

# DISABILITY MEDICINE

The Official Periodical of the American Board  
of Independent Medical Examiners

Editorial Board

**ABIME**  
American Board of Independent Medical Examiners

Contents

*Editor-in-Chief*

Mohammed I. Ranavaya, MD, MS, FFOM,  
FRCPI, FAADEP, CIME

*Assistant Editors*

Thomas A. Beller, MD, FAADEP, CIME

Steven Mandel, MD

*Editorial Advisory Board*

Rory Wagon MB, BS, CIME, *Australia*

Prof. John B Walden, MD

Richard Sekel, MB.BS, CIME, *Australia*

Niall J. Buckley, BSc, MD, CIME, *Canada*

Gordon Waddell, DSc, MD, FRCS, *UK*

Lester L. Sacks, M.D., Ph.D., FACOEM

Randall L. Short, DO, CIME

Robert L. Nierenberg, MD, CIME

Alfred Taricco, MD, FACS

Jalees K Razavi, MD, *Saudi Arabia*

Clement Leech, MD, DMA, *Ireland*

Stan Bigos, MD

William S. Shaw, MD, CIME

David P. King, BSc, MD, CIME, *Canada*

Jan Von Overbeck, MD, CIME, *Switzerland*

Sigurdur Thorlacius, MD, PhD, *Iceland*

Yat Cho Chu, MBBS, MSc(O.M.)(London), CIME,  
*Hong Kong*

Prof. Zaliha Omar MD, CIME, *Malaysia*

Mohammed Azman B. Aziz Mohammed, MBBS,  
LFOMRCP, CIME, *Malaysia*

Rahman Gul, MBBS, MFOM RCP (Ireland),  
CIME, *Malaysia*

Prof. Robert B Walker, MD, CIME

Kathleen M. Bennett, *Managing Director*

Rebecca McGraw-Thaxton MD, CIME

PAGE

Guest Editorial: Waddell's Signs- Do They Mean Malingering Professor Gordon Waddell .....	38
The Annular Tear as a Source of Low Back Pain .....	40
Contemporary Surgery for Lumbar Degenerative Disk Disease .....	43
CME Questions .....	50
Increased Prevalence of Disability Pension in Iceland Between 1996 and 2003 .....	52
Impairment and Disability Evaluation- Neurologist Perspective .....	58
Book Review Ergonomics and the Management of Musculoskeletal Disorders .....	60



# GUEST EDITORIAL: Waddell's signs- Do they mean malingering?

Gordon Waddell CBE DSc MD FRCS

Centre for Psychosocial and Disability Research, University of Cardiff, UK

Address for correspondence:

6 Heatherbrae, Bishopbriggs, Glasgow G64 2TA, UK  
gordon.waddell@virgin.net

## BOARD OF DIRECTORS

Thomas A. Beller, MD, CIME  
President  
Kansas City, Missouri

Mohammed I. Ranavaya, MD, CIME  
President Elect/Secretary  
Chapmanville, West Virginia

Alex Ambroz, MD, MPH, CIME

Donald L. Hoops, PhD  
Prospect Heights, Illinois

John D. Pro, MD, CIME  
Kansas City, Missouri

Kathleen M. Burnett  
Executive Director  
Barrington, Illinois

## BOARD OF ADVISORS

Rory Wagon MB, BS, CIME,  
Australia

Jalees K Razavi, MD  
Saudi Arabia

Presley Reed, MD, CIME  
Boulder, CO

David E. Brown, DC, CICE  
Charlottesville, VA

Rebecca McGraw, MD, CIME  
Morgantown, WV

Richard Sekel, MB, BS, CIME  
Redfern, NSW Australia

Niall J. Buckley, BSc, MD, CIME  
Halifax, NS, Canada

Gordon Waddell, DSc, MD, FRCS  
Glasgow, UK

Lester L. Sacks, M.D., Ph.D., FACOEM  
Laguna Niguel, CA

Randall L. Short, DO, CIME  
Chapmanville, WV

Robert L. Nierenberg, MD, CIME  
Honolulu, HI

Alfred Taricco, MD, FACS  
Manchester, CT

Prof. Zaliha Omar MD, CIME,  
Malaysia

Clement Leech, MD, DMA  
Dublin, Ireland

Stan Bigos, MD  
Seattle, WA

William S. Shaw, MD, CIME  
Denver, CO

David P. King, BSc, MD, CIME  
Yellowknife, NT Canada

Jan Von Overbeck, MD, CIME  
Zurich, Switzerland

Sigurdur Thorlacius, MD, PhD  
Reykjavik, Iceland

Yat Cho Chu, MBBS, MSc(O.M.)  
(London), CIME  
Kowloon, Hong Kong

Prof. Robert B Walker, MD, CIME

Mohammed Azman B. Aziz Mohammed,  
MBBS, LFOMRCP, CIME  
Kuala Lumpur, Malaysia

Rahman Gul, MBBS, MFOM RCP  
(Ireland), CIME  
Ipoh, Malaysia

Prof. John B Walden, MD

Nonorganic signs in low back pain were described a century ago in the context of workers compensation and the modern set of signs was standardized in 1980 (Waddell et al 1980). They have stood the test of time, despite periodic controversy about their clinical use (Main & Waddell 1998, Fishbain et al 2003, Conteno et al 2004, Waddell 2004a & b).

They are also relevant to disability evaluation, where they are still often misinterpreted. In the context of a claim for compensation, nonorganic signs may (reasonably) raise the question of 'malingering'. However, nonorganic signs are common in chronic pain patients in a clinical setting where there is no compensation. Thus, the presence of nonorganic signs *per se* does not necessarily mean that a patient is lying or attempting to deceive the examiner, and that conclusion cannot be based on this clinical finding alone. It is then necessary to consider further the logic of the medical evidence and expert opinion.

Malingering is the conscious and deliberate faking or exaggeration of symptoms and disability, with intent to deceive, for financial or other gain (Halligan et al 2003). True malingering, i.e. faking an injury or health condition that does not exist, is rare. However, various studies (Green 2003, Halligan et al 2003) suggest that 20-30% of compensation claimants who have a genuine injury demonstrate some degree of 'lack of effort' or exaggeration of their complaints.

## The logic of the medical evidence:

1. The starting point is to compare the patient's (subjective) description of symptoms and disability with the (objective) medical evidence of injury, diagnosis and impairment.
  - a) When these are proportionate, the medical evidence supports the patient's account.
  - b) When the patient's report of symptoms and disability is out of proportion to the objective medical evidence, further evidence is required.
2. Are there nonorganic signs or other evidence of illness behavior (Waddell 2004a)?
  - a) When there is no evidence of illness behavior:
    - Double check the medical assessment (i.e. the validity and reliability of the medical evidence, a matter for the medical expert).
    - True disproportion (i.e. assuming the medical assessment is correct) may be due to exaggeration, lack of motivation or effort, or lack of credibility. That is not a matter of medical opinion, but for judicial decision.  
(It may seem paradoxical, but the *absence* of illness behavior may sometimes be more suspicious than its presence.)
  - b) When there is evidence of illness behavior, this may be due to:
    - 'conscious' exaggeration, under-motivation and lack of effort and/or
    - 'unconscious' psychological disturbance.



3. This distinction is fundamental to medico-legal assessment, but requires further evidence:

- a) Is there other evidence of psychological disturbance?
- clinical history
  - psychological distress or dysfunction
  - psychiatric illness
  - other clinical evidence of illness behavior
  - adaptation to invalidity.
- b) Is there other evidence on credibility?
- nonorganic signs in the absence of other evidence of illness behavior
  - illness behavior in the absence of psychological distress
  - inconsistencies within the patient's account or between the patient's account vs. other evidence

- inconsistencies between the patient's account or the medical assessment vs. other evidence (e.g. video surveillance)

4. The medical evidence and expert opinion should then address the physical or mental injury or pathology, symptoms and disability [particularly (in)-capacity for work], illness behavior and psychological/psychiatric disturbance, and any medical evidence relevant to credibility. Medical opinion(s) should be reasoned and based on the evidence, rather than dependent on the standing of the expert. Final judgments of credibility and 'malingering', however, are not matters of medical diagnosis but for judicial decision.

## References

- Conteno CJ Elkins WL Freeman M 2004 Editorial: Waddell's signs revisited. *Spine* 29: In press
- Fishbain DA, Cole B, Cutler RB, Lewis J, Rosomoff HL, Rosomoff RS 2003 A structured, evidence-based review of the meaning of nonorganic signs: Waddell signs. *Pain Medicine* 4:141-181
- Green P 2003 The patient seemed to be making an effort but the results were not valid. *The Canadian Neuropsychologist*, The Canadian Psychological Association Section 23 Clinical Neuropsychology, Newsletter, May 2003, 6-12
- Halligan PW Bass C Oakley DA (Eds) *Malingering and illness deception*. Oxford: Oxford University Press 2003
- Main CJ, Waddell G 1998 Behavioral responses to examination. A reappraisal of the interpretation of "nonorganic signs". *Spine* 23:2367-2371
- Waddell G, McCulloch J A, Kummel E, Venner R M 1980 Nonorganic physical signs in low back pain. *Spine* 5: 117-125
- Waddell G 2004a *The Back Pain Revolution*. 2nd Edition Edinburgh: Churchill Livingstone. pp 195-202
- Waddell G 2004b Editorial: I stand by the nonorganic signs. *Spine* 29: In press

## General Information - Disability Medicine, Volume 4, Number 2

*Disability Medicine* is an educational publication of the American Board of Independent Medical Examiners (ABIME) intended to provide a forum for dissemination of a wide range of responsible scholarly opinions, research, and practice relevant to Independent Medical Examiners and disability medicine. The editors and all contributors to *Disability Medicine* enjoy a full latitude in expressing opinions on the subjects presented to better inform the readers. The views expressed by contributors are not necessarily those of the American Board of Independent Medical Examiners. *Disability Medicine* does not endorse or sponsor any articles, but rather presents them for the information and education of its readers.

*Disability Medicine* is published four times a year by the American Board of Independent Medical Examiners (ABIME, 111 Lions Drive, Suite 217 Barrington, IL 60010). American Board of Independent Medical Examiners claims copyright to the entire contents. All rights reserved. Reproduction in whole or in part without written permission is strictly prohibited.

**Subscriptions:** The subscription is free to all members of the ABIME Board of Registry. The standard subscription rate for 4 quarterly issues is \$100 in the US, \$150 for delivery outside the US,

payable in US Funds only. Individual copies are \$15 each in the US, \$25 each outside the US.

**Inquiries Regarding Advertising and Subscriptions.** Should be sent to Kathleen M. Bennett, Managing Director Disability Medicine, ABIME, 111 Lions Drive, Suite 217, Barrington Illinois 60010, phone (800) 234-3490.

**Manuscripts** should be addressed to Mohammed I. Ranavaya, MD, Editor-in-chief of *Disability Medicine*, RR 4, and Box 5C, Chapmanville, WV 25508. Fax (304)-855-9442, e-mail: mranavayamd@newwave.net.

**Reprints**, except special orders of 100 or more, are available from the authors.

**Advertising Policy:** *Disability Medicine* may carry advertisements either in *Disability Medicine*, as attachments to *Disability Medicine* or associated with the mailing of *Disability Medicine*. There may also be advertisements in association with *Disability Medicine* on the ABIME web site dedicated to *Disability Medicine*. Services or products eligible for advertising will be relevant to the practice of disability medicine. These will general fall into the categories of: Independent Medical Examination services providers, other relevant paramedical service organizations, publishers or professional textbooks or professional journals,

employment related advertisements, other services or products which are of particular interest to the practice of Independent Medical Examination services or disability medicine.

The appearance of advertising in *Disability Medicine* is neither an American Board of Independent Medical Examiners guarantee nor an endorsement of the product or service, or of the claims made for any product or service by the advertiser or manufacturer. The American Board of Independent Medical Examiners reserves the right to decline any submitted advertisement, in its sole discretion.

The Editor of *Disability Medicine* determines the eligibility of advertising and the placement of advertisements in *Disability Medicine* for products intended for diagnostic, preventive or therapeutic services. Scientific and technical data concerning product or services safety and efficacy may be required before advertising is accepted for publication. In order to determine eligibility of advertising for books or journals a copy will usually be requested for review.

**Instructions to Authors** May be obtained by writing to *Disability Medicine* for a copy and outlines requirements for acceptance of manuscripts.



# The Annular Tear as a Source of Low Back Pain

Steven G. McCloy, MD, CIME<sup>1</sup>  
Clinical Assistant Professor of Medicine, Brown University

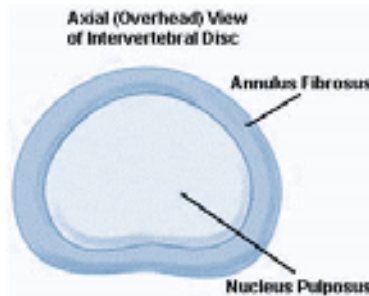
## ABSTRACT:

*Clinicians who evaluate disability are frequently confronted with the problem of chronic, recalcitrant low back pain. The examinee may present with a paucity of objective findings, yet the examinee appears to be sincere and sincerely suffering. This paper examines the annular tear of the intervertebral disc as a pain-generating tissue. There are specific things to look for in the examination as well as specific treatments that might be pursued prior to declaring an examinee or patient to be at Maximal Medical Improvement.*

## INTRODUCTION:

The purpose of this brief overview is to increase the reader's familiarity with annular tears and their clinical significance.

Low back pain is the second most common presenting symptom in physicians' offices. In 1990, there were an estimated 15 million office visits for mechanical low back pain (LBP). Workers' compensation costs in 1989 exceeded \$11.4 billion. The Bureau of Labor Statistics recorded in 2001 373,000 low back injuries.<sup>1</sup> There is no argument that LBP is a major health problem worldwide. Mechanical LBP is the most common cause of work-related disability in persons aged less than 45 years in the US.<sup>2</sup>



## Sources of Pain for the "Painful Disk"

The concept of primary discogenic pain is well accepted in the medical literature.<sup>3</sup> Lesser agreement exists about the source of this pain. Since the 1930's there has been an increasing elegance in the demonstration of the innervation of the disc. Initially through microdissection and more recently through enzymatic assays and tissue markers we have clear evidence that the disc is innervated certainly in its outer third with nociceptor (pain) fibers and with pressure sensors.<sup>4,5</sup> Following injury to the disc, the common inflammatory response ensues with neovascularization after release of numerous cascades of inflammatory substances. In this setting, Freemont et al<sup>6</sup> demonstrated the presence of neural fibers as deep as the inner one-third of the disc.

Some argue that these nociceptors directly respond to trauma to the disc while others attribute pain to the release of cytokine, a leukocyte cell reaction and immunoglobulin response.<sup>7</sup> This leads to secondary nerve irritation and pain. If the tissue-inflammation mechanism is the primary one, it can be argued that a "burnt out" annular tear would not be a

likely source of mechanical LBP.

Hampton et al<sup>8</sup> showed that artificially created cuts in the annulus heal poorly and continue to leak disc material for up to 12 weeks after injury. This leakage may actually be of longer duration since his experiment ended at 12 weeks.

Further research may help to elucidate whether one mechanism or the other is primary.

## Load-bearing mechanics of the spinal column

The biomechanics of the spine have been studied extensively. Each of the elements of the spine (vertebrae, discs, facet joints, and anterior and posterior longitudinal ligaments) and the surrounding muscles, tendons and ligaments plays a role in resisting/assisting motion. An estimated 80-90% of flexion/extension occurs at L4-5 and L5-S1.<sup>2</sup> Axial loading is resisted by the circumferential fibers of the annulus. If axial loading is of longer duration, the force is transmitted radially to the endplates of the vertebrae. If the endplates are intact, this force is absorbed. If the endplates are degenerated, tears may occur. Because of the central position of the posterior longitudinal ligament, shear forces will tend laterally. An annular tear is a rent in the ring of dense connective tissue [see drawing<sup>9</sup>] that makes up one-third of the intervertebral discs in the spine.

Tears seem to occur after falls and sports injuries, lifting with the spine in flexion or lift-twist motions. The supposed



mechanism is a strain/tear of the attachment of the annular fibers to the vertebra. Degeneration of the annular ring also is seen in non-traumatic aging of the spine. Because of all these etiologies, determining causality is a clinical challenge not only for the treating clinician but also for the physician evaluating disability.

## What are the clinical pain features that may help to identify discogenic pain?

### History:

Wheless' *Orthopedics*<sup>10</sup> notes the predominant element in the history of annular tear is back pain, either alone or in excess of leg pain. The pain may be either unilateral or bilateral and is made worse by increases in intradiscal pressure (as with coughing/sneezing/sitting upright/forward bending and lifting). Slipman et al<sup>11</sup> demonstrated poor to no correlation between the site of the tear and where the patient felt pain. Pain could even be felt on the side opposite from the tear. This may be due to the complex and incompletely defined pathways of pain nerves in the disc.

The physical exam<sup>12</sup> should emphasize an effort to elicit signs and symptoms of discal pain:

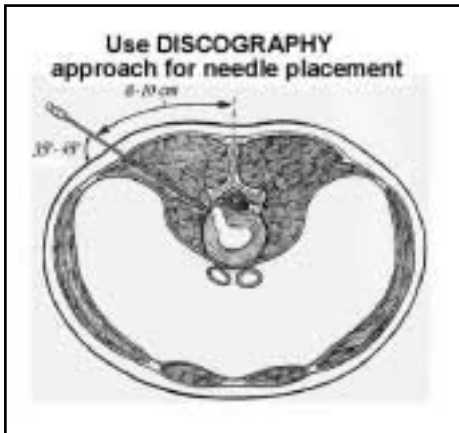
- **POSTURE:** The patient will be more comfortable standing, pacing or sitting in a reclined (spine extended) position. These postures decrease the forces on the posterior disc.
- **HEIGHT, WEIGHT AND BODY-MASS INDEX:** Obesity may produce excess load to the low lumbar intervertebral discs.
- **INSPECTION** for scars of prior lumbar surgery. Inspection while the patient is standing and during forward flexion and extension may reveal a kyphotic or scoliotic deformity. Inspection and palpation should be performed in flexion with the patient standing and seated to determine whether the pain source is in the pelvis or sacral area. Commonly, pain will localize to the level below the offending disc.
- **PALPATION** of the lumbar paraspinals and spine stabilizers may elicit tenderness, as these muscles may be tight, have active or latent trigger or tender points, or be in reactive muscle spasm. A step deformity, in which the spinous process of the segment involved protrudes ventrally, may exist as a consequence of spondylolisthesis.
- **MEASURE** the lower extremity circumference at mid thigh and mid calf at the same time of day so comparable results are obtained; they should be symmetric. A useful landmark is the tibial tubercle with measurement 15 cm. above and below the tubercle. Measure leg length from the navel to the medial malleolus of the ankle and from the anterior superior iliac spine to the medial malleolus. Unequal leg lengths of >2 cm are significant and may indicate short leg, sacroiliac dysfunction and a correctable cause of chronic low back pain.
- **MOVEMENT** of hips, knees, and ankles should be full, without crepitus or effusions.
- **DISCOGENIC STRESS MANEUVERS** usually reproduce the patient's low lumbar and buttock symptoms. These maneuvers include pelvic rocking and sustained hip flexion.
- Perform pelvic rocking with the patient in a supine position. Flex the patient's hips until the flexed knees approximate to the chest; then, rotate the lower extremities from one side to the other. Flattening of the lumbar lordosis in this way increases posterior disc pressure.
- Perform sustained hip flexion with the patient supine; raise the patient's extended lower extremities to approximately 60° in relation to the examination table. Then ask the patient to hold the lower extremities in that position and release. Query the patient regarding reproduction of low lumbar and/or buttock pain. Then lower the extremities successively approximately 15°, and, at each point, note the reproduction and intensity of pain. The test is positive if the patient complains of low lumbar and/or buttock pain of increasing intensity as the extremities are lowered at successive angles. Sacroiliac joint stress maneuvers do not provoke pain. Root tension signs are negative.
- The **key finding** is positive sciatic stretch test that produces back pain or back pain greater than leg pain.

## Evaluation

After MRI, the **definitive test** is discography with CT.<sup>13</sup> Discography showing dye extending into the epidural space or extending to the periphery of the disc where it can contact innervated portion of the annulus fibrosis correlates well with the annular tear as a cause of lumbar pain. A positive test also requires



a reproduction of pain accompanying injection of dye. Pressure is increased inside the disc. If that pressure reproduces the same pain in the same site, the disc is presumed to be generating the pain. A vital stain can be injected to identify the disc for endoscopic removal. IDET can follow immediately or at a later date.



Drawing from reference (13).

Dallas Discographic<sup>2</sup> criteria rate tears on a 0-5 scale:

- Grade 0 is defined as contrast entirely within a normal nucleus pulposus,
- Grade 1 if contrast extends radially along a fissure involving the inner third of the annulus fibrosus,
- Grade 2 if it extends into the middle third
- Grade 3 if it extends into the outer third of the annulus, either focally or radially within the outer annulus to an extent not greater than 30° of the disc circumference
- Grade 4 was added by Aprill and Bogduk defined as a grade 3 tear that dissects radially within the outer third of the annulus to involve more than 30° of the disc circumference.
- Grade 5 defined as a full-thickness tear, either focal or more circumferential, with extra annular leakage of contrast (added by Schellhas et al).

## Treatment

Not all annular tears require treatment. The finding of annular tears in asymptomatic volunteers evidences this. It is when the standard conservative treatments of NSAIDS and exercise fail that treatment considerations require our clinical judgment.

Theoretically, steroid injection in the area of the facet or the epidura ought to help. This is based on the theoretical mechanism of inflammation caused by leaking disc gel. While anecdotal evidence abounds, epidural steroid injections have not shown significant efficacy in the treatment of chronic low back pain.<sup>14</sup>

Intradiscal Electrothermy<sup>15</sup> (IDET) is a recent addition to the treatment of discopathy including annular tears. A thin wire probe is inserted into the disc. When its correction position is confirmed, an electric current passes into the probe. This generates heat to coagulate the disk collagen (Types I and II<sup>16</sup>) and presumably to seal a leaking hole. The temperature of 45-48°C also denervates the surrounding annular tissues.<sup>17</sup> While initial reports were enthusiastic, further testing in larger groups of patients is needed in order to determine whether initial excitement is warranted.

Yeung<sup>18</sup> demonstrated improvement of pain in 80% of patients who underwent endoscopic discectomy for treatment of chronic back pain accompanying a torn annulus.

### CONCLUSION:

Some clinicians are happy to send the patient with an unusual back problem

on to the orthopedist or neurosurgeon. Unfortunately, patients with “non-surgical backs” often end up as medical orphans with no one interested in treating them. They become “crocks” and malingerers. Most are not: they are patients seeking relief from the odious pain of chronic mechanical LBP.

Other clinicians enjoy the challenge of the unusual back patient. Physicians performing disability examinations have a particular obligation to be confident that their examinee is truly at Maximal Medical Improvement. Recognizing the annular tear can help us do a better job of identifying pathology and of recommending treatment options.

## References

- 1 Dr. McCloy is an occupational physician in practice at Occupational Health + Rehabilitation Inc in Pawtucket, RI.
- 1 <http://www.bls.gov/iif/home.htm>
- 2 Hills, EC. Mechanical low back pain. <http://www.emedicine.com/pmr/topic73.htm>.
- 3 <http://www.ub.rug.nl/eldoc/dis/medicine/m.h.coppes/c3.pdf>
- 4 Boduk N et al. “Nerves of the lumbar spine.” Clinical anatomy of the lumbar spine, 1987, Churchill Livingstone, 92-102.
- 5 Coppes MH et al. Innervation of ‘painful’ lumbar discs. Spine, 1997 22(20), 2342-2349.
- 6 Fremont AJ et al. Nerve ingrowth into diseased intervertebral disc in chronic back pain. Lancet, 1997. 350(9072), 178-181.
- 7 Windsor and Sullivan. <http://www.emedicine.com/SPORTS/topic63.htm>
- 8 Spine. 14(4):398-401, 1989.
- 9 [http://www.coloradospineinstitute.com/anatomy/intervertebral\\_16.html](http://www.coloradospineinstitute.com/anatomy/intervertebral_16.html)
- 10 <http://www.ortho-u.net/o12/48.htm>
- 11 Spine2001;26:E165-E169.
- 12 Patel and Slipman. <http://www.emedicine.com/pmr/topic67.htm>
- 13 Welch and Gertzen. <http://www.neurosurgery.org/focus/aug02/13-2-7.pdf>
- 14 Clinical evidence. June 2003. BMJ Publishing Group (London). p. 241.
- 15 Welch and Gertzen. <http://www.neurosurgery.org/focus/aug02/13-2-7.pdf>
- 16 <http://www.peloza.com/research.html>
- 17 Smith HP et al. Radiofrequency neurolysis in a clinical model. 1981. J. Neurosurgery 55, 248-253.
- 18 <http://www.aaos.org/wordhtml/anmt2000/poster/pe163.htm>



# Contemporary Surgery for Lumbar Degenerative Disk Disease

Victor M. Hayes, M.D., Resident Orthopaedic Surgery, Department of Orthopaedic Surgery  
Long Island Jewish Medical Center, New Hyde Park, NY11040

Jeff S. Silber, M.D., Assistant Professor, Department of Orthopaedic Surgery  
Long Island Jewish Medical Center, New Hyde Park, NY11040

Alexander R. Vaccaro, M.D., Professor, Co-Chief, division of Spine Surgery, Co-Spine fellowship Director  
Co-Director Delaware Valley Regional Spinal Cord Injury Center  
Thomas Jefferson University  
And  
The Rothman Institute, Department of Orthopaedic Surgery  
Philadelphia, PA 19107

## Introduction:

Low back pain is extremely common in the workplace and is the most common cause of disability in working adults. At present low back pain is the leading cause of loss of workdays and expenditure of health care dollars. Recent advances in lumbar surgery have focused on minimizing the invasiveness of surgical procedures designed to reduce the morbidity associated with traditional open techniques. The majority of the improvements in lumbar surgical techniques have focused on improving outcomes in the surgical treatment of lower back pain (LBP) secondary to degenerative disk disease (DDD). The surgical outcomes of patients undergoing interbody fusion for DDD have been inconsistent and variable with approximately 60-80% of patients experiencing good results in carefully selected patients<sup>35</sup>. The desire to improve these results has been the driving force for exploring new techniques to treat this disease. Research has made significant gains over the past 10 years in understanding the pathophysiology of the pain generator in degenerative spinal disorders. As a result, invasive and noninvasive procedures

have evolved that are designed to ablate the most common pain generator-the intervertebral disk. These newer techniques include tissue engineering strategies, anular fibrosus augmentation treatments, nucleoplasty, intradiscal electrothermal annuloplasty (IDET), nuclear pulposus replacement, intervertebral disk replacement, all of which are intended to modify the natural history of symptomatic intervertebral disk regeneration. Outcomes following lumbar surgery for radiculopathy secondary to a herniated nucleus pulposus, neurogenic claudication due to spinal stenosis and low back pain secondary to degenerative instability (i.e. isthmic spondylolisthesis), have a more predictable response to surgical intervention and will not be discussed in this paper.

This article will review the recent advances in lumbar surgery, highlight the indications for surgery and consider the efficacy and controversy of these surgical techniques.

## Degenerative Disk Disease:

Pain generators in the lumbar spine may include the facet joints, intervertebral disks, an isthmic defect in the pars interarticularis, nerve roots, posterior longitudinal ligament, dura and muscles. Since chronic lower back pain can arise from numerous etiologies, differentiating the precise cause of a patient's LBP symptoms is crucial for effective treatment. Degenerative disk disease is an age related process that is influenced by caused by the repetitive macro or micro trauma experienced in daily living. This trauma can result in peripheral tears in the anulus fibrosus and these tears may accelerate dehydration of the intervertebral disk, with resultant fraying and disruption of the nucleus pulposus.<sup>43,44</sup>

Although the etiology of disk degeneration pain is unknown, several studies have implicated increased nerve sensitization and in-growth in the periphery of the intervertebral disk as causal factors<sup>45</sup>. Cadaver degenerative disk tissue has demonstrated an increased in-growth of nerve fibers within the disk's periphery. The extent



of this neoneuralization has been shown to be greatest at the painful levels in post-mortem studies.<sup>45</sup> The nerves present in degenerative disk tissue has also been shown to express increased levels of substance P which sensitizes nerve endings to painful stimuli<sup>45</sup>. Since the etiology of symptomatic DDD is unknown, the true pathology likely involves a complex interaction of outer annulus disruption, stimulation of free nerve endings (sinovertebral nerves) and the release of inflammatory mediators from the degenerative disk itself.

Controversy exists about the relationship between disk degeneration and LBP due to the poor correlation between the presence of DDD and the report of symptoms in the general population. Numerous studies have documented that a high percentage of asymptomatic patients have the imaging presence of DDD<sup>27,28,29,30,31,37</sup>. Some authors, however, have reported a strong correlation (86%) between the presence of a High Intensity Zone (HIZ) annular tear and symptomatic DDD<sup>32,33,36,38,42</sup>.

In contrast, a recent prospective observational study by Carragee et al,<sup>42</sup> evaluated the incidence of magnetic resonance imaging (MRI) high intensity zone annular tears in 42 symptomatic patients with LBP and 54 asymptomatic patients. The prevalence of a high-intensity zone in the patient populations was 59% in the symptomatic group and 24% in the asymptomatic group<sup>42</sup>. They concluded that the prevalence of a high-intensity zone in asymptomatic individuals with degenerative disk disease (24%) is too high for meaningful clinical use<sup>42</sup>.

Although 80% of adults will experience axial back pain, only 1-2% of these patients will undergo an invasive surgical procedure to treat their symptoms. For outcomes to be successful, the decision to undertake surgical management of DDD is extremely patient dependent. The pre-surgical work-up should always include a complete history, physical examination, and appropriate imaging studies which may include plain radiographs, MRI and provocative discography. The surgical indications guidelines are listed in Table I. Red flags for poorer surgical outcomes include patients with active psychological issues, litigation or workers compensation claims.

The decision to undertake surgical intervention should be deferred until all reasonable non-operative treatments have been considered and have failed to provide adequate relief of symptoms. The appropriate surgical procedure must address the proposed pain generator (i.e. the intervertebral disk) and must achieve a solid, rigid interspace if fusion is the goal in order to support and redistribute the biomechanical forces across the diseased level, or recreate stable motion if an intervertebral disk replacement is chosen.

Many treatment strategies have resulted in less than satisfactory outcomes at long-term follow-up for the treatment of low back pain. This has led to the development of alternative technologies that modify the architecture of the disk such as tissue engineering strategies, annular fibrosis augmentation, nucleoplasty, intradiscal electrothermal annuloplasty (IDET), nucleus pulposus replacement, or intervertebral disk

replacement. At present, the traditional method of ablating a pain generator, such as the intervertebral disk, is through surgical fusion. Advances in bone graft alternatives have greatly modified the morbidity of these procedures by avoiding the need for autologous bone graft harvesting. An overview of some of these technologies will be discussed.

## Intradiscal Electrothermal Annuloplasty (IDET)

Intradiscal Electrothermal Annuloplasty (IDET) is a minimally invasive procedure, which utilizes a heating electrode that is introduced into the disk through a cannulated needle. The theory behind the use of IDET is that by heating of the annulus fibrosus to an appropriate temperature, shrinkage of collagen fibers may occur which seals and stiffens a disrupted annular tear improving the biomechanics of the intervertebral disk. Alternatively, heating of the annulus may cause denervation of small nerve endings in the lining of the disk leading to decreased pain perception. IDET is currently being used to treat patients refractory to appropriate conservative management suffering from discogenic low back pain. The ideal candidate for this procedure is a patient younger than 55 years old with a single-level, painful disk identified by both MRI and provocative discography with adequate preservation of disk height.

The developers of the technology, have reported results of 62 patients following IDET for chronic discogenic low back pain<sup>16,34</sup>. Patients had an average of 60



months of symptoms prior to the IDET procedure. At a mean follow-up of 16 months, symptomatic improvement was observed in 81% of patients. Other authors including Karasek and Bogduk<sup>17</sup>, and Wetzel et al.<sup>18</sup> have also reported a fairly high rate of success using IDET. Kleinstueck et al.<sup>19</sup> evaluated the heating potential of IDET in a human cadaveric model, by measuring the heat gradient in the periphery around the heating electrode. They reported that adequate temperatures necessary to denature and alter the infrastructure of collagen fibers were only identified in a 1-2 mm diameter around the heating probe. The authors concluded that less than 5% of the disk surface area was subjected to adequate temperatures to denature collagen resulting in shrinkage and possible stiffening. This study and others argues against the proposed physiologic theory to explain the biomechanical effects of the procedure. Further investigation is needed to determine the mechanisms and role of IDET in the management of symptomatic degenerative disk disease.

## INTERBODY FUSION

### **Anterior and Posterior Interbody Fusion Techniques**

The use of lumbar interbody fusion for painful conditions of the intervertebral disk has received significant attention in recent years.<sup>1-7</sup> Interbody fusion techniques including Anterior Lumbar Interbody Fusion (ALIF), Posterior Lumbar Interbody Fusion (PLIF), or Transforaminal Lumbar Interbody Fusion (TLIF) and circumferential (anterior and posterior) fusions have all

been supported by various investigators. The most effective surgical fusion procedure and the degree of invasiveness to accomplish the fusion are also hotly debated. Some surgeons favor anterior fusions only, while others support posterior only approaches, while still others always recommend a circumferential fusion procedure. Anterior procedures may be performed open or through laparoscopic methods.

Interbody fusion procedures have been shown to be biomechanically superior to posterolateral intertransverse fusions in providing support to axial loads.<sup>2</sup> A variety of interbody fusion devices or cages have been developed, tested, and utilized clinically. The shapes and number of the devices inserted vary and may be trapezoidal/ramped, or cylindrical and single or paired.

Cages of various designs are currently being used successfully for a variety of applications including degenerative disease, trauma and deformity. However, the use of stand-alone cages in degenerative spinal disease over multiple segments or in the setting of circumferential instability has met with an unacceptable rate of failure.<sup>4</sup> Although technical complications are important to identify and avoid, the most prevalent reason for clinical failure is poor patient selection. As has been shown with other invasive management strategies, workers compensation, pending litigation and secondary gain, as well as ill-defined pain syndromes often contribute to less than optimal reported outcomes.

Cages can be inserted from either an anterior or posterior approach. With either approach, various modifications

have been introduced to decrease the morbidity of the surgical exposure with the intent of improving functional outcome.

Zdeblick et al.<sup>5</sup> compared an anterior laparoscopic approach with a mini-open technique in the performance of an L4-L5 interbody fusion with threaded cages. No statistical difference was found in operating time, blood loss, or length of hospital stay between the two groups. Complications, however, were higher in the laparoscopic group (20% versus 4%). The authors concluded that when compared to a mini-open approach, laparoscopic surgery at the L4-L5 level provided no significant advantage.<sup>5</sup>

The proposed advantages of anterior compared with posterior interbody fusion techniques include direct visualization and increased ability to prepare the intervertebral endplates, the biomechanical advantage of restoring lumbar lordosis with the use of a ramped shaped device, and the lack of iatrogenic surgical trauma to the posterior paraspinal musculature. Complications specific to the anterior approach include retrograde ejaculation in 0.4 to 8% of males, vascular and abdominal visceral injuries and post-operative incisional hernias. Complications specific with the posterior approach for interbody device insertion include dural lacerations, epidural fibrosis and nerve root injuries.<sup>7</sup>

The most predictable method ensuring an interbody fusion for treating discogenic disk disease is a 360-degree spinal fusion. Many surgeons debate about whether a complete fusion procedure is necessary to achieve good to excellent results. Similar outcomes



with regards to post-operative pain relief, fusion rates and patient satisfaction have also been demonstrated in 270-degree fusions in which an interbody fusion is performed but only internal fixation is used posteriorly without adjunctive bone graft. A recent study by Schofferman et al<sup>23</sup>, compared the clinical outcomes, costs, and utilization of health resources of 360 degrees versus 270 degrees fusions. They demonstrated no significant clinical differences in patient satisfaction, pain relief, or percentage of solid ALIF between the 360 degrees and 270 degrees fusions groups<sup>23</sup>. However, the 270 degrees fusion group had significantly less blood loss, shorter operative times, shorter hospital stays, and less utilization of health care resources<sup>23</sup>.

## Transforaminal Interbody Fusion Techniques

The transforaminal lumbar interbody fusion (TLIF) technique is a modification of the PLIF technique. This method allows placement of an interbody device from a posterior approach from a more lateral approach. The advantage of the TLIF technique over the PLIF method is the minimal retraction of the neural structures required for cage insertion. The TLIF approach involves unilateral removal of the pars interarticularis and facet joint and an approach to the intervertebral disk space lateral to the thecal sac. Originally, the TLIF technique involved two interbody devices introduced from a bilateral approach. This has been modified by many surgeons utilizing a single obliquely placed interbody fusion device from a unilateral approach. Studies have shown

that a single oblique cage with pedicle screw instrumentation approximates the stiffness of an intact normal spine.<sup>11</sup> When utilizing the TLIF technique, it should always be performed with adjunctive posterior pedicle screw instrumentation to decrease the likelihood of a pseudarthrosis due the planned removal of the entire facet joint on one side needed to perform this technique.

## Bone Graft Substitutes

When performing interbody fusion techniques the goal is to achieve a solid fusion in order to maximize clinical outcomes. This has led to an enormous interest in developing bone graft alternatives or extenders that enhance or replace autologous bone graft. Optimal bone graft substances generally possess one or more of three essential elements: (1) osteoinductive factors that induce the various stages of bone regeneration, (2) an osteoconductive matrix which provides physical support and direction to the repair process, and (3) osteogenic stem cells that are capable of differentiating and facilitating the bone formation process<sup>39</sup>. Autogenous bone graft obtained from the iliac crest is currently still the gold standard among graft materials because it contains all of these essential properties<sup>39,40,41</sup>.

The search for a synthetic graft better than iliac crest bone graft has intensified recently due to the emphasis on minimizing the invasiveness of surgical techniques and because harvesting iliac crest autograft can be associated with significant donor site morbidity. Minor complications associated with graft harvesting include superficial infections,

seromas, and minor hematomas whereas major complications include vascular injuries, deep infections at the donor site, neurologic injuries, deep hematoma formation requiring surgical intervention, and iliac wing fractures. In fusion surgeries for lumbar degenerative disk disease, over the last several years, we have seen a significant increased interest in biologically active substances intended to extend, enhance and/or even replace autologous bone graft. Osteoconductive materials including allograft cancellous chips, and cortical spacers and coralline hydroxy-appetite (ceramics) have been shown to be useful in certain human spinal fusion applications. Additionally, weakly osteoinductive materials including demineralized bone matrix (DBM) products have also been used in the augmentation of autologous bone graft in human spinal fusions. More recently, human recombinant bone morphogenetic proteins are being investigated in human clinical trials. They appear to show promise as an autologous bone graft substitute in spinal fusion applications. Recombinant human bone morphogenetic protein 2 (rhBMP-2) and recombinant human osteogenic protein 1, known as rhOP-1 or rhBMP-7 and have been shown in both animal and human spinal fusion studies and are likely to be available commercially in the near future.

## Minimally Invasive Spinal Fusion Procedures

The standard surgical exposure for posterior interbody fusions involves a posterior midline incision and soft tissue dissection to elevate or strip the



paraspinal muscles off the posterior elements. Some surgeons are now using specially designed metal tubes (dilators), to gradually separate muscle fibers until an appropriately sized tunnel is created. These tubular instruments are used to retract the muscles and soft tissues, holding the tunnel open to allow for surgical instruments to be inserted. This technology allows surgeons to perform surgery through small incisions (< 1 inch in length) without stripping them from their bony.

These new approaches may reduce iatrogenic soft tissue injury, pain, blood loss and recovery time associated with traditional open techniques. Working through small tubes does however reduce the visual field that may increase surgical times. Interbody devices as well as pedicle screw instrumentation can all be inserted through these less invasive techniques. Prospective, randomized outcome studies will be required to validate the efficacy of these evolving surgical techniques.

## Lumbar Intervertebral Disk Replacement

The thought of a mechanical disk prosthesis or replacement similar to those seen in the hip or knee joint has been sought for many years. Like their counterparts for the hip and knee the idea of the disk replacement was to provide a motion sparing, mobile, and painless joint. Unfortunately, the intervertebral disk mechanical environment imposes significant engineering challenges. This is due to extremely large and complicated forces that exist in the

lumbar intervertebral disk. Presently, several different types of disk replacements are being investigated to provide a prosthesis or replacement for either the nucleus pulposus (center of the disk) or the entire intervertebral disk.

Batterjee et al. reported a study of 17 patients treated with a Prosthetic Disc Nucleus (PDN) for degenerative disk disease<sup>20</sup>. At 2-year follow-up, the majority of patients improved low back pain and better overall function based on the Oswestry and Visual Analog scales. The implant is composed of a high molecular weight polyethylene case with a hydrogel core center. Interestingly, studies have shown this device to mimic the healthy human intervertebral disk by shrinking and swelling during normal loading and unloading of the lumbar spine.

Marnay et al. reported an 8 to 10 year follow-up of a lumbar disk prosthesis. This type was composed of plasmapore-covered titanium plates encasing an inner polyethylene dome<sup>22</sup>. The authors reported good or excellent results in 78% of the patients with no patients requiring removal of the device.

McAfee PC et al,<sup>26</sup> sixty patients with one-level discogenic pain were randomized to either an anterior interbody fusion or an anterior SB Charite artificial disk replacement. The length of surgery was mean 88.4 minutes (range 54-137 minutes) for both groups and the length of the hospital stay was a mean of 3.03 days (range 2-6 days)<sup>26</sup>. Oswestry Disability Index scores for the SB Charite disk (aggregate study group) were 50.0 +/- 14.3 preoperatively and 25.0 +/- 20.1 at 1-3 years' follow-up

( $P < 0.001$ )<sup>26</sup>. This is the first study that demonstrated improvement of functional outcome measures in a prospective randomized study using a disk arthroplasty device for primarily mechanical back pain. The SB Charite disk replacement device achieved comparable successful results reported in studies using lumbar interbody fusion cages supplemented with BMP or interbody autograft and pedicle screw instrumentation.<sup>26</sup>

## Summary

Over the last several years we have seen many advances in lumbar spine surgery technology that have vastly improved the quality of life of those suffering from years of disabling low back pain from degenerative disk disease. Newer fusion procedures are being developed with the overall trend towards less invasive approaches with less iatrogenic soft tissue morbidity to the patient. Improved bone graft substitutes are being utilized with increasing potential for obtaining lumbar spinal fusion success. The newer introduction of several clinically tested recombinant bone morphogenic proteins (BMPs) are now becoming available. In Europe and now in the United States, intervertebral disk replacements are presently being utilized and studied in patient cohorts prospectively and will be available commercially in the near future. Presently, Biologically active answers are being sought to modify the natural history of lumbar intervertebral disk degeneration. Tissue engineering techniques and/or physical intervertebral disk modifying procedures may provide alternatives for traditional motion sacrificing procedures such as interbody



fusions. Although, the future looks promising in the management of painful degenerative disk disease in the lumbar spine, as with all new developments, careful prospective, long-term trials are needed to fully define their role.

## TABLE I Surgical Indications for Lumbar Degenerative Disc Disease

- 1) Patient with chronic (> 6months) low back pain of discogenic origin whose symptoms had failed to improve with aggressive non-operative care.
- 2) Patient who has failed a comprehensive non-operative treatment program:
  - **Activity modification**
  - **Progressive physical exercise program**
  - **Physical therapy**
  - **Oral NSAID's**
  - **At least one fluoroscopic epidural injection**
  - **Comprehensive back education program**
- 3) Normal Neurological Examination with no radicular symptoms.
- 4) "Normal" Psychology
- 5) Absence of neural compression on MRI and evidence of abnormal disc morphology (IE: "Black Disc Disease" on T2 weighted images).
- 6) A positive provocative discogram which includes normal control levels (above and/or below) the degenerative disc and is concordantly positive.
- 7) \*\*\*\*\*Non-litigation/Non-Workers compensation patient who in an appropriate, educated, motivated, and has realistic goals and expectations<sup>46</sup>.  
\*\*\*\*\*Relative indication

## References:

1. Tzantrizos A, Baramki HG, Zeidman S, et al. Segmental stability and compressive strength of posterior lumbar interbody fusion implants. *Spine*. 2000;25:1899-1907.
2. Enker P, Steffee AD. Interbody fusion and instrumentation. *Clin Orthop*. 1994;300:90-101.
3. Zeidman SM. Intradiscal biomechanics: anterior vs. posterior approach-decision making ALIF vs. PLIF and why? Augmentation vs. stand alone implant. Proceedings of the 16th Annual Meeting of the Federation of Spine Associations. 2001;10.
4. Shaffrey CI. Indications for threaded interbody devices. Proceedings of the 16th Annual Meeting of the Federation of Spine Associations. 2001;9.
5. Zdeblick TA, David SM. A prospective comparison of surgical approach for anterior L4-L5 fusion: laparoscopic versus mini anterior lumbar interbody fusion. *Spine*. 2000;25:2682-7.
6. Regan JJ. Laparoscopic lumbar fusion: single surgeon experience in 127 consecutive cases. Proceedings of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001;469.
7. Albert TJ. Complications of cages and dowels. Instructional Course Lecture #209 of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001.
8. Lieberman IS. Revision strategies for failed threaded interbody fusion devices. 16th Annual Meeting of the Federation of Spine Associations, San Francisco, California, March 3, 2001.
9. Sylvain GM, Raizadeh K, Macuire CD, et al. Failure of lumbar interbody implants. Proceedings of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001;463.
10. Oxland TR, Hoffer Z, Nydegger T, et al. A comparative biomechanical investigation of anterior lumbar interbody cages: central and bilateral approaches. *J Bone Joint Surg Am*. 2000;82:383-93.
11. Savas PE, Harris BM, Hilibrand AS, et al. Transforaminal lumbar interbody fusion: the effect of various instrumentation techniques. Proceedings of the 15th Annual Meeting of the North American Spine Society. 2000;216-7.
12. Grauer JN, Patel TC, Erulkar JS, et al. Evaluation of OP-1 as a graft substitute for intertransverse process lumbar fusion. *Spine*. 2001;26:127-33.
13. Boden SD, Zdeblick TA, Sandhu HS, et al. The use of rhBMP-2 in interbody fusion cages. Definitive evidence of osteoinduction in humans: a preliminary report. *Spine*. 2000;25:376-81.
14. Matsumoto T, Masuda K, An HS, et al. Tissue engineered intervertebral disc: enhancement of formation with osteogenic protein-1. Proceedings of the 15th Annual Meeting of the North American Spine Society. 2000;88-9.
15. Moon SH, Nishida K, Gilbertson L, et al. Cocktail therapeutic gene transfer to human intervertebral disc cells cultured in three-dimensional alginate beads. Proceedings of the 15th Annual Meeting of the North American Spine Society. 2000;89-92.
16. Saal JA, Saal JS. Intradiscal electrothermal treatment for chronic discogenic low back pain: A prospective outcome study with minimum 1-year follow-up. *Spine*. 2000;25:2622-7.
17. Karasek M, Bogduk N. Twelve-month follow-up of a controlled trial of intradiscal thermal annuloplasty for back pain due to internal disc disruption. *Spine*. 2000;25:2601-7.
18. Wetzel FT, Andersson GB, Peloza JH, et al. Intradiscal electrothermal annuloplasty to treat discogenic low back pain: Preliminary results of a multicenter prospective cohort study. Proceedings of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001;479-80.
19. Kleinstueck FS, Diederich, CJ, Nau WH, et al. Intradiscal electrothermal therapy (IDET) thermal dosimetry in human lumbar discs. Proceedings of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001;480.
20. Batterjee KA, Ray CD, Osman MA, et al. One year followup on 17 Saudi patients implanted with a prosthetic disc nucleus. Proceedings of the Annual Meeting of the International Society for the Study of the Lumbar Spine. 2000;114.
21. Kotani Y, Fujinaga T, Kaneda K, et al. Total artificial intervertebral disc replacement using ultra-high strength bioabsorbable spinal fixation device. Proceedings of the 15th Annual Meeting of the North American Spine Society. 2000;94-5.
22. Marnay T. Lumbar disc arthroplasty: 8-10 year results using titanium plates with a polyethylene inlay component. Proceedings of the 68th Annual Meeting of the American Academy of Orthopedic Surgeons. 2001;476.
23. Schofferman J, Slosar P, Reynolds J, Goldthwaite N, Koestler M. A prospective randomized comparison of 270 degrees fusions to 360 degrees fusions (circumferential fusions). *Spine*. 2001 May 15;26(10):E207-12.
24. Hochschuler SH, Ohnmeiss DD, Guyer RD, Blumenthal SL. Artificial disc: preliminary results of a prospective study in the United States. *Eur Spine J*. 2002 Oct;11 Suppl 2:S106-10. Epub 2002 Sep 13.
25. Bertagnoli R, Kumar S. Indications for full prosthetic disc arthroplasty: a correlation of clinical outcome against a variety of indications. *Eur Spine J*. 2002 Oct;11 Suppl 2:S131-6. Epub 2002 Sep 06.
26. McAfee PC, Fedder IL, Saiedy S, Shucosky EM, Cunningham BW. SB Charite disc replacement: report of 60 prospective randomized cases in a US center. *J Spinal Disord Tech*. 2003 Aug;16(4):424-33.
27. Erkiñtalo MO, Salminen JJ, Alanen AM, Paajanen HE, Kormanen MJ. Development of degenerative changes in the lumbar intervertebral disk: results of a prospective MR imaging study in adolescents with and without low-back pain. *Radiology*. 1995 Aug;196(2):529-33.
28. Salminen JJ, Erkiñtalo M, Laine M, Pentti J. Low back pain in the young. A prospective three-year follow-up study of subjects with and without low back pain. *Spine*. 1995 Oct 1;20(19):2101-7; discussion 2108.
29. Savage RA, Whitehouse GH, Roberts N. The relationship between the magnetic resonance imaging appearance of the lumbar spine and low back pain, age and occupation in males. *Eur Spine J*. 1997;6(2):106-14.
30. Jensen MC, Brant-Zawadzki MN, Obuchowski N, Modic MT, Malkasian D, Ross JS. Magnetic resonance imaging of the lumbar spine in people without back pain. *N Engl J Med*. 1994 Jul 14;331(2):69-73.
31. Borenstein DG, O'Mara JW Jr, Boden SD, Laueran WC, Jacobson A, Platenberg C, Schellinger D, Wiesel SW. The value of magnetic resonance imaging of the lumbar spine to predict low-back pain in asymptomatic subjects: a seven-year follow-up study. *J Bone Joint Surg Am*. 2001 Sep;83-A(9):1306-11.
32. Lam KS, Carlin D, Mulholland RC. Lumbar disc high-intensity zone: the value and significance of provocative discography in the determination of the discogenic pain source. *Eur Spine J*. 2000 Feb;9(1):36-41.
33. Schellhas KP, Pollei SR, Gundry CR, Heithoff KB. Lumbar disc high-intensity zone. Correlation of magnetic resonance imaging and discography. *Spine*. 1996 Jan 1;21(1):79-86.



34. Saal JA, Saal JL. Intradiscal electrotheramyl therapy for the treatment of chronic discogenic low back pain. *Oper tech Orthop* 2000; 10:271-281

35. Zdeblick TA. The treatment of degenerative lumbar disorders. A critical review of the literature. *Spine*. 1995 Dec 15;20(24 Suppl):126S-137S

36. Saifuddin A, Braithwaite I, White J, Taylor BA, Renton P. The value of lumbar spine magnetic resonance imaging in the demonstration of anular tears. *Spine*. 1998 Feb 15;23(4):453-7

37. Boden SD, Davis DO, Dina TS, Patronas NJ, Wiesel SW. Abnormal magnetic-resonance scans of the lumbar spine in asymptomatic subjects. A prospective investigation. *J Bone Joint Surg Am*. 1990 Mar;72(3):403-8

38. Aprill C, Bogduk N. High-intensity zone: a diagnostic sign of painful lumbar disc on magnetic resonance imaging. *Br J Radiol*. 1992 May;65(773):361-9

39. Khan SN. Clinical applications of bone graft substitutes. *Orthop Clin North Am* - 01-Jul-2000; 31(3):389-98

40. Abbott LC, Schottstaedt ER, Saunders JB de CM, Et al: The evaluation of cortical and Cancellous bone as grafting material. *JBJS* 1947 29:381-414

41. Heiple KG, Goldberg VM, Powell AE, Et al: Biology of Cancellous bone Grafts. *Orthop Clin North Am* 1987 18:179-185

42. Carragee EJ, Paragioudakis SJ, Khurana S. 2000 Volvo Award winner in clinical studies: Lumbar high-intensity zone and discography in subjects without low back problems. *Spine*. 2000 Dec 1; 25(23):2987-92.

43. Osti OL, Vernon-Roberts B, Moore R, Fraser RD: Annular tears and disc degeneration in the lumbar spine: A post-mortem study of 135 discs. *J Bone Joint Surg Br* 1992;74:678-682.

44. Osti OL, Vernon-Roberts B, Fraser RD: Anulus tears and intervertebral disc degeneration: An experimental study using an animal model. *Spine* 1990;15: 762-767.

45. Freemont AJ, Peacock TE, Goupille P, Hoyland JA, O'Brien J, Jayson MI: Nerve ingrowth into diseased intervertebral disc in chronic back pain. *Lancet* 1997;350:178-181.

46. Kwon BK, Vaccaro AR, Grauer JN, Beiner J. Indications, techniques, and outcomes of posterior surgery for chronic low back pain. *Orthop Clin North Am*. 2003 Apr;34(2):297-308

# Reach 5,000 IME Physicians Per Issue

## Disability Medicine Journal - Quarterly Publication

### Advertising Price Sheet

Inside Back Cover Full Page.....\$500	Full Page Other.....\$400
Inside Back Cover Half Page.....\$300	Half Page Other.....\$250

**The American Board of Independent Medical Examiners looks forward to your participation.**

Name: \_\_\_\_\_ Title: \_\_\_\_\_

Company/Clinic: \_\_\_\_\_

Street Address: \_\_\_\_\_

City: \_\_\_\_\_ State: \_\_\_\_\_ Zip: \_\_\_\_\_

Phone: \_\_\_\_\_ Fax: \_\_\_\_\_ E-mail: \_\_\_\_\_

I am paying by credit card. Please circle appropriate card (Visa/Mastercard or American Express).

Credit Card Number: \_\_\_\_\_

Exp. Date: \_\_\_\_\_ Signature: \_\_\_\_\_

**You may fax this form or send it with a check to:**

**The American Board of Independent Medical Examiners (ABIME) • 111 Lions Drive, Suite 217 Barrington, IL 60010 USA**  
**Fax (847) 277-7912 • Phone (800) 234-3490 or (847) 277-7902 • [www.abime.org](http://www.abime.org)**



# CME Questions File

These questions are based on information contained in article beginning on page 43.

Please select the *BEST* answer

## Question #1

New research has shown that the etiology of pain associated with disc degeneration is:

- A. Due to increased nerve sensitization and in-growth in the periphery of the intervertebral disc
- B. Caused by the release of inflammatory mediators from the degenerative disk itself
- C. Still unknown
- D. Caused by a complex interaction of outer annulus disruption, stimulation of nerve endings and the release of inflammatory mediators

## Question #2

High-intensity zone annular tears that are found on MRI are:

- A. Excellent predictors of whether a patient with DDD will be symptomatic
- B. Poor predictors of whether a patient with DDD will be symptomatic
- C. Excellent predictors of whether a patient with DDD will be asymptomatic
- D. Associated with DDD however controversy exists about the relationship between this finding and the presence of symptomatic DDD

## Question #3

“Red flags” associated with poorer outcomes in patients having surgery for discogenic back pain include individuals with:

- A. Active litigation
- B. Active psychological issues
- C. Workers compensation claims
- D. All of the above

## Question #4

Which of the following is false regarding interbody fusions:

- A. Anterior approaches for interbody fusions have higher rates of retrograde ejaculation when compare to posterior approaches
- B. Posterior approaches for interbody fusions traumatize posterior paraspinal muscular
- C. The least predictable method of ensuring an interbody fusion is a 360-degree spinal fusion
- D. Interbody fusions are biomechanically superior to posterolateral intertransverse fusions in providing support to axial loads

## Question #5

Which of the following is false regarding Transforaminal Interbody Fusion (TLIF)

- A. Decreased neural structure retraction
- B. Uses a more medial surgical approach to the intervertebral disc that PLIF
- C. Involves removal of the pars interarticularis and facet joint
- D. Should always be supplemented with pedicle screw instrumentation

## Question #6

Intradiscal Electrothermal Annuoplasty (IDET) is currently being used:

- A. To treat patients suffering from discogenic back pain who have failed conservative (non-surgical) treatment
- B. As an adjuvant therapy with a (non-surgical) conservative treatment plan
- C. To treat patients who have failed surgical intervention
- D. As a primary treatment in patients with newly diagnosed symptomatic DDD

## Question #7

The mechanism of pain relief with intradiscal electrothermal annuloplasty (IDET) is:

- A. Heating and shrinkage of the collagen fibers in the annulus fibrosis
- B. Denervation of painful nerve endings
- C. Stiffening of the disrupted annular tear improving biomechanics
- D. Unknown.

## Question #8

A recent randomized study comparing anterior interbody fusion to anterior lumbar disk replacement surgery for one-level discogenic pain demonstrated

- A. Comparable successful outcomes between the two groups
- B. An increase in successful outcomes disk arthroplasty group
- C. Increased hospital length of stay for the disk arthroplasty group
- D. Decrease in functional outcomes in the disk arthroplasty group

## Question #9

Osteoconductive substances include all of the following except:

- A. Demineralized bone matrix
- B. Cortical spacers
- C. Allograft cancellous chips
- D. Coralline hydroxyappetite

## Question #10

Recent developments in spinal surgery for degenerative disk disease are progressing toward fusion procedures that do not require:

- A. Bone grafting or bone graft substitutes
- B. Invasive surgical exposures
- C. Instrumentation until fusion is complete

# 3D Interactive Series

## The World's Finest Musculoskeletal Software



Foot & Ankle



Hand/Wrist



Hip



Knee



Shoulder/Elbow



Spine



Head & Neck

The exceptional 3D anatomical model on these disc are built from a full cadaveric MR data set. It can be viewed layer-by-layer, bone to skin, including such features as muscle attachment points, bony regions and dermatomes. Every visible structure can be clicked on to reveal detailed anatomical and clinical text, comprehensive enough for those in training and detailed enough for experts. Also included are hundreds of slides (MR, X-Rays, diagrams), fully labeled dissection pictures. Beautiful video clips of a moving dissection and biomechanics that demonstrate the dynamic actions for most major muscles.

### Features Include:

- Windows or Macintosh Compatible
- Unsurpassed in Comprehensiveness, Resolution, and Clarity
- 3D Computer Graphic Models of Human Anatomy, Derived from CT and MR Scan Data
- Complete 3D Model, Can be Rotated and Every Visible Structure Labeled
- Layers of Anatomy Can be Added or Stripped Away
- Animations and Video Clips Show Functions, Biomechanics, and Some Surgical Procedures
- Print or Export Images and Text into Programs Such as PowerPoint
- Anatomical Text Links to Anatomical Dissections and Clinical Pathology Slides
- MRI Sections, Allowing Correlation of 3 Planar MRI to 3D Anatomy
- Wealth of Information on Therapy Related Topics and Clinical Pathologies
- Quizzes and Multiple Choice Questions
- Outstanding Educational & Lecture Tool

## Range of Motion Testing

With the Acumar™ Digital Inclinometer Suite  
For Objective Evaluation

### Features:

- Easy to read digital LCD
- Large liquid crystal display readout
- Covers 360° (displays +180° to -180°)
- Respect to gravity or zero at neutral position
- Multiple data storage
- Recall data for viewing
- Supports the AMA Guides Inclinometer



Compact, handheld unit, features large digital display for easy reading. Store measurements with the hold button, review maximum, minimum and average values. This full featured unit reduces examination time and enhances the objectivity of measurement and documentation. Supports range of motion evaluation as described in the AMA Guides to the Evaluation of Permanent Impairment. Inclinometer comes with built-in wireless transmitter to optional computer interface.

**Sports Medicine Technologies** • 800-279-1479 • 602-971-4353 • Fax:(602) 404-2506  
E-mail: [tom@sportsmedtechnologies.com](mailto:tom@sportsmedtechnologies.com) [www.sportsmedtechnologies.com](http://www.sportsmedtechnologies.com)



# Increased prevalence of disability pension in Iceland between 1996 and 2003.

## Internal or external determinants?

Sigurður Thorlaciús<sup>1,2</sup>, Sigurjón B. Stefánsson<sup>1,2,3</sup>

<sup>1</sup> State Social Security Institute of Iceland, <sup>2</sup> Faculty of Medicine, University of Iceland and <sup>3</sup> Department of Neurology, National University Hospital of Iceland

Correspondence and requests for offprints:  
Sigurður Thorlaciús, Tryggingastofnun ríkisins, Laugavegur 114, 150 Reykjavík, Iceland  
tel. (+354) 5604400, fax (+354) 5604461, e-mail sigurdur.thorlaciús@tr.is

### SUMMARY

**Objective:** To determine whether an observed increase in the number of recipients of disability pension in Iceland is in excess of what is to be expected on basis of changes in the size and age distribution of the population.

**Material and methods:** The study includes all those receiving full and partial disability benefits in Iceland in December 1996 and December 2003 as ascertained by the disability register of the State Social Security Institute of Iceland. Age standardised risk ratio between the years 1996 and 2003 was calculated for both pension levels combined and for full disability pension alone.

**Results:** The age standardized risk ratio showed a significantly increased risk in 2003 for both men and women receiving full disability pension (1.42 [1.36-1.49] and 1.49 [1.43-1.54]) and both pension levels combined (1.29 [1.24-1.35] and 1.31 [1.26-1.35]). In 2003 the prevalence of disability pension was 6.2%; full disability pension 5.8% and partial disability pension 0.4%. Mental and behavioural disorders and diseases of the musculoskeletal system and connective tissue were the most prevalent causes of disability.

**Conclusions:** There was a marked increase in the prevalence of disability pension from 1996 to 2003. This increase is probably mainly an effect of an increasingly competitive labour market, but the introduction of the “All work test” in Iceland in 1999 is probably also a contributing factor.

**Key words:** disability, disability pension, social security, functional capacity assessment

### INTRODUCTION

In Iceland there are two disability pension levels. Full disability pension (degree of disability assessed as being at least 75%) is granted to those between the age of 16 and 66 years suffering from considerable and prolonged disability. Partial disability pension (degree of disability assessed as being 50-74%) is granted to those who have less pronounced disability or considerable expenses due to disability<sup>1-3</sup>.

Prior to September 1999 the disability evaluation in Iceland was based on information on the claimant's medical, financial and social circumstances<sup>4</sup>. Since September 1999 the assessment of new claimants for disability pension in Iceland has been based on the “All work test”<sup>5</sup> later renamed “Personal Capability

Assessment” which was first introduced in Britain in 1995. The assessment is based on a medical certificate and the claimant's answers to a questionnaire with questions about physical health problems and empty boxes to describe mental health difficulties. The questions on physical disability are based on a list of descriptors of incapacity which are used to decide the disability grade. If required the claimants have also to attend a medical examination for further evaluation of functional capacity.

Following the introduction of the “All work test” in Britain there was a reduction in the number of recipients of disability (incapacity) pension (information from the Department for Work and Pensions, London). In Iceland, however, the number of recipients of disability pension has been rising recently<sup>6</sup> having been fairly stable since 1976<sup>7,8</sup>. The present study was carried out to determine whether this increase is in excess of what is to be expected on basis of changes in the number of inhabitants of Iceland and their age distribution. A comparison is made between the number of recipients of disability pension living in Iceland on December 1st 2003 and December 1st 1996. Demographic factors - gender, age and place of residence - are also examined.



## MATERIAL AND METHODS

Information was obtained from the disability register of the State Social Security Institute (SSSI) of Iceland on age, gender, place of residence, degree of disability and main diagnosis according to the International Classification of Diseases<sup>9</sup> for all those receiving disability pension (partial or full disability pension) in Iceland on December 1st 2003 and December 1st 1996. Information was obtained on the number of inhabitants in Iceland aged 16-66 years in December 2003 and December 1996 and their distribution according to age, gender and place of residence<sup>10</sup>. On the basis of this information the prevalence of disability pension in Iceland was calculated. Statistical significance was determined with the chi-square test<sup>11</sup>. The results for the year 2003 were compared with those from 1996. To compensate for changes that had occurred in the age distribution of the nation in this period age standardization was carried out and the standardized risk ratio (SRR) for disability pension calculated for each gender using the figures for 1996 as a standard<sup>7, 8, 12</sup>. If the SRR is greater than one disability was more prevalent in 2003 than in 1996, but less prevalent if the SRR is lower than one. The 95% confidence interval indicates whether the SRR is statistically significant at the 5% level (if both the higher and lower confidence limits fall on the same side of one the SRR is significant).

## RESULTS

On December 1<sup>st</sup> 2003 there were 12.299 individuals receiving disability pension in Iceland, 7.382 females (60.0%) and 4.917 males (40.0%). The majority of these

(11.505) fulfilled the medical criteria for full disability pension (had disability assessed as being at least 75%), 6.853 females (59.6%) and 4.652 males (40.4%). Disability was significantly more common among women than men ( $p < 0.0001$ ) for full as well as partial disability pension. The prevalence of full disability pension was 6.1%, of partial disability pension 0.4% and of both pension levels combined 6.5%.

On December 1<sup>st</sup> 1996 there were 8.404 individuals receiving disability pension in Iceland, 7.005 full disability pension and 1.399 partial disability pension. The

prevalence of full disability pension was 4.0%, of partial disability pension 0.8% and of both pension levels combined 4.8%.

Table 1 shows the age distribution of those who qualified for full disability pension in December 1996 and December 2003. The age distribution was similar on both occasions showing the prevalence of full disability pension increasing with age. Females and males showed a different age distribution ( $p < 0.0001$ ). Among those older than 25 years disability was more prevalent among females than males, but in the age group 16-19 years the prevalence was higher among males.

Table 1. Percentage of age group of individuals with disability grade assessed as being at least 75% in Iceland in December 1996 and December 2003.

Age in years	1996		2003	
	Females	Males	Females	Males
16-19	0.8	1.3	0.9	1.4
20-24	1.7	1.7	1.8	1.9
25-29	2.8	2.4	2.9	2.4
30-34	3.0	2.5	3.9	2.8
35-39	5.7	3.9	6.1	4.1
40-44	7.9	5.1	7.7	5.0
45-49	9.3	6.4	8.5	6.0
50-54	12.3	7.9	10.5	6.5
55-59	18.3	11.6	14.0	8.4
60-64	20.3	12.9	20.6	13.0
65-66	26.4	14.5	28.0	14.7
16-66	4.8	3.3	7.3	4.9



Table 2 shows the first (main) diagnosis among recipients of full disability pension and of both disability pension levels combined in December 2003 according to diagnostic groups. This is the diagnosis the insurance physician at the SSSI regards as most important in his disability evalu-

ation. The distribution of the diagnostic groups shows a significant difference ( $p < 0.0001$ ) between females and males for full disability pension as well as for both pension levels combined. For both genders the two most prevalent disease groups were mental and behavioral dis-

orders and diseases of the musculoskeletal system; for full disability pension these two groups accounted for 67% of cases among females and 59% among males; for both pension levels combined these two groups accounted for 66% of cases among females and 57% among males.

Table 2. First (main) diagnosis according to the ICD\* among recipients of disability pension in Iceland December 1st 2003.

	Full disability pension		All disability pension (partial and full pension)	
	Females	Males	Females	Males
Infections	0.6%	0.8%	0.6%	0.9%
Malignant neoplasms	2.0%	2.0%	2.0%	2.1%
Endocrine, nutritional and metabolic diseases	2.3%	1.7%	2.7%	2.3%
Mental and behavioural disorders	32.6%	41.8%	31.2%	40.1%
Diseases of the nervous system and sense organs	8.9%	11.7%	9.0%	12.1%
Diseases of the circulatory system	4.5%	9.1%	4.4%	9.0%
Diseases of the respiratory system	3.1%	1.9%	3.0%	2.0%
Diseases of the digestive system	1.0%	0.5%	1.1%	0.6%
Diseases of the skin and subcutaneous tissue	1.1%	0.5%	1.1%	0.5%
Diseases of the musculoskeletal system and connective tissue	34.7%	17.0%	34.9%	17.0%
Congenital mal/deformations and chromosomal abnormalities	2.2%	3.5%	2.3%	3.6%
Injuries	4.7%	8.2%	5.3%	8.5%
Other diagnoses	2.3%	1.3%	2.4%	1.3%
Total	100%	100%	100%	100%

\* International classification of diseases<sup>9</sup>



Table 3. Prevalence of disability pension in 2003 as compared with 1996: standardized risk ratio (SRR) and 95% confidence intervals (CI) for full disability pension (assessed disability at least 75%) and both pension levels combined according to selected main groups of diseases (ICD)\*

Groups of diseases	Full disability pension				All disability pension (partial and full pension combined)			
	Females		Males		Females		Males	
	SRR	95% CI	SRR	95% CI	SRR	95% CI	SRR	95% CI
Infections	1.24	0.77 to 1.99	1.34	0.80 to 2.25	1.16	0.74 to 1.81	1.33	0.82 to 2.14
Malignant neoplasms	0.77	0.61 to 0.97	0.71	0.54 to 0.92	0.63	0.51 to 0.78	0.64	0.50 to 0.82
Endocrine, nutritional and metabolic diseases	1.05	0.86 to 1.33	0.70	0.51 to 0.93	1.07	0.87 to 1.32	0.90	0.69 to 1.17
Mental and behavioural disorders	1.69	1.58 to 1.82	1.92	1.77 to 2.08	1.42	1.33 to 1.52	1.69	1.57 to 1.83
Diseases of the nervous system and sense organs	1.30	1.15 to 1.47	1.65	1.43 to 1.90	1.19	1.06 to 1.34	1.58	1.38 to 1.80
Diseases of the circulatory system	0.70	0.60 to 0.81	1.38	1.18 to 1.60	0.58	0.51 to 0.67	1.22	1.06 to 1.41
Diseases of the respiratory system	1.03	0.85 to 1.27	0.49	0.38 to 0.63	0.96	0.78 to 1.16	0.49	0.38 to 0.63
Diseases of the digestive system	1.38	0.93 to 2.03	0.69	0.40 to 1.19	1.36	0.96 to 1.93	0.73	0.45 to 1.22
Diseases of the skin and subcutaneous tissue	0.64	0.47 to 0.86	0.21	0.13 to 0.33	0.66	0.49 to 0.87	0.21	0.14 to 0.33
Diseases of the musculoskeletal system and connective tissue	2.22	2.06 to 2.40	1.22	1.09 to 1.36	1.93	1.80 to 2.07	1.07	0.97 to 1.18
Congenital mal/deformations and chromosomal abnormalities	0.78	0.63 to 0.97	1.04	0.83 to 1.31	0.71	0.58 to 0.87	0.99	0.80 to 1.23
Injuries	1.42	1.19 to 1.70	2.71	2.21 to 3.32	1.40	1.20 to 1.65	2.35	1.95 to 2.82
Other diagnoses	0.99	0.79 to 1.25	0.80	0.56 to 1.13	0.99	0.80 to 1.23	0.89	0.65 to 1.20
All diseases	1.49	1.43 to 1.54	1.42	1.36 to 1.49	1.31	1.26 to 1.35	1.29	1.24 to 1.35

\* International classification of diseases<sup>9</sup>



Table 3 shows the SRR for full disability pension and for both disability pension levels combined between the years 1996 and 2003. This includes all diseases as well as selected main diagnostic groups according to the International Classification of Diseases<sup>9</sup>. For the whole group (all diseases included) the prevalence of full disability pension was significantly increased in 2003 for both genders, as the SRR is 1.49 and the CI 1.43-1.54 for females and the SRR 1.42 and the CI 1.36-1.49 for males. There was a significant increase for both genders in disability due to mental and behavioural disorders, diseases of the musculoskeletal system and connective tissue, diseases of the nervous system and sense organs and injuries and for males in disability due to diseases of the circulatory system. There was a significant decrease for both genders in disability due to malignant neoplasms and diseases of the skin and subcutaneous tissue. For females there was a decrease in disability due to diseases of the circulatory system and congenital mal/deformations and chromosomal abnormalities and for males there was a decrease in disability due to endocrine, nutritional and metabolic diseases and diseases of the respiratory system. The prevalence of both disability pensions levels combined for all diseases was significantly increased for both genders with a SRR of 1.31 and a CI of 1.26-1.35 for females and a SRR of 1.29 and a CI of 1.24-1.35 for males. For the individual disease groups the differences

are similar to those observed for full disability pension, but in general the risk ratios are lower.

The prevalence of full disability pension was significantly higher in the capital region than in other regions in 1996 for males ( $p < 0.0001$ ) and females ( $p = 0.0095$ ). In 2003, however, full disability pension was less prevalent for females living in the capital region than in other regions ( $p < 0.0001$ ), but for males the prevalence was similar in the capital region as elsewhere ( $p = 0.07$ ).

## DISCUSSION

The results of this study show that there has been a significant increase in the prevalence of disability pension in Iceland between December 1996 and December 2003. A previous study shows that over the 20 year period from December 1976 to December 1996 there was actually a slight decrease in the prevalence of disability pension<sup>7,8</sup>.

Since September 1999 the British functional capacity evaluation the "All work test" has been used to evaluate the disability grade of those claiming disability pension in Iceland. In a study carried out shortly after the "All Work Test" had been introduced it was found that the number of new cases of full disability pension had increased among females<sup>5</sup>.

The "All Work Test" emphasizes strict medical criteria and abolishes the social

and financial criteria for the assessment of disability grade that were used prior to the change to the "All work test".

With the introduction of the new method some increase was expected in the number of those receiving full disability pension (mainly people with serious health impairment excluded from disability pension on basis of their income by the old evaluation method). However, the increase that has occurred is more marked than was anticipated. This can probably in part be attributed to a difference in the application of the method in Iceland as compared to Great Britain. In Great Britain a considerably greater proportion of claimants of disability pension has been summoned for an interview and a clinical examination by a physician working for the social insurance office than has been the case in Iceland, making the process more objective there than in Iceland. From 2003 an increasing emphasis has been put on summoning the majority of the claimants to see a physician working for the SSSI.

The question now arises whether the present finding of increased prevalence of disability pension from 1996 to 2003 is caused by this new evaluation method or can be attributed to other causes, especially recent changes in the socio-economic climate in Iceland.

Over the last few years there have been marked changes in the Icelandic economy characterized by increased



competition and mergers and reorganization of companies. This has put an increased pressure on the labour force, with rising demands for efficacy and increased unemployment. Under these circumstances it is to be expected that those who have a reduced capacity to work due to diseases or handicap are more likely to leave the labour market than others and then claim disability pension<sup>3, 4, 13, 14</sup>. In addition, long-standing unemployment can lead to health deterioration, especially anxiety and depression<sup>14-16</sup>. The unemployment rate in Iceland has been considerably higher the last decade than it had been the four decades before<sup>10, 17</sup>. It is likely that unemployment strikes rural areas harder than urban areas as those with reduced capacity for work have fewer opportunities for employment in the rural regions. This would explain the finding of a marked increase in disability pension prevalence in rural areas compared with the capital region in 2003. A recent survey on the social circumstances of new recipients of disability pension in Iceland showed that almost half of them had previously been unemployed<sup>18</sup>. All this suggests strongly that external economic forces are more to blame for the recent increase in the prevalence of disability pension in Iceland than internal changes brought on by the "All Work Test".

## REFERENCES

1. The National Social Security Act of Iceland (No. 117/1993).
2. Act 62/1999 amending Act 117/1993.
3. Thorlacius S, Stefansson S, Olafsson S. Prevalence of disability in Iceland 2001 and comparison with other Nordic countries. *Disability Medicine* 2003; 3: 36-40.
4. Thorlacius S, Stefansson S, Olafsson S. Umfang og einkenni ororku a Islandi arid 1996 [Disability in Iceland 1996: size and characteristics]. *Laeknabladid* [the Icelandic Medical Journal] 1998; 84: 629-35.
5. Thorlacius S, Stefansson S, Johannsson H. Incidence of disability pension in Iceland before and after introduction of the British functional capacity evaluation "All work test". *Disability Medicine* 2003; 3: 5-8.
6. Stadtolur almannatrygginga [Social Insurance Statistics] 2002: 47-48. Tryggingastofnun ríkisins [State Social Security Institute of Iceland], 2003.
7. Thorlacius S, Stefansson S, Olafsson S, Rafnsson V. Breytingar a algengi ororku a Islandi 1976-1996 [Changes in the prevalence of disability pension in Iceland 1976-1996]. *Laeknabladid* 2001; 87: 205-209.
8. Thorlacius S, Stefansson SB, Olafsson S, Rafnsson V. Changes in the prevalence of disability pension in Iceland 1976-1996. *Scandinavian Journal of Public Health* 2002; 30: 244-248.
9. International Statistical Classification of Diseases and Related Health Problems. Tenth revision. World Health Organization, Geneva, 1994.
10. Homepage of Statistics Iceland: <http://www.hagstofa.is>.
11. Bland M. An Introduction to Medical Statistics. Oxford University Press, 1995.
12. Anders Ahlbom. Biostatistik för epidemiologer. Lund: Studentlitteratur, 1990.
13. Stefan Olafsson. *Islenska lei\_in*. *Almannatryggingar og velferd i fjoltjodlegum samanburdi* [The Icelandic way. Social security and welfare in an international comparison]. Reykjavik: Tryggingastofnun ríkisins - Haskolautgafan [State Social Security Institute - University press], 1999.
14. Selander J, Marnetoft SU, Ekholm J, Bergroth A. Unemployment among the long-term sick. *Eur J Phys Med Rehabil* 1996; 6: 150-153.
15. Jonsdóttir GA, Olafsson S. *Atvinnulausir a Islandi 1993* [Unemployment in Iceland 1993]. Felagsvisindastofnun Haskola Islands [Institute of Social Sciences, University of Iceland], 1993.
16. Marnetoft SU, Selander J, Bergroth A, Ekholm J. Unemployed long-term sicklisted people in rural Jämtland compared with circumstances in the city of Stockholm, Sweden. *Work* 1998; 10: 3-8.
17. Hagskinna. *Sogulegar hagtölur um Island* [Icelandic Historical Statistics]. Hagstofa Islands [Statistics Iceland], 1997.
18. Thorlacius S, Stefansson SB, Jonsson FH, Olafsson S. Social circumstances of recipients of disability pension in Iceland. *Disability Medicine* 2002; 2: 141-146.

The American Board of Independent Medical Examiners (ABIME) has a list rental service.

To place an order, call 800-234-3490, e-mail: [info@abime.org](mailto:info@abime.org) or fax to 847-277-7912.

ABIME is highly confident that we will expedite list orders to effectively meet your needs.

Thank you for your patronage. If you have any questions or concerns, please do not hesitate to contact the ABIME office.

Item	One-Time Use	Unlimited Annual Use
ABIME Physician List Rental	\$450 Flat	\$2,995 Flat
Phone Number Select	\$135 Flat	\$1,000 Flat
Fax Number Select	\$180/M	\$1,200/M
Email Broadcast Service	\$200 Flat	\$450 Flat
IME Schedulers	\$200 Flat	\$450 Flat



# Impairment and Disability Evaluation- Neurologist Perspective

Steven Mandel, M.D.  
Heidi Mandel, M.S., D.S.W.  
William O'Flanagan, Ph.D.

The role of the disability-evaluating physicians who conduct independent medical examinations is to objectively determine and describe the impairments and disability of individual examinees. These evaluations are grounded in medical and legal definitions and scales as they relate to various disability compensation systems. We are expected to have expertise in writing reports, be cognizant of litigation and insurance issues and job function in the background. The credibility of an independent medical examiner is frequently brought in to question as we have no doctor/patient relationship and are more frequently hired by insurance companies as opposed to those representing the patient or the patient themselves.

In this new millennium should we continue to be content to serve as examiners with medical degrees who determine eligibility for entitlements and document the losses related to physical, intellectual and emotional impairments? Or, as we believe, should we aspire to a more humanistic and empowering vision and focus on broader and more positive outcomes for our clients, who in other contexts could very well be our neighbors and

members of our community. Whether we evaluate an individual with cerebral palsy, an adult with multiple sclerosis, a spinal cord injury patient who is paraplegic, or an individual with mild cognitive impairments, as we define their disease, determine prognosis and predict outcome, we should then set the framework for those individuals to lead more productive lives rather than emphasizing their losses.

For role models for this new vision of ourselves, we need look no farther than Oliver Sacks, the noted neurologist, who wrote *The Anthropologist From Mars*. In this inspiring book, he describes people who do not let their limitations, such as blindness and brain damage, frame and dictate their future. Instead, they engage in the process of redefining their goals to achieve greater self-worth and productivity. Dr. Sacks is a physician who can appreciate the heroism of his patients. And we must also note the remarkable contributions and creativity of Stephen Hawking who is a role model for perseverance as well as scientific genius. One other accomplished professional comes to mind, Temple Grandin, who has dedicated her life mission not only to

her science, but to raising awareness of autism in the lay and professional community.

Many questions remain to be answered. In the recent movie, "I Am Sam", can an individual who is mentally challenged care for a child? How can deaf parents communicate to their normal hearing child? Should people with schizophrenia be precluded from performing various occupations? Should we discriminate or accommodate those with AIDS, Lyme disease, cancer, and psoriasis that have gone beyond the stage where we perceive physical impairments of lesser citizens and Americans?

We, as disability evaluating physicians must accept the responsibility to join with educators and other professionals to help empower our clients and students, both children and adults, with physical, cognitive and emotional challenges to develop their self-esteem, self-determination and gain independence in housing, employment and social relationships. Our evaluations are powerful tools. They can focus attention on etiology, limitations and loss, or they can be used as a framework to advance the assets, motivations and ambitions for living productive lives.



Many individuals have demonstrated that despite Physical challenges they lead productive lives. The courageous and generous response many of the graduating special education students had to the September 11 tragedies is well known. They led a four figure fund-raising effort for 9/11 victims and survivors, volunteered in a variety of venues to improve their communities and worked hard at developing the skills and abilities to be optimally independent, contributing citizens.

Our new perspective is the message we take from the events of September 11, 2001. Just as our country gradually went from shock and despair to hope and determination, so too can we help set the course for those who we evaluate. If the message is that everyday people can rise to heroism, would we choose to limit that to non-disabled people? At The Pathway School a culture of community service thrives. But the students are the volunteers and community servants, not the recipients. They share their strengths and gifts in line with Colin Powell's call to service

rather than focus on the challenges their special education school aspires to help them overcome. Out of the darkness has emerged a new vision. As professionals who are proud to be disability evaluating physicians and educators, we can appreciate our clients and students as the heroes and role models they in fact are. Despite their losses, they can meet and overcome many challenges in their lives, help and inspire others along the way and live and work as productive and successful citizens in our great country.

## Gerger-Moretti Sten-Tel

DIGITAL DICTATION, TRANSCRIPTION AND DOCUMENT CONTROL SERVICES

- ❑ Custom Reports
- ❑ Network & Legacy Integration
- ❑ 128 Bit Encryption
- ❑ Electronic Signature
- ❑ HL7, XML, ADT & EDI
- ❑ Online Voice & Text Storage
- ❑ Document Management Systems



- ❑ HIPAA Compliant
- ❑ 24 X 7 System Monitoring
- ❑ Professional
- ❑ 24 Hour TAT
- ❑ Volume Pricing
- ❑ 65 Character Lines
- ❑ Scalable Design
- ❑ Industry Partners

471 W. South Street Suite 41 B  
Kalamazoo, MI 49007  
**Phone: 269-343-0118**  
**Toll Free: 800-536-0804**

*"your link to a  
digitally mastered world"*

[www.gerger-moretti.com](http://www.gerger-moretti.com)

For Personal Assistance  
Please Contact:  
**Jon Moretti at 269-998-1939** or  
**Pat Moretti at 269-217-9225**



# Book Review

## ERGONOMICS AND THE MANAGEMENT OF MUSCULOSKELTAL DISORDERS

by Martha J. Sanders

Published by Butterworth Heinemann, 2<sup>nd</sup> Edition, 2004

Reviewed by Parasad Rao Mukkamala MD, CIME

The ergonomics and the management of musculoskeletal disorders in the work-place has become quite important topic as the cost of work related injury claims has escalated in the recent years. The importance of understanding the ergonomics in the work place becomes even more important as the claims of work related cumulative trauma disorders have reached epidemic proportions. This affects the economic viability of the industry, the society at large and eventually the country itself unless it is controlled.

It is extremely important to identify the risk factors, try to minimize the risk factors to reduce the incidence of musculoskeletal disorders. Furthermore, once a musculoskeletal disorder develops, the injured worker should be treated adequately to prevent unnecessary suffering and to eliminate needless disability. Therefore, proper understanding of the ergonomics in the work place and its role in the musculoskeletal disorders will help the industry as well as the worker and eventually it will benefit the society itself.

The book Ergonomics and the management of Musculoskeletal disorders addresses the issues in a well organized six sections spread over twenty-four chapters.

The first part deals with "Symptoms Involved in Musculoskeletal Disorders Management: Worker, Medical and Regulatory Perspectives." In this section, the author deals with an overview of the problem that physician commonly face with management of musculoskeletal disorders.

In the first chapter, the scope of the problem is laid out. The author also presents a worldwide prospective on the topic.

In the second chapter, the individual worker perspective is dealt with. All the health care providers that are involved

with management of musculoskeletal disorders, particularly the work related musculoskeletal disorders would benefit from the information regarding paying attention to the psychosocial aspects that are involved to optimally manage the work related injury.

In the third chapter, the terminology, the pathogenesis and common characteristics of the musculoskeletal disorders has been addressed. Good case examples are also given.

Chapter 4 deals with the regulatory perspective. In this chapter the role of OSHA and the Workers' Compensation systems as well as the part played by the unions has been dealt with. The role of National Institute of Occupational Safety and Health (NIOSH) has also been well described.

The part two deals with the conditions related to musculoskeletal disorders "Diagnosis and Intervention".

The fifth chapter deals with the pathomechanics of musculoskeletal disorders. Chapter 6 deals with treatment of musculoskeletal disorders and related conditions. Chapter 7 deals with joint and arthritis in the spectrum of work place musculoskeletal disorders.

The part three deals with ergonomic risk factors related to musculoskeletal disorders in business and industry.

Chapter 8 is an exhaustive review of the expanded definition of ergonomics. Chapter 9 deals with the physiological risk factors. In this chapter, the author describes the stages of the musculoskeletal disorders as they relate to physiological risk factors. The author divides the pathomechanics into eight stages starting with hyperresponsivity progressing finally to adaptive failure. There is

excellent description of each stage, how the case progresses and then there is a good case example.

Chapter 10 deals with biomechanical risk factors. In this chapter, the importance of the posture, the repetition of force and repetition of the activity and their role in the development of musculoskeletal disorders is described.

Chapter 11 deals with job design. Here the anthropometrics of the worker and then fitting the work place or work station to the individual worker is dealt with. The various tools and how they can be modified to prevent the development of musculoskeletal disorders also have been adequately explained. Chapter 12 deals with psychosocial factors.

Next part four deals with developing and implementing worksite programs.

In Chapter 13, the job analysis and worksite assessment has been well described. Chapter 14 deals with reducing injuries, claims and costs. Practical strategies designed to minimize or eliminate pre-disposing factors that can cause or aggravate work related musculoskeletal disorders is described. Chapter 15 deals with employment examinations.

Chapter 16 deals with implementing effective injury prevention process. In that chapter, the importance of having adequate input from the worker and effective communication between the management and the worker is stressed. Chapter 17 deals with outcome assessment of prevention programs.

Next, part five deals with managing musculoskeletal disorders in home and leisure environments.

Chapter 18 deals with ergonomics in the home. Chapter 19 deals with ergonomics



in child care. Chapter 20 deals with ergonomics with leisure activities. Finally, part six presents specific programs for high risk populations. Chapter 21 deals with the older worker.

Chapter 22 deals with preventing work related musculoskeletal disorders in dental hygienists. Chapter 23 deals with managing musculoskeletal disorders in performing artists. The last chapter,

Chapter 24 deals with addressing musculoskeletal disorders at computer work stations.

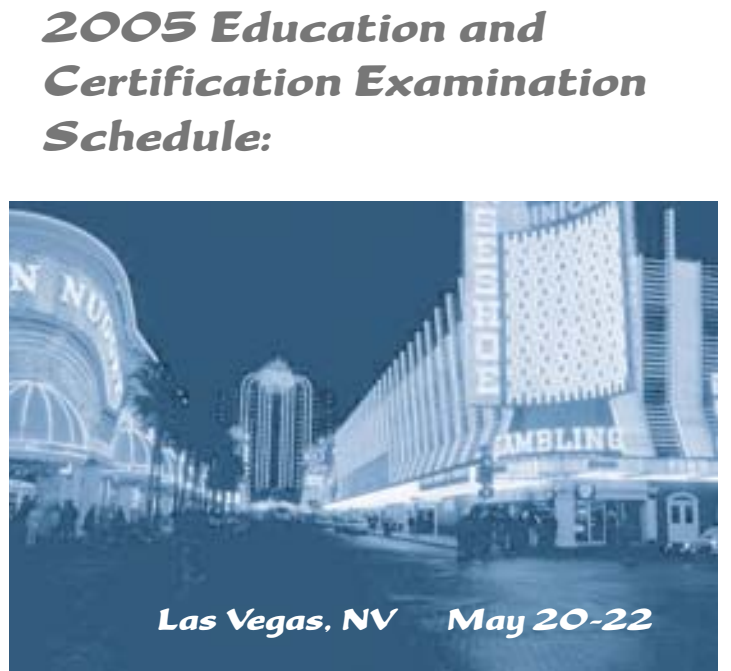
In this reviewer's opinion this book is very useful addition in the field of ergonomics. The material presented is well organized. The authors present the subject in a very cogent and understandable manner. Reference has been

given to web sites for organizations such as OSHA and NIOSH.

This book will be useful for primary care physicians occupational physician, Independent medical examiners dealing with musculoskeletal disorders particularly the orthopedic surgeons, physical medicine and rehabilitation specialists. I would highly recommend the book as it will be a useful source of information.



**Orlando, FL January 28-31**



**Las Vegas, NV May 20-22**



**Chicago, IL October 21-24**



**Alexandria, VA  
August 12-14**

**Tentative dates/locations  
at press time,  
check our website  
[www.abime.org](http://www.abime.org)  
for updates**



# A Distinction *that Sets You Apart*

Achieve certification through the American Board of Independent Medical Examiners (ABIME) and gain recognition from disability and compensation professionals. ABIME certification offers you added advantages:

- State-of-the-art training in AMA Guides
- Increased demand for your specialized services
- International promotion of your certification status to prospective clients
- Enhanced credibility and competency as a medical examiner
- Advanced knowledge and training in impairment and disability evaluation
- Added professionalism and career advancement

*Be among the first in your area to earn this prestigious distinction. Fax us today to achieve the ABIME distinction that sets you apart.*

**Yes,** I'm interested in ABIME Certification.  
Please send an information packet right away.

Name \_\_\_\_\_

Title \_\_\_\_\_

Company/Clinic \_\_\_\_\_

Address \_\_\_\_\_

City, State, Zip \_\_\_\_\_

Telephone \_\_\_\_\_ Fax \_\_\_\_\_

E-mail \_\_\_\_\_

***For faster response, fax this form to 847-277-7912***

111 Lions Drive, Suite 217

Barrington, IL 60010-3175

Telephone: 847-277-7902 or 800-234-3490

E-mail: [info@abime.org](mailto:info@abime.org)

**Website: [www.abime.org](http://www.abime.org)**

**ABIME**  
American Board of Independent Medical Examiners