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CASE REPORT / *OLGU SUNUMU*

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Red Cell Exchange Transfusion in Severe Falciparum Malaria and its Effects on Clinical Outcomes: A Case Report

Ciddi Falciparum Sıtmasında Eritrosit Süspansiyonu ile Kan Değişimi Kararı ve Klinik Seyir Üzerine Etkileri: Olgu Sunumu

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SUMMARY Red cell exchange transfusion (RCET) is a treatment option for severe falciparum malaria, which reduces the parasite load and toxemia. Pulmonary edema, metabolic changes, hyperkalemia, arrhythmia, hypocalcemia due to citrate toxicity, rebound hypoglycemia, hypothermia, anaphylactic reactions, hypotension or hypertension, thrombocytopenia, thrombo-embolism, coagulopathy, and necrotizing enterocolitis are the major acute phase RCET complications. In our case of severe falciparum malaria that was resistant to treatment; reduction in parasite load and sepsis was observed following RCET, but severe acute respiratory distress syndrome (ARDS) has developed.

Key Words: Severe falciparum malaria, red cell exchange transfusion, acute respiratory distress sendrome (ARDS)

ÖZET Eritrosit süspansiyonu ile kan değişimi (red cell exchange transfüzyon, RCET) ciddi falciparum sıtmasında parazit yükü ve toksemiyi azaltmak için uygulanan bir tedavi seçeneğidir. Pulmoner ödem, metabolik değişiklikler, hiperkalemi, aritmi, sitrat toksisitesine bağlı hipokalsemi, rebound hipoglisemi, hipotermi, anaflaktik reaksiyonlar, hipotansiyon veya hipertansiyon, trombositopeni, trombo-embolizm, koagülopati ve nekrotizan enterokolit RCET uygulamasının erken döneminde görülebilen majör komplikasyonlardır. Tedaviye direnç gelişmiş ciddi falciparum tanılı olgumuzda, RCET sonrası parazit yükü ve septik tabloda gerileme olmasına rağmen ciddi akut respiratuar distres sendromu (ARDS) gelişmiştir.

Anahtar Kelimeler: Ciddi falciparum sıtması, eritrosit süspansiyonu ile kan değişimi, akut respirator distres sendromu (ARDS)

Introduction

Immature trophozoites in infected erythrocytes are seen in peripheral blood smear in the form of ring formation (1,2). Red Cell Exchange Transfusion (RCET) is a treatment option considered in severe falciparum malaria in presence of hyperparasitemia and organ failure or hyperparasitemia and resistance to treatment at over a rate of 10%, or hyperparasitemia alone at over a rate of 30%.3,4 Herein, we present our case of falciparum malaria with hyperparasitemia (25% involvement in blood smear) who underwent RCET because of severe septic shock; and ARDS was developed

despite an improvement in septic shock condition. We aimed to discuss benefits of RCET accordingly.

Case

A 35-year-old male patient admitted to the emergency department with complaints of fever, sore throat, and fatigue lasting for two days. The patient, who had been working in Nigeria, was reported to be conscious, cooperative, and spontaneously breathing in room air with blood pressure of 100/70 mmHg, heart rate 95/min, oxygen saturation (SpO2) 98%, tympanic temperature 38.6°C, white blood cell count 5.81 x103/mm3, platelet (PLT) count 38x103/mm3, hemoglobin 15 g/dL, hematocrite 46%, aspartate aminotrasferase 91 U/L, alanine aminotransferase: 91 U/L, gamma-glutamyl transferase 95 U/L, lactic dehydrogenase 480 U/L, total bilirubin 1.2 mg/dL, blood urea nitrogen 17 mg/dL and creatinine 1.0 mg/dL. The patient was diagnosed with falciparum malaria after plasmodium was observed in peripheral blood smear, and his parasite load was determined to be 25%. Mefloquine 1000 mg salt was administered to the patient followed by 500 mg 8 hours later and the patient was admitted to the internal medicine department. Hypotension, fever, PLT count 17x103/mm3, tachypnea and increased in demand were developed in the patient under oral mefloquine treatment. Informed consent form was taken from the patient and the patient was admitted to the intensive care unit (Figure 1). Body temperature increased up to over 40°C within the first 20 hours at the intensive care unit. Due to tachypnea, dyspnea, and decrease in SpO_2 with a PaO_2/FiO_2 ratio of 137, the patient was put under invasive mechanical ventilation support in the 13th hour and with positive end expiratory pressure (PEEP) of 12 cmH_2O at controlled ventilation (PCV) mode. Therefore, mefloquine treatment was combined with doxycycline treatment. RCET decision was made since the patient was having a septic shock associated with 39°C body temperature, tachycardia, hypotension, PLT count 60x103/mm3, non-improving SpO2 (91%) and hypoxemia (PaO_2/FiO_2 of 113) had developed under the treatment and a parasite load was 25%. With the RCET performed between the 20th and the 24th hours of the patient's stay at the intensive care unit, 4000 ml of erythrocytes were separated and 12 U of erythrocyte suspension was administered. Body temperature was under control during the RCET but the SpO_2 (90%) and PaO_2/FiO_2 ratios (54) further decreased. During the 6-hour post-RCET period, hemodynamic stability was achieved, $PaO2/FiO_2$ (137) and saturation (SpO_2:95%) increased (Figure 2), and the parasite load in the peripheral blood smear had decreased from 25% to 1%. There was ground glass opacity upon lung tomography at the 6th post-RCET hour (Figure 3) and PaO_2/FiO_2 ratios had not improved. Therefore, recruitment maneuver in the prone position was performed on the second day of his stay at the intensive care

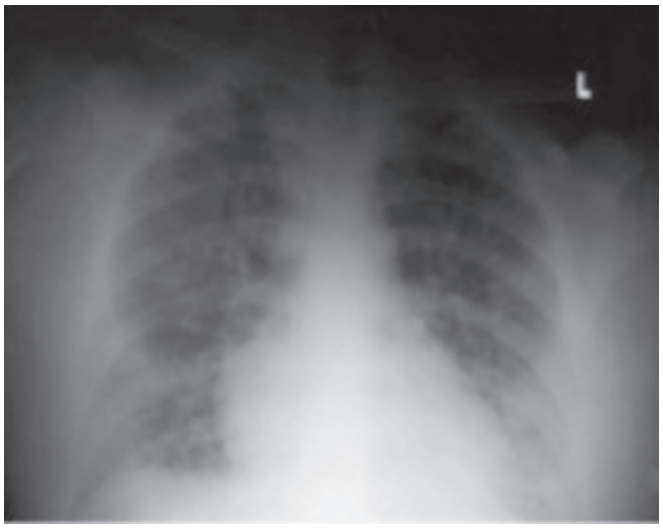

Figure 1. Radiological imaging- ICU income

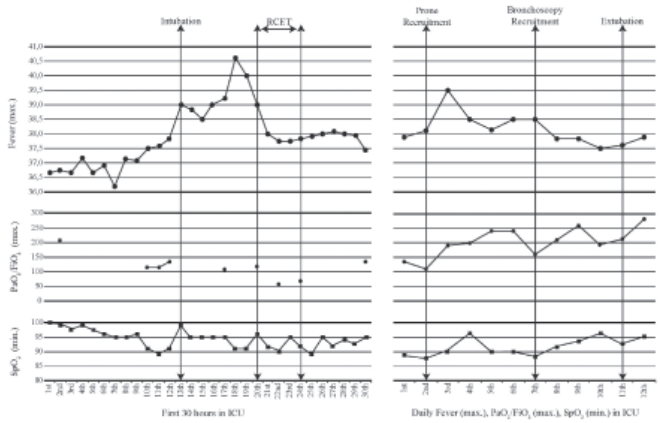

Figure 2. First 30 hours and Daily Fever (max.), PaO_2/FiO_2 (max.), SpO_2 (min.) in ICU

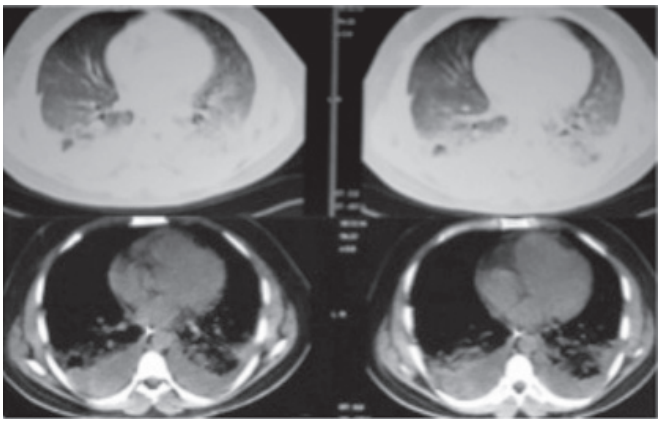

Figure 3. CT- after RCET

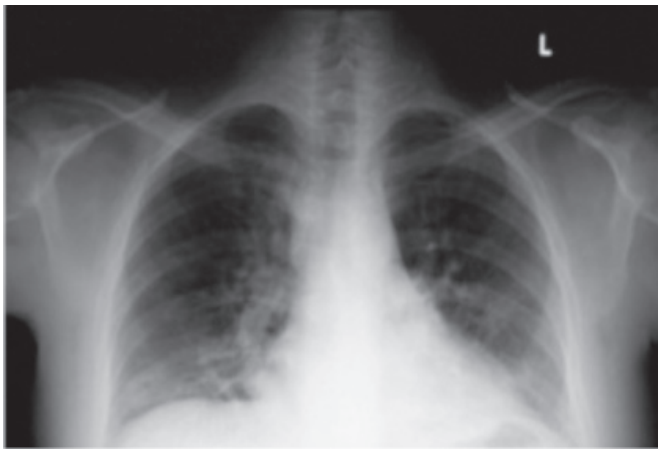

Figure 4. Radiological imaging- ICU outcome

unit; was repeated after bronchoscopy on the 7th day and was extubated on the 11th day. The patient was spontaneous breathing and discharged on the 13th day on nasal oxygen support (Figure 2 and Figure 4).

Discussion

The clinical outcomes of falciparum malaria can include multi-organ failure. Complications of plasmodium nature and IV quinine resistance impact the choice of and response to treatment (5). Clinically, weakness, hyperpyrexia, anemia, hypoglycemia, thrombocytopenia, acute pulmonary edema, renal and hepatic dysfunction, cerebral involvement, metabolic acidosis, fluid-electrolyte imbalance, hemoglobinuria, hyperparasitemia, shock and disseminated intravascular coagulopathy (DIC) may be observed (6,7). Type of the pathogen, presence of complications, IV quinine resistance and the geographic region impact the treatment algorithm (8). Mefloquine treatment in non-complicated malaria (mefloquine 750 mg salt, followed by 6-12 hours later), and the quinine dihydrochloride treatment (was 20 mg/kg loading dose, followed by maintenance dose 10 mg/kg at 8 hours) are recommended to be combined with doxycycline, tetracycline, or clindamycin in severe malaria (9). In our case, mefloquine was combined with doxycycline due to development of thrombocytopenia, hypotension, and respiratory failure. IV quinine could not be administered since it was not yet available in the market in Turkey. Ventricular arrhythmia, hypotension, hypoglycemia, and prolonged QT restrict the use of IV quinine (10). In cases of severe falciparum malaria, clinical deterioration is almost always observed along with cerebral involvement, renal dysfunction, and hyperparasitemia (4,5). Cerebral involvement in falciparum malaria increases mortality by 30%, while this rate can increase up to 80% with renal or respiratory failure (11). Hyperparasitemia and immune status also effect mortality (12). In our case, hyperparasitemia was observed without cerebral and renal involvement. The 25% parasite load seems to be the only cause of the serious clinical course of the case. In severe malaria, RCET is a treatment option considered in case of hyperparasitemia, organ failure, and resistance to treatment (13-15). Studies show that sepsis can decline with decreased parasite load through RCET (16-18). Our case had a parasite load of 25% and had developed septic shock within hours despite mefloquine and doxycycline treatment. Therefore, RCET treatment was chosen. RCET is usually administered within 4-5 hours via extracorporeal circulation and erythrocytes are transfused along with the patient's own plasma while infected erythrocytes are removed.19 The high fever pre-RCET is controlled during RCET as the fever declines with decreased parasite load. The SpO_2 and PaO_2/FiO_2 ratios, which were low before RCET did not improve as expected during RCET and has declined even further.

Consequently, mortality in severe falciparum malaria is high due to septic shock and organ failure. RCET proves to be an appropriate method to prevent mortality in presence of hyperparasitemia before organ failure develops. Parasite load significantly decreases and septic conditions decline through RCET. Absence of expected improvements in SpO_2 and PaO_2/FiO_2 ratios after RCET is considered as a sign that extracorporeal circulation and the massive transfusion has worsened the acute respiratory distress syndrome (ARDS). Severe ARDS can prolong the intensive care and mechanic ventilation duration.

In conclusion, we recommend that in a severe falciparum malaria case with <30% hyperparasitemia without renal and cerebral involvement, despite the risk of severe ARDS development risk, RCET should be considered as early as possible by close monitoring by clinical findings.

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