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Effect of Trabeculae on the Hemodynamics of an Embryonic Left Ventricle[1] VIJAY VEDULA, Stanford University, JUHYUN LEE, TZUNG HSIAI, University of California, Los Angeles, ALISON MARSDEN, Stanford University — The left ventricular (LV) endocardium is not smooth, but has "trabeculae" protruding into the LV cavity. Recent studies have indicated that trabeculae significantly influence LV hemodynamics by enhancing the diastolic penetration depth of inflow and facilitating a better apical systolic washout. However, it remains unclear how the role of hemodynamics modulates the initiation of trabeculae during cardiac morphogenesis. While such an assessment of mammalian heart models is hampered by the prolonged duration of cardiac development and complexity of surrounding internal organs, embryonic zebrafish is a genetically tractable model for investigating cardiac morphogenesis. We employ a novel light-sheet fluorescent microscopy to extract 4D LV models of zebrafish and develop an ALE-based moving domain CFD solver to perform flow simulations and extract quantitative data related to flow velocities and pressure gradients. We will compare near-wall flow dynamics between the wild type zebrafish (with trabeculae) and the cloche mutant lines that fail to develop trabeculae, to provide new insights into the flow-induced mechano-transduction relevant to the initiation of trabeculae during cardiac morphogenesis.

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