

Cardiac MRI - Viability Imaging

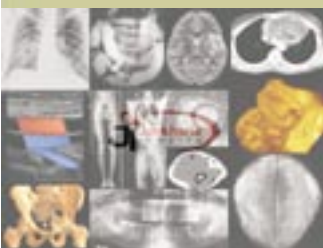


Inner Spaces

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Special points of interest:

- Viability imaging implies evaluating infarcted myocardium to see whether there is enough viable tissue available for revascularization
- Contrast enhanced cardiac MRI (CMR) is today the gold standard for viability imaging
- All infarcts irrespective of age enhance.
- The percentage involvement of the myocardial wall thickness by an infarct determines viability
- Involvement of the myocardium by more than 50% usually implies that there will be no improvement after revascularization
- Less than 25% involvement of the myocardium by infarction usually implies that there is an 80% chance of improvement after revascularization
- Contrast enhanced CMR allows differentiation of dilated from ischemic cardiomyopathy using the same principles



The concept of myocardial viability is based on the fact that even severely dysfunctional myocardium in patients with coronary artery disease may show functional improvement after revascularization. Reversal of myocardial dysfunction is particularly relevant in patients with depressed ventricular function because revascularization improves long-term survival.

There are many methods available to assess viability, including

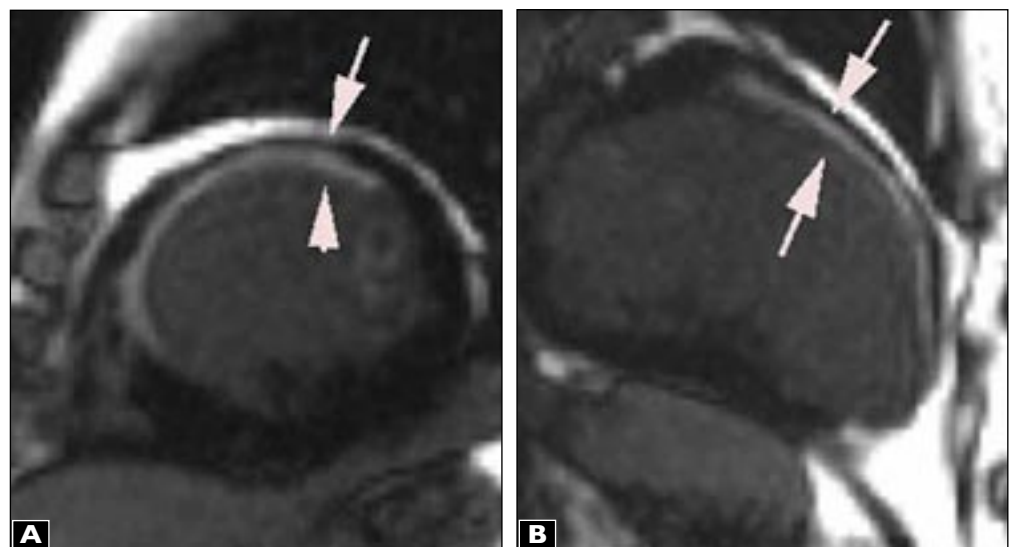
- Low-dose dobutamine stress echocardiography
- Thallium-SPECT
- FDG-PET
- CMR - cardiac MRI

All recent studies^[1] have shown that CMR is superior to low-dose dobutamine echocardiography and thallium-SPECT for viability imaging. CMR is as good as FDG-PET^[2] for picking up the infarcts with the added advantage of better spatial resolution, which allows evaluation of the exact transmural involvement of the myocardium.

The whole concept of viability on CMR is based on the fact that all infarcts enhance vividly 10-15 minutes after intravenous contrast administration. This phenomenon of delayed hyperenhancement has been proven to correlate with the actual extent of the infarct, in numerous animal and human studies^[3]. CMR shows the transmural extent of the infarct very reliably. In infarct imaging, on contrast-enhanced CMR, it is now said that "white is dead".

In areas of hypokinesia, if there is a rim of "black" or non-infarcted myocardium that is not contracting well, it indicates the presence of hibernating myocardium, which is likely to improve after revascularization of the artery supplying that particular territory. Viability imaging reliably allows identification of areas of hibernation and viable or non-viable myocardium.

The same logic allows differentiation of idiopathic dilated cardiomyopathy from ischemic cardiomyopathy in patients who present with low ejection fraction and cardiac failure.



Contrast enhanced short axis image (A) shows an infarct in the antero-septal region involving more than 50% of the myocardial wall thickness (arrow). The infarct is also well seen on the 2-chamber view (B). This implies that the myocardium involved by the infarct is non-viable and unlikely to improve after revascularization



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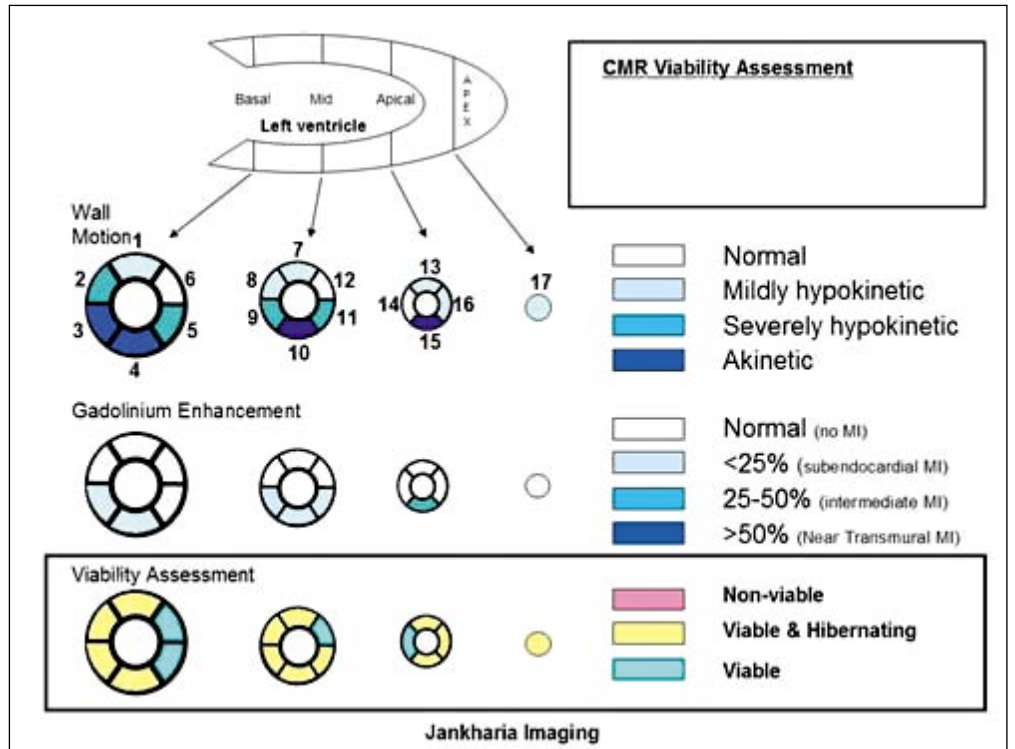
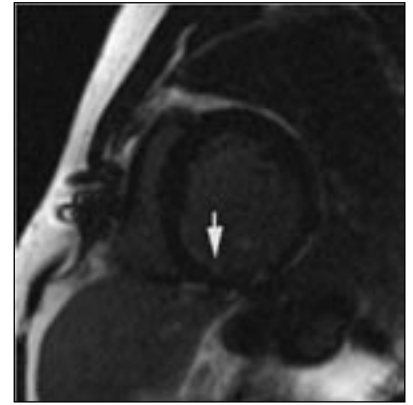
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Case Report:

A 56-year old man presented with a low ejection fraction. He had a bypass done 3 years ago. The cine MRI and echo showed significant hypokinesia in the septal, inferior and lateral walls, the inferior wall being almost akinetic.

The contrast-enhanced CMR shows that the involvement by the infarct of the myocardium is less than 25% of the thickness of the myocardium in the inferior wall, suggesting that there is significant viable myocardium with an approximately 80% chance of improvement after revascularization



Color maps showing a typical viability assessment. The first row shows the wall motion abnormality in all the 17 segments. The second row maps the infarction in all the 17 segments. The last row puts this information together to give a viability map. In this patient virtually the entire myocardium is viable and hibernating, since virtually all segments show some wall motion abnormality with or without infarction.

REFERENCES

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2. Kuhl HP, Beek AM, van der Weerd AP et al. Myocardial viability in chronic ischemic heart disease: comparison of contrast-enhanced magnetic resonance imaging with (18) FDG PET. JACC 2003; 16: 1341-1348.
3. Kim RJ, Wu E, Rafael A et al. The use of contrast-enhanced magnetic resonance imaging to identify reversible myocardial dysfunction. NEJM 2000; 343: 1488-1490.

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