

# Misdiagnosis of Hemothorax as Atelectasis After Minimally Invasive Transforaminal Lumbar Interbody Fusion Surgery

Won Jun Seo, Won Sang Lee, Yu Sun Choi, Myeong Jong Lee, Kyu Chang Lee, Hye Young Kim

Department of Anesthesiology and Pain Medicine, Konkuk University Medical School, Chungju, Korea

## Email address:

hae1127@kku.ac.kr (H. Y. Kim)

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**Abstract:** This report describes a case in which a patient presented with hemothorax after a minimally invasive transforaminal lumbar interbody fusion (mTLIF) was performed under general anesthesia. Diagnosis of hemothorax was delayed because it is a rare complication of mTLIF. Following surgery, the patient was diagnosed with total atelectasis by a respiratory physician in the intensive care unit. The atelectasis did not improve following ventilator care and bronchial washing under bronchoscopic guidance. Chest radiography revealed a hemothorax, chest tube drainage was performed, and the patient's condition improved. Hemothorax is rare complication of mTLIF. However, anesthesiologists should carefully observe the symptoms and the vital signs of the patient for this possibility.

**Keyword:** Atelectasis, Hemothorax, Spine

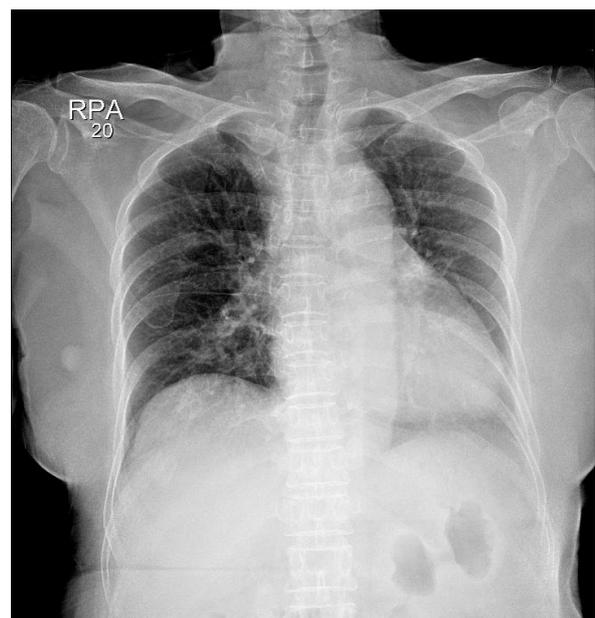
## 1. Introduction

Lumbar spine surgery has been performed for decades using the so-called dorsal open approach. Although established as a safe and effective procedure, it is associated to some extent with extensive collateral damage in the area of the operative field. For over ten years, minimal-invasive spine surgery techniques, which are considerably less destructive and less traumatic, have earned their place as valuable and at times superior to the established dorsal open approach. Advantages include smaller skin incisions, less soft tissue and muscle damage, less perioperative blood loss, lower infection rate, earlier postoperative return to function or work as well as shorter hospital stays [1]. However, we report a case that misdiagnosed of hemothorax as atelectasis after a minimally invasive transforaminal lumbar interbody fusion (mTLIF).

## 2. Main Body

The patient was a 77-year-old woman (height, 153 cm; body weight, 49.3 kg) with chronic back pain due to spondylolisthesis and was scheduled for L5-S1 mTLIF. She had a history of hypertension and depression with medications. She had not been administered antiplatelet

agents or anticoagulants. One month prior to surgery, she was diagnosed with the syndrome of inappropriate secretion of antidiuretic hormone and pneumonia.



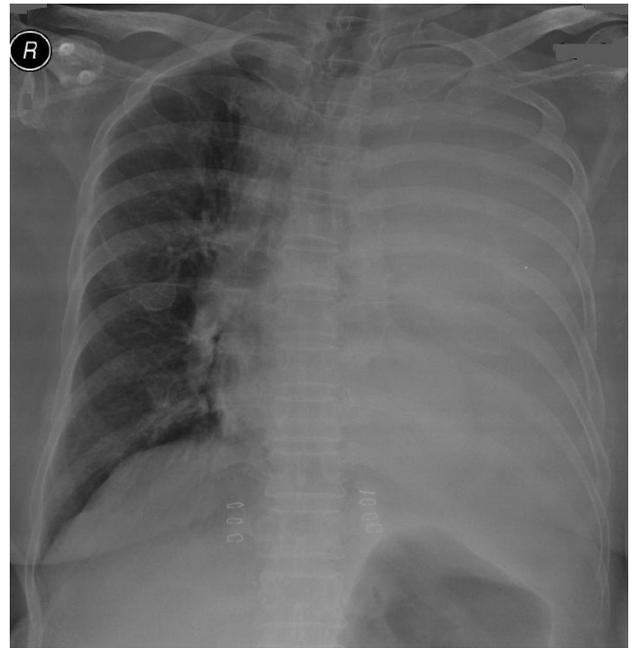
**Fig. 1.** Preoperative chest X-ray shows small effusion in the left pleural space after pneumonia.

The results of all preoperative examinations including laboratory tests, electrocardiography and echocardiography were normal. Her preoperative chest radiography revealed small pleural effusion after pneumonia (Fig. 1). However, this finding of chest radiography was judged without clinical significance by pulmonologist. These of arterial blood gas analysis (ABGA) were as follows: pH 7.48, PaO<sub>2</sub> 135 mmHg, PaCO<sub>2</sub> 30 mmHg, and BE 1.2 mEq/L in room air. The patient received an intramuscular injection of glycopyrrolate 0.2 mg prior to surgery. Vital signs prior to induction of general anesthesia were stable: blood pressure (BP) 120/80 mmHg, heart rate (HR) 80 times/min and SpO<sub>2</sub> 99%. Anesthesia was induced with fentanyl 50 µg, etomidate 10 mg, and rocuronium 40 mg. Intubation was performed with an endotracheal tube with an inner diameter of 7 mm. Breath sounds and ventilation were normal after intubation.

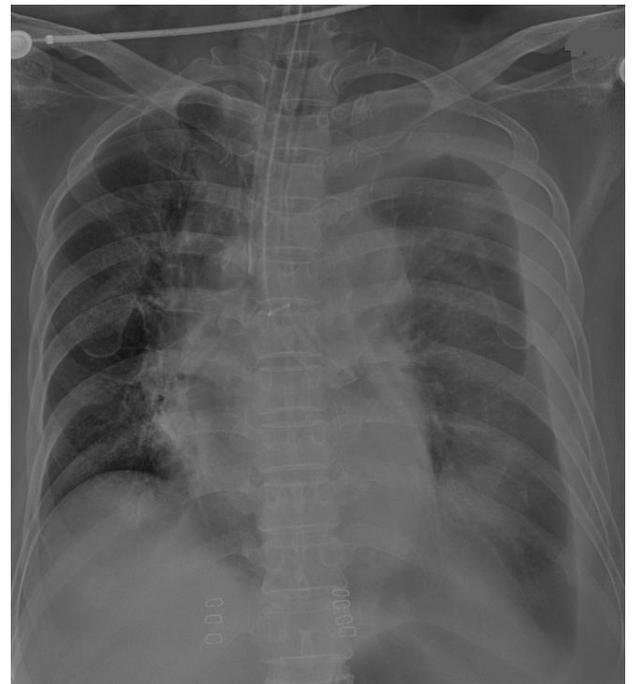
Anesthesia was maintained with N<sub>2</sub>O at 2.0 L/min, O<sub>2</sub> at 2.0 L/min, and desflurane 6.0 vol%. During anesthesia, the patient's vital signs were normal, and surgery was performed without any complications. The intraoperative results of ABGA were as follows: pH 7.35, PaO<sub>2</sub> 132 mmHg, PaCO<sub>2</sub> 38 mmHg, and BE 0.6 mEq/L in FIO<sub>2</sub> 0.5. The surgical time was 2 hours 50 minutes with the patient in a prone position and the anesthesia time was 4 hours 30 minutes. A total of 3,400 ml of fluids were infused including 500 ml of colloid. Three units of packed red blood cells were transfused. The estimated blood loss was 500 ml, and urine output was 1,400 ml. Postoperative hemoglobin level was 11.2 mg/dl and the other test results, including those of blood coagulation, were within normal limits. The patient was awakened and extubated. She could breathe spontaneously and was administered muscle relaxant antagonists: glycopyrrolate 0.4 mg and pyridostigmine 10.0 mg. However, the patient had reduced breath sounds on the left side and low oxygen saturation (90 to 95%) in the room air. We thought the cause of low oxygen saturation aging and long operation time. BP was 120/60 mmHg and HR was 100 times/min. The patient was transferred to the intensive care unit (ICU) with an oxygen mask.

When she arrived at the ICU, her oxygen saturation level was 98% with an oxygen mask delivering a flow rate of 7 L/min. BP was 90/60 mmHg and HR was 140 times/min. Twenty minutes after transfer to the ICU, BP decreased and so dopamine 2–10 µg/kg/min was continuously infused. Portable chest radiography was performed (Fig. 2). The ABGA results showed blood pH 7.35, PaO<sub>2</sub> 132 mmHg, PaCO<sub>2</sub> 38 mmHg, BE 4.2 mEq/L and SaO<sub>2</sub> 99%. After the patient was referred to the pulmonologist, intubation was performed under total atelectasis impression. Positive end-expiratory pressure was applied via a ventilator, FIO<sub>2</sub> 0.65 and lung expansion was attempted. The ABGA results immediately after intubation were as follows: pH 7.43, PaO<sub>2</sub> 230 mmHg, PaCO<sub>2</sub> 26 mmHg, BE 5.8 mEq/L and SaO<sub>2</sub> 100% in FIO<sub>2</sub> 1.0. The patient did not complain of respiratory symptoms and was fully conscious. BP slowly normalized, but atelectasis did not improve after mechanical ventilation. The following morning, the patient's vital signs improved:

HR 100–108 times/min, SpO<sub>2</sub> 98–100%, and SBP 100–110 mmHg. However, the atelectasis did not improve. For accurate diagnosis and treatment, the pulmonologist was consulted for bronchoscopy. A double lumen endotracheal tube was inserted into the lungs after induction of anesthesia, lung expansion was attempted (Fig. 3) and bronchoscopy was performed. There were no abnormal findings in the bronchoscopic examination except that the left bronchus was compressed (Fig. 4).



**Fig. 2.** Postoperative portable chest X-ray shows total radio-opaque sign on left side. At the time it was diagnosed as atelectasis.



**Fig. 3.** Chest X-ray shows atelectasis seemed better during attempting lung expansion after double-lumen intubation.



**Fig. 4.** Bronchoscopic image shows that left bronchus was compressed.

The patient was readmitted to the ICU. After pleural puncture was performed under ultrasound observation, the patient was diagnosed with hemothorax. After a chest tube was inserted, 700 ml of blood was drained and the hemothorax improved (Fig. 5). Total volume of drained blood with a chest tube was 3450 ml. A total of 10 units of packed red blood cells and 7 units of fresh frozen plasma were transfused while the patient was in the ICU. On postoperative day 5, the patient's vital signs were stable and extubation was performed. At that time, the ABGA findings were as follows: pH 7.47, PaO<sub>2</sub> 153 mmHg, PaCO<sub>2</sub> 37 mmHg, BE -2.8 mEq/L and SaO<sub>2</sub> 99% in FIO<sub>2</sub> 0.5.



**Fig. 5.** Chest X-ray shows fully expanded lung after chest tube insertion.

The chest tube was removed 10 days after insertion. Neurosurgical treatment was performed and the patient was discharged on postoperative day 39. The patient is currently receiving neurosurgical treatment for pain on an outpatient basis for 6 months.

### 3. Discussion

The gold standard for the treatment of lumbar degenerative disease or lumbar instability has been posterior pedicle screw fixation and interbody fusion with the use of cages [1,2]. However, this surgical procedure has some disadvantages, including intense trauma, severe bleeding, long-term hospitalization, and postoperative lumbar pain. However, a recently developed percutaneous mTLIF does not appear to be associated with these types of complications and its efficacy exceeds that of conventional open surgery. Although complication rates reported thus far have varied, the complications observed are similar and include neurologic deficits, dural tear, wound infection, screw misplacement, and cage migration [2–6]. As with other surgical procedures, however, complications related to the surgeon's learning curve can also occur with mTLIF [7,8]. This case was the fourth case of mTLIF that have been conducted in our hospital.

The method used in this case was paramedian approach with total facetectomy and foraminotomy and TLIF using Capstone cage filled with allograft and grafton and CD horizon Sextant II percutaneous rod insertion system. For TLIF, the incision made for decompression and cage insertion was reused for pedicle screw fixation. For the Sextant system, another stab incision was required in the proximal area for rod insertion [7]. Per the literature, the lower boundary of the lungs in the back is the T10 level, and that of the pleura is T12. The parenchyma does not fill the costophrenic recess during stable breathing, but its location varies depending on the depth of breathing and patient's position. That can be taken down two vertebral levels during deep breathing in the prone position [9]. We believe that in our patient's case, during the process of embedding a rod with incision above the operation lesion, the blood vessels that supplied the pleural space were damaged, and blood collected in the pleural cavity.

If hemothorax occurs during anesthesia, decreased breath sounds on the same side, elevated airway pressure, decreased blood pressure, decreased oxygen saturation, increased heart rate, and engorgement of the jugular vein can be observed. Hyporesonance may also be observed when chest percussion is performed. Rapid diagnosis and treatment are essential because heavy bleeding can cause hemorrhagic shock. When hemothorax occurs, complications that may arise during surgery and dyspnea may present after surgery because of reduced compliance and ventilation [10]. In this case, our diagnosis was delayed because the blood pressure, heart rate, and peak airway pressure were stable during surgery. Decrease in the left lung sounds following surgery was thought to be indicative of atelectasis, and the cause of tachycardia was thought to be postoperative pain. We did not suspect

hemothorax because the surgery was performed at vertebral level L5/S1. Most cases of nontraumatic hemothorax are caused by underlying lung disease. Frequently, it occurs on both sides of the lungs. Therefore, in this case, hemothorax occurred because of the surgical procedure.

If symptoms of hemothorax are observed during mTLIF, there is sufficient reason to perform chest radiography. Therefore, differential diagnosis of total atelectasis and hemothorax is also important and is made on the basis of mediastinal movement as seen in a chest radiograph. We found that in this case, the mediastinum had moved to the contralateral side in hemothorax.

If hemothorax is diagnosed, a chest tube should be inserted during surgery to help maintain the patient's vital signs and to aid postoperative care. Following chest tube insertion, it is necessary to screen for the presence of indications for thoracotomy, which are  $\geq 1,200$  mL drainage,  $\geq 200$  mL drainage per hour for 4 hours, hemodynamic instability, and difficulty breathing [11]. The amount of blood drainage, which was suspected to be because of damage to the arterioles and veins, was reduced, and we believe that intrathoracic bleeding did not continue to occur due to pressure effects on the lungs.

#### 4. Conclusions

The anesthesiologist should consider the possibility of hemothorax when mTLIF is performed. Rapid diagnosis by chest radiography and treatment such as insertion of a chest tube or thoracotomy must be performed.

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