Title
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FULL ACCESS | ABSTRACT

CORE 1. CARDIOVASCULAR IMAGING

SESSION TITLE: ECHOCARDIOGRAPHY: CLINICAL APPLICATIONS OF CONTRAST ECHOCARDIOGRAPHY

Abstract 14952: Volumetric Echocardiographic Particle Image Velocimetry (V-Echo-PIV)

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Abstract

Introduction: The two-dimensional (2D) echocardiographic particle image velocimetry technique that was introduced in 2010 received much attention in clinical cardiology. Cardiac flow visualization based on contrast echocardiography results in images with high temporal resolution that are obtainable at relatively low cost. This makes it an ideal diagnostic and follow-up tool for routine clinical use. However, cardiac flow in a cardiac cycle is multidirectional with a tendency to spin in three dimensions rather than two-dimensional curl. Here, for the first time, we introduce a volumetric echocardiographic particle image velocimetry technique that robustly acquires the flow in three spatial dimensions and in time: Volumetric Echocardiographic Particle Image Velocimetry (V-Echo-PIV).

Methods: V-Echo-PIV technique utilizes matrix array 3D ultrasound probes to capture the flow seeded with an ultrasound contrast agent (Definity). For this feasibility study, we used a pulse duplicator with a silicone ventricular sac along with bioprosthetic heart valves at the inlet and outlet. GE Vivid E9 system with an Active Matrix 4D Volume Phased Array probe at 30 Hz was used to capture the flow data (Figure 1).

Results: The 3D particle field was obtained with excellent spatial resolution without significant noise (Figure 1). 3D velocity field was successfully captured for multiple cardiac cycles. Flow features are shown in Figure 2 where the velocity vectors in two selected slices and some streamlines in 3D space are depicted.

Conclusions: We report successful completion of the feasibility studies for volumetric echocardiographic PIV in an LV phantom. The small-scale features of flow in the LV phantom were revealed by this technique. Validation and human studies are currently in progress.

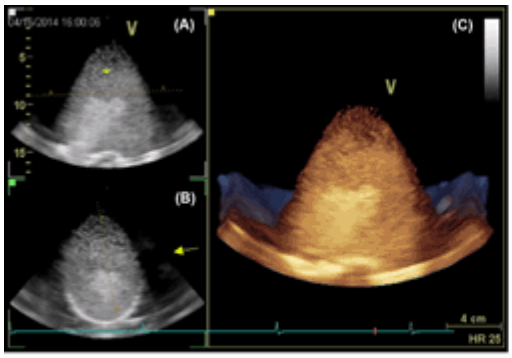

Figure 1. The particle field inside the LV phantom acquired by GE 4V probe. **(A)** and **(B)** are 2D slices and (C) is a 3D rendering of lipid-shelled microbubble agents inside the phantom.

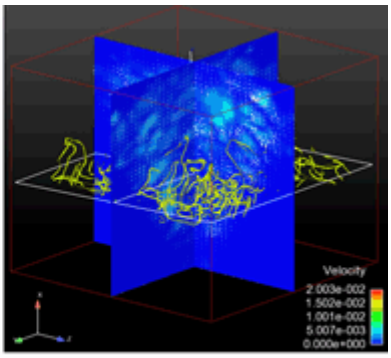

Figure 2. The velocity vectors in two selected slices and some streamlines in 3D space in between are obtained by V-Echo-PIV.

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Footnotes

Author Disclosures: **A. Falahatpisheh:** None. **A. Kheradvar:** None.

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