

Detection of Myocardial Scarring by Strain Analysis Using 2D Speckle Tracking  
Echocardiography in CAD Patients with Fragmented QRS Complex  
—Comparative Study with LGE MRI—

Naka SAITO<sup>1</sup>, Shingo KATO<sup>3,4</sup>, Ayumi TANAKA<sup>1</sup>, Takako ISHIKAWA<sup>1</sup>,  
Kozue NAKAGOMI<sup>1</sup>, Noritaka SAITO<sup>1</sup>, Mamiko NAKAMURA<sup>1</sup> and Kazuki FUKUI<sup>2</sup>

Abstract

**Purpose:** The aim of this study was to assess the detectability of strain analysis by 2D speckle tracking echocardiography (2D-STE) for myocardial scarring on late gadolinium enhanced (LGE) magnetic resonance imaging (MRI) in coronary artery disease (CAD) patients with fragmented QRS complex (fQRS). **Subjects and Methods:** We studied 72 CAD patients with fQRS and 22 control subjects. All study subjects underwent echocardiography and LGE MRI examinations. We defined myocardial scarring to be positive if patients had a high signal intensity area on the LGE MRI. Quantitative assessment of myocardial strain was performed in 3 directions (longitudinal strain, LS; circumferential strain, CS; and radial strain, RS). We compared myocardial strain between 3 groups (CAD patients with LGE, n=54; CAD patients without LGE, n=18; control subjects, n=22). A receiver operating characteristic (ROC) curve was generated to assess the diagnostic accuracy of strain measurements by 2D-STE for the detection of myocardial scarring on LGE MRI.

**Results:** LS was significantly reduced in CAD patients with LGE compared to those without ( $-16.2 \pm 3.5$  vs  $-19.3 \pm 3.4$ ,  $p < 0.01$ ). CS and RS were not significantly reduced in CAD patients with LGE compared to CAD patients without LGE (CS:  $-24.4 \pm 7.3$  vs  $-28.3 \pm 6.4$ ,  $p = 0.084$ ; RS:  $31.8 \pm 13.3$  vs  $40.3 \pm 17.8$ ,  $p = 0.086$ ) but CS and RS were reduced in comparison to control subjects (CS:  $-24.4 \pm 7.3$  vs  $-31.3 \pm 4.5$ ,  $p < 0.01$ ; RS:  $31.8 \pm 13.3$  vs  $47.8 \pm 14.0$ ,  $p < 0.01$ ). No significant difference was found in any strain between CAD patients without LGE and control subjects (LS:  $-19.3 \pm 3.4$  vs  $-20.6 \pm 2.1$ ,  $p = 0.41$ ; CS:  $-28.3 \pm 6.4$  vs  $-31.3 \pm 4.5$ ,  $p = 0.31$ ; RS:  $40.3 \pm 17.8$  vs  $47.8 \pm 14.0$ ,  $p = 0.24$ ). The area under the ROC curve was substantially higher in LS compared to the areas of CS and RS (areas under the ROC curve: LS, 0.812; CS, 0.648; RS, 0.622).

**Conclusion:** In CAD patients with fQRS, LS was significantly reduced in LGE positive patients in comparison to LGE negative patients and controls. The area under the ROC curve of LS was larger than the areas of CS and RS, suggesting that the measurement of LS might be useful to detect even tiny myocardial abnormalities in CAD patients with fQRS.

Vol.41 No. 3 (2016) 239-250

---

<sup>1</sup>Department of Clinical Laboratory, Kanagawa Cardiovascular and Respiratory Center, <sup>2</sup>Department of Cardiology, Kanagawa Cardiovascular and Respiratory Center, <sup>3</sup>Department of Medical Science and Cardiorenal Medicine, Yokohama City University Hospital, <sup>4</sup>Department of Cardiology, Beth Israel Deaconess Medical Center

Received on August 25, 2015; Revision accepted on February 21, 2016