In-vivo synthetic aperture flow imaging in medical ultrasound

A new method for acquiring flow images using synthetic aperture techniques in medical ultrasound is presented. The new approach makes it possible to have a continuous acquisition of flow data throughout the whole image simultaneously, and this can significantly improve blood velocity estimation. Any type of filter can be used for discrimination between tissue and blood flow without initialization, and the number of lines used for velocity estimation is limited only by the nonstationarity of the flow. The new approach is investigated through both simulations and measurements. A flow rig is used for generating a parabolic laminar flow, and a research scanner is used for acquiring RF data from individual transducer elements. A reference profile is calculated from a mass flow meter. The parabolic velocity profile is estimated using the new approach with a relative standard deviation of 2.2% and a mean relative bias of 3.4% using 24 pulse emissions at a flow angle of 45 degrees. The 24 emissions can be used for making a full-color flow map image. An in-vivo image of How in the carotid artery for a 29-year-old male also is presented. The full image is acquired using 24 emissions.

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