

# Long-Term Prognostic Value of Late Gadolinium-Enhanced Magnetic Resonance Imaging in Patients With and Without Left Ventricular Dysfunction Undergoing Coronary Artery Bypass Grafting

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The value of late gadolinium-enhanced (LGE) magnetic resonance imaging (MRI) for the prediction of functional recovery after surgical revascularization has been previously established. However, the impact of LGE-MRI on the long-term prognosis after coronary artery bypass grafting (CABG) remains incompletely understood. Therefore, we aimed to evaluate the long-term prognostic value of LGE-MRI, based on the presence or absence of left ventricular (LV) dysfunction, in patients with coronary artery disease undergoing CABG. One hundred forty-six consecutive patients underwent cine- and LGE-MRI before CABG. Adverse cardiac events included cardiac death, nonfatal myocardial infarction, heart failure, and unstable angina. A 3-year landmark analysis of the primary end point was also performed for patients surviving beyond 3 years after CABG. During a median follow-up of 9.4 years, 44 patients (30%) experienced adverse cardiac events. Although a LV ejection fraction <50% was associated only with adverse cardiac events at 3 years after CABG, LGE was associated with a worse outcome both at and beyond 3 years after CABG. In the overall study population, LGE presence (adjusted hazard ratio [HR] 2.58;  $p = 0.027$ ), score (adjusted HR 1.06;  $p < 0.001$ ), and extent (adjusted HR 1.08;  $p < 0.001$ ) were independent predictors of adverse cardiac events. Moreover, in both the LV ejection fraction <50% and  $\geq 50\%$  groups, the LGE extent was an independent predictor of adverse cardiac events. In conclusion, our qualitative and quantitative analyses of LGE-MRI provide long-term prognostic information after surgical revascularization. The LGE extent was a strong predictor of adverse cardiac events, independent of the LV function. © 2016 Elsevier Inc. All rights reserved. (Am J Cardiol 2016;■:■-■)

Late gadolinium-enhanced (LGE) magnetic resonance imaging (MRI) can accurately delineate irreversible myocardial injury associated with adverse cardiac events.<sup>1-9</sup> Furthermore, LGE-MRI enables evaluation of the transmural scar extent and allows prediction of functional recovery after coronary artery bypass grafting (CABG) surgery.<sup>10,11</sup> However, no previous study has evaluated the prognostic value of LGE-MRI after revascularization. Gerber et al.<sup>3</sup> reported that

the detection of dysfunctional viable myocardium by LGE-MRI was an independent predictor of mortality in medically treated patients but not in revascularized patients. However, their study included only patients with severe left ventricular (LV) dysfunction, and survival was compared only according to the presence or absence of myocardial viability based on the transmural extent of LGE during the midterm follow-up. Herein, our primary aim was to evaluate the long-term prognostic value of LGE-MRI compared to that of the left ventricular ejection fraction (LVEF) in patients undergoing CABG. In addition, we evaluated the prognostic values of the LGE presence, score, and extent according to the presence or absence of LV dysfunction.

## Methods

The medical records of 220 consecutive adult patients who underwent CABG from June 2003 to July 2005 at our institution were retrospectively reviewed (Figure 1). One hundred sixty-five patients underwent cardiac MRI to evaluate the myocardial viability within 1 month before CABG. Of these, 19 patients were excluded because of

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Funding: This study is supported by Grant 02-2015-037 from the Seoul National University Bundang Hospital, Seongnam-si, Gyeonggi-do, Republic of Korea.

See page 8 for disclosure information.

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Consecutive patients scheduled for elective CABG between  
2003-2005 (n = 220)

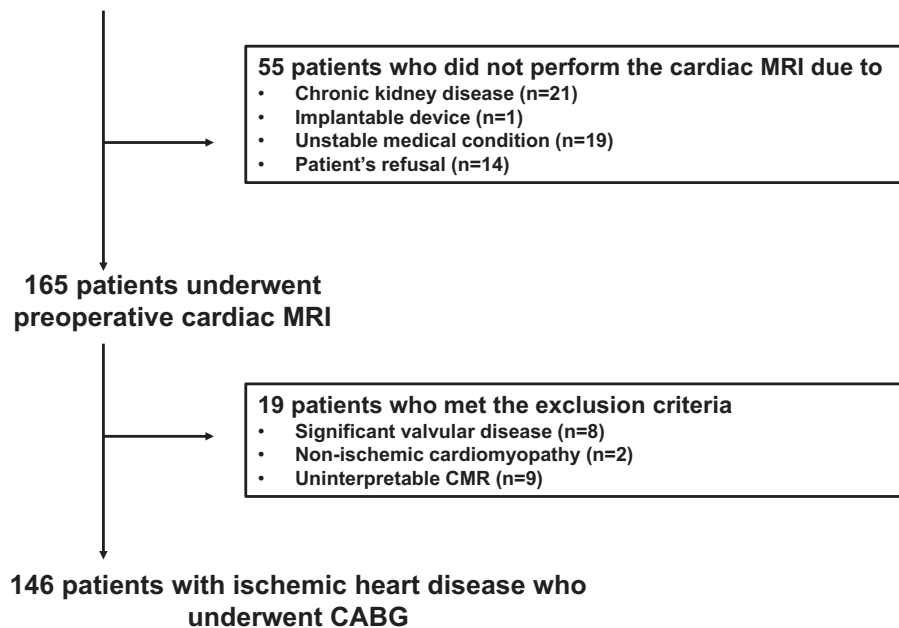


Figure 1. Composition of the study subjects.

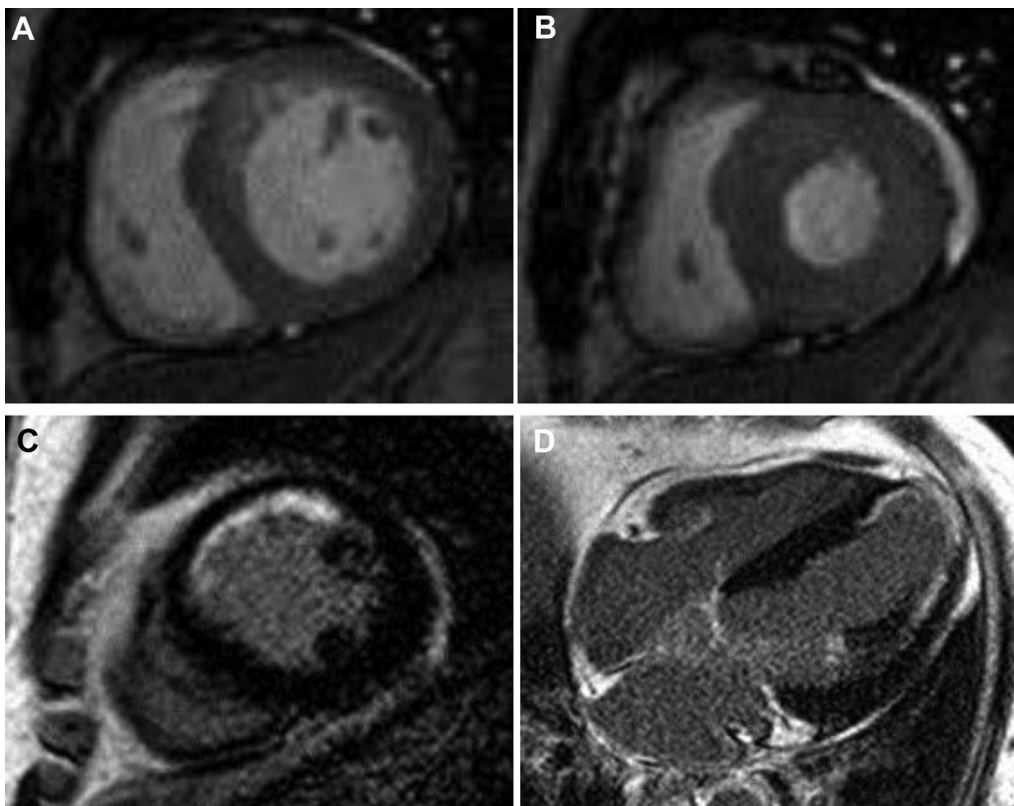


Figure 2. Magnetic resonance images of the left ventricle in a 58-year-old man with 3-vessel disease. Cine-MRI obtained in (A) diastole and (B) systole showing LVEF of 60%. (C, D) LGE-MRI showing myocardial infarction in the left anterior descending artery territory, with an LGE extent of 9.8%.

hypertrophic cardiomyopathy, significant valve disease (grade  $\geq 2$  stenosis or insufficiency), or uninterpretable MRI findings. The remaining 146 patients formed the study

cohort. The institutional review board approved this study (B-1407-258-104) and waived the need for written informed consent.

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