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Effect of regional muscle cooling on cardiovascular response during static knee extension exercise

Masaki MIZUNO¹, Ken TOKIZAWA¹, Isao MURAOA²¹Graduate School of Human Sciences, Waseda University²School of Sport Sciences, Waseda University

Purpose: The purpose of this study was to test whether there are regional differences in the exercise pressor reflex within an exercising muscle. To test this, we evaluated the effect of regional muscle cooling on the pressor response during exercise. **Methods:** Nine subjects performed 2 min of ischemic isometric knee extension at 30% of maximal torque, followed by 2 min of postexercise muscle ischemia (PEMI) without cooling (control), proximal thigh portion cooling (P-trial), and distal portion cooling (D-trial). **Results:** In both cooling trials, regional cooling significantly decreased the skin temperature of the exposed portion, with no effect apparent on the opposite portion of the thigh. During exercise, heart rate and arterial pressure significantly increased, but were not affected by regional thigh cooling. At 60 and 90 s of exercise, increasing calf vascular resistance in the D-trial was significantly attenuated compared with the control and P-trials ($P < 0.05$). During PEMI, there was no difference in heart rate and arterial pressure between trials. In contrast, calf blood flow in the D-trial was significantly higher than in the control trial ($P < 0.05$); consequently, calf vascular resistance in the D-trial tended to be lower than in the control trial during PEMI ($P = 0.07$). **Conclusion:** These findings suggest that there are regional differences in the exercise pressor reflex within an exercising muscle; that is, during static exercise, the distal portion of a thigh muscle makes a greater contribution to the pressor response than does the proximal portion.

Keywords: exercise pressor reflex, muscle temperature, heterogeneity

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Real time analysis of flow induced dilation on the rat cremaster muscle using microvessel OD-RT and video dimension analyzer

Junichi MAEDA¹, Hideaki KOMIYA²,Takashi TAKEMIYA³ and Paul C JOHNSON⁴¹Miyagi Univ. of Education, ²Utsunomiya Univ., ³Nippon Sports Science Univ., ⁴Univ. of California San Diego

Purpose: The mechanisms of arteriolar dilations induced by a parallel occlusion of opposite branch arterioles on the rat cremaster muscle are not elucidated. We reported that the dilation with or without delay time from onset of the occlusion is functionally different. The delay time is to be a crucial index to identify the flow induced dilation. Thus, real time analysis is very important to analyze the flow induced dilation with parallel occlusion. In the present study, we analyzed the arteriolar dilation induced by the parallel occlusion on the branch arterioles of the rat cremaster muscle, using a real time measurement system for the diameter and red blood cell velocity.

Methods: The right cremaster muscles of anesthetized male SD and Wistar-Hannover rats were surgically exteriorized using the modified Baez method (Baez S 1973). The cremaster muscle was suffused with Ringer bicarbonate solution. Images gained through microscope were divided into a high speed CCD camera and into an image viewing screen with a pair of photodiode. The diameter of arteriole was measured by a video dimension analyzer (V94, ISI). The Red blood cell (RBC) velocity was measured with a Microvessel Velocity OD-RT system (Circusoft). The wall shear rate (WSR) was calculated from the diameter and RBC velocity data. Vessels classified as 3 rd-order arterioles by the Wiedeman ordering system (Wiedeman MP 1962) were selected for this study. Changes in RBC velocity in the vessel selected were achieved by occlusion of the adjacent feeding arteriole with a fire-polished glass micropipette (tip diameter of ~60 micrometers). Measurements were made in vessels that branched proximal to the occlusion site. The diameter and RBC velocity of arterioles were measured and recorded for a control period of 3 min, followed by a 30 sec occlusion of an adjacent arteriole to increase the RBC velocity in the vessel under observation and 3 min recovery period.

Results and Discussion: The RBC velocity of unoccluded arterioles increased immediately after onset of parallel occlusion. There were two types of dilation of the unoccluded arterioles with delay time from the onset of the occlusion and without delay time. The real time analyzing system combined by the video dimension analyzer and the Microvessel Velocity OR-RT provided us a useful and precise data to classify the mechanism of flow induced dilation and other than the flow induced dilation.

Key words: real time measurements, flow induced dilation, arterioles, parallel occlusion