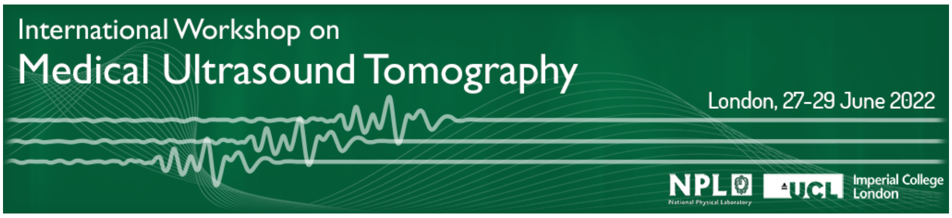

Contribution ID: **6** Type: **not specified**

Towards In-Vivo Multi-Perspective Bistatic Ultrasound Imaging Using Aberration Correction

Wednesday, June 29, 2022 9:40 AM (20 minutes)

Abdominal ultrasound imaging (US) is used to monitor rupture risk of abdominal aortic aneurysms. However, assessment of aortic geometry and wall deformation using conventional US is limited by the lateral lumen-wall contrast and resolution. We therefore introduce ultrafast multi-perspective (MP) bistatic imaging to improve aortic US. In MP bistatic imaging, two curved array transducers receive simultaneously on each transmit event. The advantage of such bistatic US imaging was investigated in US simulations and in an experimental study on *ex vivo* porcine aortas. Using MP bistatic imaging, the wall-lumen contrast-to-noise ratio was improved by up to 8 dB in vessel wall regions between transducers (Fig. 1a). This improved the accuracy of strain estimates in US simulations and resulted in more homogeneous strain results in *ex vivo* experiments (Fig 1b).

In vivo, MP image fusion is hampered by wavefront aberrations, caused by the strong speed-of-sound variations between muscle and fat in the abdominal wall. This limits abdominal ultrasound image quality by introducing distortions of the imaged structures, especially at deep imaging locations, such as the aorta. In MP US, these aberrations can be even more severe, because image features from different probes can misalign severely. We developed a generic algorithm for aberration correction in delay-and-sum (DAS) beamforming to improve image quality for both single-perspective (SP) and MP US. The method employs aberration corrected wavefront arrival times based on a speed-of-sound estimate derived from the image data. Two wavefront models are compared. The first model is based on a straight ray (SR) approximation, and the second model on the Eikonal equation, which is solved by a multi-stencils fast marching (MSFM) method. Their accuracy for abdominal imaging was evaluated in acoustic simulations and phantom experiments involving tissue-mimicking and *ex vivo* porcine tissue that were placed on top of a commercial CIRS phantom. The lateral resolution was improved by up to 90% in simulations and up to 65% in experiments compared to standard DAS, in which MSFM-DAS outperformed SR-DAS. Moreover, successful MP image fusion in the presence of aberration was shown, yielding a better overlap and reduction in position error of the wires in the CIRS phantom by up to 85% (Fig 1c).

In conclusion, a more complete understanding of aortic geometry and wall motion can be retrieved by using ultrafast MP bistatic imaging. Moreover, results show that *in vivo* MP image fusion can be enabled by aberration correction using modelled arrival times in DAS.

Preferred Contribution Type

Presentation

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