

# System Enhancements for Cardiac MR at 1.5T

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In our institution, cardiac MRI is used routinely in the diagnosis of cardiovascular disease. Until recently all of our cardiac exams were performed on a Signa HDxt 3.0T due to the inherent signal-to-noise ratio (SNR) advantage at higher field strength. In October 2009, a Discovery MR450 1.5T was installed at our facility and we began examining cardiac patients on this system. After scanning more than 300 patients, I have found the Discovery MR450 produces outstanding image quality thanks to its gradient performance, OpTix RF, and field homogeneity.

The fast gradient echo time course (FGRE-TC) in multi-plane (short axis and long axis) acquisition has an excellent contrast-to-noise ratio (CNR). As a result, we are more confident in the diagnosis of the myocardium and specifically the apex. And not less importantly, the new user interface and workflow are very intuitive.

## Case 1: \_\_\_\_\_

### Myocardial viability assessment

#### Patient history

A 71-year-old presented with angina post effort for nearly four weeks; subsequent loss of consciousness was due to acute pulmonary edema. An emergency coronary angiography showed a sub-occlusion of the common trunk of the left coronary with an ostial stenosis of the LAD bisector and moderate stenosis of the ostial circumflex, treated by stents. Echocardiography demonstrated an akinesia extended on the anterior and lateral wall with an ejection fraction (EF) estimated at 33%. Thallium scintigraphy at rest showed a complete deficiency of the apex, anterior, and lateral wall, possibly indicating non viable areas.

#### CMR technique

FGRE-TC in multi-plane (SA and 4ch) FIESTA Cine in 4ch view, long and contiguous short axes. Late enhancement (FGRE-IR) in 4ch view, long, and contiguous short axes.

#### MR findings

Circumferential pericardial effusion.

Dynamic perfusion shows sub-endocardial defects as hyposignal of the antero-septal and lateral walls, and no defect of the inferior and infero-lateral walls (Figure 1b). FIESTA Cine demonstrates complete akinesia at the apical segment, the antero-lateral and septal walls, and to a lesser degree at the basal segment (Figure 1a).

EF is estimated at 28%.

An important heterogeneous signal of the myocardium was seen on FIESTA Cine and late enhancement as transmural hypersignal with centered zones of hyposignal reflecting impaired microcirculation. A delayed transmural enhancement extended on the entire anterior, lateral, and septal walls (Figure 1c). There is strong suspicion of non-viability of the affected segments, is to be confirmed with follow up at a non-acute phase of the infarct.

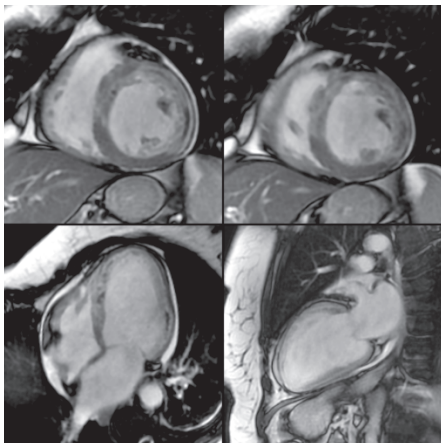


Figure 1a. Multi-plane FIESTA Cine

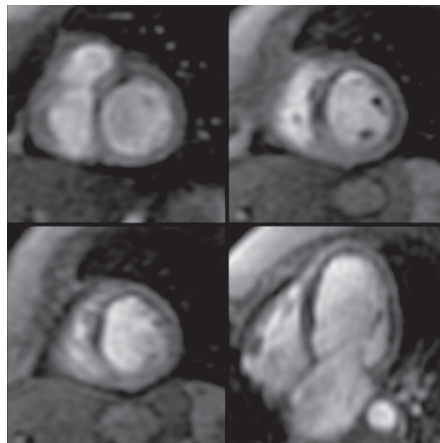


Figure 1b. Multi-plane FGRE-TC

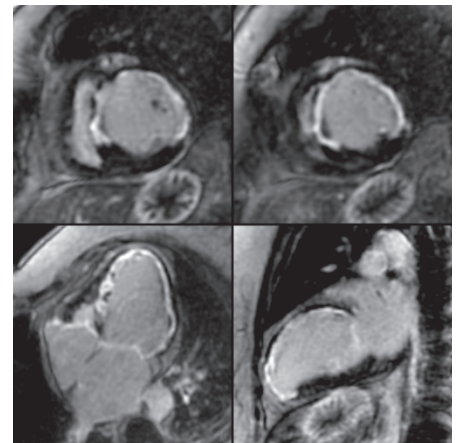


Figure 1c. Multi-plane 2D MDE

## Case 2: Myocarditis

### Patient history

A 64-year-old has a history of chest pain with troponin elevation dating to 2007. Previously, patient had a normal coronary angiography, although there was suspicion of a myocarditis or coronary spasm.

In 2010, the patient was hospitalized for ventricular tachycardia associated with infection syndrome and impairment of the liver and pancreas. Echocardiography demonstrated an EF of 48% related to a pericardial effusion. CMR was requested to rule out a recurrence of myocarditis.

### CMR technique

FGRE-TC in multi-plane (short axis and 4ch view). FIESTA Cine in 2/4ch view and contiguous short axis. Late enhancement (FGRE-IR) in 2/4ch view and contiguous short axis.

### MR findings

Pericardial effusion measuring 13 mm next to the LV lateral wall. Aspect of myocarditis and pericarditis with impairment of LV systolic function (EF 48%). Thinning of the LV lateral wall (4 mm). Hypokinesia at the mid-segment of the lateral wall and akinesia of the apex (Figure 2a). Mitral valve insufficiency grade I.

Dynamic perfusion at rest: A hypo-perfusion of the middle segment of the lateral wall of left ventricle and the apex (Figure 2b). A diffused myocarditis with a recent component associated with a sequelae of an old myocarditis of the lateral wall. An almost transmural late enhancement of the left ventricular apex (Figure 2c), suggestive to a fibrous evolution by microangiopathy related to a severe myocarditis.

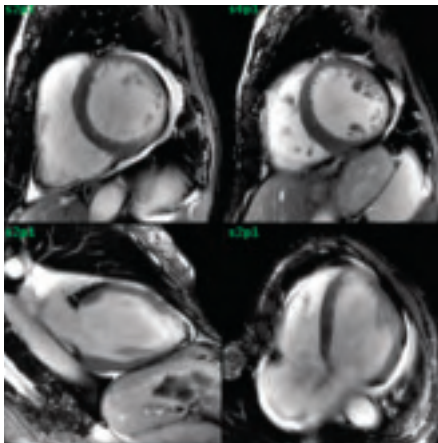


Figure 2a. Multi-plane FIESTA Cine

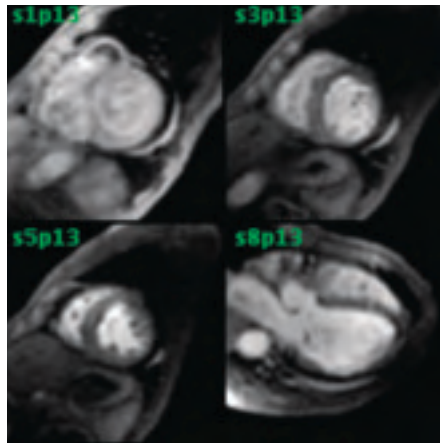


Figure 2b. Multi-plane FGRE-TC

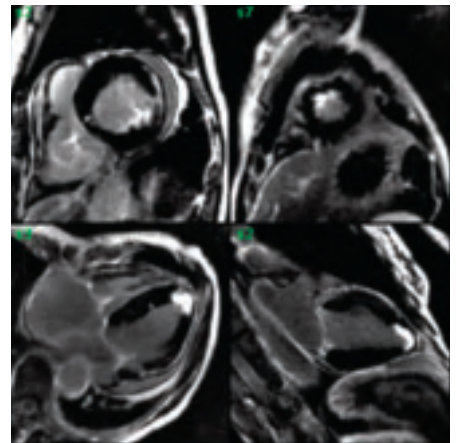


Figure 2c. Multi-plane 2D MDE



## Case 3: \_\_\_\_\_ Myocardial viability assessment

### Patient history

A 79-year-old hospitalized for an acute coronary syndrome underwent a coronarography that depicted a sub-occlusive stenosis of the right coronary, treated by angioplasty and placement of a drug-eluting stent. The patient has arterial hypertension and recurrent insulin diabetes.

### CMR technique

FGRE-TC in multi-plane (SA and 4ch) FIESTA Cine in 4ch view, long, and contiguous short axes. Late enhancement (FGRE-IR) in 4ch view, long, and contiguous short axes.

### MR findings

Dynamic perfusion at rest shows subendocardial hypo-perfusion of the basal and middle segments of the inferior wall. Myocardial delayed enhancement (MDE) shows a heterogeneous enhancement of the myocardium at the basal and middle segments of the inferior wall of the LV, extended to 75 to 100% of the myocardium wall thickness, with a zone of intramyocardial hyposignal that is highly suspicious of no reflow (Figure 3c). FIESTA Cine demonstrates akinesia of the inferior wall of the basal and middle segment (Figure 3a). Left ventricular systolic function was measured at the lower normal limit with EF 54%. Normal dimensions of the cardiac chambers were noted. A control within three months can be considered.



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### About the facility

The Centre Cardiologique du Nord (CCN) is a private practice created by a group of cardiologists in 1973 in Saint-Denis, France. CCN is considered a center of excellence in the diagnosis and treatment of cardio-vascular diseases. We perform cardiac MRI since 1998. In 2003, a GE Signa HD 1.5T MR scanner was installed and a Signa HDx 3.0T was added in December 2007. Since then more than 2,000 patients with cardiovascular indications have been scanned on the 3.0T system. In October 2009, a Discovery MR450 1.5T was installed replacing the Signa HD 1.5T. CCN also operates two GE Healthcare's CT scanners, a LightSpeed™ VCT XT and a Discovery CT750 HD, both dedicated to cardiovascular imaging.

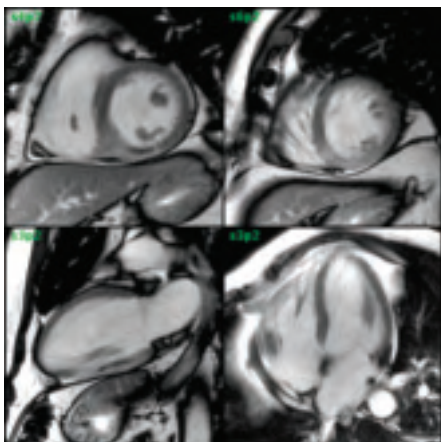


Figure 3a. Multi-plane FIESTA Cine

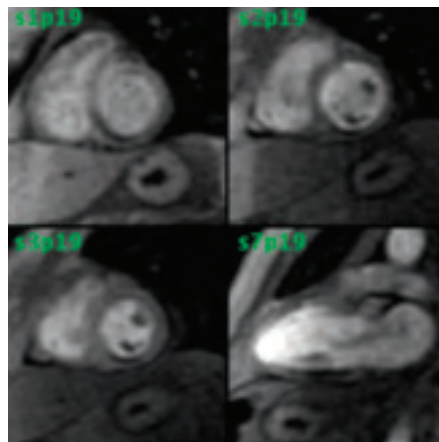


Figure 3b. Multi-plane FGRE-TC

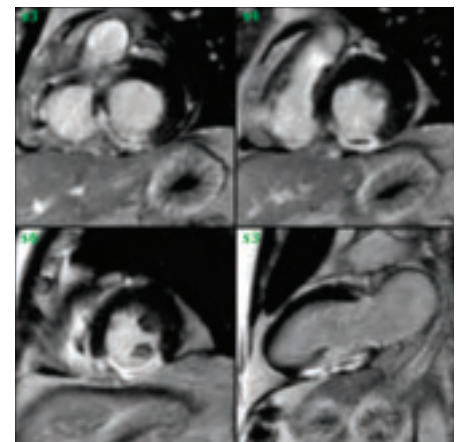


Figure 3c. Multi-plane 2D MDE

### Conclusion

After five months of scanning on the Discovery MR450, I have found the system provides excellent image quality and a fast scan time thanks to its gradient performance and OpTix RF, which also delivers a high SNR compared to standard 1.5T. ■