Purpose: X-ray image-guided interventional treatment of vascular pathology such as aneurysms involves precise delivery of devices such as stents and hence may require very high-resolution imaging capability. We report the first fluoroscopy and angiography phantom studies using a new high-resolution x-ray detector that has been developed to address this need.

Methods: The Solid State X-ray Image Intensifier (SSXII) detector is based on Electron-Multiplying Charge Coupled Device (EMCCD) technology (E2V Technologies, Chelmsford, England). An EMCCD with 13-Âµm pixels and fiber optic window is coupled to a fiber-optic taper with a taper ratio of 3.3 that views a 300-Âµm thick CsI x-ray scintillator, thus making an effective pixel size of 42.9 Âµm and a Nyquist frequency of 11.8 lp/mm for this detector.

A small aneurysm insert that was part of a flow loop was placed in the base of the brain region of an anthropomorphic head phantom (RS-230, Supertech, Elkhart, IN) to simulate pathology in the Circle of Willis of a patient and interventional procedures were done with similar attenuation and anatomical characteristics that would be experienced in the clinic. A guidewire was threaded into the aneurysm under fluoroscopic image guidance with the SSXII. Digital Subtraction Angiography (DSA) was performed using a standard contrast injection (iodine 350 mg/ml) into the flow loop and angiographic sequences were recorded with the new detector.

Results: The operation of the new SSXII detector in both fluoroscopy and angiography exposure ranges was demonstrated for the first time on human phantoms. The resolution of this detector is substantially higher than current-state-of-the-art flat panel detectors with 150 to 200 Âµm pixels.

Conclusions: The newly developed high-resolution EMCCD-based detector can potentially be used for both fluoroscopy and angiography to address the high-resolution imaging needs of x-ray image-guided neuro-vascular interventions.

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