Exchange Transfusion in Sever Falciparum Malaria with Acute Kidney Injury

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Abstract- In East Africa, where malaria is endemic, P. falciparum incidence has been steadily rising over the past ten years. Additionally, Africa has the greatest rate of malaria infections among tourists. As a result, severe malaria is an acute illness brought on by P. falciparum, but increasingly also by P. vivax. It is characterised by considerable organ failure and/or high parasitemia levels (>10%) in blood smears. Even if it is still debatable and ambiguous, exchange transfusion with antimalarial medication therapy is used as an additional therapeutic option in severe falciparum malaria with multiorgan failure. In light of this, we provide a case of severe malaria complicated by acute kidney damage (AKI), encephalopathy, and acute respiratory distress syndrome (ARDS). As a result, the patient tolerated conventional artesunate-based chemotherapy well and reacted well to hemodiafiltration and manual exchange transfusion.

Index Terms- Exchange Blood Transfusion, Malaria, Plasmodium Falciparum, Acute Kidney Injury.

I. Case Report

A 41-year-old Chinese man from Uganda who had been to Dubai was hospitalised with a five-day high-grade fever, chills, stomach discomfort, frequent vomiting, obtundation, and yellowish staining of the urine. He had a fever (38 C) when he was admitted, as well as tachycardia, hypoxia, and a blood pressure of 106/60 mm Hg. He also experienced fine bilateral respiratory crackles, icterus, and a diminished degree of awareness. He was then moved from the emergency room to the ICU. A tentative diagnosis of sepsis, symptomatic IV fluid therapy, and blood testing were given. Initial laboratory results for the patient showed mild anaemia, an average leukocyte count, no thrombocytopenia, a creatinine level of 1.99, a blood urea nitrogen level of 24 (BUN), a sodium level of 129 (Na), and a potassium level of 5.4 (K). Additionally, microscopical hematuria and proteinuria with few granular casts were detected in the urine sample. Additionally, even with high SGOT and SGPT values, urine volume was acceptable. Additionally, there was a little rise in serum bilirubin. Similar to the peripheral blood smear, the P. falciparum parasite was detected there with a parasite burden >35%. Aside from splenomegaly, the US abdomen was described as normal. The chest x-ray showed no abnormalities. The brain's CT scan was also clear. As a result, the patient's parenteral Artesunate-based therapy for severe malaria was initiated.

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9	Day 10	Day 11	Day 12	Day 13	Day 14	Day 15	Day 16	Day 17	Day 18	Day 19	Day 20	Day 21
Hb	11	10.2	10.8	10	9.5	9	8.9	9.5	9	9.1	10	10.3	9.5	10.5	10.1	9.9	9.9	10	9	9.5	10
TLC	5	6.2	6.5	9.5	13	16.1	14	17	16	18	20	17.2	12	5.93	5.27	5.57	13.3	7.58	8.8	8.6	7.1
Platelet count	150	130	125	116	70	40	33	37	32	39	40	30	39	50	80	139	153	194	186	219	228
Parasite 735/	735/	<1/						<1/	<1/	not seen											
PT	15.5	13.4	13	12.2	13.3																
INR	1.34	1.15	1.12	1.04	1.14																
BUN	47	68	87	108	106	116	87	60	67	70	76	77	59	50		40		35			30
Sr. Creatinine	1.99	2.9	3	3.5	3.7	3.99	5.14	5.2	4.3	4.8	5	3.8		4.5		3.2		2.1			1.5
Na+	138	130	136	135			137		140		141		139		138						138
K+	5.6	6.5	6	6.5	6.3		5		4.5		5		4.8		4						4.9
SGOT	89	178	48	77					40				58		35			30			29
SGPT	72	56	44	50					97				40		44			28			86
Alkpos ALP	162	209	150				155		159				98		100			140			147
Sr. Bilirubin- Total	4.6	7.6	5.9				3.2		2									1.7			
D. bill	1.48	6.41	4.52																		
PCT	693	411	259									0.960						0.40			

Figure 1 shows the lab report of the patient status for 21 days

The patient developed tachypnea, oliguric, and metabolic acidosis on the second day. He experienced two hypoglycemic episodes for which he was treated with 50% dextrose. Creatinine levels were 3.98, blood urea nitrogen (BUN) was 58, and potassium levels were K 5.6, according to the laboratory findings. Hemodiafiltration was subsequently initiated for acute renal damage.

His peripheral blood smear revealed P. falciparum >1% as previously on the sixth day. He then received an infusion of Artesunate at its maximum dosage. Additionally, a manual exchange transfusion was performed to replace 2000ml of the original amount with new frozen plasma and packed RBCs. The patient did indeed take the surgery nicely. The patient was placed on a mechanical ventilator with inotropic support early on the seventh day because of a reduced level of awareness, ARDS, severe hypoxia, and septic shock. It is significant to note that inflammatory indicators have risen. Then, a chest x-ray revealed antibiotic-coated pneumonic consolidation. The patient underwent daily hemodiafiltration for 10 days and got manual exchange blood transfusions five times. The patient was extubated on day 16, was hemodynamically stable, and had nearly fully regained renal function. His score on the Glasgow Coma Scale was 15 out of 15. The patient moved out of the ICU 20 days after being admitted, and on the 21st day, he was finally allowed to go home.

II. Discussion

Beginning with exchange transfusion, the parasite burden is reduced by the removal of contaminated RBCs. In fact, exchange transfusion is a method that is employed in addition to others to lower the fatality rate from severe falciparum malaria. It is significant to note that the blood viscosity of infected RBCs has increased with decreased deformability, decreasing sludging in microcirculation. The blood's ability to transport oxygen is also improved. Exchange transfusions help to enhance blood viscosity and flow properties as well as reduce parasite load by removing inflammatory reaction byproducts. Earlier, in 1974, exchange transfusion was first made available. Exchange transfusions are associated with a number of health risks, including fluid overload, non-cardiogenic pulmonary edema, hypotension, cerebral hemorrhage, febrile allergic reactions, metabolic disturbances, rapid effusion, and transmissible infections.

Unfortunately, there isn't a consistent treatment regimen accessible in terms of indications, exchange amount, and technique. In patients with a parasite load more than 30% or a parasite index greater than 10% and additional serious problems such as multiorgan involvement and hyperparasitaemia, exchange transfusion is typically necessary.

Automated erythrocytapheresis has the advantages of more accurate hemodynamic stability, preservation of plasma and cellular components, efficiency, and speed, but it is only offered in specialist facilities. Manual exchange transfusion, on the other hand, doesn't need for specialised equipment, thus it may be used right away at all facilities on patients with severe Falciparum malaria.

It must be understood that blood exchange only eliminates circulating parasite antigens. Although manual exchange transfusion does not exchange RBCs that are encapsulated in the microvasculature of important organs, it does help to reduce the load of toxins and byproducts of the host immunological response. Antimalarial medications, in particular Artesunate, are also responsible for the rapid clearance in addition to exchange transfusion. The postulated positive processes of exchange transfusion in eliminating parasite toxins, enhancing hemorheology, and treating anaemia cannot be concluded in our case, focused solely on parasite clearance.

The function of exchange transfusion is still unknown because randomised control trials have not been carried out. Riddle MS et al. compared patients with severe malaria who received exchange transfusions to those who only received antimalarial chemotherapy in a meta-analysis. They discovered no variations in survival rates. Unfortunately, exchange transfusion recipients had significantly higher parasitemia levels and were more seriously ill.

In retroactive reviews, the majority of research were unable to identify any benefits of exchange transfusion. The small sample size, the absence of a consistent transfusion technique, and observer bias tainting the data restrict the importance of the findings. In fact, there are very few circumstances in clinical practise where it is necessary to make treatment decisions without having enough information from prospective clinical trials. We contend that the theoretical benefits of exchange transfusions support their use in critically sick falciparum malaria patients. Before, the Centers for Disease Control and Prevention in Atlanta said that exchange transfusions were safe for some critically sick patients. The Centers for Disease Control and Prevention examined patients of severe Plasmodium falciparum malaria treated with exchange transfusion in 2013 and found no survival advantages. As a result, the CDC does not suggest transfusion exchange as an additional technique for treating severe malaria.

Exchange transfusion does not increase the survival rate, according to a meta-analysis. Since there was no standardised evaluation mechanism in place for the treatment groups, it was challenging to compare various studies. Additionally, there are no evidence-based recommendations for transfusion exchange in patients with severe malaria.

The elimination of toxins and inflammatory mediators is thought to provide benefits. Researchers have proposed hemodialysis, plasmapheresis, and plasma exchange as potential substitutes for exchange transfusion.

Electrolyte imbalance and hemodynamic difficulties brought on by manual exchange transfusion can be avoided with automated exchange transfusion. Extreme age groups, such as smaller children and the elderly population, benefit more since older patients are more likely to have negative results and just a little amount of blood is needed in youngsters, who may readily receive it from parents

and relatives. Due to changes in the healthcare systems' structures and operations, patients in Asia benefit from adjunct exchange transfusions more significantly. Variations in the virulence and antimalarial sensitivity of P. falciparum strains in various geographical locations or variations in the host's resistance to illness as a result of common genetic variables.

III. Conclusion

The majority of meta-analyses show that adding exchange transfusions to the therapy for severe malaria does not improve survival. However, one case study suggests that it has a better prognosis. Until well-designed randomized clinical research is completed, all critically ill patients may be cautiously assessed for adjunct exchange transfusion.

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