修士論文要旨

運動特性の違いによる伸張反射機能の特異的適応

Specific Adaptations of Stretch Reflex Functions in Individuals with Different Athletic Background

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Introduction

Human reflex system is known to undergo plastic adaptations in response to physical activities. More importantly, the adaptations are dependent on the tasks required for the activities and are very specific. The present study compared the characteristics of the input-output relationship or stretch reflex gain within two different stretch reflex pathways between individuals engaged in physical activities requiring different tasks. The neural mechanisms responsible for the reflex responses were also investigated by applying conditioning stimulus of vibration.

Methods

Subjects: 12 sprint-trained athletes as well as 12 endurance-trained distance runners all belonging to a collegiate athletic team.

Experiments: Stretch reflex was induced in the soleus muscle by a mechanical perturbation at the ankle joint during voluntary contraction of the muscle. The stretch reflex gain, defined as the slope of the regression line for the relationship between the reflex response amplitude against the angular velocity of the perturbation, was evaluated. Influence of the vibration on stretch reflex response as well as on H-reflex response was also evaluated.

Results

There were no differences in the stretch reflex gain between the groups for both short- and middle- latency components. Sprint- group showed relatively smaller reflex amplitude to a given stretch velocity compared to the endurance- in the short- latency component. The vibration decreased the stretch reflex gain in both groups for both short- and middle- latency components and there were no differences in the ratio of the decrease between the groups for both components. The vibration decreased the amplitude of H-reflex in both groups, but the ratio of the decrease was significantly greater in the sprint- than in the endurance- group.

Discussion

For the short-latency component of the stretch reflex, from the result that there were no differences in the gain, the difference in the stretch reflex amplitude could not be attributed to the difference in gain, but to differently applied biases such as the subliminal fringe or the presynaptic inhibition. However, the influence of the subliminal fringe was omitted because of the matched background activity between the groups although the possibility of the presynaptic inhibition still remained uncertain. The other possibility was the difference in the muscle spindle susceptibility in that alpha and gamma motoneurons are co-activated, but to a different extent. Since the vibration decreased the short- latency component of the stretch reflex gain to a similar extent between the groups, whereas the H-reflex in the sprint- was far more sensitive, it is likely that the difference in the stretch reflex amplitude could probably be attributed either to the differences in the presynaptic inhibition or the muscle spindle susceptibility since H-reflex is reported to be more sensitive to the presynaptic inhibition than in mechanically evoked stretch reflex and muscle spindle is bypassed in H-reflex.

Summary

The present results indicated that there were no differences in the input-output relationship between the sprint- and the endurance- groups both in the short- and the middle- latency components. The reflex amplitude was smaller in the sprint- than in the endurance group. It is likely that two possible mechanisms within the neural pathway, presynaptic inhibition and/or the muscle spindle susceptibility are differently adapted depending on the types of physical activities in which they are engaged.