Cell adhesion in capillary-sized, ligand-coated micropipettes

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Abstract

Several mechanisms have been proposed to explain the arrest of leukocytes and cancer cells in capillaries. It has been hypothesized that cells become mechanically trapped in these small vessels or, alternatively, that cells adhere to capillary endothelial cells via endothelial cell adhesion molecules (ECAMs) in a manner similar to that in venules. We propose that leukocyte arrest involves both mechanical and adhesive forces and further speculate that the biochemical adhesive force is strongly modulated by mechanical forces that alter the area of contact between leukocytes and the endothelium. To probe this hypothesis, we have devised an adhesion assay wherein leukocytes are aspirated into micropipettes (IDs ranging from 4-10 μm) that have been pre-coated with ECAMs. Following complete aspiration, the cells are made to flow inside the micropipettes using suction pressure. Cell displacement inside the micropipettes is measured as a function of time to assay for biochemical adhesion and mechanical trapping. By varying the suction pressure and the ECAM chemistry, insight into the relationship between mechanical and biochemical adhesive forces can be gained. Results to date suggest that the deformation imposed on the aspirated cell (the mechanical force) can dramatically change the type of adhesion supported by a given adhesion chemistry. (This work is supported by NIH grant GM057640).