AbstractID: 11629 Title: In vivo analysis of coronary blood flow and arterial tree volume relationship in swine

Purpose: To investigate *in vivo* the scaling laws relating regional blood flow and lumen volume in the coronary tree using angiographic image data. The correlation between regional blood flow and the distal lumen volume can potentially be used to assess stenosis severity during routine coronary arteriography.

Method and Materials: Coronary arteriograms were acquired at maximal hyperemia induced by intracoronary injection of papaverine (5-10mg) in a swine animal model (25-35 kg, N=3). All images were acquired using a conventional x-ray tube with a constant potential x-ray generator (Optimus M200, Philips Medical Systems) and a cesium iodide based flat panel detector (PaxScan 4030A; Varian Medical Inc.). The flat panel detector has a 40x30 cm^2 field of view and pixel size of 0.194x0.194 mm^2. Contrast material was power injected at 4 ml/sec. A calibration phantom was imaged over the heart region for system iodine calibration. The coronary arterial tree was divided into approximately 6 subtrees down to stem diameters of less than 1 mm. Regional blood flow and lumen volume measurements were made using previously validated techniques.

Results: Regional blood flow (Q) and lumen volume (V) were related by $Q = 154.67V^{3/4}$ (R=0.991). The standard error of estimate for the regression was 8.04 ml/min or 14.65%.

Conclusion: Normal hyperemic blood flow can be estimated using the distal lumen volume of the coronary arterial tree. This makes it possible to quantify fractional flow reserve, which is used to assess stenosis severity during routine coronary arteriography.