

Effects of spinal cord stimulation in peripheral nerve branch injuries in the rat.

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Aim: The aim of the present study was to compare the response to spinal cord stimulation (SCS) and the yield of neuropathic animals in several types of peripheral nerve branch injuries - variants of the spared nerve injury (SNI) model (Decosterd and Woolf 2000).

Methods: The injury procedures were: 1. ligation of tibial and common peroneal branches and removal of the peripheral parts (SNI model); 2-3. sectioning of either of these branches (PA and TA); 4. ligation, without sectioning, or partial (1/3 to 1/2) ligation of the tibial nerve (TL and PTL). In total, 153 Sprague-Dawley rats were submitted to surgery and then tested for paw mechanical (v Frey filaments) and cold (acetone drop) hypersensitivity - similar to "allodynia" observed in nerve-injured patients. A miniature electrode system for SCS was then implanted at the T10-T11 level. Stimulation was applied in awake and freely moving animals with parameters comparable to those employed clinically. Suppression of paw hypersensitivity was considered a positive response to SCS.

Results: The incidence of mechanical "allodynia" in the different models were: SNI 53%; PA 45%; TA 68%; TL 73% and PTL 50%. The allodynia persisted for about 7 weeks, somewhat longer in the SNI model and shorter in the PTL model. Cold hypersensitivity peaked after 3-4 weeks and persisted for more than 70 days in most of the models. A conspicuous observation was the high incidence of "mirror phenomena" with hypersensitivity also in the contralateral paw in about 20% of the animals. The response to SCS differed between the models with the lowest response rate in the original SNI model (8%) while the other (TA; TL; PTL) demonstrated rates in the order of 40-50%. The efficacy of SCS in suppressing allodynia was negatively correlated to the degree of hypersensitivity.

Conclusions: In conclusion, modifications of the SNI model may provide a higher incidence of neuropathic hypersensitivity and increased responsiveness to SCS. Some of these variants may prove suitable for future research on the physiological mechanisms behind beneficial effects of SCS in neuropathic pain.