

The New Emerging Paradigm in the Pathophysiology of Lumbar Spine Pain Syndromes

The principle focus of spinal pain in the past has been "structural." Most disciplines in the health care fields have concentrated their management of lumbar spine disorders toward structural correction (i.e., surgeons performing discectomy or laminectomy to decompress a discal mass effect.) Symptomatic change after surgical intervention has not correlated very well to resolution of the structural lesion (i.e., disc herniation). Current research on the pathophysiology of lumbar spine pain syndromes has included advances and contributions from the fields of immunology, biochemistry, and neurophysiology.¹

Inflammation seems to be the central focus in lumbar disc and nerve disorders with an array of enzymatic and neurochemical reactions occurring in the local area of dysfunction.⁹⁻¹² As basic and clinical science continues to research this area, medicine will undoubtedly begin to treat lumbar disc and nerve disorders via chemical intervention of abnormal neurochemistry.

Saal states that "a better mousetrap" for the care of painful lumbar disc and nerve disorders will come from the basic science laboratory as opposed to current operative and nonoperative medical models.¹ Chiropractic care has been shown to be effective for the treatment of lumbar spine pain syndromes by several authors. One of the challenges for our profession is to demonstrate and document that we are efficacious for lumbar disc protrusions with associated nerve dysfunction in addition to acute low back pain. We need to demonstrate through research that manipulative/adjustive procedures have positive clinical effects on both structural and neurophysiological components of these painful syndromes, in addition to favorable functional outcomes such as return to employment and psychosocial interaction.

Spinal manipulation may have an inhibitory effect via neurogenic reflex on A delta and C fiber afferent discharge. This inhibitory effect may interrupt the biochemical cascade of events leading to the production of neurosecretory substances such as substance P, PLA2, histamine, IgG, and stromolysin. In addition spinal manipulation may have an enhancing effect on local microcirculation due to improved biomechanics and resultant neurophysiology.

Chiropractic management may very well be the "better mouse trap" and should be offered to the public as a first line of intervention. We must provide clinical and outcome based research in this age of managed care, because our patients' care is being governed by gatekeepers referring to "guidelines" of unknown clinical origin, and because our medical colleagues including physical therapists are currently performing research on their respective efficacies.

Some Current Research:

1. Cavanaugh demonstrated that electrical stimulation to the discs annulus and posterior longitudinal ligament induced an A delta fiber response.²

2. Yamashita found evidence that the disc contains silent nociceptors that only activate to algogenic (sub P, PLA2) chemicals in times of tissue damage or inflammation.³
3. Olmarker found that nuclear material from the disc causes degenerative changes in the neural tissue of pigs.⁴
4. Saal found high levels of PLA2 in lumbar disc tissue after surgical resection.¹
5. Cavanaugh, in another study, found that herniated disc material placed next to the dorsal root ganglion caused abnormal nerve discharge.⁵
6. Tolononen found high levels of fibroblast growth factor (FGF) which suggests an active angiogenesis process at the site of the herniated disc, promoting an increased proteolytic process at the disc's extracellular matrix.⁶
7. Cooper found in his research that venous stasis and vascular abnormalities were seen as well as defective fibrinolysis leading to ischemic perineural and intraneural fibrosis.⁷

These studies published recently in the medical literature have a central recurring theme: active disc pathomorphology is always accompanied by pathoneurophysiology and a biochemical response in the symptomatic patient. It is felt by Saal and others that when injury occurs in the area of the nerve or disc, substances such as PLA2 results in chemoreception of the A delta and small unmyelinated C fibers found in the annulus of the disc. Some studies have isolated a large macrophagic response at the site of the extruded disc which was not found in cases of small disc herniations and bulges. This suggests that nociception and referred pain most probably occur as a result activation of the sinuvertebral nerve which as been shown by numerous authors to densely innervate the peripheri of the annulus.

Jenkins described a referred pain map in patients with extruded disc herniations and vertebrogenic and referred extremity pain.⁸ The referred pain zones closely resembled dermatomal zones, however, there was a large degree of overlap due to known segmental anatomical overlap of the sinuvertebral nerve and branches of the posterior primary ramus. In cases of central disc bulge or herniation without nerve root compression, patients can clearly present with as much pain as those with nerve root compression.

Conversely, asymptomatic people can have large disc herniations on MRI testing. Neurophysiological testing can be helpful in assessing these types of patients. Electrodiagnostic tests such as EMG, NCV, and evoked potentials (SSEP) and dermatomal evoked potentials (DSSEP) are helpful. Current research is demonstrating that evoked potentials with magnetic stimulation might be more sensitive than standard electrical stimulation.

Another newer neurodiagnostic tool that utilizes electrical stimulation and can be used in conjunction with classical electrodiagnosis is the current perception threshold neurometer (CPT). CPT is a neuroselective tool that can isolate and identify abnormalities in three different pain fiber populations: A delta, A beta, and C fibers which are the small, unmyelinated nerve fibers. When

discal afferent discharge occurs due to disc trauma, bulge, or herniation, A delta and C fiber activation begins¹³ and CPT neurometer may be helpful. In my next article I will present a review on the CPT neurometer and its ability to test for sensory conduction, and threshold perception. CPT is a quantitative sensory test (QST) which provides functional assessment of the peripheral sensory nervous system.

Future chiropractic research must focus on documenting the efficacy of manipulative management on cervical and lumbar disc disorders, from within the multidisciplinary fields of immunology, biochemistry, neurophysiology, and anatomical morphology, as well as clinical outcomes, and functional outcome analysis. This type of research will allow our profession to take its rightful place at the forefront of patient care for these types of clinical syndromes.

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