The power of AI in the echo lab

Redefining workflow efficiency through emerging technologies

Artificial intelligence (AI) isn't just growing – it's exploding in echocardiography. Leading cardiovascular centers all over the world are embracing new innovations that leverage AI to accelerate workflow, improve diagnostics, and deliver better patient care. The Cardiovascular Institute at Beth Israel Deaconess Medical Center (BIDMC) in Massachusetts, a major teaching hospital of Harvard Medical School, is one of them. Echocardiography Lab Director, Dr. Jordan Strom, sees the latest advancements as a possible answer to some of today's biggest challenges.

A shortage of cardiac sonographers is making it hard for hospitals and clinics across the United States to keep pace with an increasing number of patients and complex cases. BIDMC, with 600 beds, is consistently operating at maximum capacity. Besides heavy caseloads, this quaternary care center is spread out across several campuses—posing additional obstacles.

Dr. Strom oversees four busy echo labs that perform approximately 25,000 transthoracic echocardiograms a year. The team also conducts 2,000 stress echoes, and a little over 1,000 transesophageal echocardiograms annually, and those numbers are climbing. From acquisition guidance and automated measurements to new capabilities in manipulating data, a wide range of AI-based tools are powering new ways to simplify and speed up echo exams and post-processing.

Dr. Strom, who works closely with the American Society of Echocardiography (ASE) on AI initiatives, recently shared his views on how these emerging technologies are transforming echocardiography.

Why is artificial intelligence an important part of echocardiography as we move into the future?

Dr. Strom: *We are using AI all the time to assist in workflow solutions. It's built into the background of many of the tasks that we do on a daily basis. Simplifying routine and manual tasks with automation may help prevent user error and also gives reliable, consistent diagnostic information. As we get more information, it also helps our lab as a whole, and our patients by providing more diagnostic information up front. And it makes it easier for cardiologists to read echoes and other types of images.*

With AI, we're improving the reliability and reproducibilty of our measurements.[1] We're improving access to care and access to ultrasound, and ultimately streamlining what we do. There are enormous uses for these technologies, but I think we're just scratching the surface of what we can do.

The sonographer shortage and increased patient load are real challenges for many centers. How can AI and other Vivid technologies address some of these issues?

Dr. Strom: *We're always operating at maximum capacity and any bit that we can do to reduce those barriers is great. One way is making sure our echo protocols can adapt to the present time and the needs of the day-to-day workflows and efficiencies.*

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The traditional teaching has been you start with the parasternal long axis, but that's based on the era of M-mode where we were doing a lot of our measurements in the parasternal long axis view with M-mode. I think we've moved beyond that.

At our lab, we start our imaging with a triplane image from the apical view. A triplane image is essentially three simultaneous images at different angles, giving us a four, two, and three-chamber view, all on the same heartbeat. This allows us to visualize and access all aspects of the heart's walls, detect wall motion abnormalities, and measure global longitudinal strain using the AFI package. It also provides a biplane ejection fraction through AI view recognition and automated contouring, and it does so quickly. In addition to that, the triplane view allows us to assess image quality and immediately identify if we need echo contrast and can start planning ahead of time. When I tell people this they say, "Why did you start with that [view]?" I say, "Well, why did we start with the parasternal long axis?"

Triplane and AI is one example, another is utilizing 3D full volume clips. We acquire 3D of the left and right ventricle at the start of the exam and use the 4D Auto LVQ and RVQ packages to quantify ventricular function. Those 3D images also allow us to subsect or crop in multiple ways and verify assumptions in 2D imaging. In addition, both our sonographers and physicians use the AI Auto Measure function to trace Doppler waveforms and perform 2D measurements, on-cart or off, with just a button click, which gives us very reproducible results. Our ability to view the raw image files in EchoPAC™ allows us access to all these tools at any time. All of this allows us to do more with the information that we have and shortens the time for interpretation of a study. Even if we're doing a focused protocol, we get relevant data that answers the questions.

> *The Auto Measure Spectrum Recognition AI tool is also great for a sonographer. It automatically measures the Doppler spectral tracings with just a button click.*

What ways are AI and automation helping deliver more reliable and consistent exams?

Dr. Strom: *Consistency is always challenging for labs in general. Developing set protocols and having the AI trigger the machine to move to the next view and the next setting can be really helpful for sonographers. It goes a long way in making sure they are following the set protocol and doing it with consistency. The AI Auto Measure Spectrum Recognition tool is also great for a sonographer. It automatically measures the Doppler spectral tracings with just a button click.*

How can AI tools make a difference in strain imaging and what is the impact?

Dr. Strom: *Strain is increasingly becoming a standard part of the examination. The ability to not only have auto view recognition, automatically place a region of interest, and auto calculate the speckle-tracking strain value through the AFI package is tremendous.*

We are in the process of building a new inpatient cancer hospital with the Dana Farber Cancer Institute. You can bet that AFI and strain will play a central role in our ability to monitor patients for cardiotoxicity. We also use it to screen our heart transplant patients, patients with suspected amyloidosis, and patients with structural heart disease. A couple of years ago, strain was made a category 1 CPT code and that means there is reimbursement for its use. We don't use strain on everyone, but it is helpful to have for selected cases where we deem it necessary.

With AI, automation, and improved workflow technologies, do you think it's possible to add AFI strain and 3D volume measurements to a standard echo without creating a time burden on the sonographer?

Dr. Strom: *We are already doing strain and 3D acquisitions routinely on multiple exams and it hasn't really added a time burden because the EchoPAC suite allows us to manipulate the 2D and 3D dataset and obtain these measures offline. I think these technologies can help short cut and identify solutions for labs relatively easily, and help us get more robust information up front, early, and with less work.*

How is GE HealthCare's ViewPoint™ with EchoPAC Suite impacting your post-processing review and analysis with raw data?

Dr. Strom: *What we are used to looking at are DICOM® images, which are challenging to manipulate or change after they've been acquired. Raw data allows us to manipulate the data after the fact as we had just acquired it on the cart. We can do a number of different things, like measurements or*

pull up studies from years ago. We can then pull those measurements or studies into EchoPAC and use the data in new ways—let's say for a research project. We can then layer on newly developed technologies that weren't even around at the time the study was performed. So, not only do we have a PACS workstation that allows us to easily query studies and bring them up, but we have a really powerful robust software to manipulate those images and understand what we should be reporting.

How has the integration of ViewPoint with EchoPAC Suite helped your readers stay efficient, especially with an institution that is spread out across campuses?

Dr. Strom: *By using EchoPAC as a plugin within ViewPoint, this allows us to essentially install a workstation capable of both viewing and image manipulation on basically any computer. We get requests all the time to put workstations in the CCU or other areas of the hospital so people can look at images or do data analysis in real-time. I have one in my office—many clinicians even can access theirs from their home. It's enormously helpful and allows for portability and a means to be able to view images across the entire network.*

How has the ability to review, analyze, and perform measurements at remote workstations impacted workflow and care?

Dr. Strom: *Our workflow is that we do the measurements and the AI more so on the workstation instead of the sonographer spending excess time doing the analysis on the machine. We would rather they focus on an accurate echo study and then shift to the next examination. The fine tuning can be done fairly easily in EchoPAC and we can also check on the sonographers' work. Our EchoPAC workflow allows us two-way communication between our sonographer group and our physician group, which really enables us to deliver the maximal standard of care.*

Your echo fleet includes Vivid E95 and Vivid S70N ultrasound systems. What ways have they affected performance and productivity?

Dr. Strom: *About 80% of our studies are done portably, and a lot of our sonographers love the Vivid S70N because it's lightweight and ergonomically friendly. The Vivid S70N has been a great system for efficiency, allowing us to go to the patient's bedside and make real-time decisions on the fly. On the other hand, when you want the advanced workhorse for TEEs or structural heart procedures and all the functionality, the up-to-date 3D acquisition, etc., we use the Vivid E95 and have had good success. Really, that combination has served our institution very well.*

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Improving efficiency is universally appealing, but some clinicians are still hesitant to adopt AI. Do you have any advice?

Dr. Strom: *I think it's important for people to recognize that AI is part of our present and is used in many of our workflow solutions. Still, my advice is 'trust but verify.' You can use AI as a clinical decision support tool—not to replace your underlying judgement but to assist it. In fact, clinical decision-making is paramount. I think it's important to recognize that AI is just part of the greater arc of overall advancement in ultrasound technology that we can use to improve workflow, shorten time for echocardiograms, and really get more information in less time.*

How do you see AI evolving in the future?

Dr. Strom: *I think AI is increasingly going to play a central role, particularly in imaging. The reason is that images themselves are really high-resolution data arrays containing pixel and location information. When you take sound, a video, or pictures and feed them into some of these future machine learning models, you're really able to get a much better prediction of patients likely to do well, patients likely not to do well, and patients likely to have a certain diagnosis.*

As we get more skilled and develop more data sets, AI algorithms are going to get better. I think ultimately, we will see great improvement in workflow, the ability to read studies quickly, and make reliable diagnoses.

GE HealthCare is a proud partner of BIDMC. What surprises you most about the Vivid products and services?

Dr. Strom: *One thing that surprises me is the degree of integration into the field—the personal touch. It's been really tremendous, and I think it's fairly unusual for large companies. For GE HealthCare, I think it's very personal for the people involved, the people making decisions, and the people you get to know. They really helped create the cutting edge technologies we use with our patients. I would want my study done with those kinds of technologies. I think it's great that we can provide the same kind of quality and standard of care to our patients, too.* ■

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Dr. Jordan Strom is an Assistant Professor of Medicine at Harvard Medical School, Director of the Echocardiography Laboratory, and Director of Echocardiographic Research at Beth Israel Deaconess Medical Center in Boston, Massachusetts. Dr. Strom is also a Section Head for Cardiovascular Imaging Research at the Richard A. and Susan F. Smith Center for Outcomes Research in Cardiology. His research involves evaluation of the relationship of cardiac structure and function to health outcomes and the optimal use and timing of cardiac imaging in practice. Dr. Strom has published more than 90 papers and is a member of the Editorial Board of the Journal of the American Society of Echocardiography (ASE).

1 The Role of AI in Streamlining Echocardiography Quantification White Paper, Kristin McLeod and Jurica Sprem – JB20789XX.

Doctors are paid consultants for GE HealthCare and were compensated for participation in this article. The statements described here are based on their own opinions and on results that were achieved in their unique setting. Since there is no "typical" hospital and many variables exist, i.e. hospital size, case mix, etc., there can be no guarantee that other customers will achieve the same results.

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