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Abstract 27: FFR As A Gold Standard For CT-FFR Validation. Does The FFR Measurement Device Alter The Flow?



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Introduction: CT-FFR is a new diagnostic tool which uses CT data to perform flow simulations. Accuracy is dependent on the segmentation and boundary

conditions and reports have indicated that CT-FFR could be inaccurate in the range of FFR = 0.75 to 0.85. Typically CT-FFR is compared with invasive-FFR which is considered as a gold standard despite using endovascular devices which could interfere with the hemodynamics. We investigated changes in invasive-FFR measurements in 3D printed patient specific phantoms to determine the effect medical devices have on pressure gradients within the subject vessel for invasive FFR.

Methods: We built four patient specific phantoms from CCTA scans in patients who underwent minimally invasive-FFR and CT-FFR. A programmable pump was connected and blood mimicking fluid was pumped through the phantom at physiological flow rates and pressures. For each of these phantoms, benchtop flow experiments were conducted while simulating an invasive-FFR procedure. Pressure sensors were embedded in the phantom at the aorta and the location where invasive-FFR was recorded in the patients. Pressure gradients were monitored dynamically and the maximum pressure gradient change was recorded. The benchtop FFR, invasive-FFR, and CT-FFR were

measured at the same distal distance on the subject vessel. 16 experiments were conducted for each of the four phantoms with the insertion of a 4F catheter + pressure guidewire, 5F catheter + pressure guidewire, 6F catheter + pressure guidewire, and absence of all medical devices.

Results: The range of invasive-FFR values was 0.77 to 0.89. The absolute average difference between CT-FFR and invasive-FFR using patient data was 8%. The absolute average percent difference between benchtop experiments and invasive-FFR was 9% range (4% to 14%). After invasive-FFR simulation in phantoms we observed absolute average changes in benchtop-FFR values of 7%, range (0% to 17%) as indicated by sensors embedded in the wall of the vascular phantoms.

Conclusions: The insertion of medical devices within the subject vessel during FFR determination affects the pressure gradients in the phantoms as indicated by our experiments in patient specific phantoms. Changes could be clinically insignificant for patients outside the range of FFR = (0.75 to 0.85), however within this range invasive-FFR devices could also be a source of error and further investigation should be performed. Invasive-FFR measurements can be affected by the devices used during measurements.

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