

Comparison of different strain-based parameters to identify human left ventricular myocardial infarct: a three-dimensional finite element study

Gerardo Kenny Rumindo¹, Jacques Ohayon^{2,3}, Magalie Viallon⁴, Matthias Stuber^{5,6},
Pierre Croisille⁴, Patrick Clarysse¹

¹Univ Lyon, INSA-Lyon, Université Lyon 1, UJM-Saint Etienne, CNRS, Inserm, CREATIS UMR 5220, U1206, F-69621, LYON, France

²Laboratory TIMC-IMAG/DyCTiM, UJF, CNRS, UMR 5525, In³S, Grenoble, France

³Polytech Annecy-Chambéry, University of Savoie Mont-Blanc, Le Bourget du Lac, France

⁴Univ Lyon, INSA-Lyon, Université Lyon 1, UJM-Saint Etienne, CNRS, Inserm, CREATIS UMR 5220, U1206, F-42023, Saint-Etienne, France

⁵Department of Radiology, University Hospital and University of Lausanne, Lausanne, Switzerland

⁶Center for Biomedical Imaging and Center for Cardiovascular Magnetic Resonance Research, University of Lausanne, Lausanne, Switzerland

Abstract: Assessment of post-ischemic myocardial damage is important to obtain an accurate long-term prognosis after myocardial infarction. Myocardial strains have been shown to be good indicators of the myocardial viability [1]. Strain analysis has been used to identify dysfunctional regions, and several strain-based parameters have been proposed to detect regions of infarct: fractional anisotropy [2], principal strain [3], and local directional strains [1]. In this study, these parameters were used to detect synthetically generated infarct lesions on left ventricles. In addition, effective strain, and stretches in fiber, sheet, and sheet-normal directions were also tested. The parameters were investigated on ten virtual three-dimensional cases based on healthy human left ventricles extracted from MRI examinations [4]. Realistic infarcts were generated for each virtual case with different locations, shapes, sizes and stiffer materials. Diastolic virtual strain data were obtained via finite-element simulations using widely implemented passive constitutive law [4] and rule-based myofiber orientation. This simulation-based approach enables a definite ground truth for the quantitative assessment of each tested parameter. Our preliminary results show that in comparison with the other tested parameters, the stretch in the fiber direction is able to better delineate the infarct in pathological hearts.

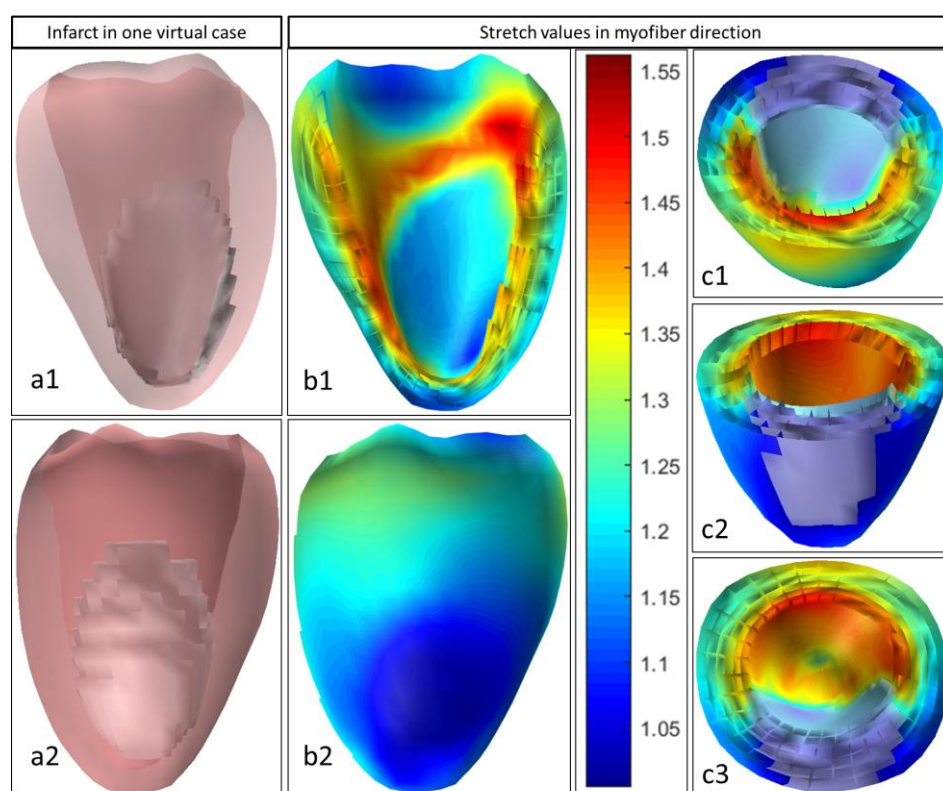


Figure Caption: Visualization of one virtual case at end-diastole. The left ventricle (red) and the synthetic infarct (grey) in posteromedial (a1) and anterolateral (a2) view. Color map of the stretch in fiber direction: endocardial cross-section (b1) and epicardium (b2) views. Lateral (c1,c2) and axial (c3) cross-section views, with superimposed synthetic infarct (grey).

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