

# Sudden intraoperative pulmonary congestion in a patient with severe anemia transfused 3 days prior to surgery

### ABSTRACT

Preoperative blood transfusion is sometimes controversial. We describe a case of a 43-year-old woman who developed sudden pulmonary congestion during surgery despite a small amount of intravenous crystalloid administration. She had no allergic disorders. Preoperative examination revealed that her hemoglobin was 5.6 g/dl, and she was diagnosed as folate-deficiency anemia although she never felt any symptoms before. Therefore, blood transfusion was performed and her hemoglobin increased to 9.4 g/dl. Amid surgery, airway pressure increased suddenly and pulsed oxygen saturation dropped. Chest roentgenogram revealed that the lungs were congested and her heart was markedly enlarged indicating the state of circulatory overload. We suggest that preoperative transfusion in a patient with chronic anemia should be carefully considered, and strongly recommend the confirmation with chest roentgenogram.

**Key words:** Blood transfusion; pulmonary congestion; severe chronic anemia

### Introduction

A decreased oxygen-transport capacity in chronic anemia is generally compensated by an increase in cardiac output and a rightward shift of the O<sub>2</sub> dissociation curve.<sup>[1]</sup> Thus, blood transfusion is rarely performed in patients with chronic anemia to avoid transfusion-associated complications including hemolysis, allergic reactions, GVHD, and transmission of viral disorders. We report a case of pulmonary congestion that rapidly developed after induction of general anesthesia in a patient with chronic anemia who had a blood transfusion. We speculate that volume overload caused by the preoperative blood transfusion may have aggravated pulmonary congestion.

### Case Report

A 43-year-old female (weight, 52 kg; height, 152 cm) with no history of allergic disorders was scheduled for open reduction and internal fixation of the right humerus. At the first visit, physical examination, chest roentgenogram [Figure 1], and electrocardiogram were normal. Blood analysis showed hemoglobin (Hgb) 5.6 g/dl and hematocrit (Hct) 17.4%. Because she was diagnosed as having folate-deficiency anemia, she was transfused 2 units packed red cells twice (4 units in total) 6 and 3 days prior to the surgery at the orthopedist and hematologist's discretion. Her hemoglobin increased to 8.3 and 9.4 g/dl, after transfusion. After the second transfusion, she suffered from coughs with wheezes

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and was diagnosed as bronchial asthma. She was treated with aminophyllin 250 mg DIV and hydrocortisone 100 mg IV, and recovered rapidly.

On admission, her blood pressure (BP) and heart rate (HR) were 148/92 mmHg and 116 beats/min (bpm), respectively. Pulsed oxygen saturation (SpO<sub>2</sub>) was 98% under room air. Her Hgb and Hct were 9.1 g/dl and 27.4%, respectively. Physical examination showed no other abnormalities.

Just before induction of anesthesia, her BP was 155/95 mmHg, and her HR was 108 bpm. General anesthesia was induced with propofol 100 mg and fentanyl 100 µg, and her trachea was intubated smoothly after inducing vecuronium 6 mg IV. Anesthesia was maintained with isoflurane 0.7–1.2% in 67% nitrous oxide in oxygen under mechanical ventilation. Forty-five min after induction of anesthesia, airway pressure increased suddenly and SpO<sub>2</sub> decreased to 88%. Coarse crackles with obvious secretion were heard. Oxygen 100% was given, but SpO<sub>2</sub> was not fully improved (94%). Chest roentgenogram taken immediately after surgery revealed that the lungs were congested and her heart was markedly enlarged [Figure 2a]. Arterial blood gas analysis showed pH 7.280; Pa<sub>CO2</sub> 55.8 mmHg; Pa<sub>O2</sub> 74.0 mmHg; and SpO<sub>2</sub> 92.9%. She apparently showed the state of circulatory overload. Until this sudden onset of respiratory failure, estimated blood loss was 300 ml, and 500 ml of lactated Ringer's solution was administered during the procedure. She had been fasted for over 15 h before surgery, and 300 ml of lactated Ringer's solution was given during this period. Urine output was 225 ml. Methylprednisolone sodium succinate 500 mg and furosemide 30 mg was given IV. As a result of these treatments, additional 1800 ml of urine was excreted, and oxygenation improved under spontaneous respiration with insufflated oxygen 3 l/min (pH 7.430; Pa<sub>CO2</sub> 37.6 mmHg; Pa<sub>O2</sub> 142.2 mmHg; and SpO<sub>2</sub> 98.9%). Pulmonary congestion



Figure 1: Chest roentgenogram taken at the first visit

was alleviated on chest roentgenogram [Figure 2b]. Hence, her trachea was extubated and oxygen 3 l/min using a face mask was given. Because desaturation was not observed for more than 10 min, she left the operating room 1.5 h after the end of operation. The patient's subsequent course was uneventful, and she was discharged 1 week after surgery.

## Discussion

Indication for preoperative transfusion may often be controversial. There is little scientific evidence to support specific Hgb or Hct values that require preoperative blood transfusion in patients with chronic anemia.

In the present case, the patient's history of anemia cannot be clearly described because no previous medical records existed, and it is only a speculation that she had no intrinsic disease causing sudden pulmonary congestion. A possible cause might be that her intravenous volume had been at the critical state of congestion because of transfusion and water retention.<sup>[2]</sup> A subsequent change of sympathetic tone by mildly increased catecholamine could have led to pulmonary vasoconstriction. This postcapillary vasoconstriction may have affected vascular permeability and led to a consequent capillary fluid leakage.<sup>[3]</sup> In that sense, symptoms after the second transfusion could have been a sign of congestion similar to transfusion associated circulatory overload (TACO) rather than bronchial asthma.<sup>[4]</sup> However, transfusion-related acute lung injury or TACO are deniable because of their onset time, that is not compatible with the case.<sup>[5]</sup> B-natriuretic peptide has been proposed as a diagnostic marker in the differential diagnosis of TACO though we did not undergo the thorough examination for the patient.<sup>[6]</sup>

There is a possibility of “non-cardiac circulatory congestion” for patients with chronic severe anemia without other cardiovascular diseases. The low concentration of hemoglobin causes a change in secretion of nitric oxide from the vascular endothelium and may lead to hypotension.<sup>[7]</sup> It consequently causes redistribution of sodium and water, which may increase the cardiac filling and decrease the oncotic pressure,<sup>[8]</sup> resulting in pulmonary congestion.

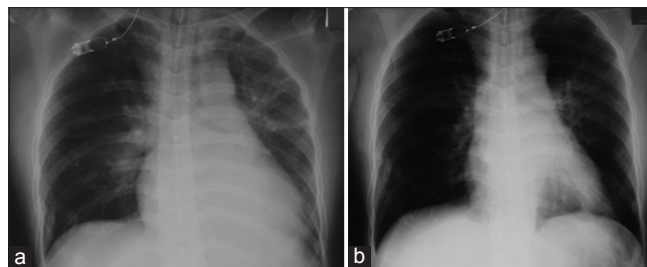


Figure 2: (a) Chest roentgenogram taken immediately after surgery. (b) Chest roentgenogram taken after diuretic administration

Yamashita, *et al.*<sup>[9]</sup> reported a case of congestive heart failure secondary to severe anemia (Hgb 1.3 g/dl; Hct 6.0%). Similarly, transfusion of the first 1 unit of packed red cells led to the congestive heart failure and the pulmonary congestion. These symptoms were ameliorated with diuretics.

We do not support that it was caused by allergic reactions because of the following reasons. First, we did not observe reddening of the skin at all. Second, the increase of airway pressure appeared later than expected. Tracheal intubation may also induce vagal mediated bronchoconstriction. However, it has been reported that isoflurane 1.0% for 10 min decreased the airway resistance.<sup>[10]</sup> In our case, the airway pressure increased 45 min after intubation and the anesthesia was maintained with isoflurane 0.7–1.2%. We did not observe any severe asthmatic reaction following intubation either.

### Conclusion

Avoiding complications related to blood transfusion can be achieved by avoiding unnecessary transfusion. We suggest that preoperative or preanesthetic transfusion as preparation for patients with chronic severe anemia should be avoided if they have no symptoms. It might be safer to replenish only the amount lost during surgical procedures. When transfusion is performed, the use of diuretics should be considered not to overload. Confirmation with chest roentgenogram is strongly recommended.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published

and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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