WEBINAR:

(May 9, 2024) Enhanced Ultrafast Vector Flow Imaging (VFI) Using Multi-Angle Plane Waves

Questions and answers from the May 9, 2024 webinar titled: "*Enhanced Ultrafast Vector Flow Imaging (VFI) Using Multi-Angle Plane Waves*"

This document includes questions we received and answered during the webinar, as well as those that we did not have time to address.

1. **Sadi Loai: I saw you had in vivo experiments in your research, and then you also perform some clinical experiments with the system. Because we know getting systems into the clinic like FDA approval certifications takes a while, how far away is the clinical translation for the Prodigy? Are we talking maybe a couple of years? Is it possible now, with the right approvals?**

Dr. Geng-Shi Jeng: Yeah, this is a good question. For the research platform. We have a clinical research platform in the market. The Prodigy is one, and the other one is Verasonics, but for this research platform, I think the advantage is that you can modify your pulse sequence - you can design your own pulse sequence. But it is not a clinical machine. For the Prodigy, the research platform in my lab, we can conduct human experiments, because we have our IRB approved. So, if we want to do a human scan using the Prodigy, it is not really a problem, because in my case, the approval is not difficult to get. For the Prodigy, if we want it to become a clinical machine, the FDA certification is required. But I think this is a time-consuming process. In my case, it's not a problem, for this kind of certification is not difficult to get. It depends on the company's strategy.

Sadi Loai: Thank you for clarifying that I know. That's usually on everyone's mind, which is a clinical translation.

2. **Can you explain more about the LS-ST Method?**

Dr. Geng-Shi Jeng: So, when we look at this, they are 2 words, right? LS means this is square. ST means a speckle tracking. So, the idea is we use a speckle tracking to estimate

the axial velocity component. And then we use the LS square to combine this velocity component from different angles, to get the final velocity vector. For the velocity vector, what we need to know is the two velocity components: one is axial and the other one is lateral. But we don't know the lateral, but we actually can use a different angle to get the different component. So yeah, the idea is, we combine the velocity components at the different angles to produce the final velocity vector.

3. **What are the limits to the spatial and temporal resolution that can be achieved with the Prodigy? And if someone is interested in micro circulation, for example, in kidneys or cardiac, is that possible?**

Dr. Geng-Shi Jeng: For the spatial resolution, it depends on the kernel you select in the speckle tracking. But this is a tradeoff, if you want to have a height of spatial resolution your velocity estimation will be great. For the temporal resolution, for the conventional VFI most of them use a doppler. For a doppler, they needed to use 8 to 16 samples. So, the temporal resolution depends on the number of samples you use. For the speckle tracking, in principle, you can only use the 2 samples to get the one velocity. So, I expect speckle tracking is best as VFI has a higher resolution than the doppler.

For the microcirculation, as I mentioned, it's very challenging. Even for the conventional doppler, it is challenging as well. So, if you look at the commercial machine for the mindray and GE healthcare, they usually visualize the bigger vessels. They don't visualize the small vessels. But I think it is very challenging.

4. **Sadi Loai: And we have another question, and they are saying that currently they're using 2D auto correlation to estimate muscle, tissue velocity and detecting single motor unit tissue displacements. So, they're wondering right now, they're estimating axial velocity. Do you think that with the LS-ST method, with multiple angles, can be used to estimate the velocity vector of the muscle tissue?**

Dr. Geng-Shi Jeng: Yeah, sure because we use a multi angle brain wave You can generate the framework with the different angles. So, you can estimate an axial velocity component along this angle. So basically, you also can get the velocity vector. So, this is not only for blood vessel, it can be applied to the myocardial muscle tissue. I think that this this is doable.

5. **How are the advancements with contrast imaging and would that allow you to get better sensitivity.**

Dr. Geng-Shi Jeng: Yes, I think so because for the contrast imaging, I think that for the micro circulation can benefit from the contrast agent. But I'm not the contrast agent guy, so I have no contrast imaging in my hard disk, but I think it is also doable for the Prodigy to conduct the contrast imaging. I expect, the contrast imaging can get a better VFI imaging. So right now, I think one of the popular research is regarding a super resolution imaging, they leverage contrast agents to localize the particle inside of the microvascular. So, I think that the Prodigy is doable for this application.

Sadi Loai: I know there's also a lot with Photoacoustics being developed right now. But I don't think that would correct me if I'm wrong that wouldn't really be for micro vascular imaging or disease. Or could you do that?

Dr. Geng-Shi Jeng: Yeah, I do photoacoustic imaging, but for the micro vessel imaging using the photoacoustic, I think we would leverage the optical resolution photoacoustic imaging, you can get to the higher resolution then the conventional ultrasound to visualize the result.