Abstract Submitted
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Mitigation of Shear-Induced Blood Damage by Mechanical Bileaflet Heart Valves[1] BORIS ZAKHARIN, SIVAKKUMAR ARJUNON, NEELAKANTAN SAIKRISHNAN, AJIT YOGANATHAN, ARI GLEZER, Georgia Institute of Technology — The strong transitory shear stress generated during the time-periodic closing of bileaflet mechanical heart valves that is associated with the formation of counter-rotating vortices near the leaflet edges may be damaging to blood elements and may result in platelet activation and therefore thrombosis and thromboembolism complications. These flow transients are investigated using fluorescent PIV in a new, low-volume test setup that reproduces the pulsatile physiological conditions associated with a 25 mm St. Jude Medical valve. The flow transients are partially suppressed and the platelet activation is minimized using miniature vortex generator arrays that are embedded on the surface of the leaflets. Measurements of the ensuing flow taken phase-locked to the leaflet motion demonstrate substantial modification of the transient vertical structures and concomitant reduction of Reynolds shear stresses. Human blood experiments validated the effectiveness of miniature vortex generators in reducing thrombus formation by over 42 percent.

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