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Presentation Abstract

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Title: State dependent changes in the fractal structure of spontaneous cord dorsum potentials induced by peripheral nerve and spinal lesions in the anesthetized cat

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Abstract: A multidimensional detrended fluctuation analysis (mDFA) was used to examine the fractal structure of spontaneous cord dorsum potentials (CDPs) recorded with surface ball electrodes simultaneously from the L4-L7 segments in the spinal cord of the anesthetized cat. Time series included both negative (nCDPs) and negative-positive (npCDPs) potentials, the latter appearing together with spontaneous dorsal root potentials generated by primary afferent depolarization. In 4 experiments with intact spinal cord and peripheral nerves, CDPs recorded from a single spinal segment had a non-random structure and were long-term correlated, as indicated by the auto similitude value of a=1.01±0.04 (a=0.5 indicates randomness and a>0.5 long-term correlation). Similar 'a' values were obtained from mDFA calculated for multiple (left L4, L5, L6 and L7) segments (a=1.01±0.04). Following randomization, the same set of data showed DFA a=0.48±0.007 and mDFA a=0.49±0.004. In 2 experiments, the acute section of the left superficial peroneal and sural nerves had very small effects on the mDFA values of 'a' calculated for the left L4-L7 potentials (from control a=1.03±0.2 to a=0.99±0.09 after nerve section). These values were slightly reduced by the additional section of the sciatic nerve (a=0.95±0.10), even though

there was a noticeable increment in the amplitude fluctuations of the spontaneous CDPs, and more markedly by the additional bilateral section of the dorsal roots (a=0.78±0.18). The subsequent section of the left dorso-lateral fasciculus (DLF) between L5 and L6, followed by the section of the right DLF produced no additional changes in 'a' (0.77±0.01 and 0.78±0.01, respectively), even though there was a clear reduction in the correlation between pairs of spontaneous nCDPs or pairs of npCDPs. All together these observations support the proposal that the ensembles of dorsal horn neurons involved in the generation of the spontaneous CDPs form a segmentally distributed system of interconnected neurons leading to a structured organization that partly depends on sensory inputs. This organization is maintained after interposed DLF lesions despite the interruption of intersegmental connections.

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