Can we predict coronary stenosis localization using regional strain analysis in non-ST elevation acute coronary syndrome?

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KEYWORDS: regional 2D strain, acute coronary syndrome, coronary stenosis localization.

CITATION: *Cardiol Croat.* 2017;12(4):117–118. | <https://doi.org/10.15836/ccar2017.117>

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Background: It has been shown that 2D strain (2DS) is a sensitive indicator for subclinical myocardial injury due to various agents. However, for detecting coronary artery disease (CAD) global longitudinal 2DS has shown only modest diagnostic accuracy, but the sensitivity of regional 2DS assessment has not been adequately evaluated.¹⁻⁶ The purpose of this study was to assess the value of regional 2DS performed early in patients with non-ST elevation acute coronary syndrome (NSTEMI-ACS) for predicting presence and localization of ischemia-inducing stenosis, which could then lead the team in further decision-making.

Methods: We performed a retrospective analysis of patients admitted through our Emergency Department to the Department for Cardiovascular Diseases from January 2013 till December 2015 with the diagnosis of NSTEMI-ACS. Patients who did not undergo coronary angiography, patients with known prior coronary artery disease and patients who did not receive an echo in the 24 hours prior to angiography were excluded, as were the patients with images not adequate for 2D strain analysis. A total of 123 patients fulfilled the criteria and were included in the analysis. 4 different clinicians blinded to laboratory and ECG results performed 2DS analysis of global and regional 2D longitudinal peak systolic strain (LPSS) according to the 18-segment model prior to coronary angiography.

Results: We found significant correlation of a flow limiting stenosis, defined as a stenosis of >70% narrowing on coronary angiography, with segmental decrease in LPSS for all three major coronary vessels. Patients with significant left anterior descending artery (LAD) lesion had significantly lower regional LPSS in anterior, septal and anterolateral mid segments and all apical segments (Table 1), as well as global LPSS (-14.43 vs. -17.22, $p < 0.0001$) when compared to patients without significant stenosis in that vessel.

TABLE 1. Regional 2D longitudinal peak systolic strain values according to segments and location of coronary stenosis.

Segment	Lesion location	LPSS values (normal vs. pathologic)	P
Mid anterior	LAD	-15.54 vs. -10.93	<0.0001
Apical anterior	LAD	-20.68 vs. -14.08	<0.0001
Mid anterolateral	LAD	-14.20 vs. -11.38	0.003
Apical anterolateral	LAD	-20.35 vs. -14.26	<0.0001
Mid anteroseptal	LAD	-19.55 vs. -15.33	<0.0001
Apical anteroseptal	LAD	-22.89 vs. -16.15	<0.0001
Mid inferoseptal	LAD	-16.28 vs. -13.88	0.008
Apical inferoseptal	LAD	-24.00 vs. -17.15	<0.0001
Apical inferior	LAD	-22.67 vs. -18.31	0.01
Apical inferolateral	LAD	-19.36 vs. -14.27	0.001
Basal anterolateral	LCx	-14.76 vs. -10.92	0.001
Mid anterolateral	LCx	-14.12 vs. -10.96	0.003
Basal inferolateral	LCx	-16.28 vs. -12.09	<0.0001
Mid inferolateral	LCx	-15.19 vs. -12.28	0.008
Basal inferior	RCA	-16.39 vs. -11.97	<0.0001
Mid inferior	RCA	-16.78 vs. -14.27	0.02
Basal inferolateral	RCA	-15.58 vs. -12.56	0.01

LAD = left anterior descending coronary artery; LCx = left circumflex coronary artery; RCA = right coronary artery; LPSS = longitudinal peak systolic strain.

RECEIVED:
 March 11, 2017

ACCEPTED:
 April 6, 2017

FIGURE 1. Example of significantly reduced regional 2D longitudinal peak systolic strain (A) in a non-ST elevation acute coronary syndrome patient with ostial 95% significant left anterior descending artery stenosis and preserved anterior wall myocardial thickness (B).

Patients with a significant stenosis in LCx had lower global LPSS in basal and mid anterolateral and inferolateral segments, while patients with a significant RCA stenosis has lower global LPSS in basal and mid inferior and basal inferolateral segments (**Figure 1**). Statistically significant difference was present in all myocardial layers and was present even after accounting for potentially confounding factors like arterial hypertension, smoking, alcohol, atrial fibrillation, valvular disease, age or prior medical therapy.

Conclusion: We have shown that there is significant correlation between a decrease in LPSS and localization of significant stenosis in patients with NSTEMI-ACS. The segments with significantly decreased LPSS closely match the areas of perfusion of each coronary vessel. It seems regional 2DS can help define the territory involved in NSTEMI-ACS and lead further clinical and interventional decision making, but further prospective studies are needed to confirm this assumption.

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