Myocarditis

Authors: Ashwin Venkateshvaran and Aideen Fallon

Myocarditis is an inflammatory disease of the myocardium, most commonly caused by viral infections, but it can also arise from autoimmune, toxic, or drug-related triggers. The clinical presentation varies widely, ranging from mild symptoms to acute heart failure, arrhythmias, or sudden cardiac death, particularly in younger individuals.

For the CMR Technologist or Allied Health Professional (AHP), recognizing the imaging features of myocarditis is essential, as cardiac MRI plays a pivotal role in non-invasive diagnosis. CMR allows for detailed assessment of ventricular function, myocardial oedema, and fibrosis, using a combination of cine imaging, T1 and T2 mapping, and late gadolinium enhancement (LGE). A thorough understanding of the protocol and diagnostic criteria enables technologists to optimize image quality and contribute meaningfully to the detection and management of this potentially life threatening condition.

1. Imaging Workflow

Sequence	Objective	Details
Cine SSFP	LV/RV morphology and function	Short-axis stack, 2-, 3-, 4-chamber views
T1 Mapping (optional)	Tissue characterization (fibrosis/inflammation)	Native T1 (± post-contrast T1 for ECV if gadolinium used)
T2 Mapping (optional)	Quantitative oedema assessment	Global or regional inflammation; more sensitive than T2w-STIR
T2-weighted STIR (T2w)	Edema imaging	Compare SI myocardium vs. skeletal muscle (SI ratio ≥ 2.0)

Late Gadolinium Enhancement (LGE)	Necrosis/fibrosis	Typical pattern is subepicardial or mid-wall; exclude infarct pattern
Pericardial Imaging	Effusion and pericardial inflammation	Check for pericardial effusion or enhancement

2. Reporting Essentials

- LV and RV dimensions: EDV, ESV, SV, EF (corrected for BSA)
- Note regional wall motion abnormalities
- Oedema: Presence, pattern, and location
- LGE: Presence, distribution (mid-wall or subepicardial typical), extent relative to LV mass
- Pericardium: Assess for effusion or pericardial enhancement

3. Key Diagnostic Criteria

Based on updated Lake Louise Criteria and ESC/EACVI recommendations:

- Require at least one T1-based marker (LGE or abnormal native T1/ECV) AND at least one T2-based marker (elevated T2 mapping or T2-STIR signal)
- Regional/global dysfunction or pericardial effusion serves as supportive evidence
- Repeat CMR in 1–2 weeks if none (or just 1) of the criteria are present but strong clinical evidence exists

4. Tips & Tricks

- RV dysfunction is a strong adverse prognostic indicator
- Utilize quantitative mapping (T1/T2/ECV) for subtle or diffuse myocarditis
- LGE extent predicts prognosis – higher burden associates with worse outcome
- In athletes or suspected sports-related cases, specific return-to-play CMR criteria apply

Reference: Herzog, B. A., Greenwood, J. P., Plein, S., Garg, P., Haaf, P., & Onciul, S. (2017). Cardiovascular magnetic resonance pocket guide. *Eur Soc Cardiol*.