

AI in Echocardiography: Any Role for the Physician?

Announcer: Welcome to the Mayo Clinic cardiovascular continuing medical education podcast. Join us each week to discuss the most pressing topics in cardiology and gain valuable insights that can be directly applied to your practice.

Dr. Friedman: Hello, my name is Paul Friedman. I'm chair of the department of cardiovascular medicine. And I have the great pleasure of being joined by Dr. Patty Pellikka, professor of medicine, editor of "The Journal of the American Society of Echocardiography", previous chair of the division of cardiac ultrasound at Mayo Clinic in Rochester. And today I'm here to learn about artificial intelligence in echocardiography. Dr. Pellikka, thank you for joining me.

Dr. Pellikka: Thanks for having me, Paul.

Dr. Friedman: So let's jump into it. Tell me about the current practice of echo. There's certainly a lot of talk, a lot of excitement about artificial intelligence in echo. Is it used today?

Dr. Pellikka: That's a great question. We do use it, but I think its clinical application is still in the early stages. We use it for some of the volumetric measurements, for example, in our laboratory for three dimensional measurements, those are based on AI, the measurement packages that are used. But we're using it increasingly with research and there are commercially available tools that are used currently for AI. You can quantitate volumes, ejection fraction, and global longitudinal strain with commercially available AI tools, some that are cloud based. There's also an interesting tool by which you can teach an inexperienced user to obtain echocardiographic images using a point of care device that kind of tells you how to move your hand. And it really works quite well.

Dr. Friedman: So in other words, this will increase the labor pool in a very scarce labor market, and that is sonographers, by helping people with less skills maybe acquire some of the images?

Dr. Pellikka: Well, possibly. It might help with some point of care screening assessment and perhaps would keep some of the patients from needing a full echocardiogram.

Dr. Friedman: In my mind, I think of artificial intelligence as doing two things. One is things that human beings can do very well but to do it at scale, we don't have enough echo readers and now it may read an EF or something else. And the other one is to identify patterns in the data that humans can't see right now. And I guess I would ask you currently where do you see it and going forward where do you see it?

Dr. Pellikka: I think that going forward part is really exciting. But currently AI was used in the COVID era. And really in the early COVID days we were very uncomfortable about doing echocardiograms because the sonographer was so close to the patient. But AI allowed us to quantify ejection fraction, LV volumes, and strain with just very limited images and AI tools. So that was a great assist in the early stages of COVID. I agree that it is really important, though, to be able to make diagnoses. The current echocardiograms that we do have become increasingly complex, many measurements. And as you know, the patients have become more complex with

greater severity and complexity and acuity of disease. And so there's a lot going on. We make multiple measurements. But AI tools could potentially help us increase the accuracy or precision and perhaps detect things that could be missed in a very complicated exam.

Dr. Friedman: I'm gonna come back at that point a little more, but I'd like you to speak more to some of the specific developments that are underway in echo, things like proposing diagnoses, risk stratification, those sorts of things.

Dr. Pellikka: Yes, there's a lot going on, as you know, at our laboratory here. Our colleague Adelaide Arruda-Olson is applying AI to the measurements and findings that have been obtained on the clinical echocardiogram. And so looking at those measurements and findings, a diagnosis might be suggested using AI. And I think this could help detect uncommon diseases that might be in the background, not maybe the main issue why the patient is having the echo, but still important things not to miss. We've also been interested in the application of AI to assessment of diastolic function, because diastolic function is such a conundrum. We have long guidelines, documents, but still there are many patients, oh, 30% to 40%, that don't really fit into a classification of diastolic function. And meanwhile, heart failure with preserved ejection fraction is just growing as a cause of morbidity and mortality. So being able to accurately classify diastolic function is important. And using cluster analysis, we were able to risk stratify patients even when some of the measurements on the echocardiogram were missing. We've also been interested in applying AI to the echocardiographic images, the raw images. And we hypothesize that from a simple four chamber view, which is standard with any examination including the point of care examination, that we might be able to detect patients with heart failure and preserved ejection fraction and diastolic dysfunction. And so we trained a model to, based on patients without heart failure and with normal diastolic function and another group with diastolic dysfunction and heart failure with preserved ejection fraction, and were able to actually get good results in testing this in an independent group, just from that one simple four chamber view without all that Doppler information that we usually acquire.

Dr. Friedman: I was gonna say, so there that's really remarkable. So you put the probe on the chest and in a few seconds, just from the motion of the walls, the AI can understand what normally we would use Doppler to measure motion and look at tissue characteristics and whatnot. That's exciting and phenomenal. And certainly I can see how it would make the image acquisition more expeditious and hopefully more reproducible. Now everyone's applying AI to numerous things. As you know, I have a passion for applying it to the ECG and it's being applied to nuclear medicine. What are the advantages of AI applied specifically to echo?

Dr. Pellikka: There certainly are a lot of advantages to applying AI to echo. I think that it will allow us to do more quantitation than what is currently available with our time slot to do an echocardiogram. And I know this has been the case in radiology where all the information on a CT scan can hardly be digested within the time period that the radiologist has to look at it. So quantitation will increase, the volumes and dimensions of chambers can be accurately measured. The reproducibility from one examiner to the next will increase. All of this should help with our efficiency. And I know that will make you happy to hear since we always scrap for resources in the echo lab. But then also I think it will help with accurate disease detection, recognizing for

example, amyloid in the background when the patient is really there for evaluation of their aortic stenosis.

Dr. Friedman: You know, we sort of smile when we talk about efficiency but the reality is from what I hear from colleagues around the country and around the world is that in many places, echos are underutilized because there's inadequate capacity for the huge demand. And so increasing that efficiency will actually make that diagnostic modality available to patients. So that really is important. I just wanna underscore what you've said. And of course the flip side of that is some people get nervous. They say, will AI replace me? Will it replace the physician interpreters of echocardiography? What are your thoughts about that?

Dr. Pellikka: I don't think that it's going to replace the physician interpreters soon. There's just so much to be done still. And everything takes time. It requires big data sets. The complexity of information is enormous. There's just so much information in an echocardiogram. But it will help patients in remote areas where they don't have access to everything that they can access here in Rochester, Minnesota. It will help them get better care. And I think that is terribly exciting.

Dr. Friedman: Yeah, it is hugely exciting. I share your enthusiasm. You know, I do have one more question for you. And I hear a lot all the time about POCUS, point of care ultrasound. And I'd like to get your thoughts on, does it replace echo or is it a screening tool to identify who gets an echo? Who's holding the POCUS? Does it need to be an experienced echocardiographer or do you see this as part of the physical exam that all physicians are using? And then they identify those patients who need the comprehensive echocardiogram. So tell me your thoughts on POCUS and the role of AI in it in particular

Dr. Pellikka: I'm glad you brought up POCUS Paul. Our medical students are now having some training in POCUS, and this is quite common for medical schools. It really helps to understand physiology and also to improve physical examination skills. I think that it contains much more information or allows us to access more information than the stethoscope. But there are also tools that combine the auscultation information from the stethoscope with point of care ultrasound, which is just a magnificent teaching tool. In the future I think all of us will be using point of care devices, but I would hypothesize that this might actually increase detection or suspicion of disease and lead to more referrals for comprehensive echocardiograms hence the need for really good AI tools.

Dr. Friedman: Yeah, it's a super exciting time. Thank you for taking the time to discuss it with me and for all the work you're doing to help advance the field. At the end of the day this will help us detect disease early and help us care for patients better. So, very exciting. Thank you so much, Patty.

Dr. Pellikka: Thank you, Paul.

Announcer: Thank you, and thank you for your time, and thank you to our audience for taking their time to listen to Interviews with the Experts, Rochester, Minnesota.

Announcer: Thank you for joining us today. Feel free to share your thoughts and suggestions about the podcast by emailing cvselfstudy@mayo.edu. Be sure to subscribe to the Mayo Clinic

cardiovascular CME podcast on your favorite platform and tune in each week to explore today's most pressing cardiology topics with your colleagues at Mayo Clinic.