Abstract submitted for Celebration of Women in Australian Mathematical Sciences

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Title: Direct quantification of host removal in Plasmodium infection and the effects of antimalarial drugs on removal of parasites

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The mononuclear phagocytic system (MPS) is thought to play a pivotal role in the removal of malaria parasites from circulation. Artesunate causes a rapid reduction in parasitemia compared to other drugs, such as mefloquine, and it has been suggested that artesunate treated parasites are rapidly cleared by the host phagocytic system. However, a direct comparison of the removal of artesunate-treated parasites relative to untreated parasites, or parasites treated with different drugs is still lacking. Here we combine experimental data and mathematical modelling. Using a novel experimental system, we track the loss and replication of Plasmodium berghei (PbA) infected cells in mice. Our novel mathematical modelling approach directly estimate the host rate of removal and the replication rate of parasitized red blood cells (pRBCs). Our analysis showed that in untreated mice pRBCs were removed from circulation by the host with a half-life of around 14.7 hours. The effect of antimalarial drugs on the host removal of pRBCs was also explored by treating the mice with either artesunate or mefloquine. High dose artesunate-treated parasites were removed from circulation approximately twice as fast as in an untreated infection (half-life of 8.7 hours), while the half-life of circulating parasites after mefloquine treatment was not significantly different from that in untreated infection. Finally, we used clodronate-containing liposomes to demonstrate a key role for phagocytes in the removal of pRBCs in the murine PbA infections.