A High-Resolution Rapid-Sequence Imaging System For Region Of Interest Micro-Angiography

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Stroke is the third leading cause of death in the United States and around the world. The most common causes of stroke are cerebrovascular stenosis (vessel constrictions), and ruptured aneurysms (bulges). Science and technology have advanced rapidly in the past few years towards understanding the causes, diagnosis and treatment of stroke related problems and better imaging is a key to this progress.

The cerebral vasculature is highly complex with extremely sharp bends, branching vessels, and a large number of tiny, difficult-to-visualize vessels called perforators. Furthermore imaging even the main cerebral vessels (often smaller than 3mm) through the skull is extremely difficult. Intravascular treatment often is the only option for many of these cases and is largely dependent on the ability of the neurointerventionalist to dynamically visualize the procedure using x-ray angiography. The more powerful the imager they use, the more complex cases they will be able to treat and the more lives will be saved. Smaller and finer therapeutic devices to treat complex cases will always be limited by the imaging capabilities used to guide their deployment.

We built an imaging system for Region Of Interest (ROI) microangiography, that meets the current imaging demands for endovascular neurointerventions. Region of interest means the small region (5cm x 5cm) centered at the diseased site of the vessel where the neurointerventionist needs the highest resolution dynamic images. Such imaging will enable the neurointerventionist to insert and manipulate tiny devices necessary for the treatment. This is the first time that the combination of very high resolution (50micron pixel size) and rapid sequence (5 frames per second) is being provided in the same microangiography system specialized for the cerebral vasculature. Our camera is versatile in the sense that it can be used in conjunction with currently available angiographic systems. The system as a whole can perform all the standard functions of the commercial digital angiographic imagers; however, at much higher resolution.

This advance in medical imaging opens new horizons. Future applications that derive from the powerful capabilities of the imaging system are: new devices with asymmetries and customized characteristics depending on the need of each individual patient will be able to be developed and used for the treatment of complex cases that were untreatable

before. High resolution studies of cerebrovascular blood flow characteristics will be able to be performed and this will provide us with better understanding of the cerebral hemodynamics. The potential result is development of new and less invasive therapies for stroke and other neurovascular diseases.