

CARDIAC IMAGING

Cardiac MRI on the Leading Edge



The American Heart Association estimates that nearly one million US residents die of heart disease annually, and according to the US Centers for Disease Control and Prevention it is the leading cause of death for both men and women. As a result, finding ways to detect heart disease earlier and more accurately are becoming increasingly important. Toshiba's advancements in MRI are helping physicians quantify heart disease, thus improving diagnosis and treatment.

MRI has long been used to assess the structure and morphology of the heart, but as the technology advances, so do the procedures available to clinicians for quick and accurate diagnosis of heart disease in their patients. "The bread-and-butter sequence is called SSFP [steady-state free precession] cine imaging," Erin Kelly, clinical science manager for MRI at Toshiba America Medical Systems, explains. "It gives an image of the heart as it moves through the cardiac cycle to tell the clinicians how the muscles are functioning, and they can use these images to calculate ejection fraction and left-ventricular volume."

The ability to perform SSFP cine imaging is one of many cardiac-friendly features included in Toshi-

ba's Vantage™ Titan MRI, a 1.5T system that also includes a 16-element cardiac coil that can be combined with the 32-element spine coil. The center elements are smaller, resulting in higher-resolution imaging of the heart, and "the elements in the coils can be turned on and off to optimize the signal-to-noise ratio," Kelly notes. Various sequences and parameters are selectable from the scanner to facilitate successful evaluation of the heart, including delayed-enhancement, myocardial imaging, retrospective gating, black-blood imaging, and real-time motion correction to name a few. Non-contrast techniques are also available on all Toshiba MR systems. For example, Whole Heart Imaging is one contrast-free sequence that allows physicians to assess the coronary arteries without contrast.

Timothy Albert, MD, is medical director of the Cardiovascular Diagnostic Center at Salinas Valley Memorial Healthcare System, Salinas, California, and he uses the Vantage Atlas system. He says, "We try to use noncontrast imaging as much as possible, both for patient convenience and safety and because of concerns about patients with kidney problems. For scar imaging, you still need contrast, but the other stuff, we can often do without it."

Albert says that MRI has an important place in the portfolio of modalities used to detect and plan treatment for heart disease. "I use CT for coronary imaging, but that's a small part of the cardiac question," he says. "MRI's strengths are really in functional imaging—the shape of the heart and how it's beating. There's an increasing amount of scientific data coming out about new uses for MRI in cardiac care." Albert and his team even run a two-day training course designed to help educate referring physicians on the robust applications of cardiac MRI.

"MRI is ideal for assessment of the heart-failure patient, looking at the potential causes to guide treatments and diagnostic tests, and we use it to determine whether someone would benefit from being revascularized after a heart attack," Albert

says. “For patients with congenital abnormalities, it’s the gold standard, since CT radiation could be cumulative over time. In the future, we hope physicians will hear about these new uses for MRI and recommend it more frequently.”

3D Wall-motion Tracking Offers Quantitative Data

Echocardiography is a valuable tool in the diagnosis of coronary artery disease, but evaluation of myocardial function using 2D echocardiography relies primarily on visual detection of wall-motion abnormalities. In 2009, Toshiba America Medical Systems introduced a 3D Wall Motion Tracking (WMT) tool for its Aplio™ Artida ultrasound system, which helps clinicians quantify the function of the left ventricle in 3D—including left-ventricular ejection fraction, volume and strain information.



“3D Wall Motion Tracking allows sonographers and physicians to quickly and accurately identify wall motion defects and the timing of cardiac events,” Berkeley Cameron, cardiac marketing manager for Toshiba, explains. “This greatly improves the detection of wall motion abnormalities in many cardiac disease states and Cardiac Resynchronization Therapy (CRT), and helps physicians optimize pace maker settings.”

In addition, the tool can be useful in diagnosing heart disease in women. Although stress studies have been shown to detect heart disease fairly accurately in men, women sometimes experience an increased risk of false-positive results. “Usually, for women, physicians want to do stress echocardiog-

raphy instead of a treadmill study,” Cameron says. “That’s one area where Wall Motion Tracking is particularly useful for women. Having quantitative data helps make the diagnosis more accurate.”

The response from clinicians using the tool has been enthusiastic, Cameron says. “We’ve gotten quite a bit of positive feedback,” she notes. “The clinicians using WMT feel it’s going to help them diagnose coronary-artery disease. Anything they can do to diagnose disease earlier and to be more accurate—to make echocardiography less subjective—is a big benefit.”

Cardiac-ready Vascular Labs Optimize Room Utilization

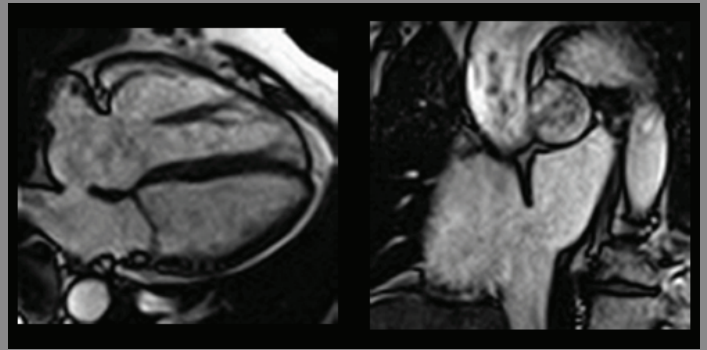
As procedure mixes continue to shift in facilities nationwide, it’s increasingly important for capital investments in imaging technology to offer versatility, according to Allen Berthe, X-ray senior product manager for Toshiba America Medical Systems. That’s why the company’s vascular labs come automatically equipped with features for cardiovascular procedures.

“One of our philosophies is that customers’ needs are changing and it is very likely a system will be required to perform cardiac and vascular procedures, so we’ve tried to gear our systems to maximize room utilization,” Berthe says. “A hospital today may know exactly what it wants, but five years from now, its staffing may change, its requirements may change, and its clinicians may like to do different types of procedures—so we created a system that would give them flexibility.”

Features that are part of the company’s vascular labs include digital subtraction angiography provided, standard, irrespective of system type or panel size, and a stepping feature that allows more efficient and accurate lower-body exams. A third feature is what Berthe calls a “true multitasking digital processor,” which, he explains, “means that if a physician comes in and wants to look at the images taken yesterday on a particular patient, he or she can do that without affecting the procedure currently in progress.” This parallel-processing capability is also included, standard, in Toshiba’s vascular labs.



Clinical Case of the Month: Atrial Septal Defect (ASD)



Berthe notes that all labs are 3D ready; if a facility chooses to upgrade to 3D, the base system is configured to accept it, “so if your practice changes in three years, you can add it.” Labs are also optimized for fingertip-to-fingertip, head-to-toe patient access and coverage. “Our systems are designed to give you unprecedented patient access,” Berthe says. “Sometimes, cases require on-the-fly changes, and our systems can adapt to that. If there’s a lot of additional equipment around, then having an easy-to-position C-arm is really helpful.” He adds that all Toshiba systems are configured using the same base platform, the same features, the same user interface, and the same consoles. “If you’re buying multiple systems from us, you can go from room to room with high confidence because everything’s going to perform virtually the same way,” he says.

Berthe emphasizes the importance of versatile, flexible purchases in an environment of fluctuating reimbursement and potential health care reform. “We’re just making sure we give you a room that can address your clinical needs,” he says. “If you don’t have a cardiovascular program and choose to start one, you can do that. You have a system that’s ready to do it.”

ASD is a congenital heart defect that is ideally suited for evaluation using cardiac MRI. Cardiac MRI allows accurate assessment of heart structure, function, and blood flow. In addition, cardiac MRI is an ideal method of evaluation because it does not use radiation and is non-invasive.

Cardiac Magnetic Resonance imaging can be challenging due to the constant motion of a beating heart and respiration. To successfully image the heart using MR it is essential to acquire images rapidly with optimal resolution and contrast.

Toshiba uses a 16 element Atlas SPEEDER body array coil coupled with the 32 element Atlas SPEEDER spine array coil to produce the signal required for successful evaluation of the heart. Vantage MRI systems have a complete cardiac software package available which includes specialized sequences for speed and image quality as well as the post processing software for cardiac analysis.

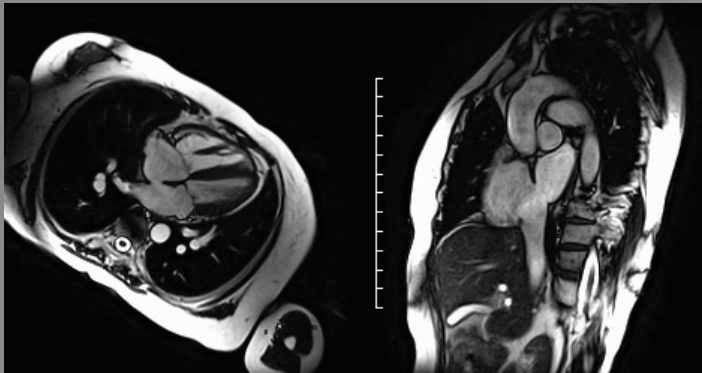
Case Study: MRI of the heart to evaluate cause for shortness of breath and heart murmur.

Technology: Toshiba Vantage Atlas MRI system using body array and spine array coils. The heart is imaged using SSFP cine sequences in varying planes.

2D cine sequences clearly depict the atrial septal defect allowing blood to flow between the right and left atrium. High blood-flow between the atria leads to volume overload and can lead to right heart failure. In this patient the right ventricle is enlarged consistent with a large ASD. This contributes to the patient’s shortness of breath and can progress to

heart failure if not treated.

By using Toshiba's cardiac MR system and specialized sequences no contrast or radiation was necessary in making this diagnosis.



Four-chamber (left) and short axis (right) cine views of the heart demonstrating atrial septal defect (ASD). (Cines and images courtesy of Dr. T. Albert, MD, FACC, Cardiovascular Diagnostic Center, Monterey, CA.)

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