七247 Effects of unilateral denervation on metabolic and morphologic properties of rat phrenic motoneurons

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(Objective) The main purpose was to examine the effects of changes in electrical activation and trophic factors on phrenic motoneurons.
(Methods) To label the phrenic motoneurons, a fluorescence tracer (Fluorogold) was injected into the both side of diaphragm in twelve rats. In 6 rats, a week after the injection of tracer, the right phrenic nerve was cut to make the denervated (DNV) motoneurons on right side and overloaded (OVL) motoneurons on left side. After histochemical processes, the succinic dehydrogenase (SDH) activities and soma areas of the labeled phrenic motoneurons were quantified using a computerized image-processing system that calibrated for densitmetry and morphometry.
(Results) As compared to the control motoneuron, the relative numbers of large motoneurons (> 1000 um2) were decreased in the DNV and OVL motoneurons. The SDH activities of the denervated motoneuron were lower at the middle (500-1000um2) and large size motoneuron (> 1000 um2) groups. There were no significant differences in the soma areas and SDH activities between control and OVL motoneurons.
(Conclusion) Based on previous studies, these larger motoneurons putatively innervate fast-twitch muscle. Therefore, the results indicated that the denervation induced changes in the metabolic and morphologic properties of the phrenic motoneurons, and that the changes were restricted to the fast type motoneurons.
(Key words) phrenic motoneuron, denervation, SDH activity, soma area

七248 MUSCLE SPINDLE AFFERENT RESPONSES AS INFLUENCED BY RUNNING EXERCISE

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To clarify whether the activity of γ motoneuron-muscle spindle system are influenced by loading of physical exercise or not, the afferent responses of the muscle spindle endings to stretch of the muscle of rats were examined. Rats run on a treadmill at the speed of 40 m/min for 15 sec repeatedly 24 times at the intervals of 15 sec in a day. Such daily running exercise was continued for 8-10 weeks. In urethan-anesthetized rats, the dorsal root (L7 or S1) was dissected to isolate the GIa fibers from the primary endings as well as the GII fibers from the secondary endings in the soleus muscle by measuring their conduction velocity. The conduction velocities of the GIa and GII fibers in TR were not significantly different from those in CR, without showing any adaptive changes derived from physical training.
In each stretch response, peak frequency(P) at the end of stretching, static frequency (S) 0.5 sec later and the dynamic index(DI) were measured, and in terms of these three parameters the spindle afferent responses of trained rats(TR) were compared with those of untrained rats(CR). Regarding the stretch responses of the GIa fibers, P and DI in TR were significantly greater than those in CR ($p<0.001$), whereas regarding the stretch responses of GII fibers, P, S and DI in TR were significantly greater than those in CR ($p<0.001$). Such the significant increases in these parameters of the stretch responses of both types of muscle spindle endings in TR strongly suggest the activation of γ motoneuron-muscle spindle system as an adaptive change derived from loading of treadmill running for a certain period. On whether the γ motor neuron activated is dynamic or static, the increased P accompanied with the resultant increase in DI in the responses of GIa fibers in TR may indicate the activation of dynamic γ motoneuron, whereas the increase in P, S and DI in the responses of GII fibers in TR may indicate the activation of static γ motoneuron. However, such a response pattern as an increased S accompanied with a resultant decrease in P in the responses of GIa fibers in TR was not encountered. Therefore, whether static γ motoneuron is activated by physical exercise or not remains for further study.

KEY WORDS: muscle spindle, training, rats