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Flow in an Integrated Model of Heart and Aorta

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Computational fluid dynamics of blood flow in the left ventricle and the aorta was carried out in an integrated manner to investigate the effect of flow dynamics created within the ventricular cavity on the aortic flow. The results showed that recirculating flow beneath the aortic valve that was brought about by blood inflow during diastole effectively redirected blood to the outflow tract, thus accommodating ventricular blood ejection to the aorta during systole. It was also demonstrated that ejected blood flow through the open aortic valve had markedly skewed velocity profiles with increasing velocity to the mitral valve side in early systole and to the septum side in later systole with swirling secondary flows. They led to the generation of helical flow in the aorta during later systole. These findings addressed the importance of inclusion of intraventricular flow in the analysis of the aortic flow.

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