

A new treatment modality for unilateral atelectasis: Recruitment maneuver with endobronchial blocker

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Abstract

Atelectasis is a commonly seen complication during the post-operative period in intensive care units. The treatment of atelectasis depends on the underlying cause. We aimed to share our experience on the treatment of right total atelectasis in our intensive care unit applied with the help of the endobronchial blocker.

Keywords: Atelectasis, endobronchial blocker, treatment

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Introduction

Atelectasis is the collapse of the lung parenchyma. It may be secondary to obstruction, structural and developmental abnormalities, trauma, and postoperative respiratory problems. The treatment of atelectasis in patients with spontaneous ventilation is based on the respiratory exercises, medical treatment, continuous positive airway pressure (CPAP) mask, and bronchoscopic intervention. In intubated patients or patients with tracheostomy, on the other hand, positive end-expiratory pressure (PEEP), and the recruitment maneuver can be applied additionally. The recruitment maneuver primarily effects the lung tissue with normal compliance rather than the lung tissue with normal compliance. As a result, high pressure ventilation methods, which may cause barotrauma, are needed to expand the collapsed lung, most of the time.

Here, we are presenting a patient with right total atelectasis who has a tracheostomy and mechanically

ventilated in our intensive care unit. An endobronchial blocker (EBB) is placed to the left main bronchus of the patient and recruitment maneuver was utilized to the atelectatic right lung. The recruitment maneuver was applied for 3 min every 2 h for one day. Thus, high pressure during the recruitment maneuver was able to be applied to atelectatic lung, directly. At the end of the first 24 h, the lung pressures were reduced and the atelectasis of the right lung was totally recovered.

Case Report

A patient with pneumonia, congestive heart failure and diabetes mellitus was referred to our intensive care unit. A tracheostomy was performed at day 10 because of the ongoing respiratory insufficiency. The lung X-ray showed total atelectasis in the right lung at day 11 [Figure 1]. The cause of the atelectasis was thought to be bleeding due to fiberoptic bronchoscopy (FOB), which had been performed prior to hospitalization. Thus, a second FOB examination was done, and the right main bronchus and all its branches were found normal. Performing a recruitment maneuver was decided. Lidocaine (1.5 mg/kg, i.v), prednisone (1 mg/kg, i.v) and propofol (100 mg i.v.) were administered prior to the procedure. The EBB (Arndt, Cook®Critical Care, Bloomington, IN; 9F, 65 cm) was inserted to the left main bronchus under FOB guidance from the tracheostomy

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cannula. The proximal portion of EBB was fixed to a connector at 26 cm and the connector was attached to mechanical ventilator [Figure 2]. The patient was ventilated with 100% O₂ for 3 min before the cuff of the EBB was inflated. Later, the cuff of the EBB was inflated. Recruitment maneuver was performed manually with a resuscitator (ambu bag) having pressure limitation (40 cm H₂O) for 3 min and attention was paid to keep the SpO₂ above 90. The ventilation mode was then adjusted to pre-recruitment maneuver as follows: Bi-level positive airway pressure (BIPAP); FiO₂40%, PEEP:10 cm H₂O, peak inspiratory pressure (PIP) 32 cm H₂O. This procedure was repeated every 2 h for oneday, without requiring sedation. Additionally, salbutamol sulphate 2.5 mg (4 times a day) and budesonide 0.5 mg inhalers (4 times a day) was administered to the patient. At the end of the first 24 h, control X-ray showed a total resolution of the atelectasis [Figure 3]. EBB was removed and the patient was continued to be mechanically ventilated at BIPAP mode. Although the pneumonic infiltration decreased and atelectasis recovered completely, the patient passed away due to the congestive heart failure 30 days later.

Discussion

Atelectasis is the collapse and volume reduction of one or more segments or whole of the lung and it can be derived from many etiology.^[1] Among these reasons are obstruction (tumor, mucus, foreign body), compression (tumor, pneumothorax, hemothorax), structural and/or developmental (surfactant deficiency) and postoperative respiratory insufficiency (pain, analgesics). During the early period of atelectasis, the perfusion of the affected lung segment continues and a hypoxemia develops because of the ventilation/perfusion mismatch.^[2] In case of ongoing atelectasis, fibrosis develops in the affected lung parenchyma which results in persistent changes such as bronchiectasis. Treatment of atelectasis in patients with spontaneous ventilation is based on the respiratory exercises, postural drainage, and CPAP mask, prophylactic antibiotherapy, bronchodilators, as well as O₂ treatment in severe cases. Patients who are intubated or having tracheostomy may also need mechanical ventilation and PEEP. Recruitment maneuvers are sometimes warranted. Although our case was mechanically ventilated with 10 cm H₂O PEEP, he developed atelectasis.

Recruitment maneuver is frequently used in acute respiratory distress syndrome (ARDS), bariatric and laparoscopic surgery.^[3] The efficiency of recruitment maneuver is shown in both bilateral lungs and unilateral lung with double lumen tubes.^[4] When recruitment

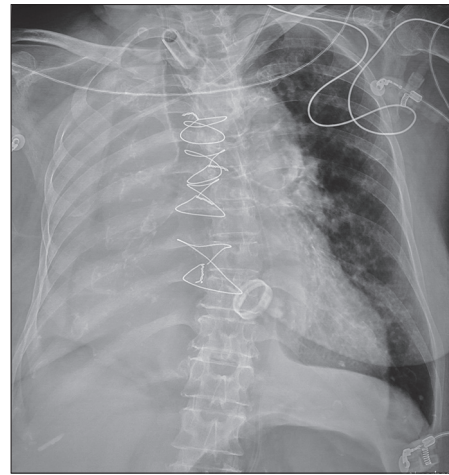


Figure 1: The lung X-ray showed total atelectasis of the right lung at day 11

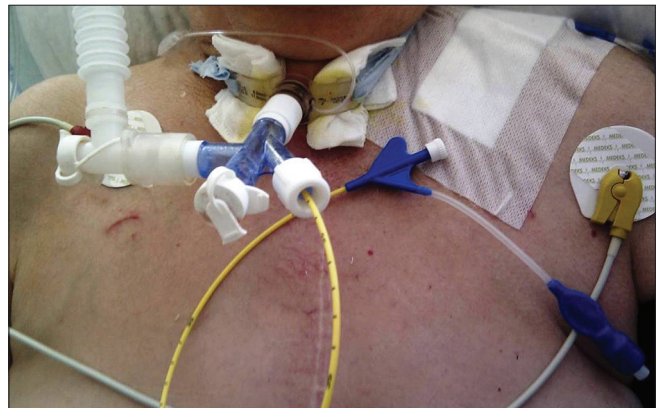


Figure 2: Placement of endobronchial blocker

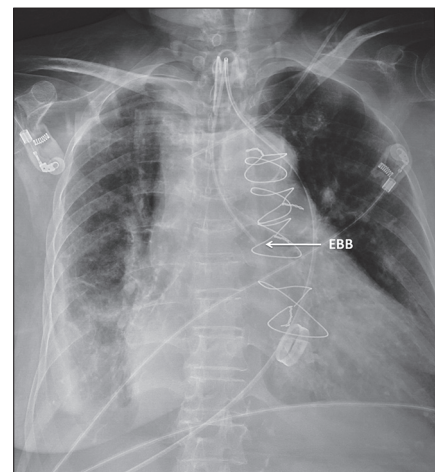


Figure 3: Control lung X-ray showed total resolution of the atelectasis (end of the first 24 h, white arrow indicates the endobronchial blocker)

maneuver is applied to a long-term atelectasis, lung edema, and bronchospasm may develop because of the rapid re-expansion. In order to avoid re-expansion related lung edema, we continued to mechanical ventilation and performed recruitment maneuver intermittently during

a 24 h period. Additionally, we gave bronchodilator to prevent reflex bronchospasm.

When recruitment maneuver is applied to patients who are intubated or having tracheostomy high PEEP and PIP pressures are needed. During recruitment maneuver, the aim is to provide expansion to atelectasis site. However, these high pressures may cause barotrauma in lung. In our case, we aimed to give high pressures solely to affected lung by using EBB.

There are only a few articles in the literature reporting application of unilateral recruitment maneuver for treatment of atelectasis. In a study, 18 patients with postoperative atelectasis which have a history of one week or longer are treated with bronchial intubation and expansion with constant pressure. Radiologic and physical examination at 24 h later revealed a resolution of atelectasis in 17 (94.4%) patients.^[5] Endobronchial intubation may cause many complications including rupture and hemorrhage. Moreover, during endobronchial intubation the normal lung is not ventilated, which may cause collapse of the unaffected lung.^[6,7] In our case, we used EBB which is known to have fewer complications. Additionally, when we blocked the left lung, we applied PEEP with ventilator (CPAP; FiO₂ 40%, PEEP: 10 cm H₂O) using EBB lumen to left lung and prevented the probable collapse of this lung. In order to prevent re-expansion complications, we planned to perform recruitment maneuver intermittently for 24 h. During this period, using endobronchial intubation or double lumen tube might increase the possible complications. Because our patient had tracheostomy, we decided that using EBB would be more appropriate for our treatment plan.

Recruitment maneuvers and applied pressures may cause bronchospasm. During bronchoscopy, bronchospasm may be seen in 3.5% of the patients.^[8] In order to prevent reflex bronchospasm, lidocaine (1.5 mg/kg, i.v.), salbutamol sulphate (2.5 mg) and budesonide (0.5 mg, inhaler) were used both before the insertion of EBB and during the whole treatment period.

As a conclusion, application of recruitment maneuver with EBB can be an effective, easy and safe method for the treatment of unilateral atelectasis in intubated or tracheostomized patients. It provides expansion of the atelectasis without causing barotraumas to normal lung.

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