

Coronary Artery Disease (CAD)

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Indications and Purpose of the Scan:

In patients with coronary artery disease or ischemic cardiomyopathy, CMR is recommended

- To obtain accurate measurements of left and right ventricular size and function
- To assess likelihood of recovery of function with revascularization
- To assess presence of left ventricular thrombus

Description:

Coronary artery disease affects a large number of patients and require long term medical care. Traditionally, echocardiogram is the major non-invasive modality in assessing the damage caused by myocardial infarctions. However, CMR has become more utilized due to many of its strengths.

CMR has high interobserver and intraobserver reproducibility of ventricular size and systolic function measurements.^{1,2} In patients with coronary artery disease, regional wall motion abnormalities can have an impact in 2D echocardiography assessment since method of disc is based on a uniform ellipsoid estimation from 2 and 4 chamber views only.

One of the most common indication for CMR is viability assessment. In patients with obstructive coronary artery disease who are planned to undergo revascularization. With gadolinium based contrast agent (GBCA), CMR with late gadolinium enhancement imaging can assess the transmural of scar tissue.³ In coronary territories where there is $\leq 50\%$ transmural of scar tissue, revascularization has a higher likelihood to improve contractility compared to segments that have $>50\%$ transmural of scar tissue.^{4,5} In patients with a history of myocardial infarction, the size of late gadolinium enhancement portends to worse prognosis beyond the predictive value of ejection fraction.⁶

In patients with acute myocardial infarctions, CMR is able to identify various pathologies: myocardial edema (T1 and T2-weighted imaging, T1 and T2 parametric mapping),⁷ intramyocardial hemorrhage, microvascular obstruction⁸ and myocardial necrosis (late gadolinium enhancement imaging). Identification of persistent microvascular obstruction and intramyocardial hemorrhage can predict wall segments that may not recover with revascularization. Myocardial edema can help identify the area at risk, which would be beneficial in research of medications that can reduce infarct size.

In patients with coronary artery disease, there is a subset of patients who develop left ventricular thrombus. With GBCA, left ventricular thrombus can be easily detected compared to traditional echocardiography even with echo contrast.⁹

Why CMR (Specific Advantages):

- Provide highly reproducible measurements of ventricular size and systolic function¹
- The only modality that can non-invasively visualize myocardial scar³, myocardial edema (area-at-risk)⁷, microvascular obstruction, intramyocardial hemorrhage⁸ due to myocardial infarction
- Can predict the likelihood of myocardial wall motion recovery after revascularization^{4,5}
- Provide prognostic information in patients who have coronary artery disease⁶
- Assess presence of left ventricular thrombus effectively⁹

Evidence:

- Revascularization of dysfunctional segments improved contractility in 66% (411/622) of the segments that have $\leq 50\%$ transmural scar; whereas $< 8\%$ (14/182) of dysfunctional segments improve contractility with revascularization when there is $> 50\%$ transmural scar.^{4,5}
- In a study of 122 revascularized STEMI patients, infarct size was the only significant predictor of adverse outcomes in multivariate analysis.⁶
- In a study of 121 patients at risk of developing left ventricular thrombus, contrast enhanced CMR was able to detect thrombus in 24 patients, while contrast enhanced echo identified 14 and non-contrast echo identified 8.⁹

Contraindications:

- Presence of contraindications for MRI
- Severe renal failure (eGFR < 30) or acute renal failure.

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