

AbstractID: 10128 Title: Physics and applications for imaging vascular disease

Vascular Imaging includes a wide variety of imaging modalities applied to an even wider variety of vascular diseases related diagnostic examinations and procedures. The most recent statistics indicate that 34.2% of deaths in the United States can be attributed to cardiovascular disease (CVD) and that in excess of 4 million in-patient CVD associated procedures utilizing x-ray imaging are performed in the US annually. Vascular imaging applications have evolved from some of the earliest x-ray experiments performed by Roentgen to sophisticated 4-dimensional modalities that are being introduced clinically. A review of the vascular anatomy and diseases related to the current clinical applications is presented along with an overview of vascular imaging procedures and objectives. The capabilities of major vascular imaging modalities including ultrasound, MR, CT, PET, SPECT and traditional x-ray angiography are presented along with general predictions of future capabilities and applications of these systems.

While many new technologies provide promising capabilities, technological developments in x-ray angiography permit this traditional "gold standard" to provide flexible and continued applications for a number of invasive procedures. Many of these improvements are the result of improved detector elements which can provide high resolution and potentially lower patient dose, but when integrated into large area flat panel detectors may result in net a increase in dose from scattered radiation to medical staff and patients. Recent trends in technology and performance of these systems is discussed along with the increased clinical capabilities associated with improved visualization of arterial walls and structure. Future benefits of vessel visualization and details of plaque detail and differentiation are presented in the context of the next generation of vascular imaging techniques.

Ultrasound provides a non-ionizing and low cost alternative for the vascular imaging of localized regions of the body. For arteries located relatively near the surface of the body, ultrasound can provide dynamic anatomical imaging and quantitative flow measurements based on spectral Doppler analysis. Technological advances in ultrasound provide additional prospects for minimizing operator-dependent variations in exam quality and the potential to further differentiate plaques for improved diagnosis.

Educational Objectives:

1. Understand the vascular anatomy and examples of diseases relevant to diagnosis through vascular imaging.
2. Understand the unique imaging requirements, and how they are achieved, for technologies applicable to diagnosing and treating cardiovascular disease.
3. Understand the physical principles and technological advances in ultrasound applications in vascular imaging.
4. Understand the physical principles and technological advances in fluoroscopic applications in vascular imaging.