



Unilateral Total Atelectasis Caused by Endobronchial Secretion: A Case Report

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Abstract

Background: Intraoperative hypoxemia is common unwanted situation. It is important to figure out the mechanism which caused hypoxemia to individual patients.

Case: A 78-year-old male patient without underlying disease underwent craniectomy and external ventricular drainage surgery under general anesthesia. During induction of anesthesia, patient's saturation dropped to under 80% with 100% O₂. Total atelectasis of right lung was found on portable chest X-ray. Complete obstruction of the right main bronchus due to thick yellowish secretion was observed on fiberoptic bronchoscopy. Aspiration with endobronchial suction catheter guided with fiberoptic bronchoscopy was done. Saturation and atelectasis were recovered and there was no desaturation event. After 12 days, extubation was completed without any complications.

Conclusions: This case shows importance of finding accurate cause of hypoxemia, as well as efficacy of fiberoptic bronchoscopy as a diagnostic and therapeutic tool for intraoperative atelectasis.

Keywords: Atelectasis; Hypoxemia; Fiberoptic Bronchoscopy; General Anesthesia

Introduction

Intraoperative hypoxemia is common unwanted situation that makes anesthesiologists be concerned about it. Various circumstances should be ruled out such as circulatory collapse, bronchospasm, endotracheal tube malposition, or lung parenchymal problem, etc. To handle the hypoxemia properly and prevent tissue damage, it is important to figure out the mechanism which caused hypoxemia to individual patients. In this report, we discuss rarely severe case of obstructive atelectasis which was diagnosed by portable chest radiograph and fiberoptic bronchoscopy, and could be treated properly.

Recently, fiberoptic bronchoscopy is used in many different circumstances. In anesthetic field, fiberoptic bronchoscopy is often used especially in difficult intubation, or confirming tube position in double lumen endotracheal tube. In daily cases using ordinary endotracheal tube with normal airway, fiberoptic bronchoscopy is not used much. Herein, we report this case as a good example that fiberoptic bronchoscopy takes its role as a diagnostic and therapeutic tool at treating intraoperative atelectasis.

Case Report

A 78-year-old, male (height; 170cm, weight; 60kg) patient was admitted for emergency surgery of craniectomy and external ventricular drain. The patient had no underlying disease but arrived at the emergency room (ER) due to stuporous mentality and found bilateral cerebellar hemorrhagic infarction. Partial atelectasis of right lung was found in chest x-ray examination, (Figure 1a). Because pulse oximetry (SpO₂) decreased to less than 81%, intubation was performed in the ER. During ER stay, SpO₂ was checked 90-96% with ventilator care.

Upon operation room (OR) arrival, the patient was oxygenated with 10 L/min flow using the ambu bag, but the initial SpO₂ was checked 82%. After routine monitoring was established, including electrocardiography, heart rate, non-invasive blood pressure, SpO₂, and invasive blood pressure monitoring, we quickly performed general anesthesia with propofol 50 mg, rocuronium 50 mg intravenously and start ventilation with 480 ml of tidal volume and 12 breaths/minute through FiO₂ 1.0. However, SpO₂ was decreased to 70~80% with FiO₂ 1.0. To figure out the cause of desaturation, a sequential approach was conducted. Since this case was an emergent surgery, the patient did not receive enough assessment about pulmonary function. However, at least the patient did not have any history of pulmonary disease before other than the fact that he was an



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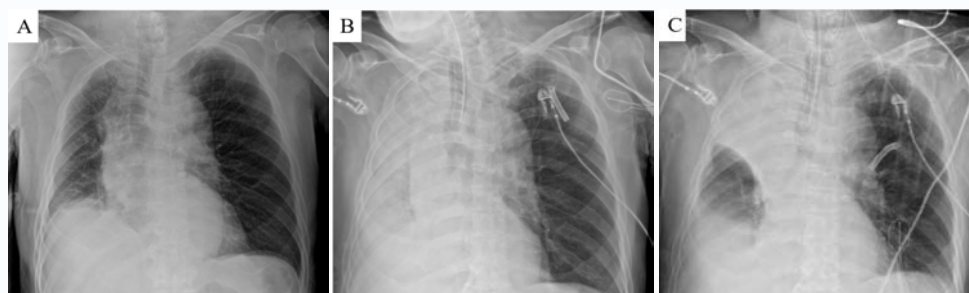


Figure 1: The patient's chest radiograph finding. (A) Preoperative chest X-ray taken at emergency room. (B) After induction, when the patient presented hypoxemia. (C) After massive suction was done.

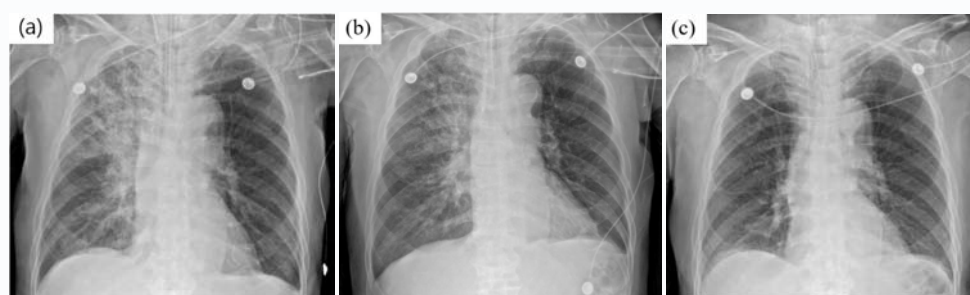


Figure 2: The patient's chest radiograph finding. Postoperative day 1 (a), day 3 (b), day 12 (c).

ex-smoker. Auscultation was done to find out whether endotracheal tube depth was adequate and is there any abnormality in lung sound. Asymmetric dull lung sound, much smaller at right side without wheezing or other significant abnormal sound was auscultated.

Portable chest x-ray was taken, and increased right lung consolidation with decreased right lung volume, mediastinal shifting to right suggesting total atelectasis of right lung was observed (Figure 1b). Because recruitment maneuver and manual ventilation with large tidal volume didn't have the effect of increasing SpO_2 , fiberoptic bronchoscopy examination was performed. It confirmed that the right bronchus was totally blocked by thick secretion. Secretion suction was performed through endobronchial suction catheter assisted by fiberoptic bronchoscope. After suction completed, SpO_2 improved to 96~100%. Portable chest X-ray was examined again, and showed partially opened bronchus and decreased extent of atelectasis (Figure 1c). After confirmation of SpO_2 maintained 100% at FiO_2 of 0.7, position was changed to prone position and surgery started. Through the periodic repeated endobronchial suction for removing large amount of watery secretions, SpO_2 was sustained 93~95% with FiO_2 of 0.7 during the operation. After all the procedure was finished, the patient was transferred to the intensive care unit (ICU).

The patient's initial postoperative chest X-ray showed partially improved atelectasis with remaining combined pneumonia at right lung (Figure 2a). In ICU with mechanical ventilation, the patient's chest radiography showed gradual improvement (Figure 2b), and at postoperative day 12, extubation was completed without significant event (Figure 2c).

Discussion

Various degrees of hypoxemia is a common intraoperative event despite of many efforts to prevent and detect it earlier [1]. Since hypoxemia can cause many other complications, it should be

evaluated and managed properly. Various problems can result in hypoxemia in an intraoperative setting, during anesthesia. When hypoxemia is detected by pulse oximetry, anesthesiologists will check for possible causes. Some conditions that should be considered include hypoventilation, bronchospasm, low cardiac output, and also problems in oxygen delivery such as circuit disconnection, endotracheal tube position and patency, ventilator working. Diagnosing can receive help from auscultation, checking airway pressure and end-tidal CO_2 , blood gas analysis, etc. Then increasing FiO_2 and observing for response will give some impression [2].

In this case, the patient showed refractory hypoxemia even with 100% O_2 . The patient's preoperative chest radiograph showed opacity in the unilateral lung field, so we decided to take a portable chest X-ray again to figure out whether exacerbation of lung radiography exists. Portable X-ray gave us information of total atelectasis.

Atelectasis is a common pulmonary complication associated with anesthesia. In general, development of atelectasis is caused by several mechanisms. Compression atelectasis occurs when transmural pressure decreases to a level that alveolus can collapse. Resorption atelectasis is related to obstruction of airway or relatively fast flow into capillary compared to inspired flow. Surfactant impairment also affects formation of atelectasis. All three mechanisms are influenced by general anesthesia [3]. Atelectasis is first suspected by clinical information such as impaired oxygenation, in a clinical setting that atelectasis is likely to be developed. Then, it can be detected by simple chest radiography, computed radiography, or lung ultrasound.

Many cases of atelectasis can be reversed with recruitment maneuver and manual ventilation with large tidal volume [4, 5]. However, in this case, the above method was ineffective because the cause of atelectasis was complete obstruction of bronchus due to sputum.

In these situations, fiberoptic flexible bronchoscopy can be performed for diagnostic and therapeutic use. Removal of foreign body, mucus plug or lavage would be the examples of therapeutic use [6, 7]. In our case, fiberoptic bronchoscopy was an excellent tool to identify problems with secretions blocking the right main bronchus. In order to resolve obstructive atelectasis and maintain ventilation, massive suction was done assisted by bronchoscopy like bronchial toilet. It would have been difficult to remove the secretion and resolve atelectasis if we just tried endotracheal suction without fiberoptic assistance because the secretion was deep and thick enough to block the right main bronchus, that it did not be removed easily indeed. Endobronchial suction catheter was 30cm longer than the endotracheal suction catheter, so we could easily remove the secretion from right main bronchus. Appropriate application of fiberoptic bronchoscopy in treating intraoperative atelectasis brought acceptable results. It is certain that fiberoptic bronchoscopy can be a useful tool at understanding pulmonary complication and solving the problem.

Although we found the cause of hypoxemia combining various clinical information and succeeded to partially improve the oxygenation, there were some modifiable points for better outcome. Prediction and prevention of pulmonary complications are also important, as well as diagnosis and treatment of them. If this was not an emergency case, assessment of the patient's pulmonary function and risk factors for pulmonary complication would be helpful [8]. In this case, simple chest radiography gave the impression of the cause of hypoxemia, and fiberoptic bronchoscopy helped treating it. If the chest radiography is not available in the operating room or the finding is inconclusive, lung ultrasound can be another option [2]. It would help to figure out the cause of hypoxemia such as pneumothorax, pleural effusion, or pneumonia, etc. In intraoperative emergency cases with refractory hypoxemia unresponsive to non-invasive management like recruitment maneuvers, complete airway obstruction from thick secretions should be suspected. As shown in this case, fiberoptic bronchoscopy with endobronchial suctioning is a highly effective diagnostic and therapeutic tool to rapidly relieve unilateral atelectasis and restore adequate oxygenation and ventilation.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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