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Red blood cell aggregates in malaria - the role of flow

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Malaria causes about half a million deaths and more than 200 million new patients per year. Most casualties occur due to the adhesion-based sequestration of red blood cells in the microvasculature, which causes blood vessel obstruction and subsequent failure of vital organs. So far, static assays already revealed many biomolecular aspects of the involved adhesion phenomena being linked to the development of the illness. However, they cannot account for the flow-induced shear in the microcirculation. We investigate the influence of shear forces on rosetting and sequestration in vitro employing microfluidic techniques. We developed microfluidic channels to mimic vessels of the microvasculature system to analyze the dynamics of rosettes under physiological flow conditions. Referring to a static reference, we found a large deviation in rosetting frequency under flow and a correlation of rosetting frequency and shear rate. On this basis, we plan to study rosette formation and stability in situ, as well as the interplay of cytoadhesion and rosetting to gain new insights into fundamental mechanisms of the pathophysiology of malaria.