

The Diagnostic Value of Quantification of Myocardial Deformation in the Assessment of Patients with Coronary Artery Disease

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Introduction

Two-dimensional speckle-tracking echocardiography (2D-STE) is a semi-automated quantitative technique for assessment of cardiac function based on grayscale images. Strain echocardiography has proven to be an accurate tool for assessment of regional¹ and global² myocardial function and has demonstrated to be more sensitive and accurate than conventional echocardiographic measurements of systolic function, such as ejection fraction (EF), especially in early myocardial disease. Strain is a measure of deformation, an intrinsic mechanical property, and measures myocardial systolic function more directly than conventional

cavity-based echocardiographic measures. Accurate analysis of myocardial viability is important to optimize therapy and to define prognosis in patients with ischemic myocardial disease. Non-ST elevation myocardial infarctions (NSTEMI) affect primarily the subendocardial layers while the subepicardial layers are spared. However, transmural infarction can also be present in patients with NSTEMI^{3,4}. Presented here are two cases demonstrating 2D STE analysis in risk-stratification of patients with NSTEMI.

CASE 1:

A patient was admitted with chest pain but without ECG changes or elevation of myocardial infarct markers. Conventional echocardiography showed no abnormalities, 2D-STE demonstrated normal strain values (Figure 1) and coronary angiography confirmed the absence of any significant stenosis (defined as >50% stenosis in any coronary artery).

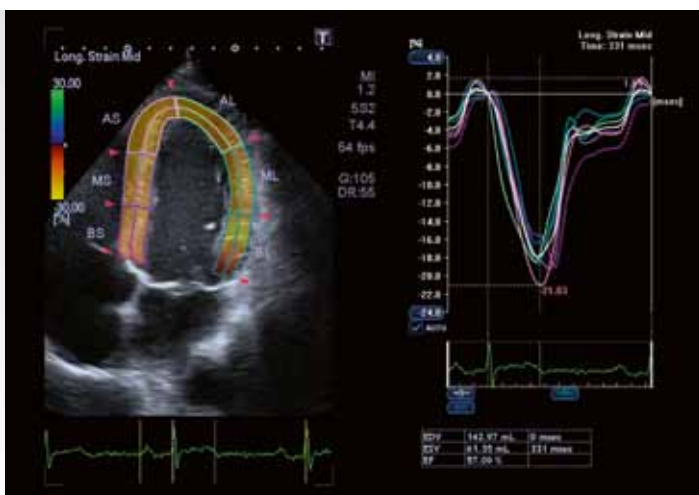


Fig. 1: The automatic strain analysis in Case 1 – a patient with no significant coronary artery stenosis. The image on the left is a colour coded longitudinal strain image acquired from an apical four-chamber view. Strain curves for the six myocardial segments are displayed on the right.

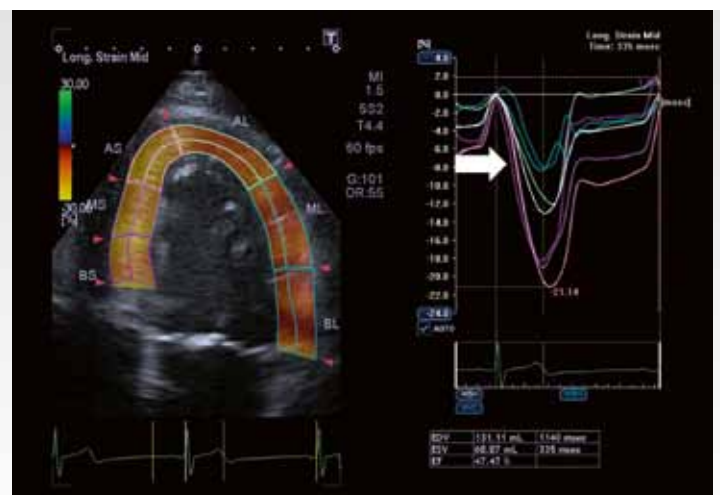


Fig. 2: The automatic strain analysis from an apical four-chamber view in a NSTEMI patient with occluded circumflex (Cx) artery shows reduced colour-coded strain values in the segments supplied by the Cx artery (left). Colour-coding from yellow to green indicates strain from +30% to -30%. Yellow/orange indicates preserved strain. Brown indicates areas with reduced strain. Strain curves for the six LV segments are displayed on the right. The curves representing the segments supplied by the Cx artery show reduced strain values of -8% (white arrow).

CASE 2:

This patient presented with several risk factors for coronary artery disease including hypertension, diabetes mellitus and smoking. The patient was admitted to a local hospital with crescendo angina, increased myocardial infarct markers and ST-depression on ECG. Subsequently the patient was transferred to our hospital for coronary angiography where conventional echocardiography showed normal left ventricular (LV) function assessed by EF (56%) ad modum Simpson. The endocardial borders of the 2D images were traced in the end-systolic frame from the three apical views for the assessment of longitudinal strain. Peak systolic longitudinal mid-myocardial strain was assessed by 2D-STE in sixteen LV segments and averaged to LV global longitudinal strain (GLS). Figure 2 shows a four-chamber view of the LV from this case, demonstrating reduced longitudinal mid-myocardial strain in the baso-, mid- and apico-lateral segments, segments mainly supplied by the circumflex (Cx) coronary artery. LV GLS was reduced to 14%. Coronary angiography showed a proximally occluded Cx artery.

Summary and conclusion

Two-dimensional speckle-tracking echocardiography is an accurate tool for assessment of regional and global myocardial function. It is a simple and fast bedside procedure performed as part of the echocardiographic study. LV global longitudinal strain might provide better insight into myocardial contractility than LV ejection fraction in patients with coronary artery disease. The case presented here shows that strain echocardiography could identify a NSTEMI patient with coronary artery occlusion.

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