TORSO MAPPING CAN IDENTIFY CHANGES IN VENTRICULAR ACTIVATION-RECOVERY INTERVALS DURING REGIONAL ISCHAEMIA THAT ARE NOT DETECTED USING THE STANDARD ECG

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Diagnosing myocardial ischaemia with a standard 12 lead ECG may result in false negatives due to its poor spatial resolution. We correlated changes in epicardial and torso electrograms (EGs) during regional ventricular ischaemia in a 29 kg anaesthetised pig that was artificially ventilated and thoracotomised. A suture snare was used to ligate the left anterior descending (LAD) coronary artery and an elasticized sock containing 127 unipolar stainless steel contact electrodes (inter-electrode spacing approximately 7 mm) was placed over the epicardium. The chest was re-closed and a vest containing 256 ECG electrodes (inter-electrode spacing approximately 15 mm) was fitted to the torso. Simultaneous arrays of epicardial and torso EGs (sampled at 2 kHz using a UnEmap data acquisition system[1]) were recorded at 20 s intervals during four minutes of LAD occlusion, followed by a period of reperfusion. Activation-recovery intervals (ARIs) and Q-T intervals (QTIs) were calculated from the EGs. Data were fitted to anatomically accurate computational models of the porcine ventricular epicardium (obtained using 3D echocardiography) and thorax (obtained by customizing a generic thorax model, derived from computerised tomography imaging)[2]. LAD occlusion caused the minimum ventricular epicardial ARI to steadily decrease (see table), whilst the location of this minimum shifted from the posterio-basal ventricular muscle (control) to the middle of the ischaemic region on the anterio-apical myocardium. These changes were associated with a steady decrease in the minimum torso QTI as it moved from the shoulder region (control) to the sternum. The 12-lead ECG was relatively unchanged. All electrical activity was fully restored following six minutes of reperfusion. We conclude that high spatio-temporal resolution torso mapping can detect cardiac ischaemia that is not always identifiable using indices derived from standard ECG leads.

Protocol time (s)	**0**	**20†**	**40†**	**60†**	**120†**	**180†**	**240†**	**260‡**	**600‡**
Epicardial ARI (ms)	153	149	137	134	103	85	93	128	152
Torso QTI (ms)	152	150	145	141	104	95	112	134	158
12-lead QTI (ms)	153	150	149	151	146	149	138	145	162

Minimum ARI and QTI computed from the ventricular epicardium, torso and standard 12-lead ECG recordings during regional ventricular ischaemia (†) and reperfusion (‡).

References:

1. Nash MP, Thornton JM, Sears CE, Varghese A, O'Neill M, Paterson DJ. Ventricular activation during sympathetic imbalance and its computational reconstruction. *J Appl Physiol*. 2001;90(1):287-98.
2. Nash MP, Bradley CP, Kardos A, Pullan AJ, Paterson DJ. An experimental model to correlate simultaneous body surface and epicardial electropotential recordings in-vivo. *Chaos, Solitons and Fractals*. 2002;13(8):1735-42.