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Novel Non-invasive Estimation of Coronary Blood Flow using Contrast Advection in Computed Tomography Angiography PARASTOU ESLAMI, JUNG-HEE SEO, Johns Hopkins University, AMIRALI RAHSEPAR, RICHARD GEORGE, ALBERT LARDO, Johns Hopkins School of Medicine, RAJAT MITTAL, Johns Hopkins University — Coronary computed tomography angiography (CTA) is a promising tool for assessment of coronary stenosis and plaque burden. Recent studies have shown the presence of axial contrast concentration gradients in obstructed arteries, but the mechanism responsible for this phenomenon is not well understood. We use computational fluid dynamics to study intracoronary contrast dispersion and the correlation of concentration gradients with intracoronary blood flow and stenotic severity. Data from our CFD patient-specific simulations reveals that contrast dispersions are generated by intracoronary advection effects, and therefore, encode the coronary flow velocity. This novel method- Transluminal Attenuation Flow Encoding (TAFE) - is used to estimate the flowrate in phantom studies as well as preclinical experiments. Our results indicate a strong correlation between the values estimated from TAFE and the values measured in these experiments. The flow physics of contrast dispersion associated with TAFE will be discussed. This work is funded by grants from Coulter Foundation and Maryland Innovation Initiative. The authors have pending patents in this technology and RM and ACL have other financial interests associated with TAFE.

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