Cardiac MR workflows for early detection of heart failure

It's not just managing heart failure.
It's early detection before symptoms occur.

Challenge

Prevalence of heart failure is increasing, but it's not always easy to diagnose at-risk patients to start managing them early enough to avoid some of the most serious outcomes.

Solution

Strengthen clinical confidence for early detection of heart failure with an integrated solution that brings together patient data, smart diagnostic systems, advanced visualization and superb workflows. Philips IntelliSpace Cardiovascular offers a complete view of the patient's cardiac history, with multi-modality image and information management for easy, effective collaboration. Philips MR is allowing for shorter, time-saving sequences. Philips IntelliSpace Portal provides advanced visualization with workflow innovations such as automatic contour for LV and RV and strain quantification.

Results

An integrated solution of fast CMR, advanced visualization and analysis tools, and image and information management can help improve cardiovascular workflows and speed high-quality exams for the early management of heart failure. These tools allow for appropriate decisions to be made at the point of care, based on a full understanding of where the patient is on their care journey.

The global prevalence of heart failure is increasing.[1] To enhance clinical outcomes, there is a need to detect cardiac dysfunction before the appearance of symptoms. An integrated solution of imaging and informatics that includes a comprehensive view of a patient's cardiovascular history is essential to fast detection and diagnosis, and to determine if imaging is necessary. When imaging is called for, cardiac MR (CMR) can directly measure the early and subtle changes in heart function that may eventually lead to heart failure. Detecting heart dysfunction early so that it can be appropriately managed relies on improved cardiac workflows, including access to the full patient cardiac history with relevant images and information, MR exam acquisition with speed and comfort, and advanced visualization to quickly and efficiently quantify relevant parameters.

"You can only improve what you can measure. A cardiac timeline means that cardiac imaging studies are accessible to the multidisciplinary team."*

– Dr. Jorge Solis
Hospital Universitario 12 de Octubre, Madrid, Spain

Heart failure prevalence increasing

Heart failure is responsible for a significant number of deaths and hospitalizations every year, and its prevalence is predicted to increase globally, with 46% increased prevalence by 2030 in the US alone.[1] The need for earlier diagnosis of patients at risk for heart failure is clear. Having a comprehensive cardiac history of the patient can aid clinicians in identifying a potential cardiac issue early for effective management.

Identifying patients at risk for heart failure needs to become less complex

Assessing patients using their histories is key to identifying risk for heart failure. When imaging is necessary, optimized workflows can help. Despite the advantages that CMR offers in terms of image clarity and contrast (and lack of radiation), the complexity of protocols and long scan times have hindered its adoption in routine clinical use for the early diagnosis and management of heart failure. Now, bringing together fast CMR, advanced visualization and comprehensive informatics makes it more practical for clinicians to identify and manage asymptomatic patients at risk for heart failure.

CMR is the gold standard

CMR is acknowledged as the gold standard for measurement of volumes, mass and ejection fraction (EF) of both the left and right ventricles.[2] It provides an effective alternative cardiac imaging modality for patients with non-diagnostic echocardiographic studies (particularly for imaging of the right heart) and is the method of choice in patients with complex congenital heart diseases.[2] Recent research suggests that measuring early and subtle changes in heart function can help identify patients at risk, which allows for the development of an effective management program for heart failure.[3]

Recommendations for cardiac imaging in patients with suspected or established heart failure

Recommendations	Class	Level
CMR is recommended for the assesment of myocardial structure and function (including right heart) in subjects with poor acoustic window and patients with complex congenital heart diseases (taking account of cautions/contraindications to CMR).	I	C
CMR with LGE should be considered in patients with dilated cardiomyopathy in order to distinguish between ischaemic and non-ischaemic myocardial damage in case of equivocal clinical and other imaging data (taking account of cautions/contraindications to CMR).	IIa	C
CMR is recommended for the characterization of myocardial tissue in case of suspected myocarditis, amyloidosis, sarcoidosis, Chagas disease, Fabry disease non-compaction cardiomyopathy and haemochromatosis (taking account of cautions/contraindications to CMR).	I	C

Adapted from Ponikowski P, Voors A, St Anker S, et al, ESC Scientific Document Group. 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure: the task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC).

Early detection of heart failure

Combining data, smart imaging and advanced visualization is helping in the early detection of heart failure. Due to its image clarity, speed and detail, indications and recommendation for the use of CMR are increasing for diagnosis and monitoring of heart failure patients at earlier stages. Simplified workflow for these studies helps make them more accessible and can expand access to this high-quality diagnostic support.

Clinical implications of early diagnosis

There is a need to detect cardiac dysfunction before the appearance of symptoms. Directly measuring early and subtle changes in heart function that may eventually lead to heart failure helps physicians manage heart dysfunction early.

A type of CMR known as "fast-strain encoded magnetic resonance" (Fast-SENC**) acquisition sequence and the MyoStrain analysis tool by Myocardial Solutions allow for shorter sequences for fast identification of patients who to date have exhibited no symptoms but who were shown to have subclinical left ventricle (LV) dysfunction compared with LV ejection fraction. Fast-SENC** and MyoStrain also allow for risk stratification of patients with asymptomatic heart failure. Identifying these types of patients may have important clinical implications.[3]

Dr. Henning Steen, Head of Cardiac Imaging at medneo in Germany, has been conducting research comparing the ability of Fast-SENC** and CMR vs standard clinical and CMR data to classify and stratify patients with different stages of chronic heart failure (stages of heart failure A to D, based on the American College of Cardiology/American Heart Association guidelines). The study included 1,169 consecutive patients who underwent CMR for clinical reasons and 61 healthy volunteers. The researchers found the percentage of normal myocardium to be an independent predictor of heart failure stages, exhibiting an even closer association that did LV fraction.[3] In the study, 149/399 (37%) of patients who had been classified as stage A were reclassified to stage B (subclinical dysfunction based on normal myocardium <80%). Those patients exhibited significantly higher rates of all-cause mortality and hospital stay due to heart failure during follow-up, compared with patients with normal myocardium >80%.[3]

> ## "Now we have a metric to locate where the patient is on the road to heart failure."
>
> – Dr. Henning Steen
> medneo, Germany

Clinical relevance of identifying subclinical disease

Does the identification of asymptomatic patients have clinical relevance? Dr. Steen says, "We have a new measure to identify and quantify subclinical probable chance of heart failure. We guessed that there were a huge number of normal asymptomatic patients that really had subclinical disease. When we went into our database we could see that these patients who were asymptomatic but who had segmental dysfunction already had worse outcomes. Some had died, some had an infarction, and some had heart failure. That's why we created the heart failure curve. Now we have a metric to locate where the patient is on this road to heart failure."

The value of positioning MR earlier on the patient care pathway when needed

"I wish MR would become more prominent and available to the patients who really need it. You can do it early, it's highly reproducible, it's without X-ray, and it gives you lots of information. Think of MR not as the last imaging modality, to use in very rare cases. The paradigm shift is to get people to use MR, with an exam of 15 or 20 minutes, depending on what kind of questions you have. You'll get very good, very reliable insights on pathophysiology. MR has changed so dramatically in the last couple of years, and will change in the next five to ten years with AI," says Dr. Steen.

Detect early dysfunction across 48 heart segments in 10 minutes[4]

Imaging workflows are key

Fast image acquisition is one thing, but workflow after acquisition is equally important. Advanced visualization and reporting through IntelliSpace Portal offers workflow improvements such as AI-based LV and RV automatic contouring of CMR studies, supporting the common ejection fraction and other related functional parameters, with functional analysis completed in less than five minutes. Having all data available in a timeline view of a patient's prior history of imaging and information through IntelliSpace Cardiovascular provides a more complete picture of the patient's care journey, and allows for effective collaboration among clinicians.

Dr. Jorge Solis, Director of the Non-Invasive Cardiology area and the Valvulopathies Unit of the Hospital Universitario 12 de Octubre, Madrid, Spain, describes the importance of an information management solution with a cardiac timeline in treating cardiovascular disease. "You can only improve what you can measure. A cardiac timeline means that cardiac imaging studies are now accessible to the multidisciplinary team. Having the information in one place means we can visualize the images to easily collaborate."**

COVID-19 has created an imaging backlog

Adding to the complexity of an imaging backlog is an increased need to address the expected cardiac manifestations and sequelae of COVID-19, which has resulted in added strain for many imaging operations. Access to a complete patient cardiac history, fast scanning (when imaging is warranted), advanced visualization and fast reporting of results are crucial to meet the growing demand across diagnostic imaging. As the pandemic becomes more under control and patients once again feel safe in coming into facilities for imaging appointments, their numbers are likely to surge. It's increasingly important to have an integrated solution that helps patients on the care path receive the right care at the right time for optimal results.

Integrated solutions for Cardiac MR

Philips Fast-SENC and MyoStrain
Philips Fast-SENC** MR acquisition sequence and the MyoStrain analysis tool by Myocardial Solutions allow clinicians to quickly and directly measure early and subtle changes in heart function. Now early dysfunction of heart failure can be detected across 48 segments of the heart in 10 minutes.[4] "MR is a very powerful tool that has become very, very fast," says Dr. Steen.

Philips IntelliSpace Portal
IntelliSpace Portal offers consistent workflow across applications, with ease of use and rich results in a short amount of time. The MR Strain analysis application of IntelliSpace Portal, which is feature-tracking-based, quantifies strain parameters to determine the potential severity of LV dysfunction.
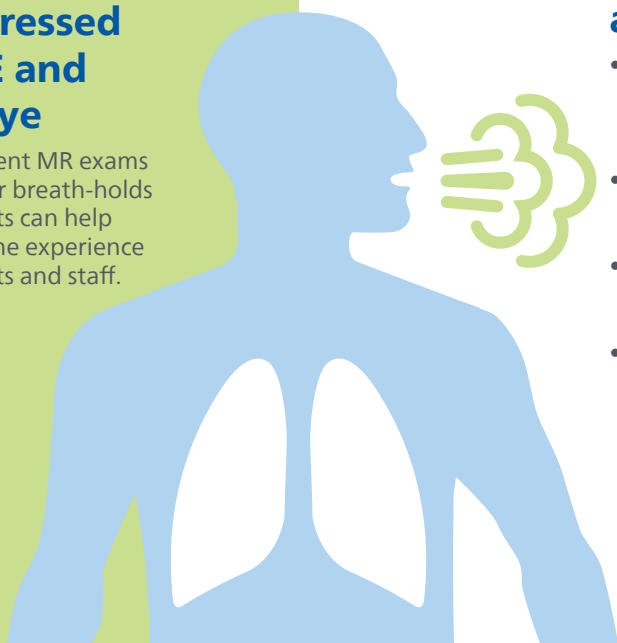
"When you use IntelliSpace Portal, you have one interface for everything and all tools in the same place. It's a one stop shop and integration with PACS makes it simple to use. The algorithms for post processing and functional analysis in clinical routine are excellent," says Dr. Bettina Baessler, Research Group Leader, Zurich, Switzerland.

Philips IntelliSpace Cardiovascular
Accessible anytime and virtually anywhere, IntelliSpace Cardiovascular is a scalable and interoperable multi-modality image and information management solution designed to help streamline the cardiovascular workflow and enhance operational efficiency of the entire cardiovascular service line across departments and the enterprise.*** A timeline view of imaging and information can empower clinicians to turn clinical findings into a decisive actionable plan and streamline efficiency with access to advanced clinical tools and integration with EMR/HIS systems from a single location.

Philips MR with Compressed SENSE and VitalEye

Fast, efficient MR exams with easier breath-holds for patients can help improve the experience for patients and staff.

Compressed SENSE breakthrough acceleration technique enables

- **Up to 40% acceleration in 2D cine,** resulting in a breath-hold down to 5 sec, with virtually equal image quality[†]

- **Up to 5 sec reduction in breath-hold time** in black blood imaging with virtually equal image quality[†]

- **Up to 30% breath-hold time reduction** with virtually equivalent image quality in cardiac imaging[†]

- **VitalEye smart sensing on Philips MR systems** Automated breath-hold commands are triggered within the natural breathing cycle of the patient.

Conclusion

An integrated solution that combines advances in cardiac imaging and informatics enhances decision-making, improves cardiovascular workflows and speed high-quality exams for the early diagnosis and management of heart failure. Smart imaging, advanced visualization and analysis tools, and comprehensive information management allow for appropriate decisions to be made at every point, based on a full understanding of where the patient is on the care journey. Early diagnosis of heart dysfunction can help clinicians manage heart failure effectively.

To learn more, visit www.philips.com/cardiology-workflow

* As mentioned during the Philips Live APAC webinar "Cardiac Imaging Units: The connecting link in the organization of Cardiovascular departments" in 2020.
** Fast-SENC is another term for SENC.
*** It is the user's responsibility to ensure that Philips network requirements (such as performance, VPN) for IntelliSpace Cardiovascular are met.
† Compared to examinations without Compressed SENSE.

1. Savarese F, Lund L. Global public health burden of heart failure. Card Fail Rev. 2017;3(1):7–11. DOI: 10.15420/cfr.2016:25:2.
2. Ponikowski P, Voors A, St Anker S, et al, ESC Scientific Document Group. 2016 ESC guidelines for the diagnosis and treatment of acute and chronic heart failure: the task force for the diagnosis and treatment of acute and chronic heart failure of the European Society of Cardiology (ESC). Developed with the special contribution of the Heart Failure Association (HFA) of the ESC. Eur Heart J. 2016;37(27):2129–2200. https://doi.org/10.1093/eurheartj/ehw128
3. Korosoglou G, Giusca S, Montenbruck M, et al. Fast strain-encoded cardiac magnetic resonance for diagnostic classification and risk stratification of heart failure patients [published online ahead of print, 2021 Jan 4]. JACC Cardiovasc Imaging. 2021;S1936-878X(20)31004-4. DOI:10.1016/j.jcmg.2020.10.024.
4. Korosoglou G, Giusca S, Hofmann NP, et al. Strain-encoded magnetic resonance: a method for the assessment of myocardial deformation. ESC Heart Fail. 2019;6(4):584-602. DOI:10.1002/ehf2.12442.

Results from case studies are not predictive of results in other cases.
Results in other cases may vary.

PHILIPS