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Effect of local hypothermia of the spinal cord on the motor evoked potentials of the hindlimb muscles after spinal cord injury in rat

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The motor evoked potentials induced by the epidural stimulation of the spinal cord can be used for assessment of the sensory motor control of the hindlimb movement and can be used for evaluation of the spinal cord functional state after spinal cord injury (SCI) (Lavrov et al. 2006). In order to better understand the developing of the regenerating processes in spinal circuit after spinal cord injury (SCI) and assess the treatment by local hypothermia of the spinal cord immediately after SCI we use the rodent model of contusion SCI and following evaluation of functional state of spinal cord circuits by the epidural induced motor evoked potentials.

Methods

The contusion SCI was modeled on the level of Th8-Th9 vertebrae, the local hypothermia was applied immediately after SCI at the site of injury for 20 minutes. The motor evoked potentials induced by epidural stimulation of L4 segment of the spinal cord were recorded from m. gastrocnemius, m. soleus, and m. tibialis anterior. The amplitude, latency and the threshold of generating of minimal response were analyzed. All procedures were made in accordance with bioethics norms. All procedures were performed in accordance to bioethics norms and data were processed statistically with one-way ANOVA.

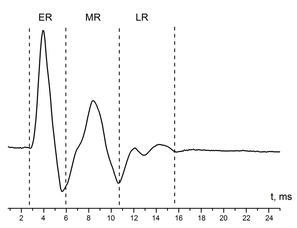

Fig.1 An example of motor evoked potential of the m. tibialis anterior induced by stimulation (5V) on the level of S1 segment of spinal cord. The potential consists of multiple components, an early response (ER) refers with direct motor response, a middle response (MR) is similar with monosynaptic reflex response and the late response (LR) reflect the processes of polysynaptic reflex pathways.The vertical dashes showes the latency of ER, MR, LR components of the potential.

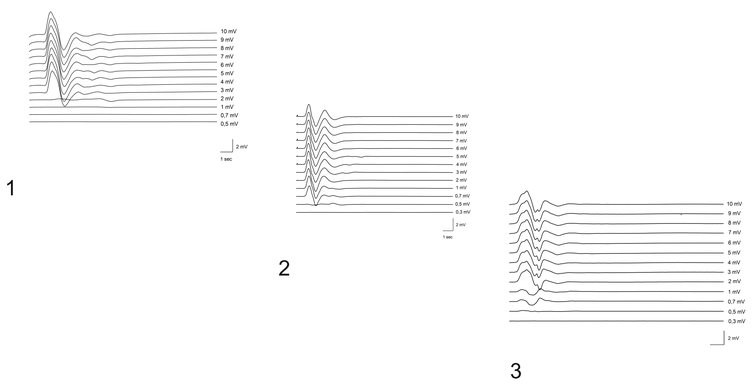

Fig.2 Examples of evoked potentials of m. soleus (1), m. gastrocnemius (2), m. tibialis anterior (3) induced by the epidural stimulation of S1 segment of spinal cord with different intensity in intact animals.

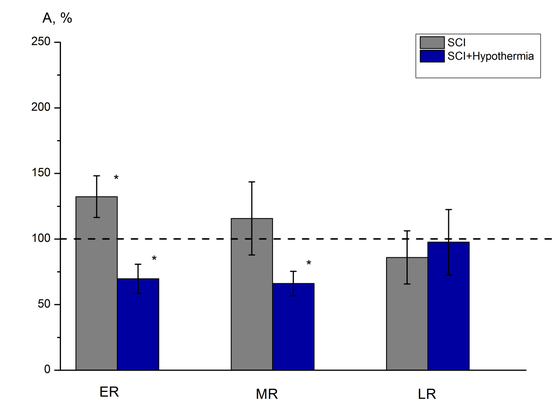

Fig.3 The maximal amplitude of ER, MR and LR (100% - the average values of maximal amplitude of ER, MR and LR in intact animals respectively) of m.soleus in rats 20 minutes after SCI and immediatly after hypothermia treatment.
* - differed significantly from the values of responses in intact animal (P<0,05).

Results

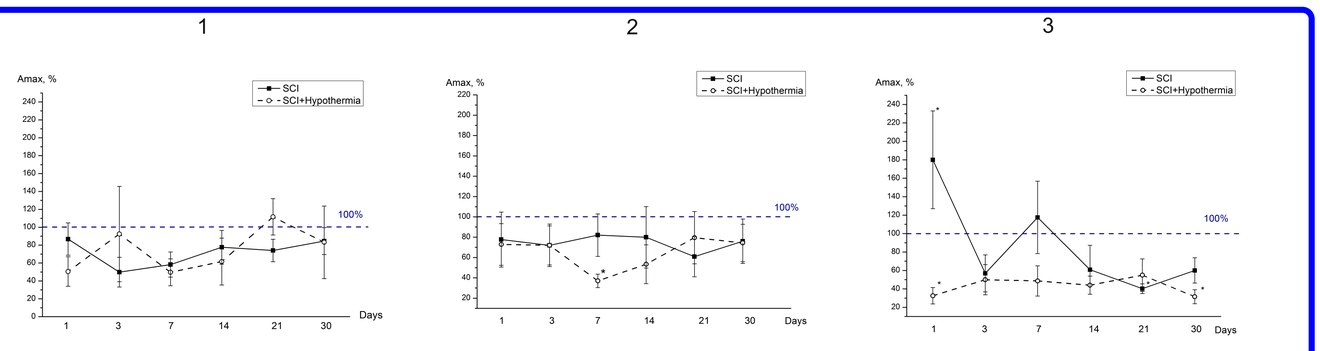

Fig.4 The maximal amplitude of MR (100% - the average values of maximal amplitude of ER, MR and LR in intact animals respectively) of m.soleus(1), m.gastrocnemius (2) and m. tibialis anterior (3) over the 30 days period after SCI and SCI with hypothermia treatment.
* - differed significantly from the values of responses in intact animal (P<0,05).

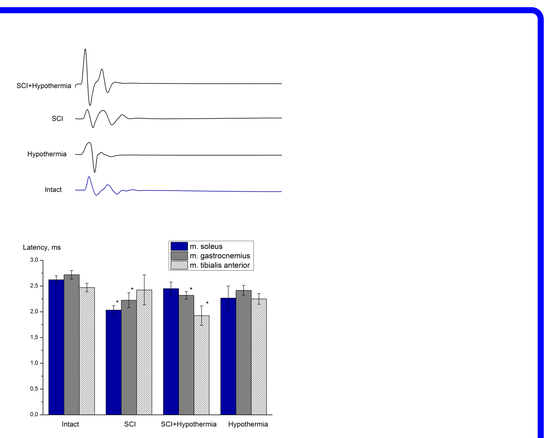

Fig.5 Examples of motor evoked potential of the m. soleus on 30th day after SCI, after SCI with hypothermia treatment and hypothermia on intact spinal cord (above). The values of latency of motor evoked potentials all muscles on 30th day in all experemetial groups.

Conclusion

The results allowed us to suggest that the treatment with local hypothermia can decrease the excessive excitability of spinal circuits observed in acute period of SCI, but it inhibited the further recovery of functions of the spinal circuits in chronic period of SCI in rat.

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