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EDITORIAL

Pericardial diseases: the emerging role for cardiac magnetic resonance imaging in the diagnosis of pericardial diseases

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This editorial refers to 'Cardiac magnetic resonance in the assessment of pericardial abnormalities: a case series', by T.B. Mano *et al.*, https://doi.org/10.1093/ehjcr/ytab444.

Clinical introduction

Pericardial diseases encompass a wide clinical spectrum. Common clinical conditions such as pericarditis can have a variety of presentations based on the stage and aetiology with manifestations ranging from the acute inflammatory state (with or without constrictive physiology) to the more chronic state of burned-out pericarditis or calcific constrictive pericarditis (CP).[1] The prevalence of recurrent pericarditis has been reported in 15–30% of patients after the first acute inflammatory episode.[2] The clinical history, symptoms, and biochemical analysis are fundamental in the diagnostic process, but establishing a definitive diagnosis in order to implement targeted management can sometimes pose a significant clinical challenge. This has led to a significant interest in imaging-guided treatment strategies for pericarditis to optimize therapeutic interventions.

Imaging in pericardial disease

Currently, echocardiography, cardiac computed tomography (CCT), and cardiac magnetic resonance (CMR) imaging are the three imaging modalities commonly used to assess and characterize the pericardium. Although contemporary international guidelines recommend echocardiography as the first-line imaging modality for all pericardial diseases, most cases of CP and complicated pericarditis in the present era involve the use advanced imaging and the integration of data from a number of imaging modalities.[3,4] Echocardiography provides valuable information on the hemodynamic changes which allow for identification of CP. CCT on the other hand provides limited haemodynamic information, but the excellent spatial resolution allows for a detailed anatomical assessment of the pericardium such as thickness and the presence of calcification.[1] However, CCT is limited in its utility in serial imaging, due to the use of ionizing radiation.[1] CMR has recently emerged as a valuable tool providing comprehensive assessment of the pericardium. The integration of a number of sequences within a single study can provide useful information on cardiac morphology, tissue characterization. and hemodynamic states.[1] Specifically, when compared to echocardiography and CCT, CMR has the unique advantage of identifying active pericardial inflammation in addition to the classical hemodynamic and anatomical changes associated with pericardial disease.

An interesting case-series from EHJ: case report

The case series by Mano *et al.*[5] nicely highlighted the additional value of CMR imaging in the diagnosis and clinical management of pericardial diseases. The three cases of pericarditis featured in this case series included the following: (i) a case of a young female presenting with acute pericarditis on a background of recurrent pericarditis where repeated echocardiography did not demonstrate any evidence of myo-pericardial disease, but CMR revealed evidence of acute myo-pericarditis; (ii) a case of constrictive physiology with an associated pericardial effusion in an elderly male where CMR revealed features of subacute pericarditis, with ongoing pericardial inflammation; and (iii) a case of chronic constrictive pericardial disease in an elderly

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male, without active pericardial inflammation, in which pericardiectomy was then performed.[5]

The main CMR sequences typically used in the evaluation of pericardial disease are those with cine images and tissue characterization. Balanced steady-state free precession (bSSFP) sequences provide high spatial and temporal resolution and can be used to identify features consistent with CP like septal bounce, conical or tubular abnormalities of the ventricles, left ventricular or right ventricular tethering, and inferior vein cava enlargement.[1,6] Mano *et al.*[5] highlighted the value of SSFP sequences by demonstrating the presence of constrictive physiology (inspiratory septal shift) in both Case 2 and Case 3.[5] Further tissue characterization using T2-weighted sequences, such as T2 short-tau inversion recovery (STIR) which are typically utilized to identify the presence of oedema by characterizing relative increases in water content in the tissue of interest, was then used to detect active inflammation in Case 2 vs. Case 3.[6] Late or delayed gadolinium enhancement (LGE) sequences (10–20 min after the injection of gadolinium) can also be used to detect and grade the severity of ongoing pericardial inflammation. Once again, LGE images were critical in differentiating disease features of Case 2 from Case 3 highlighting the value of the additional information obtained from the cardiac MRI but not available in echo or CCT imaging. This information has potential to influence the clinical management as highlighter by Cases 2 and 3. Both patients from Cases 2 and 3 had evidence of pericardial constrictive physiology, but evidence of LGE in Case 2 was suggestive of an active inflammatory process, making the patient a potential candidate for further treatment with anti-inflammatory medications or immunotherapy rather than a pericardiectomy.[1] Patients with thickened pericardium and little or no imaging or biochemical evidence of inflammation are less likely to respond to anti-inflammatory medications when compared to those with evidence of inflammation, hence more suitable for pericardiectomy for management of CP. LGE and T2 STIR sequences can also help guide the intensity and duration of anti-inflammatory therapy and immunotherapy in patients with refractory symptoms.[1,6] The decision to treat, taper, or stop therapy when managing pericardial inflammation is dependent on stage of disease and the extent of ongoing active inflammation. High-sensitivity CRP and ESR, while useful as biomarkers of active inflammation, can normalize well before resolution of pericardial inflammation process at the cellular level[7] as highlighted in Case 1. In this instance, CMR was again critical for the identification of persistent pericardial inflammation, even though serum biomarkers were not elevated and echocardiographic findings were negative, supporting the need for a more widespread and integrated diagnostic approach in patients with recurrent or chronic disease. The presence of LGE particularly in such patients while on therapy may constitute a sign of therapy failure or a worse prognosis, with higher risk of future recurrences. These patients may require escalation or a more protracted course of medical therapy.[7] On the contrary, the absence of both oedema and LGE (active inflammation) would indicate either a healed or burned-out pericardium as was the likely scenario in Case 3, where pericardiectomy was then the most appropriate management.[5,8] Case 1 also highlights the emerging value and utility of other mapping techniques like native T1 and T2 mapping sequences, for the discrimination of normal vs. diseased myocardium, fibrous tissue, fat, and water, with concomitant myocardial inflammation with/without superimposed pericarditis.[6]

Table 1 Sensitivity of imaging techniques in the evaluation of pericardial pathology

	Echocardiography	CCT	Cardiac MRI
Pericardial effusion	+++	+++	+++
Pericardial inflammation	–	–	+++
Pericardial calcification	+	+++	++
Constrictive pericardial physiology	+++	–	+

'–': not adequate; '+': adequate; '++': good; '+++': excellent.

Conclusion

Pericardial diseases are commonly encountered in daily clinical practice but can pose a significant diagnostic and management challenge. Cardiac imaging has a pivotal role in the diagnosis of acute, subacute, and chronic pericardial inflammation, with CMR imaging playing a useful role in differentiating normal and abnormal pericardium (*Table 1*). While CMR-guided management is emerging as a key component in the diagnosis and ongoing management of more complex pericardial diseases, an integrated approach is still necessary. Further evidence is needed to strengthen the routine use of CMR in determining course and duration of therapy in the clinical management of pericardial disease.

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