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Presentation Abstract

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Presentation Title: 4-Aminopyridine restores fractal structure of spontaneous cord dorsum potentials in the hemisected spinal cord

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Abstract: 4-Aminopyridine (4AP) increases evoked excitatory as well as inhibitory synaptic transmission in the spinal cord (Brain Research, 240 (1982) 117), enhances interneuronal spontaneous activity and partly restores impaired spinal cord functions (Neuroscience, 126 (2004) 511). However, few studies deal with the changes in the functional organization of the neuronal ensembles associated with the generation of spontaneous cord dorsum potentials (CDPs). We have shown that in the anesthetized cat, spontaneous CDPs are synchronously generated in several spinal segments by a distributed system of interconnected neuronal sets. This synchronicity is partly impaired by interposed spinal lesions, but the question remains on the extent to which the unaffected networks retain their original organization, and whether this organization can be restored by the systemic or intraspinal administration of 4AP. We have now simultaneously recorded the spontaneous CDPs from several spinal segments. We focused our analysis on the purely negative (nCDPs) and negative-positive (npCDPs) potentials, the latter associated with the generation of primary afferent depolarization. Systemic (0.1 mg/kg), or micropipette pressure delivered 4AP within the dorsal horn in the left L6 segment, increased the frequency of occurrence of the spontaneous nCDPs and npCDPs as well as the correlation between pairs of CDPs recorded from different segments. Fractal analysis showed

that the increment of these two types of spontaneous CDPs after administration of 4AP occurred in a non-random fashion, suggesting that the 4AP increased the effectiveness of the synaptic transmission of already existing pathways without changing their intrinsic functional structure. The frequency of spontaneous CDPs and the correlation between pairs of CDPs from neighboring segments was clearly reduced after an interposed spinal ipsilateral hemisection. Yet, after 4AP, both the frequency and correlation between the spontaneous CDPs were significantly increased and fractal analysis indicated recovery of synaptic transmission and a non-random structural restoration of these potentials. It is suggested that this improvement is achieved by changing the probabilities of activation of the involved neuronal ensembles without changing their internal functional structure. The potential clinical significance of these findings remains to be explored.

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