

AbstractID: 2264 Title: High-Resolution Vascular Radiological Imaging

Image resolution requirements and selection of imaging modality depend upon the diagnostic or treatment task to be accomplished. For image-based determination of the size, shape, and flow characteristics of small vessels or detailed features of larger vessels, a number of modalities are available involving ionizing radiation (gamma and x-rays) as well as non-ionizing radiation (ultrasound, RF, and light). In this symposium, we restrict our discussion and comparison to high-resolution implementations of those modalities which are widely used clinically, such as radiological angiography, CT, ultrasound, and MRI, as opposed to those modalities less amenable to high-resolution clinical application such as nuclear medicine imaging or those high-resolution modalities that have not achieved widespread clinical application such as optical CT.

We first discuss the inherent high spatial and temporal resolution of radiological systems and indicate the characteristics that make them the current “gold standard” for vascular imaging as compared to the non-ionizing modalities of ultrasound and MRI. Specifically, we review the latest concepts in objective characterization of radiological systems using generalizations of MTF, NPS, NEQ, and DQE that include not only detector parameters but also characterizations of the patient and imaging system as a whole (focal spot, magnification, and scatter).

We next discuss some of the latest research in high-resolution microangiography and micro-CT with specific application to image guided neurovascular interventions. In the endovascular (catheter-based) treatment of the leading neurovascular pathologies such as stenoses (constrictions) and aneurysms (bulges), high spatial and temporal resolution imaging is essential both to avoid potential catastrophic events such as hemorrhage or small vessel (perforator) blockage as well as to accurately guide deployment of endovascular devices such as stents.

Finally, we demonstrate how new micro-angiographic imaging capabilities have enabled new endovascular devices such as an asymmetric stent for treatment of cerebral aneurysms, and how flow modification induced by these new devices can be evaluated using time-density analysis of rapid-sequence angiographic images.

Educational Objectives:

1. Review different imaging modalities available for high-resolution vascular imaging and understand why radiographic modalities are the current “gold standard”.
2. Understand the need for generalized concepts for objective, application-specific characterization of imaging systems
3. Understand the application of new high-resolution angiographic techniques for image guidance of neurovascular pathologies.
4. Appreciate the potential that new, high-resolution imaging systems may have in enabling the design of new endovascular devices such as asymmetric stents in the treatment of cerebral aneurysms.