Transfusion-related acute lung injury (TRALI) caused due to the antibodies HLA-DRB1* 07:01 and HLA-DQB1*02:02: a case report

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Key Clinical Message

Transfusion-related acute lung injury (TRALI) is characterized by non-cardiogenic pulmonary oedema and acute hypoxemia. TRALI attributed to HLA-II antibodies is infrequently reported in China.

Keywords: Transfusion-related acute lung injury; HLA class II antibodies; pulmonary edema; blood transfusion

Introduction

The Food and Drug Administration (FDA) reports that transfusion-related acute lung injury (TRALI) is the main reason behind morbidity and mortality associated with transfusion.[1] This condition is characterized by the sudden appearance of non-cardiogenic pulmonary edema and hypoxemia within six hours of blood transfusion. According to data from the International Haemovigilance (HV) Network, the morbidity rate of TRALI is 0.0494 per 100,000 parts of blood transfused. Additionally, the mortality rate of TRALI among the general patient population is approximately 10-15%, reaching nearly 40% in critically ill patients.[2,3] In Chinese populations, the morbidity and mortality rate of TRALI remains unclear due to insufficient disease awareness, incomplete reporting systems, and HV data. We attempt to raise awareness among clinicians by reviewing a patient who developed TRALI after receiving frozen plasma controlled by HLA-II antibodies. The successful treatment of this patient indicates the necessity of accurate management in TRALI cases.

Case report with results

Our hospital admitted a 52-year-old male patient suffering over a month from head and neck skin ulceration and purulent secretions. The temperature of his body was 36.8°C, with a pulse rate of 67 beats/min, a pressure level of 120/76 mmHg in the blood, and a respiration capacity of 20 breaths/min. During the physical examination, clear bilateral lung sounds were observed without extensive dry or wet rales. No abnormal findings were observed on the electrocardiogram (ECG) and echocardiography. Head and neck skin cultures demonstrated the presence of gram-positive *Staphylococcus aureus* (3+) and *Serratia marcescens* (2+).

From day 2 to 6 after admission, the patient was provided four packed red blood cells (PRBC) units with 2400 ml of frozen plasma (FP) due to surgery, anemia, and severe wound exudation. No adverse effects occurred during the transfusion, and arterial blood gas analysis indicated 99.8% arterial oxygen saturation (SpO_2), 130 mmHg partial pressure oxygen (PaO_2), and 43.9 mmHg carbon dioxide partial pressure ($PaCO_2$).

On the seventh day of hospitalization, the patient suddenly developed respiratory distress, dyspnea, and severe hypoxemia after receiving approximately 100 ml of FP (SpO_2 64.1%; PaO_2 33.8 mmHg; $PaCO_2$

39.6 mmHg). The plasma transfusion was immediately discontinued, and the patient was treated with facemask oxygen at 60L/min. Additionally, he was intravenously administered 5mg dexamethasone due to suspected allergic transfusion reactions. However, the hypoxic symptoms did not improve. Coarse breathing sounds could be heard in the bilateral lungs upon auscultation, and a chest radiograph suggested bilateral pulmonary infiltrates. A heart rate of 136 beats/min was observed through an urgent echocardiogram, with the ventricle and atrium presenting a regular silhouette. The patient was intubated, mechanically ventilated, and subsequently transferred to the intensive care unit (ICU) because of worsening conditions. Ventilator settings were adjusted to synchronous intermittent mandatory ventilation (SIMV) mode using 10 cm H_2O positive end-expiratory pressure (PEEP) and a 90% fraction of inspired oxygen (FiO_2). After three days of oxygen support, the patient's condition gradually improved, and PaO_2 level became normal. He was transferred to the burn and orthopedics department to treat the infected wound. FIGURE 1 depicts the lung imaging.

We conducted high-resolution HLA genotyping to determine if TRALI was developed. The HLA type of the recipient was identified as HLA-A* 24:02, 30:01; HLA-B* 13:02, 35:03; HLA-C* 06:02, 12:03; DRB1* 07:01, 07:01; DQB1* 02:02, 03:03; and DPB1* 04:01, 13:01. The recipient had received blood transfusions from a female plasma donor. The specific antibodies HLA-DRB1* 07:01 (MFI 17322) and HLA-DQB1*02:02 (MFI 1366-1475) could be detected upon testing in donor plasma and considered responsible for TRALI development. This TRALI version, characterized by the two antibodies, was not previously reported in China.

According to the symptoms and clinical course of the patient, this case satisfies the TRALI Type I category of diagnostic assessment.[4] The case occurred within six hours of blood transfusion; hypoxemia (SpO_2 <90% on room air); novel bilateral lung infiltrates could be observed on chest radiography (Figure 1A and 1B); without any evidence of pulmonary vascular overload or acute respiratory distress syndrome (ARDS) risk factors.

Discussion

Most studies demonstrate that plasma donated by parous females is the blood product commonly associated with TRALI. Several countries have incorporated plasma from male donors to mitigate the risk of TRALI. The blood donor, in this case, was identified as female. Still, her fertility and transfusion history were unknown, preventing additional clarification of her in vivo HLA antibody sources. She had donated blood six times without any transfusion adverse events other than this. This could be due to insufficient TRALI awareness among clinicians and an imperfect reporting system for such adverse reactions in China. A study evaluating the clinical outcomes of TRALI in a Chinese population revealed that 34.5% (20 out of 58) led to death. Moreover, logistic regression analysis indicated that misdiagnosis affected patient outcomes.[5] The primary factor behind the successful recovery of this case could be attributed to the timely identification and provision of effective oxygen therapy by the clinician coupled with supportive care. Therefore, improving TRALI awareness among clinicians would ensure the well-being of patients. The diagnosis and management of TRALI still need to be fully developed in China. Consequently, several proactive measures should be implemented to minimize the occurrence and mortality rates associated with TRALI.

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Figure Legends

Figure 1 .

Lung images. **A** : Chest X-ray about 1 hour after transfusion: bilateral lung infiltrates, bilateral pulmonary edema, and cardiac shadow with standard size and normal morphology. **B** : chest computed tomography (CT) 22 days after transfusion: Obvious absorption of bilateral lung infiltrates.

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