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Fluid therapy for severe malaria

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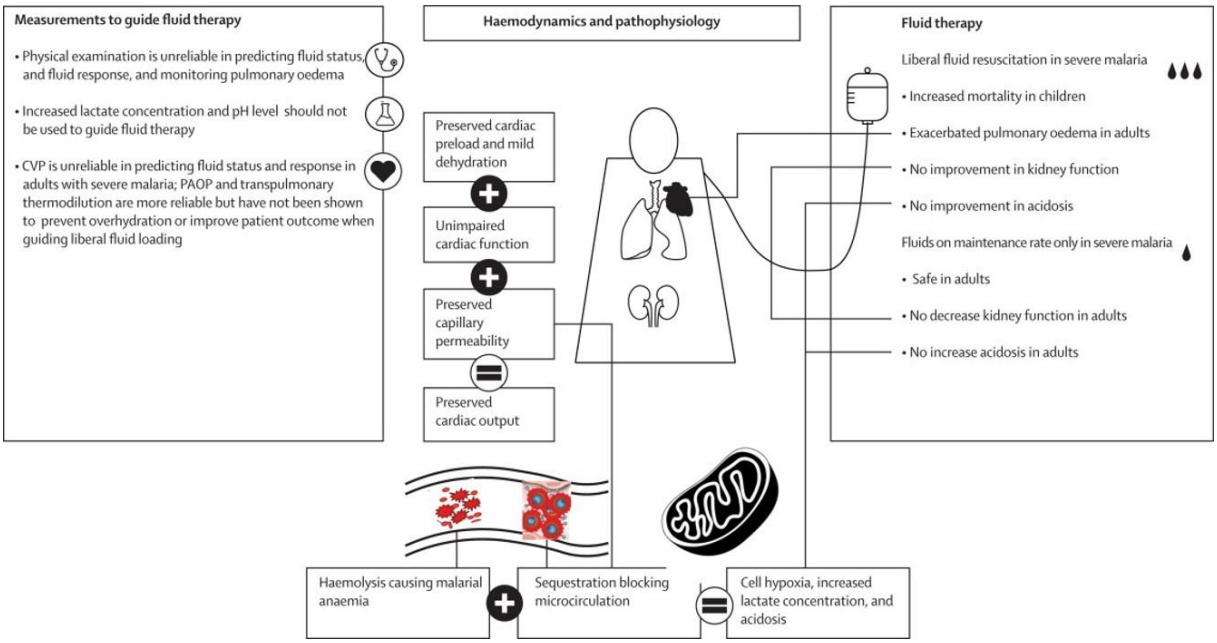
Background: This study summarises the current knowledge on fluid therapy for severe malaria and highlights the research needed to optimize fluid therapy for patients with severe malaria.

Materials and methods: a literature search was performed in MEDLINE, Embase, PubMed, Cochrane and TRIP databases, using terms related to malaria and diagnostic and therapeutic measures related to fluid therapy. All relevant articles were included in this narrative review.

Results: Patients with severe malaria usually have a normal cardiac index, vascular resistance, and blood pressure and a small degree of hypovolaemia due to dehydration. Cell hypoxia, reduced kidney function, and acidosis result from microcirculatory compromise and malarial anaemia, which reduce tissue oxygenation, not hypovolaemia. Hence, aggressive fluid loading does not correct acid–base status, enhance kidney function, or improve patient outcomes, and it risks complications such as pulmonary oedema. Individualised conservative fluid management is recommended in patients with severe malaria. Physical examination and physiological indices have limited reliability in guiding fluid therapy. Invasive measures can be more accurate than physical examination and physiological indices but are often unavailable in endemic areas, and non-invasive measures, such as ultrasound, are mostly unexplored.

Conclusion: Adults and children with severe malaria generally have mild-to-moderate hypovolaemia but normal blood pressure, cardiac function and peripheral vascular resistance. Conservative fluid management is therefore suitable for most patients. Research into reliable methods to assess fluid status and response applicable in low-resource settings should be prioritized.



	Septic shock	Severe malaria
Haemodynamic state	Cardiac preload is often reduced Peripheral vascular resistance is often impaired and capillary permeability increased	Cardiac preload is mildly reduced Peripheral vascular resistance is mostly preserved and capillary permeability unaffected (but might be impaired in some patients)
	Cardiac function preserved at first (hyperdynamic state), and impaired in a later stage of shock (hypodynamic state)	Cardiac function usually preserved (hyperdynamic state), and might be impaired in some patients (hypodynamic state)
	Cardiac output is often reduced and blood pressure is often low	Cardiac output is often preserved, and blood pressure is often normal
Fluid therapy	✓	⚠
	Some patients improve clinically when given liberal fluid therapy; as acidosis is due to macrocirculatory impairment and inflammation on a cellular level causing tissue hypoperfusion, pH might improve with fluid loading	Most patients are unlikely to clinically improve when given liberal fluid therapy; as acidosis is mainly due to microcirculatory sequestration (and in some patients severe malarial anaemia) causing tissue hypoperfusion, acidosis is usually not affected by fluid loading
Potential side-effects	Systemic vasodilatation and increased vascular permeability renders patients prone to side-effects of fluid loading	Patients are prone to developing side-effects of fluid loading such as pulmonary oedema; liberal fluid loading in children with malaria and decreased perfusion has led to excess mortality