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Heparin Leakage in Central Venous Catheters by Hemodynamic Transport MICHAEL BARBOUR, PATRICK MCGAH, University of Washington, KENNETH GOW, Seattle Children's Hospital and Dept. of Surgery, University of Washington, ALBERTO ALISEDA, University of Washington — Central venous catheters (CVCs), placed in the superior vena cava for hemodialysis, are routinely filled with heparin, an anticoagulant, while not in use to maintain patency and prevent thrombus formation at the catheter tip. However, the heparin-lock procedure places the patient at risk for systemic bleeding incidences, as heparin is known to leak into the blood stream. We propose that the driving mechanism behind heparin leakage is advective-diffusive transport due to the pulsatile blood flow surrounding the catheter tip. This novel hypothesis is based on Planar Laser Induced Fluorescence (PLIF) measurements of heparin transport from a CVC placed inside an *in vitro* pulsatile flow loop and validated with CFD simulations. The results show an initial, fast (<10s), advection-dominated phase that rapidly depletes the concentration of heparin at the CVC tip, followed by a slow, diffusion-limited phase inside the catheter lumen, where concentration is still high, that is insufficient at replenishing the lost heparin at the tip. These results, which estimate leakage rates consistent with published in vivo data, predict that the concentration of heparin at the catheter tip is effectively zero for the majority of the interdialytic phase, rendering the heparin lock ineffective.

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