The aim of this study was to compare nonfluoroscopic electroanatomic mapping (NOGA), SPECT perfusion imaging, and PET metabolic imaging for assessment of myocardial viability. In particular, we sought to elucidate differences of electromechanical properties between the perfusion/metabolism mismatch as an indicator of a potentially reversible ischemic injury and the perfusion/metabolism match indicating irreversibly damaged myocardial tissue. METHODS: Twenty-one patients with coronary artery disease underwent NOGA mapping of endocardial unipolar voltage, cardiac 18F-FDG PET of glucose utilization, and resting 201Tl SPECT of myocardial perfusion. RESULTS: Electrical activity was 10.8 +/- 4.6 mV (mean +/- SD) in normal myocardium and was unchanged in hypoperfused segments with maintained glucose metabolism (perfusion/metabolism mismatch), 9.3 +/- 3.4 mV (P = not significant). In contrast, hypoperfused segments with a perfusion/metabolism match and nonviable segments showed significantly lower voltage (6.9 +/- 3.1 mV, P < 0.0001 and 4.1 +/- 1.1 mV, P < 0.0001 vs. normal). In hypoperfused segments, metabolic activity was more closely related to endocardial voltage than was myocardial perfusion (201Tl vs. voltage: r = 0.38, SEE = 3.2, P < 0.001;
18F-FDG PET vs. voltage: $r = 0.6$, $\text{SEE} = 2.8$, $P < 0.0001)$. CONCLUSION: In hypoperfused myocardium, electrical activity by NOGA mapping is more closely related to PET metabolic activity than to SPECT myocardial perfusion. As NOGA mapping does not differentiate hypoperfused myocardium with enhanced glucose utilization from normal myocardium, results from NOGA mapping need to be correlated with results from perfusion imaging to identify hypoperfused, yet viable, myocardium and to stratify patients for revascularization procedures.