

IMG-92-001 - X-RAY - Pulse-Injector for Quantitative Angiographic Blood-Flow Measurements

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Technology description

A novel angiographic apparatus to quantitatively determine the velocity and flow rate of blood throughout the cardiac cycle.

Description

This invention describes a novel angiographic apparatus to quantitatively determine the velocity and flow rate of blood throughout the cardiac cycle. Quantitative measurements of blood velocity and flow rate are of clinical interest as they are commonly used in the diagnosis of cardiovascular disease severity (e.g., stenosis) and for evaluating the success of interventional and surgical procedures (e.g., valve implants). Because of this interest, ultrasound and magnetic resonance techniques have been developed. However, X-ray angiography remains the “gold standard” in clinical practice. The patented apparatus includes a pressurized source of contrast agent and a novel rotary valve that allows for pulsed injection of radioactive contrast into the vessel at a rate ranging from 1 to 30 Hz. Pulsed injection of multiple boli results in an improved angiographic signal since more features are presented within the vessel for the same volume of injected contrast agent. The radiographic boli are recorded by a digital system and analyzed to provide quantitative measurements of blood velocity and flow rate throughout the cardiac cycle. The in vitro performance of the pulse-injector has been verified in studies involving the use of a digital angiographic recording system and computer controlled flow simulator. Although significant advances have been made in available techniques for the diagnosis and treatment of cardiovascular disease, techniques used in the delivery of contrast agents in angiographic procedures have been slower to advance. Cardiologists have traditionally used a manual syringe with stopcocks to inject radiographic contrast material during X-ray angiography procedures. Manual injections provide physicians with precise control of the rate of contrast and volume injected, that is especially important when working in coronary arteries. Worldwide, it is reported that more than 60 million procedures involving the use of radiographic contrast agents are performed each year. More than 4.5 million x-ray angiograms continue to be performed within the United States annually at a total cost of over \$9 billion to the healthcare system. The pulsed injector of the current invention allows for optimal injection of contrast agent during X-ray angiographic procedures to permit quantitative measurement of blood velocity and flow rate.

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