A Model of Anatomically Opposed Ischaemia: Revisited

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Aims: This study aims to gain further understanding of anatomically opposed ischaemia, or “ischaemic ST-segment counterpoise”, by simulating body surface maps (BSM) resulting from two regions of subendocardial ischaemia in the left ventricle during the ST-segment.

Methods: The finite volume method was used to solve the passive bidomain equation in a torso with an idealised model of the heart. Regions of ischaemia of varying size were placed in various positions in the posterior, anterior or left lateral regions of the ventricular wall. The ischaemia was set at 50% of the thickness of the ventricle wall. Six conductivity values were used for the intracellular and extracellular spaces in the longitudinal, transverse and normal directions, respectively. Cardiac fibres rotated through 120 degrees from the epicardium to the endocardium and the ST potential for the ischaemic region was set 30mV lower than that of the normal tissue.

Results: Simulations showed that two large regions of ischaemia, one anterior and one posterior, tended to reduce the range of body surface potentials observed, compared to one anterior region alone. Also, a second valley of negative potential appeared to intensify with the two regions. Reducing the size of the posterior region did not appear to change the BSM greatly. However, moving the posterior region to the left lateral wall further reduced the range of potentials and showed a dipole pattern. For a large posterior region and a small anterior region, the range of potentials was reduced even further and gave a tripolar BSM with a large valley of negative potential on the right.

Conclusions: The presence of two regions of subendocardial ischaemia reduces the range of observed potentials in BSMs as compared to one ischaemic region. The relative size and positioning of these regions has a significant effect on the BSM.