Kazan Federal UNIVERSITY

# The analysis of the functional state of spinal circuit during a two month period after spinal cord injury

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## Introduction

Motor evoked potentials induced by epidural spinal cord stimulation can be used for evaluation of the spinal cord functional state after spinal cord injury (SCI) (Lavrov et al. 2006). 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. In order to better understand the developing of the regenerating processes in spinal circuit after spinal cord injury (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.

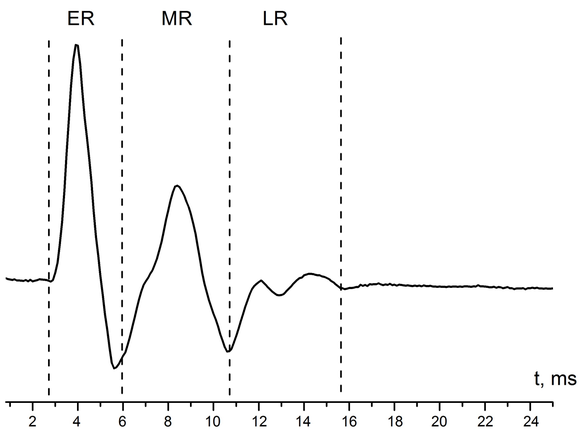


Fig.1 An example of motor evoked potential of the m. tibialis anterior induced by stimulation (5V) on the level of S1 segment of spinal cord. The vertical dashes showes the latency of ER, MR, LR components of the potential.

## Methods

The multiple components ER, MR and LR of motor evoked potentials of m. tibialis anterior (TA) were investigated during a 60 days period after SCI. The contusion SCI was made on the level of open T8-T9 vertebrae of anesthetized rats by the Allen's methods. The motor evoked potentials induced by epidural stimulation of S1 spinal cord segment were recorded from TA on 1, 3, 7, 14, 21 and 30 and 60 days after SCI. The motor evoked potentials of TA registered from intact animals were control. The visual recovering of locomotor functions was assessed according to Basso-Beattie-Breshnan (BBB) scale. All procedures were performed in accordance to bioethics norms and data were processed statistically with one-way ANOVA.

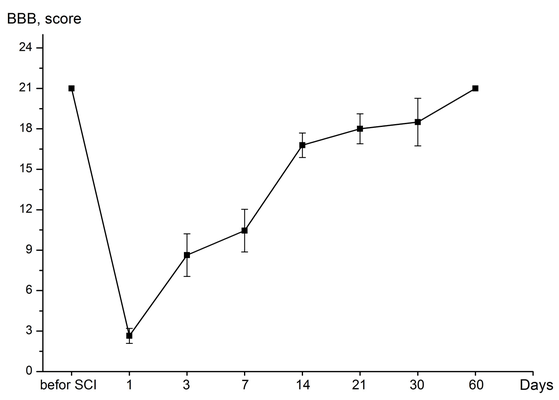


Fig.2 The open field locomotor performance assessed during 60 days after SCI acording BBB scale.

## Results

It was shown that on a first day after SCI the average amplitude of ER and MR of TA was highly increased up to 205±41,8% (ER) and 264±94% (MR) against the low locomotor activity of hindlimbs. The amplitude of LR did not change on a first day after SCI. On the 14th day we observed that the average amplitude of responses return to normal values but the locomotor performance was decreased (BBB scores 16,625). On 21 day the amplitude of ER and MR was decreased to 64±14% (ER) and 59±10% (MR). The average amplitude of ER and MR return to normal value as a locomotor activity of hindlimbs completely recovered only a 2 month after SCI.

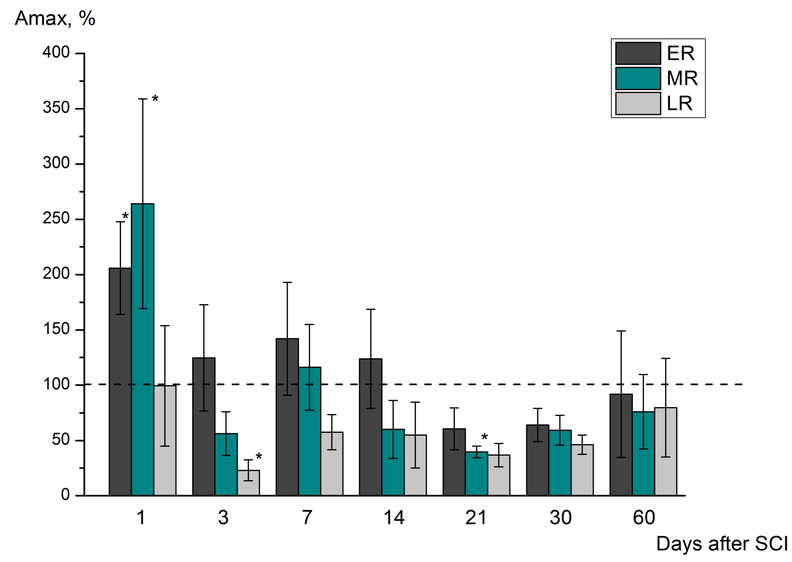


Fig.3 The maximal amplitude of ER, MR and LR (100% - the average values of maximal amplitude of ER, MR and LR in intact animals respectively) of m. tibialis anterior in rats with SCI.

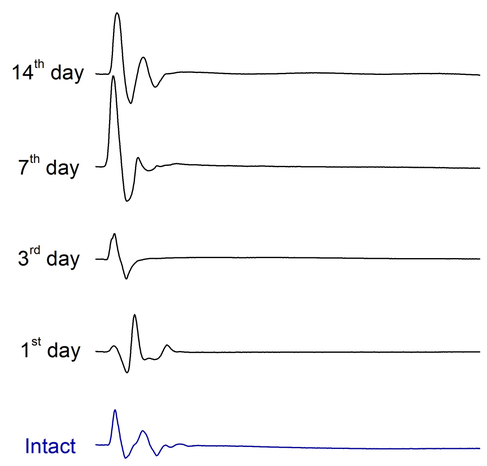


Fig.4 Examples of motor evoked potential of the m. tibialis anterior before SCI (blue) and on 1st , 3rd , 7th, 14th days after SCI.

## Conclusion

The obtain results showed that despite on low activity of hindlimbs muscles which we observed on the first week after SCI the lower spinal cord circuits continued to function but without supraspinal control they didn't perform their tasks. Further their degradation slowed down of regenerative process of locomotor recovering.

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