TRANSFUSION-RELATED ACUTE LUNG INJURY IN MULTIPLE TRAUMA PATIENT: SUCCESSFUL USE OF EXTRACORPOREAL MEMBRANE OXYGENATION

SU TRANSFUZIJA SUSIJĘS ŪMINIS PLAUČIŲ PAŽEIDIMAS LIGONIUI SU POLITRAUMA: SĖKMINGAS EKSTRAKORPORINĖS MEMBRANINĖS OKSIGENACIJOS PANAUDOJIMAS

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SANTRAUKA

Su transfuzija susijęs ūminis plaučių pažeidimas yra pagrindinė sergamumo ir mirštamumo priežastis tarp su transfuzijomis susijusių reakcijų. Sindromas pasireiškia po kraujo plazmos turinčių komponentų transfuzijos. Straipsnyje aprašomas klinikinis atvejis apie su transfuzija susijusį plaučių pažeidimą ligoniui po politraumos. Gydant buvo sėkmingai pritaikytas ekstrakorporinės membraninės oskigenacijos metodas.

ABSTRACT

Key words: acute lung injury, blood transfusion, extracorporeal membrane oxygenation.

Transfusion-related acute lung injury is the leading cause of morbidity and mortality among transfusion related reactions. The syndrome develops within 6 hours of transfusion of plasma containing blood products. We present a case report of a patient with multiple trauma who developed severe transfusion-related acute lung injury and was successfully managed with extracorporeal membrane oxygenation.

INTRODUCTION

Transfusion-related acute lung injury (TRALI) is the leading cause of morbidity and mortality among transfusion related reactions. The syndrome develops within 6 hours of transfusion of plasma containing blood products. Clinical manifestations are hypoxemia and non-cardiogenic pulmonary edema. The pathogenesis is clear to the extent that anti leucocyte-antibodies in transfused blood cause a capillary leak in the pulmonary alveolar circulation. We present a case report of a patient with multiple trauma who developed severe TRALI and was successfully managed with extracorporeal membrane oxygenation (ECMO).

CASE REPORT

31 year old patient arrived to the emergency room with multiple trauma. He presented with: pathological movement of hips, pain, and deformity. Hip x-ray findings were: bilateral fragmented and displaced femur, and bilateral open and displaced tibia/fibula fractures. Injury Severity Score was 17.

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The patient underwent bilateral femur and tibia/fibula osteosyntheses. During surgery the patient was transfused with 2 388 ml *leukocyte-depleted packed red* blood *cells (pRBC)* and 1643 ml fresh frozen plasma (FFP). Three hours into surgery, the patient developed an acute drop in oxygenation (oxygen saturation decreased from 99 % to 76 %), along with hypotension down to 80/40 mmHg, tachycardia up to 130 beats/min, and frothy discharge from the endotracheal tube. Epinephrine infusion was started and furosemide was given intravenously. The patient was admitted to the intensive care unit (ICU) postoperatively. Upon admission to the ICU, he was critically ill: on epinephrine infusion at 0.3 μg/kg/min, mechanical lung ventilation with FiO2 100 % and positive end expiratory pressure (PEEP) of 15 cmH2O. Lab results showed: white blood count (WBC) 5 x 10^9/L, platelet count 87 x 10^9/L, and lactate of 4.7 mmol/l. In 4 hours patient developed leukocytosis (20 x 10^9/L) with 79 % neutrophils. P/F ratio (PaO2/FiO2) was 30 mmHg. There were bilateral pulmonary infiltrates on the chest x-ray (Fig. 1). Based on the history of present illness and symptoms, the diagnosis of TRALI was made. There were no technical capabilities to perform serological analysis. The patient's general condition was getting worse: epinephrine dose increased up to 0.6 μg/kg/min, adequate oxygenation levels were not achieved. The decision was made to initiate ECMO to improve oxygenation. Cardiac ultrasound was performed: left ventricle function was normal, no right sided overload was observed. Murray index was 3.5. 12 hours after surgery, venovenous ECMO was initiated. ECMO parameters: blood flow 4 l/min, gas flow 2.5 l/min, oxygen concentration 40 %. After initiation of the therapy, P/F ratio improved from 30 to 260 mmHg on the first day. Subsequently, for the next five days, P/F ratio remained in the 375–400 mmHg range. Bilateral infiltrates improved significantly after 5 days of treatment on the chest x-ray (Fig. 2). The blood pressure stabilized in 2 days. ECMO was discontinued on day 6 with improved oxygenation levels. The patient also received symptomatic treatment: maintenance of fluid balance, correction of anemia and thrombocytopenia, antibacterial therapy. Length of mechanical lung ventilation and length of ICU stay were 25 and 30 days respectively. Post hypoxic encephalopathy was diagnosed during an ICU course. After the treatment, electroneuromyography was performed, and diagnosis of critical illness neuromuscular polyneuropathy confirmed. The patient was eventually discharged from the hospital after 3 months of treatment. He started walking without an aid in 8 months after the event.

DISCUSSION

Transfusion of blood and its components is a lifesaving procedure, but is also associated with severe complications. One of the complications is TRALI. It was first reported in 1951 [1]. This is one of the pulmonary damage forms with hypoxemia and oxygenation index less than 300 mmHg. Radiological findings show bilateral pulmonary infiltrates**.** The American-European Expert Consensus Conference recommends serological testing for TRALI diagnostic: antibodies directed against human leukocyte (HLA) antigen class I, class II, and human neutrophil antigen (HNA) in recipient's and donor's blood. The Working Party on Granulocyte Immunobiology of the International Society of Blood Transfusion recommends the lymphocytotoxicity test for HLA antibody detection and one of the following tests for HLA non-complement binding antibodies: enzyme assays (enzyme-linked immunosorbent assay), immunofluorescence test or

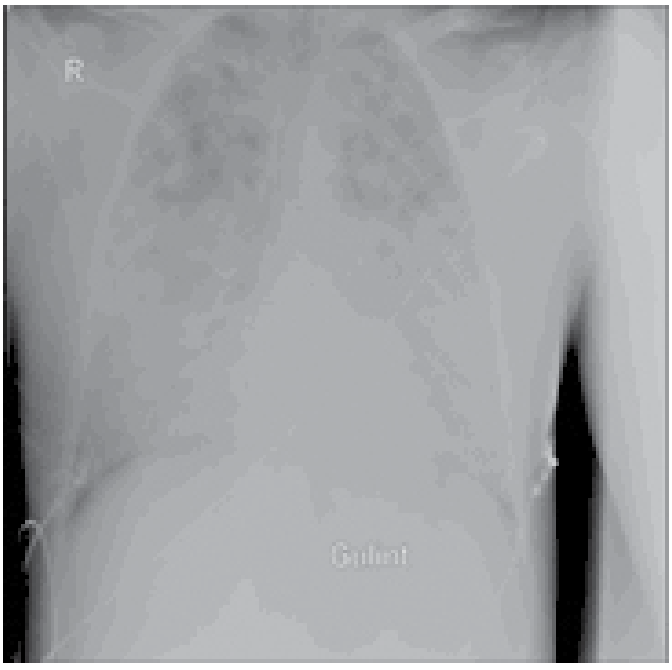

Fig.1. 4 hours after operation

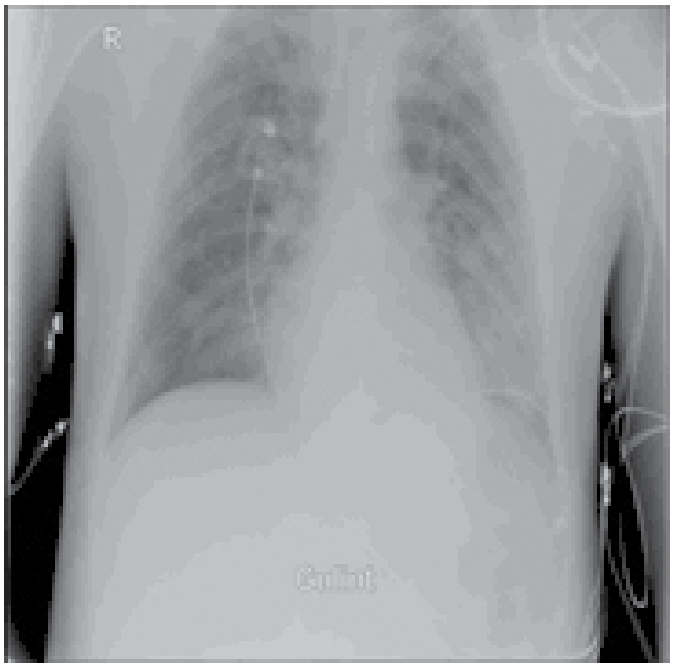

Fig.2. 5 days after treatment

luminex technique. A combination of granulocyte immunofl uorescence test and granulocyte agglutination test is usually used for anti-HNA antibody detection while the positive results are verified by monoclonal antibody immobilization of granulocyte antigens [2, 3]. It should be emphasized that antibody detection is not indispensable for TRALI diagnosis which is primarily based on the clinical picture [4]. The incidence of TRALI: 0.08–15 % patients after transfusion. Mortality of this disease is 5–10 % [5]. Acute lung injury can be caused by any blood product: pRBC, FFP, platelets, cryoprecipitate, allogeneic bone marrow cells, granulocytes, intravenous immunoglobulin. The syndrome is differentiated from transfusion-associated circulatory overload, cardiogenic pulmonary edema, anaphylactic reaction, and bacterial contamination transfusion reaction. In our case, it was differentiated from traumatic fat embolism. The treatment is symptomatic: stopping the blood product transfusion, maintaining oxygenation, using mechanical lung ventilation with lung protective techniques, and maintaining normovolemia. The diuretics in TRALI usually make the condition worse since patients are typically hypovolemic. The effectiveness of corticosteroids is not proved.

Establishing TRALI diagnosis was problematic in our case, due to common symptoms of TRALI and fat embolism, such as hypoxemia, pulmonary infiltrates, and thrombocytopenia. Our diagnosis was based on clinical presentation and exclusion of other syndromes (hypervolemia, fat embolism). Traumatic fat embolism occurs in 0.25–1.25 % of patients with bone fractures [6]. Differently from TRALI, traumatic fat embolism also presents with a petechial rash in the upper part of the body (neck, armpits, and shoulders), as well as with the damage of the central nervous system (headache, disorientation, seizures, stupor, coma), which were not observed in our case.

A computerized head tomography did not show any specific focal changes, which are usually present in fat embolism. Approximately 70 % of patients with TRALI require mechanical lung ventilation [7]. In our case, since we were not able to achieve even minimal acceptable oxygenation levels with the lung protective mechanical ventilation techniques, the decision was made to start ECMO. During the last two decades, there was only one study comparing ECMO with conventional lung ventilation. The study shows that an ECMO-based management protocol significantly improves survival without severe disability, if compared with conventional mechanical ventilation. The absolute risk reduction for the primary outcome (death or severe disability) was 16 %, which translates to a number needed to treat of six patients [8]. First case report of using prolonged bypass for TRALI treatment was described by Nouraei et al in 2003 [9]. There are very few other cases describing using ECMO in TRALI reported in literature [10, 11]. Prevention of the syndrome should consist of restrictive transfusion strategy and use of plasma with clear clinical indications only. Transfusion of female donor blood and its components was shown to pose a higher risk for developing a syndrome. For that reason, careful selection of donors is important. In our case the plasma used was from female donors. It was not tested for HLA. The male donor plasma carries a lower risk for TRALI [12, 13].

CONCLUSION

In our case, ECMO was chosen as a lifesaving technique to improve oxygenation. Because there is no specific treatment for the syndrome, utilizing ECMO in certain cases of TRALI could be the only measure to correct hypoxemia.

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