A POST-LAMINECTOMY RAT MODEL MIMICS THE CHUNG TACTILE ALLODYNYA MODEL

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Introduction: A controversy exists about the mechanism of causation of the post-laminectomy pain syndrome. Some believe that epidural scarring, and attendant nerve root scarring and tethering to the disc or pedicle at the site of surgery is the obvious explanation for radicular pain in such patients. But MRI findings have been presented showing no difference in epidural scar formation between symptomatic and asymptomatic post laminectomy patients. The purpose of this study is to determine if a post-laminectomy rat model mimics the behavioral neuropathy of the so-called Chung nerve root ligature model in which tactile allodynia is seen. A second goal is to establish whether the post-laminectomy rat model demonstrates the cytokine profile changes in the nerve root and dorsal root ganglion seen in the Chung model. The development of such models is crucial to resolution of certain persistent clinical questions that cannot be answered by tests protocols in humans.

Methods: Bilateral laminectomies (L5 and L6) and a right unilateral disc injury (L5-6) were performed on 28 male Sprague-Dawley rats, weighing 400+ grams (approved by the VA Institutional Animal Care Use Committee). There were 2 groups: 1) nonoperative; and 2) operative. Fourteen (nonoperative) weight matched male rats served as controls. Two animals in each group were used for histological studies. Thirteen rats in the operative group were sacrificed at 3 weeks and ten at 8 weeks for histology and for hydroxyproline analysis of the spinal canal and nerve roots of these rats were harvested en bloc for immunohistochemical staining of frozen sections for TNFα. Statistical analyses were performed using ANOVA and a Fisher comparison t-test.

Results: All operative animals developed a tail contracture toward the right (disc injury side) consistent with asymmetrical lumbar muscle spasm. The nerve root at the operative level was grossly adherent to the disc and adjacent pedicle. Histological studies using hard tissue processing for Masson-Goldner staining confirmed the location of peridural and perineural fibrosis. Total collagen content of the peridural and perineural fibrosis. Total collagen content of the peridural and perineural scar was observed. TNFα in nerve root and dorsal root ganglia at 8 weeks post-injury is evidence of persistence of neural pathology consistent with findings of the repeated injury modification of the Chung ligature model.

Conclusion: We describe a rat laminectomy model that mimics the Chung model of repeated ligature injury. The model demonstrates evidence of paraspinous muscle spasm with tail contracture toward the disc injury side, prominent nerve root scarring and adherence to the adjacent disc and pedicle, tactile allodynia at a significant level only on the nerve injury side, and a persisting increase of TNFα in nerve root and dorsal root ganglia at 8 weeks. The model described shows promise as a model for assessment of interventions with anti-inflammatory or other pharmaceutical agents potentially useful in the prevention or management of the post laminectomy syndrome.

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