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The democratization of cardiac MR

Cardiac MR (CMR) is recognized as one of the most comprehensive non-invasive imaging modalities available for assessing heart structure and function. However, for patients with advanced cardiovascular disease—where CMR information is most crucial—scan duration and tolerability often pose significant challenges. Many patients struggle to hold their breath during imaging or have medical conditions that limit their time in the MR bore.

Clínica MEDS La Dehesa, located in Lo Barnechea, Chile, is in the process of establishing a high-quality CMR program. This initiative is supported by the unwavering commitment of the Chief of Cardiology and is further strengthened by the ongoing collaboration between MEDS administration and the local GE HealthCare team.

MEDS boasts a unique integrated team comprised of Julián Vega Aduay, MD, a cardiologist, and Juan Jesús Urbina Romero, MD, a radiologist, both of whom hold Level III CMR accreditation. Together, they utilize the latest advancements in imaging technology to enhance patient care. Their collaboration represents the country's only integrated cardiology and radiology team capable of performing all CMR techniques.

“We prefer Sonic DL™ Cine because it allows us to acquire high-quality sequences in a shorter time,” says Dr. Vega. “This capability has enabled us to scan patients who previously could not undergo CMR studies due to inadequate breath-hold ability, effectively opening new avenues for diagnosing and managing cardiac conditions.”

The Sonic DL Cine advantage

Sonic DL Cine is a deep-learning (DL)-based acceleration technique designed to significantly reduce scan times without compromising diagnostic quality. By capturing rapidly moving anatomies, such as the heart, it can achieve scan times that are up to 83% shorter compared to traditional fully sampled Cine acquisitions.

Dr. Urbina notes, “With other MR systems, we typically scan one cardiac patient per hour. At Clínica MEDS, with Sonic DL Cine, we can often accommodate two patients in the same timeframe.” They conduct about five CMR exams weekly, out of 15 to 20 performed weekly across multiple sites.



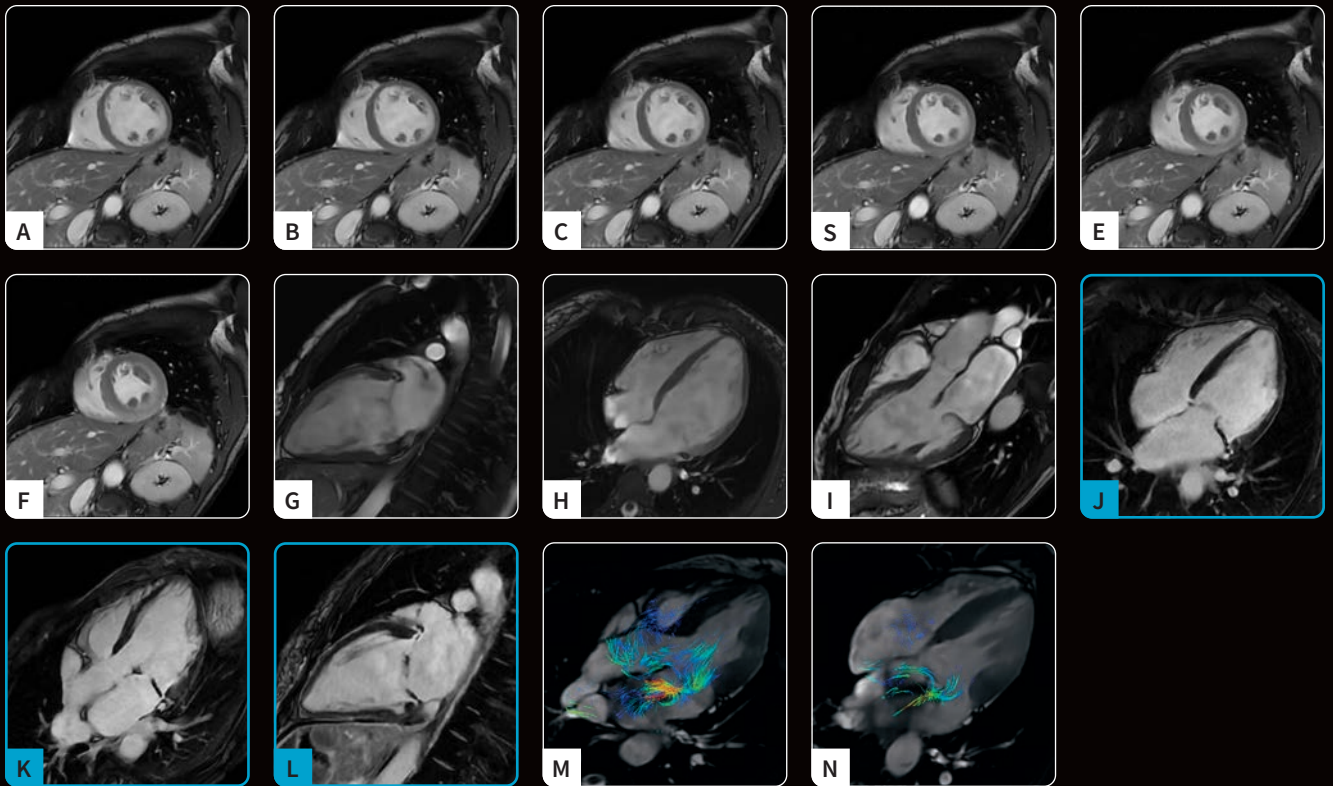


Figure 1. Patient with mitral valve disease. (A-F) Left ventricular (LV) coverage with short axis Sonic DL Cine post-contrast, 8 R-R, temporal resolution 30 ms, 1.8 x 1.2 x 8 mm, 2:17 min. (G) 2 chamber Sonic DL Cine post-contrast, 8 R-R, 1.8 x 1.2 x 6 mm, 11 sec., 1 slice, temporal resolution 22 ms. (H) 4 chamber Sonic DL Cine post-contrast, 8 R-R, 1.8 x 1.2 x 6 mm, 11 sec., 1 slice, temporal resolution 23 ms. (I) 3 chamber Sonic DL Cine, 8 R-R, 1.8 x 1.2 x 6 mm, 11 sec., 1 slice, temporal resolution 33 ms. (J-L) 2D MDE with AIR Recon DL, 1.8 x 1.8 x 8 mm, 20 sec. each acquisition, 3 slices, (J) 4 chamber (K) 3 chamber and (L) 2 chamber. (M, N) Fused Sonic DL Cine and 4D Flow, (M) 3 chamber and (N) 4 chamber.

From an economic perspective, Dr. Vega highlights the efficiency gains for hospital imaging resources. The success of DL-based reconstruction techniques in other MR exams, such as neuro and musculoskeletal imaging, is now mirrored in CMR, enabling exams of 30 minutes or less.

“Sonic DL Cine represents a significant benefit for everyone involved—physicians, patients and the hospital,” Dr. Vega says.

Expanding access to cardiac imaging

At Clínica MEDS La Dehesa, CMR is performed in a diverse patient population, ranging from young, ambulatory patients with good breath-hold capabilities to elderly, frail patients with severe cardiac issues.

“Obtaining high-quality images in the latter group is particularly challenging, necessitating a balance between quality and exam duration. In some cases, CMR has been avoided altogether due to pulmonary conditions that limit breath-hold capacity,” Dr. Vega explains. “Sonic DL Cine allows us

to substantially decrease both breath-hold duration and scan time by 50% without sacrificing quality, thus granting access to high-quality cardiac imaging for previously underserved patients.”

For elderly, infant, arrhythmic or claustrophobic patients, Sonic DL Cine provides diagnostic-quality results with breath-holds of only 3 to 4 seconds.

Dr. Vega recalls a patient with genetically confirmed right ventricular arrhythmogenic cardiomyopathy who had normal right ventricular size and function. The Sonic DL Cine technology provided high-quality imaging with a slice thickness of 4 mm and voxel sizes of 1.4 mm, delivering enough detail to enable an early diagnosis based solely on wall motion abnormalities.

Imaging with MR-Conditional devices

Dr. Vega notes that Clínica MEDS La Dehesa is among the few centers in Chile that successfully scans patients with MR-Conditional cardiac devices,

including implantable cardioverter defibrillators (ICDs) and mechanical heart valves. They estimate that 10% to 20% of their CMR patients have such implants, most commonly dual-chamber pacemakers and various valve replacements.

GE HealthCare’s myocardial delayed enhancement (MDE) sequences utilize a wideband inversion pulse to enhance image quality and homogeneity, addressing inversion inaccuracies caused by MR-Conditional devices. Drs. Vega and Urbina frequently receive referrals from electrophysiologists for reliable scar characterization in patients with ICDs and recurrent arrhythmias.

“Without the wideband MDE sequence, we would often struggle to mitigate the susceptibility artifacts caused by MR-Conditional implants, which can obscure the myocardium,” Dr. Urbina notes. “The wideband MDE sequence has dramatically improved the reliability of CMR in these patients.”

Innovations in imaging techniques

The team also relies on free-breathing SnapShot MDE sequences with respiratory compensation. Dr. Vega emphasizes the comfort and efficiency of free-breathing MDE, which eliminates the need for multiple breath-holds and thus saves significant time during exams.

For example, a patient with chronic obstructive pulmonary disease (COPD), who could only manage breath-holds of 4 seconds or less, successfully underwent CMR imaging using Sonic DL Cine for Cine acquisition and free-breathing late enhanced imaging with SnapShot MDE.

At Clínica MEDS La Dehesa, Sonic DL is transforming cardiac imaging, enabling high-quality thin-slice imaging that is beneficial across a broad range of CMR applications. Dr. Urbina explains, “This technique enhances spatial resolution without sacrificing temporal resolution, pushing the boundaries of what CMR can achieve. It reveals intricate details of cardiac pathologies, potentially reshaping our understanding of these conditions.”

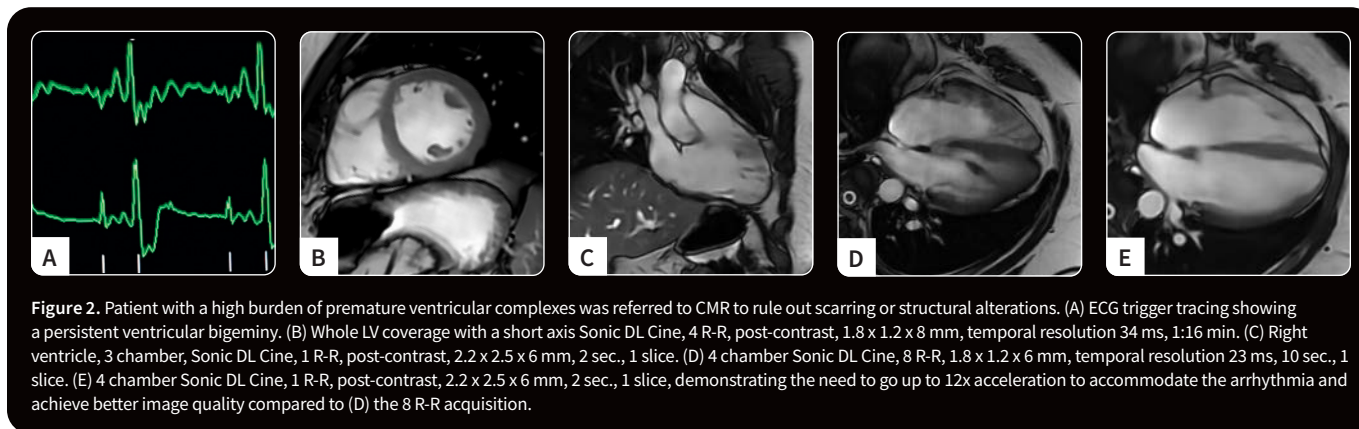


Figure 2. Patient with a high burden of premature ventricular complexes was referred to CMR to rule out scarring or structural alterations. (A) ECG trigger tracing showing a persistent ventricular bigeminy. (B) Whole LV coverage with a short axis Sonic DL Cine, 4 R-R, post-contrast, 1.8 x 1.2 x 8 mm, temporal resolution 34 ms, 1:16 min. (C) Right ventricle, 3 chamber, Sonic DL Cine, 1 R-R, post-contrast, 2.2 x 2.5 x 6 mm, 2 sec., 1 slice. (D) 4 chamber Sonic DL Cine, 8 R-R, 1.8 x 1.2 x 6 mm, temporal resolution 23 ms, 10 sec., 1 slice. (E) 4 chamber Sonic DL Cine, 1 R-R, post-contrast, 2.2 x 2.5 x 6 mm, 2 sec., 1 slice, demonstrating the need to go up to 12x acceleration to accommodate the arrhythmia and achieve better image quality compared to (D) the 8 R-R acquisition.

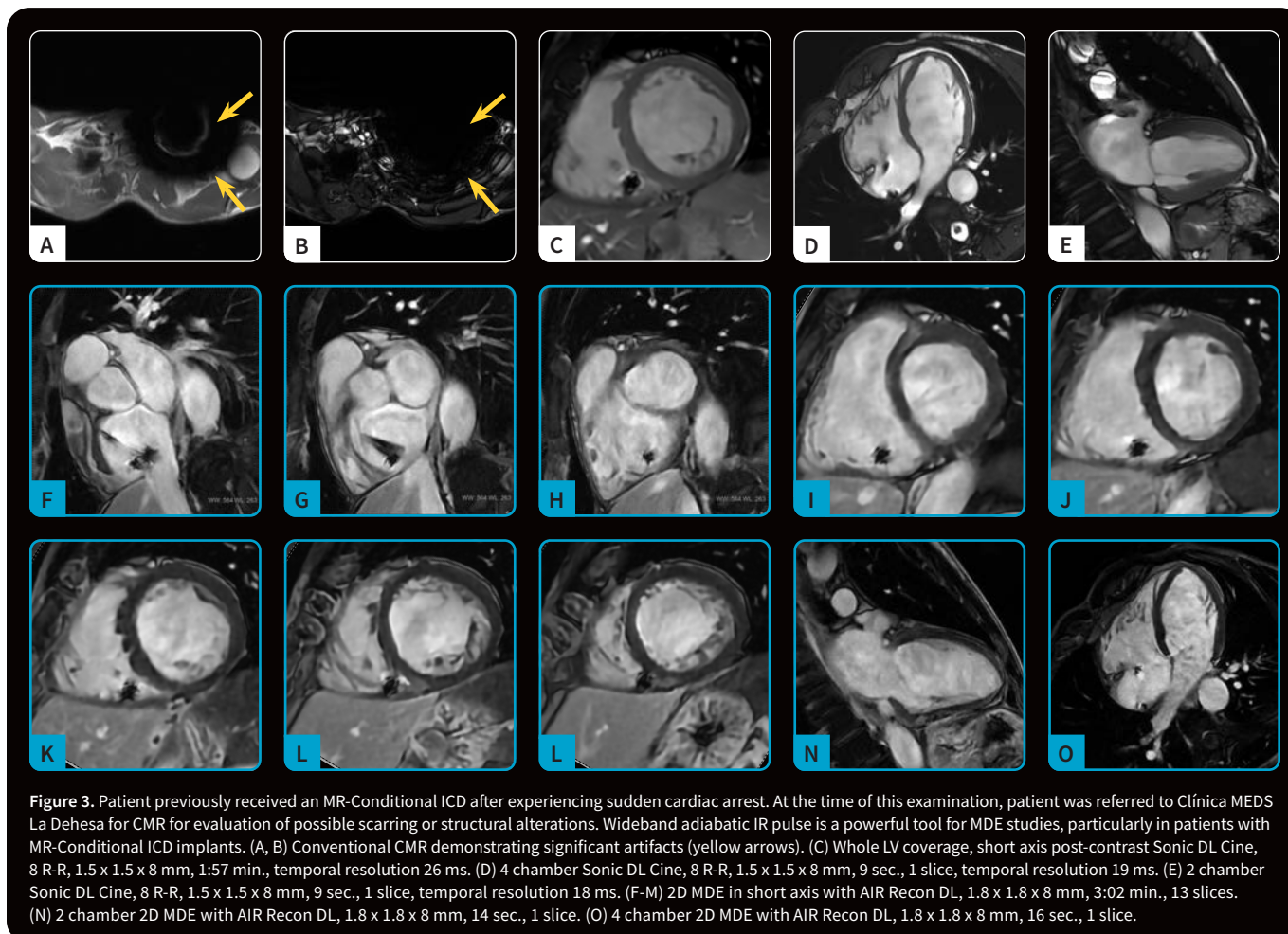


Figure 3. Patient previously received an MR-Conditional ICD after experiencing sudden cardiac arrest. At the time of this examination, patient was referred to Clínica MEDS La Dehesa for CMR for evaluation of possible scarring or structural alterations. Wideband adiabatic IR pulse is a powerful tool for MDE studies, particularly in patients with MR-Conditional ICD implants. (A, B) Conventional CMR demonstrating significant artifacts (yellow arrows). (C) Whole LV coverage, short axis post-contrast Sonic DL Cine, 8 R-R, 1.5 x 1.5 x 8 mm, 1:57 min., temporal resolution 26 ms. (D) 4 chamber Sonic DL Cine, 8 R-R, 1.5 x 1.5 x 8 mm, 9 sec., 1 slice, temporal resolution 19 ms. (E) 2 chamber Sonic DL Cine, 8 R-R, 1.5 x 1.5 x 8 mm, 9 sec., 1 slice, temporal resolution 18 ms. (F-M) 2D MDE in short axis with AIR Recon DL, 1.8 x 1.8 x 8 mm, 3:02 min., 13 slices. (N) 2 chamber 2D MDE with AIR Recon DL, 1.8 x 1.8 x 8 mm, 14 sec., 1 slice. (O) 4 chamber 2D MDE with AIR Recon DL, 1.8 x 1.8 x 8 mm, 16 sec., 1 slice.

Conclusion

Utilizing Sonic DL Cine, the team has successfully scanned a comprehensive CMR cardiomyopathy protocol—including Cine, maps, perfusion, early gadolinium enhancement (EGE) and MDE in just 33 minutes. The incorporation of AIR Recon DL further optimizes imaging speed and quality.

Dr. Vega concludes, “Widespread adoption of Sonic DL can potentially transform CMR’s role within healthcare institutions. By significantly reducing exam times and enhancing image quality, we can democratize CMR access, lowering economic and patient barriers. In challenging scenarios, we can now provide diagnostic-quality exams that were previously unattainable.” **S**

