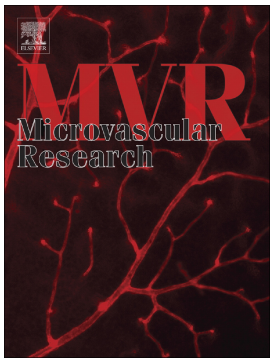

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Ana Santos Silva-Herdade, Adélia Sequeira, Ângelo Calado, Carlota Saldanha, Oualid Kafi

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Hydrodynamics of a free-flowing leukocyte towards the endothelial wall

Ana Santos Silva-Herdade[1]✉, Adélia Sequeira[2], Ângelo Calado[1], Carlota Saldanha[1], Oualid Kafi[2]

[1]*Unidade de Biologia Microvascular e Inflamação, Instituto de Medicina Molecular, Instituto de Bioquímica, Faculdade de Medicina, Universidade de Lisboa, Lisboa, Portugal*

[2] *CEMAT/IST and Department of Mathematics, Instituto Superior Técnico, Universidade de Lisboa, Lisboa, Portugal*

✉ anarmsilva@medicina.ulisboa.pt

Abstract

Leukocyte recruitment is an essential stage of the inflammatory response and although the molecular mechanisms of this process are relatively well known, the influence of the hydrodynamic effects that govern the inflammatory response are still under study. In this paper we made use of the images and experimental parameters obtained by intravital microscopy in an *in vivo* animal model of inflammation to track the leukocytes trajectories and measure their velocities and diameters.

Using a recent validated mathematical model describing the coupled deformation-flow of an individual leukocyte in a microchannel, numerical simulations of an individual and of two leukocytes under flow were performed. The results showed that velocity plays an important role in the motion, deformation and attraction of the cells during an inflammatory response. In fact, for higher inlet velocities the cell movement along the endothelial wall is accelerated and the attraction forces break faster. These results highlight the role of the mechanical properties of the blood, namely the ones influenced by the velocity field, in the case of inflammation.

Keywords

Leukocyte; inflammatory response; intravital microscopy; mathematical model; coupled deformation-flow; numerical simulations

Introduction

Leukocyte recruitment and subsequent rolling, activation, adhesion and transmigration are essential stages of an inflammatory response. Understanding this mechanism is of crucial importance in immunology and in the development of anti-inflammatory drugs. In order to in vivo observe the recruitment process, post-capillary venules are usually observed by intravital microscopy. It is now well accepted that the rolling process and the later adhesion cascade are