MYOCARDIAL BLOOD FLOW AND ADENOSINE A2A RECEPTOR DENSITY IN ENDURANCE-TRAINED AND UNTRAINED MEN

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INTRODUCTION

Adenosine (ADO) is an important metabolic regulator of myocardial blood flow (MBF). Its effects are mediated via four different receptors; A1, A2A, A2B and A3. A body of animal experiments suggests that the vasodilatory effects of ADO, especially in coronary vasculature, are mediated via A2A receptors (A2AR). It was tested in the present study, whether myocardial A2AR density is altered in endurance athletes (EA) compared to untrained (UT) men, and whether the possible changes in receptor density are related to alterations in myocardial blood flow (MBF) at rest or during adenosine stimulation.

METHODS

Ten well-trained men EA (age 24.6 ± 3.6 years; VO2max 4.7 ± 0.3 l/min) and ten UT men (age 25.7 ± 4.2 years; VO2max 3.5 ± 0.3 l/min) participated in the study. MBF was measured at baseline and during continuous intravenous infusion of adenosine (140 microg/kg body weight/min) with positron emission tomography (PET). PET and 11C-TMSX tracer was used for A2AR density measurements. Structural left ventricular (LV) parameters were measured using echocardiography and continuous incremental VO2max bicycle test was performed for fitness state evaluation.

RESULTS

EA had higher total LV MBF at baseline (217 ± 61 vs 155 ± 28 ml/min) and during ADO infusion (1056 ± 272 vs 777 ± 223 ml/min) compared to UT (p < 0.01). In contrary, when the values were related to LV mass, EA had lower MBF in both measurements (0.56 ± 0.13 vs 0.69 ± 0.09 ml/min/g at rest and 2.75 ± 0.75 vs 3.48 ± 0.94 ml/min/g, respectively, p < 0.001) due to the significantly larger LV mass (LV mass index in EA 193 ± 18 and in UT 114 ± 43 g/m2, p < 0.001). MBF reserve did not differ between the groups (p = 0.9). The total volume of A2A receptors in LV was significantly higher in ET (704 ± 145 ml in EA and 388 ± 102 ml, p < 0.001), but when related to LV mass, there were no differences in A2AR density between the groups (1.83 ± 0.43 ml/g in EA and 1.71 ± 0.29 ml/g in UT, p = 0.5). No significant correlations were found between the A2AR density and MBF at rest or during ADO infusion in either group.

DISCUSSION

The results showed that both the total volume of A2A receptors in LV and total LV MBF at rest and during adenosine are increased in EA compared to UT. However, when the increased LV mass in ET is taken into account, A2A receptor density seems not to be altered by training and MBF is even decreased in EA. Taken together, these findings suggest that both A2A receptor density and MBF capacity are altered along the increase in LV mass, and no supra-normal capacity in either parameter is observed. The poor correlation between A2A receptor density and blood flow parameters suggests that A2A receptors are not the sole ADO receptors responsible for ADO-induced vasodilation in coronary vasculature in humans.

Keywords: Blood Flow, Cardiac, Athlete’s Heart

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