Section one: Platelets (Basic & Clinical)
Experimental models
PBS08

A NEW MICROFLUIDIC POINT-OF-CARE TEST FOR MULTI-SHEAR PLATELET THROMBOSIS

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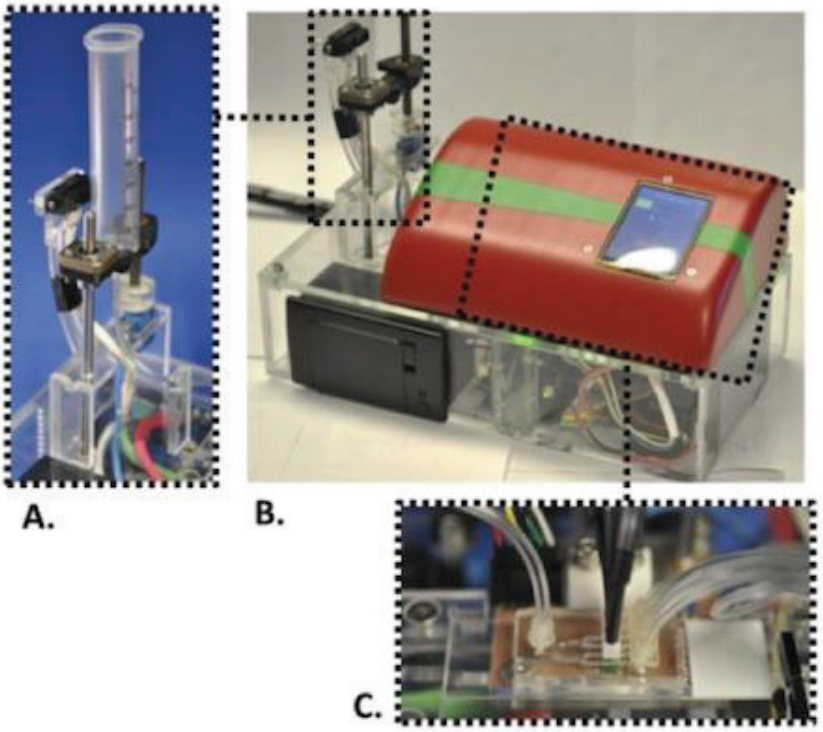
Objectives: Arterial thrombosis causes stroke and heart attack by stimulating platelet adhesion through very high shear rate hemodynamics over a ruptured plaque with exposed subendothelial collagen. Currently, few platelet thrombosis tests provide these high-shear pathologic conditions, which may reveal the significant variability of patients' responsiveness to anti-platelet treatments. We report on the development of a Point-of-Care platelet thrombosis test that uses a microfluidic chamber and optical system to measure thrombus growth.
Methods: A four-chamber test section is created in PDMS with anatomic geometries of a scaled stenotic artery producing shears of 1500, 4000, 7000, and 10,000 1/s. A total of 40 ml of whole blood flow is governed by a constant pressure head and distal resistance. Thrombosis growth on collagen is determined in real-time by transmission of a laser light that alternately interrogates each test section at 1Hz. The local shear rate within the growing thrombus is quantified using fluid modelling with ANSYS.
Results: The microfluidic system produced rapid platelet accumulation under very high shear conditions using human whole blood. At 1,500 s^{-1} shear rate, no thrombosis was observed. At 10,000 s^{-1}, occlusive thrombosis occurred in the stenosis (8/11, 73%, $p<0.05$). Computational fluid mechanics modelling of the throat demonstrates an increase in shear rate of 376% during thrombus growth. The POC design has been adapted to a prototype bench top format 30"x16"x15" in size including fluidic handling and optics that takes 30 minutes per test.
Image/Graph:



Conclusion: Thesystem enables real-time testing of human whole blood for shear induced platelet thrombosis at multiple shear flow conditions. The size and ease-of-use of the system allows for Point-of-Care measurements of high shear clotting potential from individual patient blood samples. Future work will adapt this system for simultaneous treatments by different anti-platelet agents at varying dosages.

Disclosure of Interest: None Declared

Keywords: Shear Platelets Thrombosis Point-of-Care Multi-shear anti-platelet variability