

Vectorcardiographic Changes During Exercise Test - Correlates to Lactate and Anaerobic Threshold?

JA Lipponen*, V Gladwell, H Kinnunen, PA Karjalainen, MP Tarvainen
University of Eastern Finland, Kuopio, Finland

Recently it have been found that low blood glucose concentration, i.e. hypoglycemia, affects repolarization of the heart and can be seen in vectorcardiography (VECG) as decrease in T-wave amplitude and reduction in the spatial angle between QRS complex and T wave vector loops. Motivated by these findings, the aim of this study was to investigate the correlations between blood lactate concentration, different VECG parameters, ventilatory parameters and heart rate during exercise and recovery periods. More specifically, we wanted to identify correlations between VECG parameters and commonly used exercise intensity parameters including the use of invasive collection of lactate concentration.

Six (25-37 years old) non athlete, healthy, male subjects participated in the study. All subjects performed two different bicycle ergospirometric tests, protocols P1 and P2 (see figure 1). The basic idea of using two different protocols was to attain different lactate levels with different heart rate profiles, and thus get more general results than using only ramp test.

During exercise VECG parameters are not as informative as heart rate and spirometer parameters. However, during recovery period changes in T-wave vertical angle (θ_T) were similar to those in lactate concentration. Correlations between lactate and RR interval were $r = -0.72$ (P1, $p < 0.001$) and $r = -0.53$ (P2, $p < 0.001$), whereas between lactate and θ_T they were $r = -0.54$ (P1, $p < 0.001$) and $r = -0.71$ (P2, $p < 0.001$). Although there were good correlations between lactate and θ_T it was surprising that correlation between θ_T and RR interval was as low as $r = 0.24$ (P1) and $r = 0.15$ (P2). This indicates that θ_T is not dependent on RR interval-time. Correlation between θ_T and markers of intensity suggest that the use of vectorcardiography may be an promising and interesting non-invasive tool for recovery monitoring after exercise.

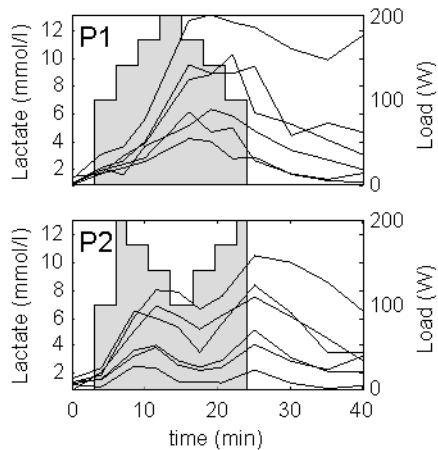


Figure 1: The two measurement protocols P1 and P2. Used load (gray areas) and measured lactate values (black lines) for all six subjects.