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Coronary artery disease detection by blood flow turbulence

Generally, blood flow throughout the circulatory system, is laminar. In a laminar flow, each particle is moving in parallel in a smooth path through the vessel with constant velocity at any point. The highest velocity is in the center. Under certain conditions such as high velocity and low blood viscosity (as in anemia caused by reduced hematocrit), stenosis, and other cardiovascular diseases, laminar flow can be disrupted and become turbulent. A turbulent flow is chaotic, irregular, with fluctuating velocity at any point with eddies, whirlpools, microbruits, and specific acoustic signatures. Turbulent flow increases shear forces activating platelets and thrombus development, can damage red blood cells. Turbulent blood flow impacts the endothelial lining causing initiation of atherosclerosis. Aging and calcification, cause hemodynamic (velocity, shear stress) changes. Assessing the degree of turbulent is highly desirable. Turbulence can be predicted by (Reynolds number) $Re = \rho d V / \eta$ Where Re: Reynolds number. Below 2000 laminar, above 2500 usually turbulent. ρ : fluid's density, d : diameter of the vessel, V : flow velocity and η : viscosity. Turbulent flow properties can be used for diagnosis of cardiovascular disease (stenosis, murmur and anemia). Several technologies have been developed for detecting turbulent. The Ottawa heart Institute is testing one of these technologies. So far, 290 patients are enrolled in the study and the results are promising. A multi-center clinical trial is planned.

Biography

Tofy Mussivand achievements and sustained outstanding scientific excellence through research, innovations, discoveries, publications, teaching, and mentoring have led to significant and meaningful contributions to the accumulation, transfer, dissemination, technologies, products and utilization of knowledge that have shaped the present and future of medical devices, with major impacts on health care worldwide. He is an internationally acclaimed and renowned scientist, problem solver, educator, humanitarian and inventor. He is an inspiring leader who through sustained creative innovations; hard work and perseverance grew to be one of the world's most prominent and respected scientists.

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