AbstractID: 9750 Title: Advances in Endovascular Image-Guided Interventions

In a recent Medical Physics “Vision 2020” paper (Medical Physics 35(1): 301-309, Jan 2008), the authors reviewed the state of endovascular image-guided interventions (EIGI) and offered some predictions for the future. Here we review the current status of the field and of some of these advances. First, endovascular devices (such as clot busting tools, stents and their catheter delivery systems, and blood flow modifiers) are becoming finer, more complex, and are enabling the replacement of invasive surgical procedures with minimally invasive EIGI procedures. Innovative methods of actuating motion at the catheter tip, such as the use of external magnetic fields, are being introduced. Second, along with improvements in devices, imaging systems that provide real-time high-resolution image guidance are being developed including a Solid State X-ray Image Intensifier based on electron multiplying charge coupled devices (EMCCDs) that provide large on-chip gain to overcome instrumentation noise such as that characteristic of current flat panel detectors. SSXIIs also have very high resolution capable of exceeding 10 lp/mm yet with no lag or ghosting. Third, the new high-resolution region-of-interest (ROI) detectors can be used in combination with large conventional detectors for dual-detector cone-beam computer tomography (CB-CT) to visualize ROIs within larger objects yet with minimal truncation artifact and with reduced integral dose. Fourth, during an interventional procedure, limited projection views can be taken to generate full 3D representations of the vasculature with accurate determination of vessel lumen morphology to enable computer fluid dynamic (CFD) calculations which in turn can be used to plan further EIGI treatment within the patient treatment time. Finally, as EIGI procedures become more complex, the consequent patient dose especially where improved image quality is implemented must be more carefully monitored. For example, we found that patient dose actually increased for certain electro-physiology (EP) procedures performed in our EP Lab following replacement of a mobile c-arm with a fixed unit capable of generating improved image quality. In conclusion, while progress is being made toward fulfilling the predictions made by the authors in the Vision 2020 paper published early in 2008, EIGI remains open to continuing exciting advancements.

Educational Objectives:

1. Appreciate the progress being made in improved EIGI devices and imaging systems.
2. Understand the operation of new high-resolution micro-angiographic systems including the SSXII and the operation of dual-detector ROI CB-CT systems.
3. Understand the role of limited view acquisition for providing 3D images.
4. Appreciate the patient exposure burden during EIGI procedures.

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