Microengineered Medical Device Mimicking Tortuous Blood Vessels for Measuring Thrombus, Coagulation and Platelet Function

Published date: July 19, 2019

Technology description

Overview

Rapid, quantitative and accurate blood clot monitoring is critical in many clinical settings (e.g., surgery, trauma, sepsis, anticoagulation and anti-platelet therapies) to anticipate, avoid and direct the management of serious disorders due to bleeding or thrombosis. Various tests and devices have been developed to assess blood clotting and platelet function (hemostasis), including assays for bleeding time, activated clotting time (ACT), activated partial thromboplastin time (aPTT), thromboelastography (TEG) and platelet aggregometry. While these tests provide useful information regarding coagulation status or platelet function, they are limited in terms of their ability to predict thrombotic or bleeding risk in clinical settings since they do not incorporate hemodynamic forces (pressure, flow and shear stress) and related cellular iteration in their assessment of blood coagulation.

Technology

We have invented a biomimetic, rapid and ultra-low-volume whole blood thrombosis and hemostasis monitoring system. Tortuous vessels have been shown to induce fluid dynamical disturbances and shear gradients that make them hotspots for forming thrombi in vivo. Also, some prior studies have shown increased thrombosis due to tortuosity in vitro. We harnessed these biological architectural principles and created a device with the integration of shear-gradients caused by tortuosity to stenosis-like expansion-contraction in the microfluidic format. We found this newly designed assay requires less than 1mL of blood and takes less than 15 minutes to complete when tested with pediatric blood samples.

Application area

Blood clot monitoring

Advantages

Better measurement performance (specificity and sensitivity)
Dynamic measurement

Institution

Texas A&M University

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