Heart Failure

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Indications and Purpose of the Scan

Heart Failure (HF) is a syndrome that can be caused by heterogeneous aetiologies. We currently define three type of left-sided HF (preserved, reduced and mid-range ejection fraction) and right-sided HF.

CMR is therefore requested:

- For initial or subsequent evaluation of left/ right ventricular function (LVEF/ RVEF)
- To identify aetiology of HF and new onset of congestive cardiac failure:
  - Myocardial infarction (acute or chronic)
  - Infiltrative myocardial diseases (Sarcoidosis, Amyloidosis, Fabry’s disease, Hemochromatosis)
  - Inflammatory myocarditis (infectious or noninfectious such as Chagas disease, Viral myocarditis, bacterial endocarditis, systemic inflammatory reaction syndrome (SIRS), endomyocardial fibrosis, rheumatologic causes such as Lupus, rheumatoid arthritis or connective tissue disorders)
  - Valvular heart lesions/ severity (mitral regurgitation, aortic regurgitations, tricuspid or pulmonary valve lesions)
  - Genetic disorders such as muscular dystrophies, hypertrophic cardiomyopathy, arrhythmogenic RV and LV cardiomyopathy (ARVC/ALVC), inherited dilated cardiomyopathy, including left ventricular non-compaction (LVNC)
  - Hypertensive heart disease
  - Athletes heart
  - Diastolic dysfunction and diastolic congestive HF
  - Constrictive pericarditis
  - Toxic cardiomyopathy and Cardio-oncology diseases
  - Congenital heart disease
  - Takotsubo cardiomyopathy

Description

- Studies are typically performed according to standardized protocol. A typical HF protocol takes 40-45 minutes. All studies start with volume and function images, usually using steady-state free precession (SSFP) ECG gated cine imaging. Tissue characterization are the key sequences: late gadolinium enhancement images are most commonly done at the end of the scan. Additional sequences can be used, depending on suspected aetiology and referral request. Such as oedema images (T2 STIR), iron quantification (T2*), T1-weighted images, myocardial blood velocities/flow, early gadolinium images, tagging (diastolic dysfunction and pericardial constriction) stress images and, most recently, T1 and T2 mapping.

Why CMR (specific advantages)

- CMR is very useful in the aetiology work up and can highlight the cause of HF. It can also provide information on congestion, looking at extra-cardiac (liver, lungs), that can be missed with objective examination or with a chest X ray. It provides excellent quality images, with accurate definition of cardiac structure and function, without exposure to ionising radiation. Tissue characterization, which is unique to CMR, gives key information. The images are highly accurate and reproducible.
- Precise measurements and observations from CMR leads to accurate diagnosis, prognosis and treatment.

Evidence examples from the literature

  - The consensus document describes the technique to assess cardiovascular structure and function, the advantages of the study, the application of CMR in HF.

  o Both papers explain why CMR plays an established role in the assessment of patients with suspected and confirmed heart failure syndromes, in particular identifying aetiology. They highlight the role in informing prognosis and guiding therapy and the specific advantages over other non-invasive imaging modalities.

  o The paper explains diagnosis, prognosis and management of heart failure patients based on imaging parameters.

Contradictions

• Implanted devices that are not MRI compatible are currently considered absolute contraindication in most Centers.
• Intravascular clips or metallic prosthesis/object are not safe.
• Inability to lie flat is a common contraindication in severe decompensated HF patient (e.g. pulmonary oedema).
• Claustrophobia altered mental status prohibit the study.
• eGFR <30mL/min unless risk-benefit analysis suggests otherwise.
• Severe arrhythmias and inability to hold breath, affect quality images and represent relative contraindication to the study.

References


5. Cardiovascular Magnetic Resonance in Myocarditis: A JACC White Paper
