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Hemodynamics of Curved Vessels with Stenosis MICHAEL E. BOGHOSIAN, KEVIN W. CASSEL, Illinois Institute of Technology — In hemodialysis access, the brachiocephalic or upper-arm fistula has less than optimal functional rates. The cause of this reduced patency is stenosis due to intimal hyperplasia in the cephalic vein. Stenosis typically leads to thrombosis and ultimately failure of the fistula. To increase our understanding of this process, numerical simulations of the unsteady, two-dimensional, incompressible Navier-Stokes equations are solved for the flow in an infinite channel having curvature and stenosis. Physiologically relevant Reynolds numbers ranging from 300 to 1500 and stenosis percentages of 0, 25, 50, and 75 are modeled. The post-stenotic flow is characterized by strong shear layers and recirculation regions. The largest shear stresses are found just upstream of the stenosis apex. The maximum shear stress increases with increasing Reynolds number and percent stenosis. The results indicate that hemodynamic conditions in the vein after fistula creation combined with curvature of the cephalic arch lead to shear stresses that exceed normal physiological values (both minimum and maximum). In some cases, the shear stresses are sufficiently large to cause damage to the endothelium and possibly denudation.

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