative pain is responsible for a decrease in FRC by 22% and a decrease in VC by 63% [4].

Most important complication of TEA is sympathetic blockade which can lead to increased bronchial tone and airway hyperreactivity [2,4]. Also disturbance of cough reflex due to intrathoracic vagal blockade may cause a diminished reduction of bronchial secretions [4] and although the patients have spontaneous respiration tolerable hypoxaemia and hypercapnia may occur [4-7]. The VATS procedure protects lung function better than thoracotomies. It has been reported that TEA reduces risk of atelectasis decreasing vital capacity (VC) and FEV₁ and increasing the VC volume above closing volume and increasing oxygen [8]. In our case, we observed arterial blood gas values, SpO₂ and lactate levels were stable during intraoperative and postoperative VATS procedure. Another cause of impairment of pulmonary function is increased in diaphragmatic shortening [9].

Despite intrathoracic vagal blockade during the procedure, TEA in the awake patient provided good preservation of pulmonary function reflected in arterial blood gas values. Our results are similar to the reports from the literature however, there are limited data on COPD patients undergoing VATS procedure in a nonintubated patient [4-7]. During surgeries, a sympathetic stimulation may reduce blood supply to the subendocardium and thoracic sympathetic blockade has been evaluated for its ability to dilate constricted coronary vessels, reduce heart rate and improve cardiac function by reducing preload and afterload and optimizing myocardial oxygen delivery [10]. During our case, there was no report of arrhythmias by continuous electrocardiography monitoring or deterioration in cardiac functions and mean arterial pressure and heart rate was maintained 10 - 20% below preoperative values which is normal with use of TEA [4-7]. In our case, during surgery iatrogenic pneumothorax did not cause deterioration in hemodynamic parameters other than increase in respiratory rate to compensate for the hypercapnia which occurred about 5 minutes after the initiation of pneumothorax however it is relieved within 20 minutes after reexpansion of the lungs. In our case, iatrogenic pneumothorax improved within 20 minutes after re-expansion of the lungs, although it did not cause deterioration in hemodynamic parameters other than an increase in respiratory rate to compensate for the hypercapnia that occurred about 5 minutes after the onset of pneumothorax [6,10]. The other reason for the well patient tolerability for the procedure is that COPD patients tolerate hypercapnia and decreases in the pH better than patients without COPD [4].

Recently, case series and several randomized controlled trials have been conducted on the successful and safe use of the awake VATS procedure under TEA [6,7]. In an other study it is reported that the incidence of ineffective TEA was low and only one patient was converted to thoracotomy due to bleeding [5]. In a recent study empysema has been reported to be the most important factor in predicting prolonged air leak [11] and for this reason our case report presentation needs to be evaluated in a randomized study including COPD patients.

This risk is of particular importance in the surgical treatment of lung nodules and mass combined with COPD because postoperative pulmonary complications occur more common in patients with COPD than in those without COPD. The methods of ambulatory thoracic surgery may further evolve by utilizing VATS techniques in an awake patient to solve the often-challenging diagnostic discussion presented by undetermined lung lesions.

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