of results. Our goal is for our toolkit to play a similar role in advancing the acceptance and utility of forward and inverse electrocardiography.

We have designed our toolkit to allow flexibility in problem formulation and solution approach by leveraging the dataflow network structure of SCIRun. This structure along with its built-in network editor provides flexible choice of geometric model, equivalent source model, forward solution approach, and inverse solution method. In particular, the toolkit integrates access to epicardial and heart surface geometric models, activation-based (equivalent dipole layer) and surface potential–based source models, finite element and boundary element forward solutions, and a variety of standard and novel inverse algorithms. It exploits SCIRun interfaces to both ECGSim and Matlab, with easy incorporation of geometries, data, and forward models from the former and provided and user-designed algorithms written in the latter. The toolkit leverages the ability of CIBC's BioMesh3d software to build multimaterial computational meshes from segmented image data, as well as CIBC's Seg3D segmentation software, but can also read computational geometries produced outside the toolkit (including ECGSim geometries). Because SCIRun gives easy access to critical algorithm parameters (which can also be passed to Matlab algorithms), the toolkit provides interactive control of all aspects of the processing pipeline. Finally, the advanced visualization capabilities of both SCIRun and the CIBC visualization software map3d allow the user to flexibly and rapidly examine many aspects of the computational process and results.

With support of the toolkit in both compiled and source code formats, varied investigators can compare algorithms and share data and eometries, thus facilitating increased progress, confidence, and eventually clinical application of results in this field. Future versions will integrate other bioelectric modeling capabilities such as defibrillation modeling and electrical impedance tomography.

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Relationship between T-wave magnitude and infarct size 3 months after myocardial infarction

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Background: The value of sequential T-wave changes on the electrocardiogram (ECG) has less well been described in the follow-up of myocardial infarction. We sought to investigate whether T-wave amplitude correlates with infarct size (IS) and left ventricular ejection fraction (LVEF) measured using cardiac magnetic resonance imaging (CMR) 3 months after reperfusion therapy.

Methods: Fifty-five patients with a first acute myocardial infarct referred for primary percutaneous transluminal coronary angioplasty (PCI) were included. Electrocardiograms were analyzed within 4 hours after reperfusion and at 3 months, measuring T-wave amplitudes of 2 contiguous infarct-related leads, summed up as 1 value called T-wave magnitude. Cardiac magnetic resonance imaging was performed at 3-month follow-up. The correlations between T-wave magnitude, IS, and LVEF were tested with Pearson r correlation coefficient. Subanalyses were performed using a 2-sample t test.

Results: A good correlation was found between LVEF and IS size ($r = -0.7$, $P < .0001$). Both in anterior ($r = -0.44$, $P = .08$) and in inferior infarcts ($r = -0.40$, $P = .012$), a positive correlation between infarct size and T-wave magnitude was found at 3 months. The correlation between T-wave magnitude and LVEF was 0.7 ($P = .002$) for anterior infarcts and 0.33 ($P = .043$) for inferior infarcts (Table 1). Both LVEF and IS were similar in patients with and without an increase in T-wave magnitude after follow-up.

Conclusion: We found a strong correlation between IS and 3-month T-wave magnitude. Three-month T-wave magnitude and LVEF correlate better in anterior than in inferior MI. This could have clinical importance in the follow-up of myocardial infarction patients treated with PCI.

Table 1
Correlation between T-wave magnitude and CMR measures

Comparison	Group	Pearson r	P
IS vs T-wave magnitude	All (n = 55)	−0.16	.43
LVEF vs T-wave magnitude	All (n = 55)	0.35	.017
LVEF vs IS	All (n = 55)	−0.66	<.0001
IS vs T-wave magnitude	Anterior (n = 17)	−0.44	.08
LVEF vs T-wave magnitude	Anterior (n = 17)	0.69	.002
LVEF vs IS	Anterior (n = 17)	−0.64	.006
IS vs T-wave magnitude	Inferior (n = 38)	−0.40	.012
LVEF vs T-wave magnitude	Inferior (n = 38)	0.33	.043
LVEF vs T-wave magnitude	Inferior (n = 38)	−0.59	<.0001

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Analysis of QRS slopes as a measure of depolarization changes during acute myocardial ischemia

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Background: Risk stratification of acute myocardial ischemia could be improved by adding depolarization changes to the conventionally used ST-T changes. No QRS method has, however, reached clinical use yet .We assessed the value of analyzing QRS slope changes to evaluate and quantify ischemia.

Methods: In 79 patients undergoing prolonged elective percutaneous coronary intervention (25 left anterior descending artery [LAD], 38 RCA, and 16 LCX occlusions), upward (US) and downward (DS) slopes of the R wave, as well as upward slope of the S wave (TS) were determined at baseline and continuously during the procedure among the 12 standard ECG leads. In 38 of the patients (8 LAD, 21 RCA, and 9 LCX), myocardial scintigraphic imaging was additionally performed during the occlusion and as a control the following day to quantify the ischemia.

Results: For the total population (N = 79), DS changes were more pronounced than US changes in all leads but V1. In subgroup analysis, LAD and RCA occlusions showed more pronounced changes of DS than US in anteriorly (V1-V5) and inferiorly (II, aVF, and III) oriented leads, respectively. For typical leads with S waves (V1-V3), TS showed equal amount of change as DS. The amount of DS change showed a clear spatial pattern, with LAD occlusions showing most changes in leads V2-V4; RCA occlusions in leads II, aVF, and III; and LCX occlusions in leads V5-V6. In the subgroup with scintigraphic imaging (n = 38), the sum of absolute, positive DS change among all leads displayed a significant correlation to both extent and severity of ischemia ($r = 0.70$, $P < .0001$, and $r = 0.73$, $P < .0001$, respectively). The corresponding correlation between sum of R-wave amplitude increase among all leads, as well as QRS duration change and extent/severity, was $r = 0.41$, $P = .011$; $r = 0.46$, $P = .004$; $r = 0.43$, $P = .007$; and $r = 0.48$, $P = .003$, respectively.

Conclusion: We conclude that analysis of QRS slopes offers a robust depolarization parameter that could be used to evaluate myocardial ischemia in addition to conventional repolarization changes.

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