The Role of Beta-1 Receptors in the Response to Myocardial Ischemia

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Introduction: Myocardial ischemia is commonly diagnosed by ST-segment deviations. These deviations, however, can show a paradoxical recovery even in the face of ongoing ischemic stress. A possible mechanism for this response may be the cardio-protective effects of the autonomic nervous system (ANS) via beta–1 receptors. We assessed the role of norepinephrine (NE), a beta-1 agonist, and esmolol (ES), a beta-1 antagonist, in the recovery of ST-segment deviations during myocardial ischemia.
Methods: We used an experimental model of controlled myocardial ischemia in which we simultaneously recorded electrical measurements intramurally and on the epicardial surface. We measured ischemia as deviations in the potentials measured at 40% of the ST-segment duration.
Results: During control intervention, 27% of epicardial electrodes showed ischemic ST-segment deviations, whereas during the interventions with NE and ES, none of the epicardial electrodes showed ischemic ST-segment deviations. Intramural electrodes revealed a different behavior with 71% of electrodes showing no ST-segment elevations during control ischemia, increasing to 79% and 82% for NE infusion and ES infusion interventions, respectively, as shown in Figure 1.

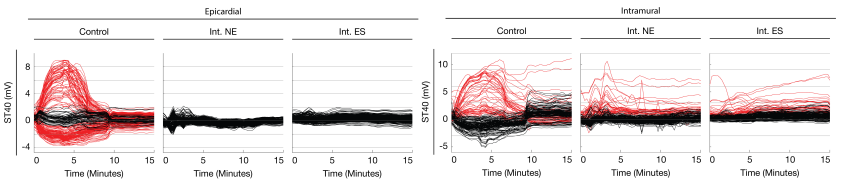

Figure 1. Run metric plot of ST40% potential changes throughout an ischemic event. The left panel shows the epicardial surface recordings and the right panel shows the intramural recordings. For both panels, the columns represent the control intervention (left), the intervention with NE (middle), and the intervention with ES (right). The row shows the ST40% potentials where each line represents the electrical activity of one electrode. A red line corresponds to an ischemic electrode and a black line corresponds to a nonischemic electrode.

Conclusion: These preliminary results suggest that recovery of intramural regions of the heart is delayed by the presence of both beta-1 agonists and antagonists even as epicardial potentials show almost complete recovery.