Automated Red Blood Cell Exchange: an Adjuvant to Antimalarial Therapy for Accelerated Recovery from Cerebral Malaria

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Case Report

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ABSTRACT:

Bangladesh holds potential endemic belts for perennial transmission of malaria. This case depicts a 42-year-old avid hiker, who travelled across Chittagong Hill tract without prophylaxis. He had severe malaria infection with a high load of parasitaemia (15%). Despite standard artesunate therapy, there was rapid neurological decline. Hence, we opted for Automated Red Blood cell exchange in adjunct to artesunate chemotherapy. Noticeably, parasitic load dropped down to 1%. We treated him successfully. Application of Automated Red Blood cell exchange in the treatment of severe malaria is in the grey area. This case will be perspective of Automated Red Blood Cell exchange as an implement to rapidly treated cerebral falciparum malaria.

Key words: Cerebral malaria, Automated red blood cell exchange, high parasite load.

INTRODUCTION:

Five plasmodium species are responsible for the protozoan illness malaria. Of them, Plasmodium falciparum is the primary cause of death due to its ability to produce most severe illness. Antimalarials are the cornerstone of treatment, however sometimes the dosage is too high, the parasite load is too great or the drug does not function in time to prevent the disease from killing the patient[1]. Plasmodium falciparum accounts for > 90% of cases.[2] The unfavourable outcome is noted in patients who present late or have limited immunity or develop cerebral oedema. The estimated mortality rate of cerebral malaria is between 15%-25% irrespective of conventional measures. About 15%-20% of survivors experience neurological complications like speech disorder, ataxia, epilepsy, and hemiplegia.[3] Infected blood cells sequester in cerebral circulation provoking ischemia and inflammation.[4] That is where, Automated Red Blood Cell exchange comes into instant role play. It clears peripheral parasitaemia, dilutes viscosity and maintains patency of peripheral circulation. Hence it improves oxygenation.

CASE REPORT:

This 42-year-old gentleman had history of high-grade fever for 5 days, generalized weakness and body aches for same duration. He presented in our ICU with shock and febrile symptoms. He was an avid traveller who undertook trekking across Chittagong hill tracts 1 month back.

On examination, patient was tachycardic, febrile (101˚ F), BP 80/50mmHg, Glasgow coma scale (GCS) 15, lung fields were clear, heart sounds were normal. Abdomen palpation showed splenomegaly. On investigation, haematological parameters showed anaemia and thrombocytopenia. Culture panel was negative and liver enzymes were raised. Renal function tests were unremarkable. Malarial Antigen was positive. Blood film, thick and thin film showed presence of Plasmodium falciparum. Parasite load was 15%. Hence patient was diagnosed as a case of cerebral malaria.

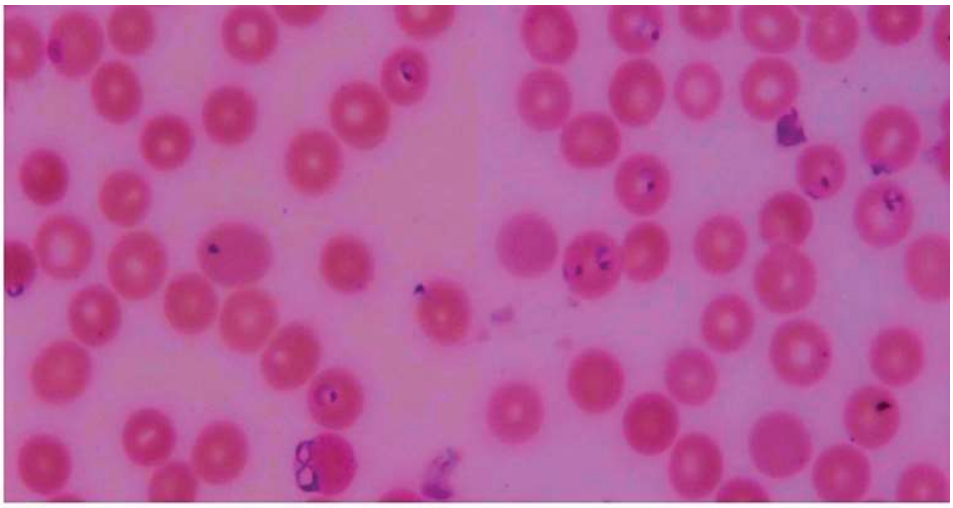


Fig -1: Peripheral Blood film with malarial parasite (Thick film)

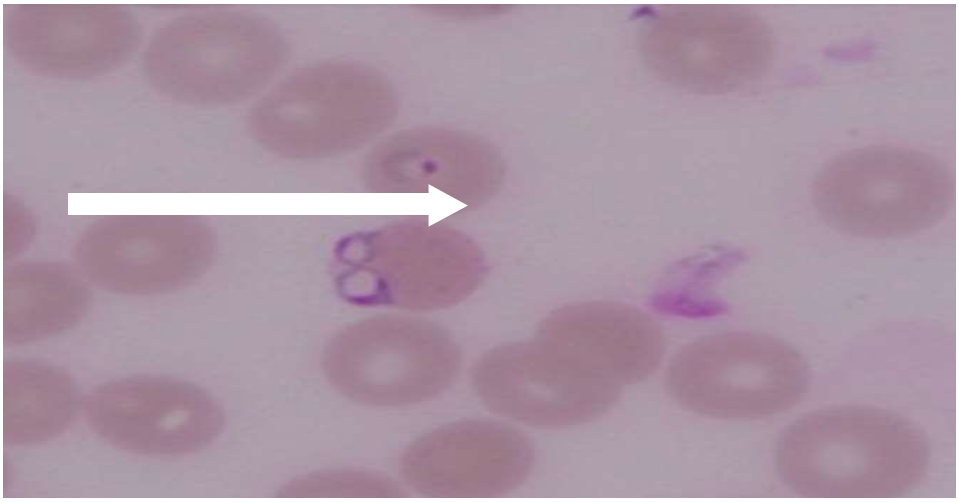


Fig -2: A classic, ring-shaped trophozoite of *Plasmodium falciparum*

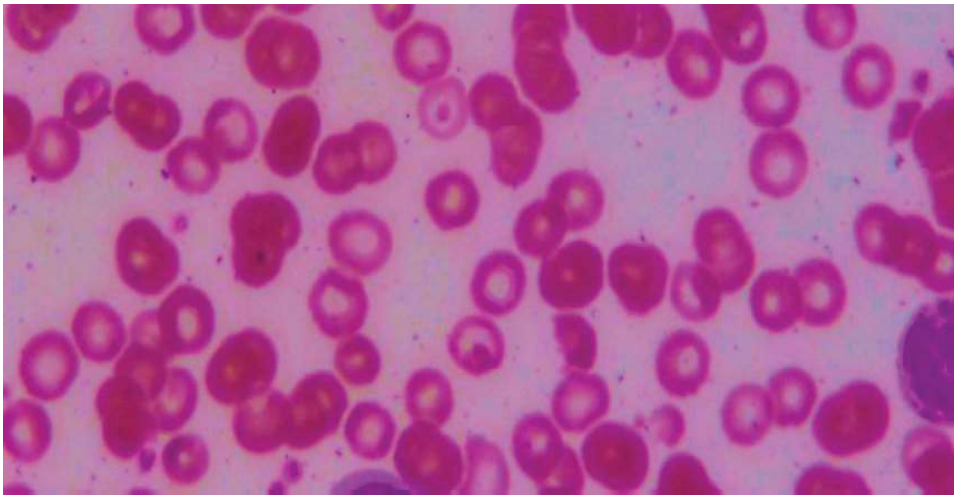


Fig -3: Peripheral Blood film: malarial parasite cleared

Course of Illness:

Conventional antimalarial therapy (Artesunate) and supportive treatment were started immediately. On 2nd day, his clinical status deteriorated, he was persistently febrile, drowsy and oligouric. On 3rd day, he sustained two episodes of convulsion. Urgent CT scan of the brain was done. It revealed no sign of bleeding or cerebral oedema. Convulsion was a red flag for this patient. Soon, we opted for red blood cell exchange as an adjunct therapy along with maintenance Artesunate.

Methods:

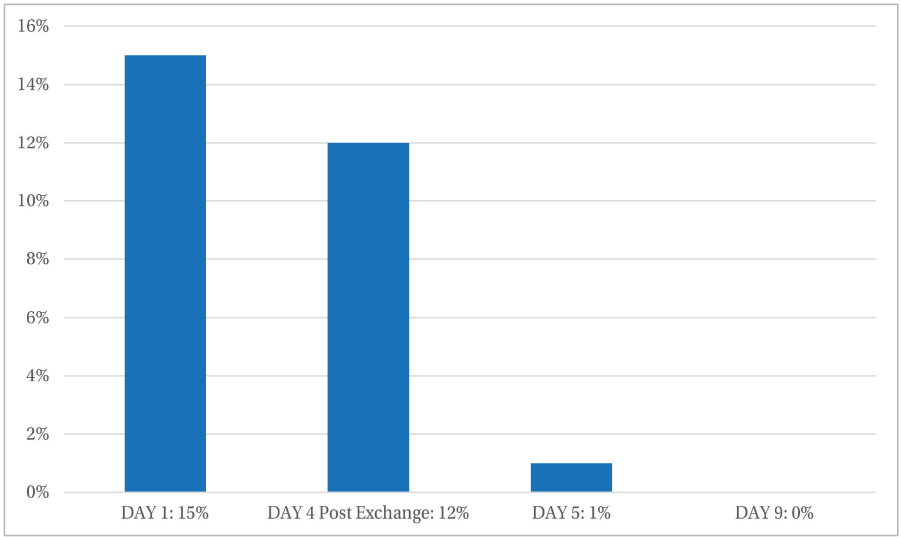
Automated red blood cell exchange (erythrocytapharesis) was initiated for physical removal of parasitized erythrocytes. A single session (3 hours duration) was propagated where 2000ml blood volume was exchanged at 40ml/min. Automated cell separator recycled plasma, leucocyte and platelet fractions in the patient while only red blood cell fractions were removed by apheresis. This procedure was efficient without any haemodynamic instability.

OUTCOME:

By next two days, parasitic load markedly declined. Improvement of clinical signs and biochemical markers were noticed. He became alert and oriented. Oral feeding was started. After 5 days he was shifted to Cabin with oral Artesunate + Lumefantrine therapy. On day 10th he was discharged with no sign of neurological deficit. Follow-up was done after 2 weeks at OPD and he was completely recovered.

DISCUSSION:

Elevated parasite load quickens pathogenic process, raising the risk of developing severe malaria and increasing treatment failure rates. Antimalarial resistance is especially concerning because it is more common in patients with high parasite loads[1]. Parasite load is reduced via exchange transfusion, which eliminates contaminated RBC. As an extra treatment option exchange transfusion lowers the mortality rate from severe Falciparum Malaria. When infected red cell are eliminated, it improves blood viscosity and minimizes sludging in microcirculation. It also increases blood's ability to carry oxygen. Exchange transfusion enhances viscosity and flow properties of blood while also reducing parasite load and helps to eliminate inflammatory reaction products[4] . Automated red cell exchange has advantage over exchange transfusion owing to its efficiency, speed and less risk of volume alteration or hemodynamic instability.[6]



	Day 1	Day 3 (on ET day)	Day 5	ON D/C
Hb (g/dl)	10.9	8.90	9.60	10.6
TC (K/µL)	8.3	14.5	6.28	9.12
PLT (K/µL)	9000	58	49	165
CRP mg/dl	281	-	64	-
SGPT/SGOT (U/L)	132/103		84/97	93
Bilirubin (mg/dL)	1.9	3.9	-	-
LDH (U/L)	398	1047	-	150

Fig -4: Malarial parasite load % before and after red cell exchange

In May 2012 retrospective cohort study at Vienna Hospital, Austria, demonstrated safety and efficiency of automated RBC exchange. Emphasised for more randomised controlled trials to appreciate the value of this adjunctive.[7] In July 2006 critical appraisal in Groningen Medical centre Netherlands Automated RBC exchange combines speed, efficiency and hemodynamic stability to reduce parasite while retaining plasma (with antimalarial drugs, clotting factors) and platelet.[8]

CONCLUSION:

Automated red blood cell exchange (erythrocytapharesis) is a forefront for prompt treatment of cerebral malaria in adjunct to antimalarial therapy. When performed in locale with defined settings, benefits can outweigh the risk of procedure. To extent of our knowledge, this is the first time an automated procedure has been implemented to exchange red blood cell for adjunctive treatment of malaria in Bangladesh.

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