SPINE Volume 21, Number 8, pp 917–924

Origin of Nerves Supplying the Posterior Portion of Lumbar Intervertebral Discs in Rats

Shin-ichiro Nakamura, MD,* Kazuhisa Takahashi, MD,* Yuzuru Takahashi, MD,* Tatsuo Morinaga, MD,* Yutaka Shimada, MD,† and Hideshige Moriya, MD*

Study Design. The authors studied the origin of nerves supplying the posterior portion of lumbar intervertebral discs in rats by resection of the sympathetic trunks.

Objective. To understand discogenic low back pain from the innervation of the lumbar intervertebral discs.

Summary of Background Data. The afferent pathways of discogenic low back pain have not been studied thoroughly. It has been reported that stimulation of an inflamed lower spinal nerve root elicits leg pain but not low back pain and that stimulation of the posterior portion of lumbar intervertebral discs evokes only low back pain. These facts suggest that pain sensation from the posterior portion of lumbar discs is not transmitted via the lower spinal nerve roots.

Methods. Forty-five Wistar rats were used. Seven days after the resection of sympathetic trunks with ganglia at different levels, the whole lumbar spine was stained by an acetylcholinesterase histochemical method. The posterior portions of lumbar intervertebral discs were observed.

Results. The dense nerve network on the posterior portion of lumbar intervertebral discs had disappeared almost completely after total resection of bilateral sympathetic trunks at L2–L6. However, there was a slight decrease in the network after bilateral single-level resection or unilateral multisegmental resection.

Conclusions. The results showed that the posterior portion of lumbar intervertebral discs was innervated by the sympathetic nerves multisegmentally and bilaterally. [Key words: innervation, low back pain, lumbar intervertebral disc, sinuvertebral nerve, sympathetic nerve, visceral pain] **Spine 1996;21:917–924**

Pain resulting from lumbar disc lesions is poorly localized. Thus, the symptomatic discs cannot be specifically identified by the pain. This characteristic resembles visceral pain.[38] The concept of "disc pain" seems to be accepted by clinicians. However, the anatomic pathways by which discogenic low back pain is transmitted remain open to speculation.[52] The most puzzling feature of discogenic low back pain is that its distribution is fairly constant, yet it does not follow any innervation area of known peripheral nerves or nerve roots.[17]

The afferent pathways of discogenic low back pain have been believed to be in the recurrent branch of spinal nerves, named sinuvertebral nerves (SVNs), which were first described by Luschka[29] according to Wiberg.[54] Sinuvertebral nerves have been believed to originate from the ventral rami of spinal nerves[23,44,48] or from the ventral rami and the sympathetic nerves.[4,6,8,11,12,20,29,41,42,49,54] However, some patients with lumbar radiculopathy do not complain of low back pain but rather of leg pain, despite the compression site being proximal to the branching point of SVNs.

It has been reported that mechanical stimulation of an inflamed spinal nerve root causes leg pain but not low back pain.[27,47,54] However, mechanical stimulation of the posterior portion of lumbar intervertebral discs causes low back pain,[15,27,47] even after two roots on the same side have been anesthetized.[54] These findings indicate that the nerve fibers in SVNs are not derived from the spinal nerves but suggest that they may originate from the sympathetic nerves, transmitting discogenic low back pain.

In the modern description of the autonomic nervous system, efferent and afferent fibers are included. In the sympathetic system, the afferent fibers return through the sympathetic trunks and the rami communicantes and pass through the same dorsal roots as do the somatosensory afferents.[55]

There are reports concerning the function of the sympathetic nerves in transmitting low back pain: 1) sympathetic afferent fibers transmit pain;[45,55] 2) low back pain is induced by electrical stimulation of the lumbar sympathetic trunk;[53] 3) low back pain disappears after lumbar sympathetic block;[13] 4) nerve fibers in SVNs originate from the rami communicantes of the sympathetic nerves;[14] 5) plasma extravasation is induced in the groin skin, which is the L2 dermatome, by chemical stimulation of the anterior portion of lower lumbar discs in rats.[51] Recently, the authors reported that

From Departments of *Orthopaedic Surgery and †Anatomy, School of Medicine, Chiba University, Chiba, Japan.
Presented at the 22nd Annual Meeting of the International Society for the Study of the Lumbar Spine, Helsinki, Finland, June 18–22, 1995.
Acknowledgment date: May 26, 1995.
First revision date: August 28, 1995.
Acceptance date: October 20, 1995.
Device status category: 1.

36

Journal of Orthopaedic & Sports Physical Therapy
2000;30(1):4–12

Neck Retractions, Cervical Root Decompression, and Radicular Pain

Sami S. Abdulwahab, PhD, PT[1]
Mohamed Sabbahi, PhD, PT, ECS[2]

Study Design: Two-group repeated measures.
Objectives: To evaluate the changes in the flexor carpi radialis H reflex after reading and neck retraction exercises and to correlate reflex changes with the intensity of radicular pain.
Background: Repeated neck retraction movements have been routinely prescribed for patients with neck pain.
Methods and Measures: Ten nonimpaired subjects (mean age, 27 ± 4 years) and 13 patients (mean age, 35 ± 9 years) with C7 radiculopathy volunteered for the study. The flexor carpi radialis H reflex was elicited by electrical stimulation of the median nerve at the cubital fossa before and after 20 minutes of reading and after 20 repetitive neck retractions. Subjective intensity of the radicular pain was reported before and after each condition using an analog scale.
Results: For patients with radiculopathy, a repeated-measures analysis of variance showed a significant decrease in the H reflex amplitude (from 0.81 ± 0.4 to 0.69 ± 0.39 mV), an increase in radicular symptoms after reading (from 4.2 ± 1.3 to 5.6 ± 1.4 on the visual analog scale), an increase in the H reflex amplitude (from 0.69 ± 0.39 to 1.01 ± 0.49 mV), and a decrease in pain intensity (from 5.6 ± 1.4 to 1.5 ± 1.3) after repeated neck retractions. There was an association between cervical root compression (smaller H reflexes) and increased pain during reading and between cervical root decompression (larger H reflex) and reduced pain ($r = -0.86$ to -0.60). Exacerbation of symptoms was found with a reading posture. There were no significant changes in the H reflex amplitude in the nonimpaired group. No changes were found in reflex latency for either groups.
Conclusions: Neck retractions appeared to alter H reflex amplitude. These exercises might promote cervical root decompression and reduce radicular pain in patients with C7 radiculopathy. The opposite effect (an exacerbation of symptoms) was found with the reading posture. *J Orthop Sports Phys Ther 2000;30:4–12.*

Key Words: electromyography, H reflex, neck pain, posture

[1] *Texas Woman's University, School of Physical Therapy, Houston, Tex.*
[2] *Texas Woman's University, School of Physical Therapy, Houston, Tex.*
Partially presented at the Combined Section Meeting of the APTA in 1998.
Send correspondence to Mohamed Sabbahi, Texas Woman's University, School of Physical Therapy, 1130 M. D. Anderson Boulevard, Houston, TX 77030-2897. E-mail: HF_Sabbahi@twu.edu

The anatomical and biomechanical nature of the cervical spine encourages mobility at the expense of stability and strength.[23] That is why cervical pain and dysfunction are common, particularly as a result of trauma[3,4] and poor spinal posture.[12] Cervical pain and dysfunction appear to affect many people.[1,2,6,7,10] The sixth and seventh cervical vertebral roots were reported to be the sites most commonly affected, representing 60 and 25%, respectively, of cervical nerve root impingement.[14,16,24]

Reading for long periods has been considered a risk factor for neck pain.[9] Clinically, patients with neck pain usually report aggravation of their symptoms with reading. This indicates possible compromise of the neuromusculoskeletal structures of the neck.

There are several techniques used to treat patients with neck pain. Neck retraction was first recommended by McKenzie[12,13] and Stevens and McKenzie[22] to treat cervical pain. It involves pulling the head and neck posteriorly into a position in which the head is aligned more directly over the thorax, while the head and eyes remain level. The end position is maintained for a short period, and then the neck is allowed to relax into a resting posture. During this movement, the lower cer-

Interrater Reliability of Judgments of the Centralization Phenomenon and Status Change During Movement Testing in Patients With Low Back Pain

Julie M. Fritz, PhD, PT, ATC, Anthony Delitto, PhD, PT, Michelle Vignovic, MS, PT, Robert G. Busse, MS, PT

ABSTRACT. Fritz JM, Delitto A, Vignovic M, Busse RG. Interrater reliability of judgments of the centralization phenomenon and status change during movement testing in patients with low back pain. Arch Phys Med Rehabil 2000;81:57-61.

Objective: To determine the interrater reliability of judgments of status change, including the centralization phenomenon during examination of the lumbar spine, and to determine the effects of training and experience on reliability.

Design: A videotape study of judgments by physical therapists and physical therapy students of the results of movement testing during the examination of patients with low back pain.

Setting: Outpatient physical therapy clinic.

Patients: Patients receiving physical therapy treatment for low back pain.

Intervention: Patients with low back pain were videotaped while performing a variety of movement tests including single, repeated, and sustained movements. Forty licensed physical therapists and 40 physical therapy students were provided with operational definitions of the three potential judgments of status change with movement testing; centralization, peripheralization, status quo. All therapists and students viewed the videotape and made a judgment regarding the patient's status change in response to the test.

Main Outcome Measure: Percentage agreement and kappa coefficient values for agreement.

Results: Interrater reliability was excellent for the total sample of examiners (kappa = .793), for the licensed physical therapists (kappa = .823), and for the students (kappa = .763).

Conclusions: Judgments of status change are reliable when operational definitions are provided. Clinical experience does not appear to substantially improve reliability.

Key Words: Low back pain; Reliability and validity; Movement; Rehabilitation.

THE MCKENZIE[1] EXAMINATION and treatment system is a widely used approach to the nonsurgical management of patients with low back pain.[2] The McKenzie examination utilizes patient history, a postural assessment, and active and passive lumbar movement testing. Lumbar movement testing may be performed in different positions (standing, sitting, prone, supine) and may include repeated or sustained movements. Examination results are used to place patients into one of three syndromes (postural, dysfunction, or derangement),[1] with treatment based on the syndrome to which the patient is assigned.

An important component of the McKenzie examination system is judging the effects of lumbar movements on the patient's status. Each test movement can be judged as having one of three possible effects: centralization, peripheralization, or no change (ie, status quo). Centralization was originally described by McKenzie as a phenomenon occurring during lumbar movement testing when the patient reports that the pain moves from an area more distal or lateral to a location more central or near midline position in the lumbar spine. Peripheralization occurs when the patient reports the movement of pain from an area more proximal in the lumbar spine to an area more distal or lateral. Movements that do not produce centralization or peripheralization are judged to be status quo.[1,3]

The centralization phenomenon has been proposed to have prognostic value in patients with low back pain. Donelson and associates[14] evaluated 87 patients with low back pain and radiation into the buttock, thigh, or calf, and found that patients in whom centralization occurred during lumbar movement testing were more likely to achieve good or excellent results with treatment. Long[5] studied 243 patients with chronic low back pain who were entering a work hardening program and found that centralization during the initial evaluation was associated with greater reductions in pain and higher percentages of return to work after completion of the program. Karas and colleagues[6] examined 126 patients and found that the inability to centralize symptoms during the initial evaluation decreased the likelihood of return to work within 6 months. The centralization phenomenon appears to be of prognostic value, yet the reliability of its determination has not been studied.

Riddle and Rothstein[7] evaluated the reliability of the McKenzie examination system and found unacceptably poor interrater reliability for the placement of patients into one of the three syndromes (kappa value = .26). They suggested that a potential source of unreliability was the determination of centralization or peripheralization with movements, although the reliability of this judgment was not reported individually. The purpose of this study was to determine the interrater reliability of judgments regarding the effect of lumbar movement testing on pain in patients with low back pain. A second purpose was to examine the effect of clinical experience on reliability.

METHODS

Subjects

In this study, licensed physical therapists and physical therapy students interpreted movement tests via videotaped portions of clinical examination procedures performed on 12 patients receiving physical therapy treatment for low back pain. This study was approved by the Institutional Review Board of the University of Pittsburgh Medical Center, and all patients

From the Department of Physical Therapy, School of Health and Rehabilitation Sciences, University of Pittsburgh, Pittsburgh, PA. Mr. Busse is presently associated with the Spine Therapy Center, Oshkosh, WI.

Submitted for publication January 15, 1999. Accepted in revised form March 24, 1999.

No commercial party having a direct financial interest in the results of the research supporting this article has or will confer a benefit upon the authors or upon any organization with which the authors are associated.

Reprint requests to Julie Fritz, PhD, PT, 6035 Forbes Tower, Pittsburgh, PA 15260.

0003-9993/00/8101-541053.00/0

SPINE Volume 29, Number 23, pp 2593–2602

Does it Matter Which Exercise?

A Randomized Control Trial of Exercise for Low Back Pain

Audrey Long, BScPT,* Ron Donelson, MD,† Tak Fung, PhD‡

Study Design. Multicentered randomized controlled trial.

Objectives. To determine if previously validated low back pain (LBP) subgroups respond differently to contrasting exercise prescriptions.

Summary of Background Data. The role of "patient-specific" exercises in managing LBP is controversial.

Methods. A total of 312 acute, subacute, and chronic patients, including LBP-only and sciatica, underwent a standardized mechanical assessment classifying them by their pain response, specifically eliciting either a "directional preference" (DP) (*i.e.*, an immediate, lasting improvement in pain from performing either repeated lumbar flexion, extension, or sideglide/rotation tests), or no DP. Only DP subjects were randomized to: 1) directional exercises "matching" their preferred direction (DP), 2) exercises directionally "opposite" their DP, or 3) "nondirectional" exercises. Outcome measures included pain intensity, location, disability, medication use, degree of recovery, depression, and work interference.

Results. A DP was elicited in 74% (230) of subjects. One third of both the opposite and non-directionally treated subjects withdrew within 2 weeks because of no improvement or worsening (no matched subject withdrew). Significantly greater improvements occurred in matched subjects compared with both other treatment groups in every outcome (*P* values <0.001), including a threefold decrease in medication use.

Conclusions. Consistent with prior evidence, a standardized mechanical assessment identified a large subgroup of LBP patients with a DP. Regardless of subjects' direction of preference, the response to contrasting exercise prescriptions was significantly different: exercises matching subjects' DP significantly and rapidly decreased pain and medication use and improved in all other outcomes. If repeatable, such subgroup validation has important implications for LBP management.

Key words: exercise, centralization, low back pain subgroups, directional preference, McKenzie method. **Spine 2004;29:2593–2602**

A number of systematic reviews have raised important questions regarding the role of exercise in the treatment of low back pain (LBP) with a lack of evidence supporting any specific type of exercise, *e.g.*, back or abdominal strengthening, McKenzie, Williams, flexion, extension, or stretching.[1–5] LBP clinical guidelines advocate advice to stay active and an early return to normal activity as the means to faster recovery with less disability.[6–8] These guidelines challenge the popular clinical practice of prescribing patient-specific exercises[9,10] determined by an individual's assessment findings and implies that nonspecific exercise can be prescribed without consideration of individual clinical signs, *e.g.*, every LBP patient is given the same exercises.

There is growing opinion that the equivocal or conflicting results among exercise trials can be attributed to the faulty assumption that the "nonspecific" LBP populations studied were homogeneous.[6,11–14] Alternatively, treatment efficacy has been demonstrated in trials that studied defined LBP subgroups, although methodologic weaknesses require cautious interpretation of results.[15–20] Meanwhile, identification of LBP subgroups was listed as the top research priority by the International Forum Primary Care Research in Low Back Pain.[21] The Cochrane Back Review Group has recently referred to the identification of subgroups and predictors of chronicity as "the Holy Grail" of LBP.[22]

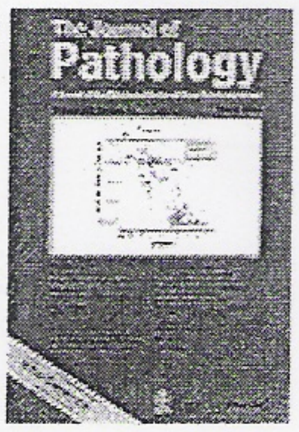
One subgroup classification method (McKenzie Method),[23] often referred to as Mechanical Diagnosis and Therapy (MDT), has demonstrated strong inter-rater reliability (kappa values ranging from 0.79 to 1.0)[17,24–30] and other clinically useful properties: predicting outcome and discogenic pathology, and providing preliminary evidence of patient-specific treatments based on assessment findings.[15,24,29,31–35]

An important feature of the MDT assessment is the identification of a patient's "directional preference" (DP).[23,36–39] DP is identified when posture or repeated end-range movements in a single direction (flexion, extension, or side-glide/rotation) decrease or abolish lumbar midline pain, or cause referred pain emanating from the spine to appear to progressively retreat in a proximal direction back toward the lumbar midline ("centralization"). There is often a rapid and concurrent restoration of lumbar range of movement.[23] The inter-rater reliability for identifying DP in the hands of qualified practitioners (McKenzie Institute credentialed) is reported as excellent (agreement 90%, kappa 0.9).[26]

The objective of this study is to determine if a subject-specific exercise prescription concordant with a study participant's DP will achieve better outcomes than non-concordant exercises.

From *Bonavista Physical Therapy, Calgary, Alberta, Canada; †Self-Care First, Hanover, NH; and ‡Department of Psychology, University of Calgary, Calgary, Alberta, Canada.
Supported by the Community Ethics Review Board of the Alberta Heritage Foundation for Medical Research, the Physiotherapy Foundation of Canada, McKenzie Institute International, and Cambridge Physiotherapy Associates.
The manuscript submitted does not contain information about medical device(s)/drug(s).
Foundation funds were received to support this work. No benefits in any form have been or will be received from a commercial party related directly or indirectly to the subject of this manuscript.
Address correspondence and reprint requests to Audrey Long, BScPT, 620 Willesden Dr. S.E., Calgary, Alberta, Canada, T2J 2G1; E-mail: longma@telusplanet.net

Mast cells in the pathogenesis of chronic back pain: a hypothesis



Authors: Freemont A.J.[1]; Jeziorska M.[1]; Hoyland J.A.[1]; Rooney P.[1]; Kumar S.[1, *]
Source: The Journal of Pathology, Volume 197, Number 3, July 2002 , pp. 281-285(5)
Publisher: John Wiley & Sons, Ltd.

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Abstract:

The pathophysiology of chronic low back pain is poorly understood, mainly because it is difficult to study experimentally or objectively. Recently it has been found that there is a relationship between neovascularization and innervation of the usually avascular and aneural intervertebral disc at the sites of discogenic pain. These data, together with the recognized involvement of mast cells in tissue repair, in the induction of angiogenesis, and in the production of and response to neurotrophic stimuli such as nerve growth factor, has suggested the hypothesis that mast cells may have a causative role in chronic low back pain. If so, the mast cell may represent an attractive therapeutic target. Copyright © 2002 John Wiley & Sons, Ltd.

Keywords: mast cells; nerve fibres; nerve growth factor; angiogenesis; chronic low back pain; intervertebral disc
Language: English
Document Type: Research article
DOI: 10.1002/path.1107
Affiliations: 1: Musculoskeletal Research Group, Medical School, Manchester University, Manchester, UK *