Patient-Specific Multiphase Simulations of Atrial Fibrillation-Induced Thrombosis in the Left Atrial Appendage

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Abstract

Thrombosis often forms in the left atrial appendage (LAA) of patients with atrial fibrillation. Factors like the shape of the LAA, blood flow speed, and blood composition affect clot formation. In this study, we introduce a new method to identify the main causes of clot formation in the LAA. We combine CT imaging, computational fluid dynamics, and thrombosis modeling. Our simulations show that vortices form at the LAA entrance and may move inside depending on the heart's cycle. We find that the "cactus" LAA shape has a higher risk of clots than the "chicken-wing" shape. Slow blood flow encourages clotting and platelet activity, while faster flow boosts the effect of red blood cells. Higher hematocrit levels also increase fibrin production, regardless of blood flow speed.

References:

[1] Bouchnita, Anass, et al. "Multiphase patient-specific simulations to study fibrillation-induced thrombosis in the left atrial appendage." Physics of Fluids 36.7 (2024).