Rehabilitation and Repair of Motor and Autonomic Functions after Spinal Cord and Cauda Equina Injuries

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Abstract

Spinal cord injuries commonly result in paralysis, sensory impairments, pain, as well as bladder, bowel and sexual dysfunctions. Here, two models for spinal cord injury and rehabilitation and repair will be presented. One model addresses neurologic rehabilitation after an upper motoneuron injury. The second model describes a lower motoneuron injury in ventral root avulsion injury model of conus medullaris/cauda equina injury. The models reflect different aspects of translational research studies for the repair of neurological function after a spinal cord injury.

Following a mid-thoracic spinal cord transection injury in the rat, extensive spinal cord reorganization of synaptic inputs to motor targets takes place. These changes include an increased inhibitory influence on both alpha- and gamma-motoneurons. Locomotor training after the spinal cord injury, however, improves stepping ability and maintains a normal ratio of inhibitory-to-excitatory synapses on spinal motoneurons. The findings highlight that synaptic plasticity involves also the less commonly studied gamma-motoneurons, which may be regarded as a potentially novel therapeutic target for neurologic rehabilitation.

A lumbosacral ventral root avulsion injury in the adult rat mimics many of the clinical findings of a conus medullaris syndrome and results in denervation of lower extremity muscles and pelvic targets, including the lower urinary tract. As a result, there is paralysis, loss of micturition reflexes, and development of neuropathic pain. Interestingly, an acute surgical implantation of avulsed ventral roots into the spinal cord is neuroprotective, ameliorates pain, and promotes functional reinnervation of the lower urinary tract.

Three representative References for the Havton laboratory:

