Red Blood Cell Adhesion in Sickle Cell Disease

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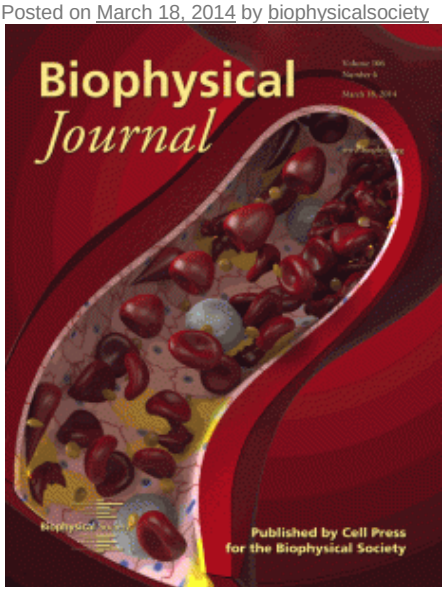

Millions worldwide live with sickle cell disease, the most common inherited blood disorder. Sickle cell disease is due to a single-point mutation in the β-globin gene resulting in the production of abnormal hemoglobin. In the deoxygenated state, hemoglobin polymerizes to form relatively stiff filaments forcing red blood cells to assume an irregular shape. It is these “sickled” red blood cells that are thought to significantly contribute to, if not initiate, occlusion of small blood vessels resulting in microvascular infarction, severe pain, widespread organ dysfunction, and early mortality. The hallmark of the disease is the development of spontaneous, intermittent, disabling episodes of severe pain called vaso-occlusive episodes.

Our article discusses adhesion of normal and sickle cell disease human erythrocytes to endothelial laminin. Erythrocyte adhesion to endothelium is thought to be a critical mediator of the complicated process of vaso-occlusion in sickle cell disease. This translational work is a collaboration between investigators at the schools of Engineering and Medicine at the University of Connecticut. When our article was accepted for publication, we thought that an image on the journal cover would be a good way to attract attention to this devastating disease and to show, at least partially, the complexity of one of its major consequences in the circulatory system. The image was created by Kostyantyn Partola, who is a first-year Ph.D. candidate in our lab. It is a three-dimensional depiction of normally and abnormally shaped sickled red blood cells interacting with endothelial cells as well as white blood cells and platelets in a human blood vessel cross-section. Some of the sickled cells are adherent to the endothelium and partially obstruct blood flow, while other cells are shown flowing freely within the blood vessel. We tried to create an interesting picture by illustrating how the interaction of cells can mediate vasoocclusion.

Please visit the website of the Cellular Mechanics Laboratory at the University of Connecticut and the Comprehensive Sickle Cell Clinical and Research Center at the University of Connecticut Health Center for more information on our research.

-Jamie Maciaszek, Biree Andemariam, Krithika Abiraman, and George Lykotrafitis