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In-vivo characterization of 2D residence time maps in the left ventricle LORENZO ROSSINI, PABLO MARTINEZ-LEGAZPI, UC San Diego, JAVIER BERMEJO, YOLANDA BENITO, MARTA ALHAMA, RAQUEL YOTTI, CANDELAS PEREZ DEL VILLAR, ANA GONZALEZ-MANSILLA, ALICIA BARRIO, FRANCISCO FERNANDEZ-AVILES, Hospital Gregorio Maranon, Madrid, Spain, SHAWN SHADDEN, UC Berkeley, JUAN CARLOS DEL ALAMO, UC San Diego — Thrombus formation is a multifactorial process involving biology and hemodynamics. Blood stagnation and wall shear stress are linked to thrombus formation. The quantification of residence time of blood in the left ventricle (LV) is relevant for patients affected by ventricular contractility dysfunction. We use a continuum formulation to compute 2D blood residence time (T_R) maps in the LV using in-vivo 2D velocity fields in the apical long axis plane obtained from Doppler-echocardiography images of healthy and dilated hearts. The T_R maps are generated integrating in time an advection-diffusion equation of a passive scalar with a time-source term. This equation represents the Eulerian translation of $D\ T_R/D\ t = 1$ and is solved numerically with a finite volume method on a Cartesian grid using an immersed boundary for the LV wall. Changing the source term and the boundary conditions allows us to track blood transport (direct and retained flow) in the LV and the topology of early (E) and atrial (A) filling waves. This method has been validated against a Lagrangian Coherent Structures analysis, is computationally inexpensive and observer independent, making it a potential diagnostic tool in clinical settings.

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