A noninvasive imaging modality for cardiac electrophysiology and arrhythmias is not yet available for clinical application. Such modality could be used to identify patients at risk, provide accurate diagnosis and guide therapy. Standard noninvasive diagnostic techniques, such as the electrocardiogram (ECG) provide only low-resolution reflection of cardiac electrical activity on the body surface. In my presentation, I will describe the application in humans of a new imaging modality called Electrocardiographic Imaging (ECGI) that noninvasively images cardiac electrical activity on the heart epicardial surface. In ECGI, a multielectrode vest (or strips) records 250 body-surface electrocardiograms; then, using geometrical information from a CT scan and an inverse solution to Laplace equation, electrical potentials, electrograms, activation sequences (isochrones) and repolarization patterns are reconstructed on the heart surface. I will show examples of imaged atrial and ventricular activation and ventricular repolarization in the normal heart and during cardiac arrhythmias. References: 1. C. Ramanathan, R.N. Ghanem, P. Jia, K. Ryu, Y. Rudy. Noninvasive Electrocardiographic Imaging for cardiac electrophysiology and arrhythmia. Nature Medicine 2004; 10: 422-428. 2. C. Ramanathan, P. Jia, R.N. Ghanem, K. Ryu, Y. Rudy. Activation and repolarization of the normal human heart under complete physiological conditions. Proc Nat Acad Sci USA (PNAS) 2006; 103: 6309-6314. 3. P.S. Cuculich, Y. Wang, B.D. Lindsay, M.N. Faddis, R.B. Schuessler, R.D. Damiano, L. Li, Y. Rudy. Noninvasive Characterization of Epicardial Activation in Humans with Diverse Atrial Fibrillation Patterns. Circulation 2010;122:1364-1372.

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