Mechanical Engineering Department Seminar

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1130 Mechanical Engineering
111 Church Street SE, Minneapolis, MN 55455

Red Blood Cell Adhesion and Deformability As a Marker of Disease Severity and Treatment Response in Sickle Cell Disease

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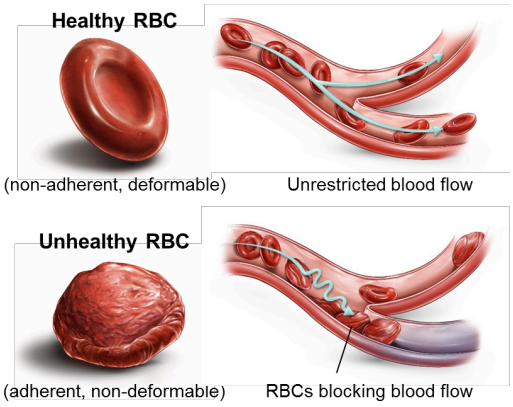
Abnormal deformability and adhesion of blood cells to endothelium are pathophysiologically central to Sickle Cell Disease (SCD). Despite recent advances in identifying and targeting cellular adhesion in SCD, knowledge of abnormal cellular adhesion has not been integrated into routine clinical care or trial design, due to a requirement for complicated custom-designed systems, highly trained personnel, and extensive sample manipulation. To address this unmet need, we have developed the SCD Biochip as a novel point-of-care (POC) microfluidic assay that allows rapid, preprocessing-free, and standardized interrogation of red blood cell (RBC) adhesion to endothelium components and adhesion molecules in whole blood. Serial quantitative and qualitative evaluations of RBC adhesion and deformability, using standardized protocols, were performed on >100 subjects with correlative clinical data. The SCD Biochip evaluates, simply and with small sample volumes, complex adhesion properties, which reflect clinical phenotypes, including hemoglobin composition, hemolysis, and treatment status. Applied serially and under varied clinical scenarios, this adaptable POC technology will yield a more precise characterization of abnormal adhesive events in a given individual and a more accurate assessment of response to therapy overall. In this talk, I will present our early results on clinical testing of this new monitoring technology, which is ongoing in urban SCD clinics in collaboration with University Hospitals and Case School of Medicine in Cleveland, OH, and The Children's Hospital at Montefiore and Albert Einstein College of Medicine in Bronx, NY.



Bio: Dr. Gurkan holds a PhD degree in Biomedical Engineering from Purdue University. He completed his postdoctoral training in medicine at Brigham and Women's Hospital, Harvard Medical School and Harvard-MIT Health Sciences and Technology after which he joined CWRU as Assistant Professor. Dr. Gurkan is leading the CASE Biomanufacturing and Microfabrication Laboratory (CASE-BML). CASE-BML's mission is to improve human health and quality of life by a fundamental understanding of cell biomechanics, and through innovations in micro/nano-engineering, microfluidics, biosensors, and point-of-care systems. Dr. Gurkan has received national and international recognitions and awards for research and education, including: (1) NSF CAREER Award, (2) "Rising Star" Award from Biomedical Engineering Society (Cellular and Molecular Bioengineering and Advanced Biomanufacturing Divisions), (3) MIT Technology Review Innovator Under 35 Award (Turkey), (4) Case-Coulter Translational Research Partnership Award, (5) Clinical and Translational Science Collaborative Award, (6) Case School of Engineering Research Award, (7) Doris Duke Innovations in Clinical Research Award, (8) Belcher-Weir Family Pediatric Innovation Award, and (9) Glennan Fellowship from the University Center for Innovation in Teaching and Education. Dr. Gurkan has authored over 50 articles in peer-reviewed journals, numerous book chapters and patents. Two of his patents have recently been licensed for commercialization.