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Thanks to Ingenia, cardiac MRI has become more robust and more efficient at St. Luke’s Episcopal Hospital (SLEH, Houston, Texas, USA). Ingenia 3.0T with MultiTransmit 4D provides excellent cardiac image quality and shortens total examination time in 3.0T cardiac MR.

“We perform a broad range of CMR examinations at St. Luke’s, including evaluation of adult congenital heart disease, evaluation of ischemic cardiomyopathy, and a wide array of tissue characterization experiments,” says Raja Muthupillai, PhD, Director of Imaging Research in the SLEH Department of Diagnostic Radiology.

SLEH has been one of the first Ingenia 3.0T users in the USA. Since cardiac patients are often larger, Dr. Muthupillai appreciates Ingenia’s wide, 70 cm bore. “We have scanned patients with a BMI greater than 50, who were difficult to image in a smaller bore.”

MultiTransmit provides a more homogeneous B1 field

“Ingenia’s MultiTransmit 4D is essential for body and cardiac applications at 3.0T,” says Dr. Muthupillai. “Studies have shown that, with a patient in the bore, the transmit B1 field can be very inhomogeneous, even across a small region such as the heart. In our experience, the MultiTransmit capability with independent control of the RF amplitude and phase can minimize the RF inhomogeneity across the heart by as much as 40%, which helps image interpretation tremendously. This high image uniformity is also critical for any attempt at quantitative imaging at 3.0T.”

“With Ingenia, we just lay the patient down, put the Anterior coil on, plug it into the table, and go.”
“With MultiTransmit technology, we can now achieve optimal imaging in real time of the beating heart.”

Distal septum thinning
A 48-year-old with diabetes and documented left descending artery disease was imaged on Ingenia 3.0T with dS Torso coil solution. The phase sensitive inversion recovery image in the 4-chamber orientation demonstrates thinning of the distal septum.

Benjamin Y. Cheong, MD, Director of Clinical CMVRI at SLEH, reports, “With MultiTransmit 4D technology, we can now achieve excellent imaging in real time of the beating heart, without the dielectric shading that conventional 3.0T systems suffer from. MultiTransmit particularly improves Balanced FFE (steady state free precession) imaging, which is the workhorse of cine imaging. With Ingenia 3.0T we can now achieve high quality cine cardiac MR.”

dStream provides higher SNR and fast patient preparation
Ingenia uses Philips’ revolutionary dStream technology to digitize the signal directly at the patient. “Because of this immediate digitization in the coil and further signal transmission through fiber optics, much less noise is added. The SNR increases and we get improved image quality,” explains Dr. Cheong.

“Myocardial tagging
Myocardial tagging in the short-axis orientation during mid-systole, performed using the Ingenia 3.0T with dS Torso coil solution. Note the persistence of tag contrast throughout the cardiac cycle due to prolongation of T1 at 3.0T.

“The dStream coils clearly reduce patient preparation time, as the Posterior coil is integrated in the MR tabletop and the system automatically selects the coil elements that provide highest SNR. In addition, the FlexCoverage Anterior coil is very flexible and lightweight,” reports Dr. Cheong. “The traditional cardiac coil was less comfortable for patients, especially those who have had surgery. Now, we just lay the patient down, put the Anterior coil on, plug it into the table, and go.”
A previously well, 48-year-old female with palpitation presents for an MR exam as surface echocardiography demonstrated a left atrial mass. Using Ingenia 3.0T with dS Torso coil solution, a well circumscribed 1.3 cm mass is seen in the posterior aspect of the left atrium (left), in close proximity to the right lower lobe pulmonary vein. No obvious stalk is seen. It has high signal intensity in T2-weighted spin echo images (right). The provisional image diagnosis of either an atypical left atrial myxoma or a left atrial hemangioma was suggested. The patient underwent surgical excision 1 week later and the pathology confirmed the diagnosis of left atrial myxoma.

**Left atrial myxoma**

dStream technology also provides the ability to automatically select only those elements that contribute to signal from the anatomy of interest. This relieves the operator from having to decide what coil elements to select to achieve the optimal SNR.

“The advances in coil handling have significantly reduced the room preparation time between patients, and have streamlined the workflow,” says MR technologist, Claudio Arena.

**Protocols optimized for Cardiac MRI**

Dr. Cheong explains how Ingenia’s high SNR improves specific cardiac exams. “We can tailor our scan sequences to either make the exam quicker or make the spatial resolution better. When a physician needs to see how much damage exists in the heart, we can improve our spatial resolution. However, in cine images where we look at heart function, we don’t have to crank up the resolution any more, so we can invest the SNR to decrease the imaging time, and reduce the number of breath-holds a patient has to perform in a single imaging session.”

“Ingenia delivers ease of use for the technologist, better images for the doctors and comfort for the patient,” Dr. Cheong says. “Its high image quality has improved our confidence and this can translate into providing more useful information to our referring physicians, so ultimately this also helps patients.”
74-channel coil designed for imaging large areas with high coil density
St. Luke’s is using a research coil with 74 independent coil elements on its Ingenia 3.0T system. This 74-element coil is designed to cover the entire anatomy, from the heart all the way through the head with sufficient coil element density. This coil is being researched for imaging both a large area as well as a specific region within the field of view at very high spatial resolution. In conventional MRI two different coils would be needed for this, often requiring repositioning of the patient.

Dr. Muthupillai explains, “We could connect this 74-channel coil on Ingenia without modifying the RF platform. Our preliminary tests with this coil showed that it can cover a large FOV as well as zoom in and image a small area with very high resolution.”
Dr. Amol Pednekar, a Philips clinical scientist working with the St. Luke’s team, presented the results from this preliminary experience at the ISMRM 2011.

“High image quality, as provided by Ingenia 3.0T, improves our confidence and this can translate into providing more useful information to our referring physicians, so ultimately this also helps patients.”

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