COMPARISON OF FIVE DIFFERENT RAT MODELS OF PERIPHERAL NERVE INJURY

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Although several animal models using peripheral nerve injury are currently described, little is available on direct comparisons between these rodent models. In this present study we compared five different models in adult male Sprague Dawley rats (180 – 300g) over a sustained period of time, involving a broad range of sensory testing to evaluate various forms of allodynia, hyperalgesia and hyperexcitabilities. The models were, complete transaction of the sciatic nerve (Wall et al 1979), chronic constriction injury (Bennet and Xie 1988), partial sciatic ligation (Seltzer et al 1990), spinal nerve ligation (Kim and Chung 1992) and the tibial and sural nerve transection (Lee et al 2000). For each of the models sham and control groups were included and sample sizes varied between n= 10-14 rats. Before and at weekly intervals after surgery, the animals were tested up to 56 days. The sensory test chosen were: neutral plate (21 ± 0.5°C), hot plate (45°C ± 0.5°C), cold plate (CP) (0 ± 0.5°C), the Von Frey (VF) test (using a pressure algometer), the pin prick (PP) test and the acetone spray (AS) test.. Difference between groups were analysed using the Mann-Whitney U test (two-tailed; p < 0.05).

With all models there was little difference between control, sham and operated groups in the neutral and hot plate tests and there was little variation among the different surgery groups. For the Von Frey test there was a significant difference between the control and sham groups versus the operated groups. The largest difference was observed in the CCI model where the mechanical threshold dropped from a baseline value of 61.58 ± 5.14g to 12.43 ± 2.17g on day 1 post operatively. The pin prick test showed increased hyperreactivity to mechanical stimulation with all models after surgery. The largest difference between control and operated groups was observed in the partial sciatic ligation where the duration of lifting increased from a pre operative value of 0 to a peak of 15.32 ± 1.38 s. The acetone test showed increased hyperreactivity after surgery with all 5 groups. The CCI group showed the greatest difference from baseline values with a peak of 52.04 ± 2.94s. With all surgical models increased lifting of the injured paw was observed with the cold plate test. This was greatest with the CCI model with a maximum value of 32.12 ± 5.1s observed. With a few notable exceptions, it appears that all 5 models of peripheral neuropathic pain produce mechanical threshold decreases (VF), mechanical hyperalgesia (PP), chemical hyperreactivity (AS), and cold allodynia (CP). However the magnitude and duration of responses on these 4 sensory clusters varies considerably depending on the surgical model used.