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Multi-perspective ultrasound imaging of abdominal aortas

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Ultrasound functional imaging of large vessels is challenged by regional low contrast of the wall. Moreover, displacement tracking in the lateral direction suffers from poor lateral resolution. These challenges can be tackled in superficial vasculature with beam steering and compounding. However, in deep vessels like the abdominal aorta, beam steering is not possible because the aorta will not be in the field-of-view. In this study, multi-perspective imaging of the abdominal aorta is proposed.

(2) Material and Methods

2D RF-data were acquired with an Esaote MyLab70 equipped with a curved array transducer (fc = 3.5 MHz). The abdominal aorta of healthy volunteers was imaged between the renal arteries and the iliac bifurcation in the cross-sectional view. The probe was mounted on a custom-made arch to constrict the movement and determine the angle of the imaging plane. Recordings were made from 7 angles ranging from -20° to 20°. The aorta was manually segmented in each of the 7 acquisitions. The images were aligned to a single coordinate system, whereas the segmentation of the aorta was used to register the images in post-processing. After rotation and translation of the multiple views, a composite ultrasound image was computed by averaging of the envelope data.

(4) Discussion and Conclusion

The proposed method has the potential to perform high contrast imaging of deeper lying abdominal organs. Aberration correction and automatic registration are required before multi-perspective motion tracking is feasible. The separation between the aorta and the vena cava remains unclear. This could be improved by increasing the maximal insonification angle. In future research, multiple probes will be used simultaneously to enable semi-tomographic transmit/receive compounding.

(3) Results

An example of the individual acquisitions and composite ultrasound image is found in Figure 1. Combination of multiple angles leads to great improvement of the contrast between the lumen and the wall of the abdominal aorta, especially in the lateral regions. Cineloops revealed no significant artefacts due to differences in heartbeat frequency or blood pressure (temporal misalignment). Some local spatial misalignment was found caused by aberration.

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