Exchange Transfusion with Red Blood Cells Preserved in Adenine Clears a Child of Severe Falciparum Malaria*

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ABSTRACT

Falciparum malaria may be associated with significant morbidity and mortality. The degree of mortality and morbidity usually corresponds to the degree of parasitemia. Quinine and other antimalarial drugs are relatively slow acting and not always effective owing to the presence of drug resistance falciparum. Rapid reduction of the number of circulating parasites may be required. Exchange transfusion has been used as a safe and quick approach to decreasing the parasitemia and antimalaria drugs used to eradicate the rest of the Plasmodium. In the present report, a case is described of a child with severe falciparum malaria who was successfully treated with exchange transfusion using the new adenine and mannitol enriched preservative media, Adsol®.

Introduction

Plasmodium falciparum infection is a serious disease, because of the likelihood of complications, which can include adult respiratory distress syndrome (ARDS), acute renal failure, disseminated intravascular coagulation, pulmonary edema, cerebral malaria, hepatic dysfunction, and hypoglycemia. The severity of such complications correlates with the percentage of infected erythrocytes. In children, prompt reduction of the level of parasitemia is essential. Although P. falciparum can be treated with quinidine or quinine derivatives, these agents are slow to reduce the number of the infected red cells. Further, there has been worldwide spread of a drug-resistance strain of P. falciparum. Laboratory studies and clinical trials have shown that the combination of intravenous quinidine gluconate and exchange transfusion can be used to treat patients with P. falciparum in whom more than 10 percent of the circulating erythrocytes are infected.

It has been suggested that red blood cells preserved in media such as Adsol® should not be used in massive transfusion of premature neonates. The authors indicate that replace-
ment of the Adsol® with fresh frozen plasma (FFP) or other diluent should make such units safe for two-volume exchange transfusion, cardiac bypass surgery, and extracorporeal membrane oxygenation. The original recommendation was based on the fear of hypothetical toxicity owing to the presence of high concentrations of mannitol and adenine. It is clear now that adenine is fixed to the cells within a few hours; exposure and exchanging the Adsol® with FFP remove the potentially toxic solution.

Case Report

A nine-year-old black girl from Ghana, who had arrived in the United States 10 days earlier, presented with fever, chills, abdominal pain, and vomiting of five days’ duration. Her oral temperature was 38.1°C, pulse 120/min, respiration rate 18/min, blood pressure 105/64 mmHg, and dehydration (estimated at 10 percent). The patient was lethargic but arousable. She demonstrated scleral icterus, and jaundice on the palms of hands and soles of her feet. The spleen was palpable. Hematogram results were Hg 115 gm/L, Hct 33.2 percent, red cell 4.1 x 10^12/L, platelets 30 x 10^9/L, and white cells 23.2 x 10^9/L. Stained blood smears showed that 30 percent of the red cells were infected with P. falciparum and contained the multiple ring forms frequently found in single mature erythrocytes. The clinical impression included early cerebral malaria. Administration of bolus quinidine gluconate and intravenous clindamycin were started immediately; however a few hours later this treatment had produced no improvement in the patient's condition.

Blood exchange was recommended in addition to intravenous antimalarial agents. Based on the patient’s weight of 25kg, 2,600 ml of blood equivalent to one and a half blood volumes was recommended. Because whole blood was not immediately available from the blood collecting center, five Adsol® packed red cell units were concentrated after removal of the supernatant mixed with fresh frozen plasma (1:1 units), and manual blood exchange was started. Between 50 and 75 ml of blood were withdrawn and replaced with the donor blood. During the exchange transfusion, the urine was clear amber, and the urine output was normal. Vital signs were stable. The chemistry of the plasma, urine, and coagulation parameters were within normal range. The patient fell asleep immediately after the transfusion. Blood smears obtained at that time showed 2 percent parasitized erythroid cells, or a 98 percent reduction of parasitization. Intravenous quinidine was continued for 48 hours. A later blood smear showed no parasitized red cells. The patient was discharged on the fifth day after admission.

Discussion

In recent years, the number of patients with P. falciparum infection has increased, not only in the United States but in many other western countries. This increase has been caused by greater immigration, as well as travel to and from countries where malaria is endemic, despite the use of antimalaria drugs.9 The mortality among patients with cerebral malaria is about 20 percent and may reach 80 percent among patients with acute respiratory distress syndrome.

In children, malaria has a higher mortality than it does among adults. High doses of antimalarial drugs can be toxic for children, causing blood hemolysis and renal failure.3 In adult patients with a high percentage of parasitized red blood cells (>10 percent), decreasing the number of parasitized red cells as quickly as possible is vital. Blood exchange can decrease the parasitized red cells to less than 5 percent. This level of parasitemia can then be treated with antimalaria drugs.5

The benefits and risks of exchange transfusion in children are not well known. Only three pediatric cases have been reported in which this treatment has been used successfully.5 In addition, it was not known whether or not the preservative containing mannitol and the high levels of adenine used in exchange transfusions would be toxic for premature infants.7 Our case showed that the use of a one-and-one-half volume exchange transfusion to treat P. falciparum in a nine-year-old girl can be done safely, yielding a marked decrease in parasitized red cells. Although the packed red cells were reconstituted with fresh frozen plasma, the use of saline or albumin may also be possible for this purpose.

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References


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