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THE EFFECTS OF ACUTE EXERCISE AND ENDURANCE TRAINING ON MYOCARDIAL BLOOD FLOW HETEROGENEITY

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Objectives

Myocardial blood flow is an important determinant of proper function of the heart, especially during exercise. Effects of acute exercise and endurance training on human myocardial blood flow heterogeneity are however largely unknown.

Methods

In the present study we measured myocardial blood flow in 17 different segments of the left ventricle in 13 untrained healthy men and 13 highly endurance-trained male athletes at rest and during supine bicycle exercise (100 watts). Myocardial blood flow was measured with positron emission tomography and regional myocardial blood flow analyzed by Carimas image analysis software. Myocardial blood flow was analysed in different segments of apex, middle ventricle, and base part of the left ventricle, and blood flow heterogeneity calculated as coefficient of variation of the all 17 segments.

Results

Blood flow was the highest in apex regions and decreased towards the base regions both at rest and during exercise in both groups, but was also consistently lower in endurance athletes in all regions. In response to acute exercise, myocardial blood flow heterogeneity did not change in endurance athletes (23±11% at rest and 19±8% during exercise), but was increased in untrained subjects (18±6% at rest and 30±4% during exercise, $p=0.0005$). Myocardial blood flow was also less heterogeneous during exercise in endurance athletes compared to untrained men. The more heterogeneous blood flow in untrained subjects was explained by a relatively larger increase in blood flow in the apex regions compared to base and middle part regions of the ventricle in transition from rest to exercise.

Conclusions

In conclusion, myocardial blood flow heterogeneity increases from rest to exercise in normal healthy untrained men as blood flow especially in the apex regions increases substantially. Furthermore, blood flow is less heterogeneous in highly endurance-trained athletes during exercise at the same absolute external workload, which may contribute to their higher cardiac pump capacity.