

# Case-Based Studies in CMR – Ischemic Cardiomyopathy

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## Definition

Ischemic cardiomyopathy is defined as significantly impaired left ventricular function in the presence of LV dilatation due to coronary artery disease.

## Role of CMR in the workup of patients with suspected ischemic CMP

Cardiac magnetic resonance imaging with use of bright blood steady state free precession sequences is the standard of reference for assessment of LV function. However, echocardiography is used as the first line imaging modality to assess LV function. If echo is inconclusive, CMR is the test of choice. Often, multi-detector row CT angiography is also performed to assess the presence and extent of coronary artery disease. The role of CMR overlaps with nuclear medicine techniques such as PET and SPECT. However, because of the better spatial resolution, CMR is regarded by many as superior for viability assessment. Important additional features MRI is able to detect with high accuracy are the presence of LV wall thinning and the presence and extent of myocardial scar tissue. Scar tissue can be recognized as areas of hyperenhanced myocardium visible 10-20 after injection of gadolinium using inversion recovery techniques. In contrast to areas of hyperenhancement associated with viral or infiltrative cardiomyopathies, scar tissue is invariably located subendocardially, with varying degree of transmural extent depending on the duration of ischemia and the extent of coronary occlusion. Areas with scar tissue contrast with areas of normal myocardium that appear dark. The transmural extent of myocardial scarring is an important determinant of treatment. If 50% or less of myocardial wall thickness is infarcted then functional recovery is likely and the affected segment is considered 'viable'. If more than half of the wall thickness is infarcted, the chance of functional recovery after revascularization is low (<20%).

## Key Imaging Findings at MR

- Anatomical images show LV dilatation and (regional) wall thinning.
- Cine images show regional or global hypokinesia or akinesia.
- Delayed enhancement images show the presence or absence, location and size of infarction.

- Coronary MRA (if performed) typically shows extensive disease of all three major coronary arteries.

## Differential diagnosis

Key differential diagnoses to consider are:

- Myocarditis (however, no coronary artery disease; typically post-viral infection).
- Infiltrative cardiomyopathy (often presents with diastolic heart failure; typical examples are sarcoid and amyloid; non-ischemic distribution of LGE).
- Restrictive cardiomyopathy (often idiopathic; there is also diastolic heart failure)
- ARVC (predominantly affects RV, but may affect LV in small percentage of cases)
- Idiopathic cardiomyopathy (diagnosis of exclusion).

## Conclusions

CMR is a highly valuable technique to assess the presence or absence of typical features of ischemic CMP.

## Further Reading

Below are some references that are recommended for further reading. This is a non-exhaustive list. Many more references can be found in these papers.

1. Kwon DH, Halley CM, Carrigan TP, Zysek V, Popovic ZB, Setser R, Schoenhagen P, Starling RC, Flamm SD, Desai MY. Extent of left ventricular scar predicts outcomes in ischemic cardiomyopathy patients with significantly reduced systolic function: a delayed hyperenhancement cardiac magnetic resonance study. *JACC Cardiovasc Imaging* 2009;2:34-44.
2. Karamitsos TD, Francis JM, Myerson S, Selvanayagam JB, Neubauer S. The role of cardiovascular magnetic resonance imaging in heart failure. *J Am Coll Cardiol* 2009;54:1407-24.
3. de Haan S, Knaapen P, Beek AM, de Cock CC, Lammertsma AA, van Rossum AC, Allaart CP. Risk stratification for ventricular arrhythmias in ischaemic cardiomyopathy: the value of non-invasive imaging. *Europace*. 2010;12:468-74.
4. Beek AM, van Rossum AC. Use of cardiovascular magnetic resonance imaging in the assessment of left ventricular function, scar and viability in patients with ischaemic cardiomyopathy and chronic myocardial infarction. *Heart* 2010;96:1494-501.