1 Effect of early sacral neuromodulation on bladder function in a rat model of incomplete spinal cord injury due to focal contusion

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Introduction & Objectives: Sacral neuromodulation (SNM) has been reported to modulate the micturition reflex to some extent in studies using a completely spinalized rat model, with several possible mechanisms underlying the action of SNM suggested. In actual clinical practice, however, 66% of all patients with spinal cord injury (SCI) are estimated to have incomplete-type of SCI induced by spinal contusion. Nonetheless, most animal studies that have addressed the effect of SNM on bladder function have used rats with spinal transection. Experiments in a rat model of incomplete SCI, which would reflect more relevant conditions of clinical SCI, are scarce. We aimed to evaluate the effect of early SNM on bladder responses in a rat model of incomplete SCI.

Materials & Methods: Altogether, 21 female Sprague-Dawley rats were equally assigned to control (CTR), SCI + sham stimulation (SHAM), and SCI + SNM (SNM) groups. In the SHAM and SNM groups, incomplete SCI was created by producing a moderate contusion with an NYU-MASCIS impactor at the T9-T10 level of the spine, with needle electrodes implanted bilaterally into the S2 or S3 sacral foramen. Only SNM group underwent electrical stimulation for 28 days, beginning on day 7 after SCI. Cystometry was performed 35 days after SCI.

Results: Although the interval between voiding contractions was significantly longer in the SHAM group than the CTR group (25.5 ± 1.4 vs 12.5 ± 1.7 min; $P < 0.05$), there were no significant differences between the SNM group (16.5 ± 1.5 min) and the CTR group. Maximum voiding contraction pressure did not differ among the groups. The SNM group had a significantly lower frequency (3.5 ± 0.5 vs 14.6 ± 2.0; $P < 0.05$) and maximum pressure (11.4 ± 6.2 vs 21.3 ± 1.8 cmH_2O; $P < 0.05$) of nonvoiding contractions than the SHAM group.

Conclusions: Our results provide experimental evidence that early SNM treatment may prevent or diminish bladder dysfunctions (e.g. detrusor overactivity, abnormal micturition reflex) in a clinical condition of incomplete SCI.