

# Clinical NEUROSCIENCE NEWS

A Publication of the Cushing Neuroscience Institute, Member of North Shore-LIJ Health System

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Dear Readers,

It is with great pleasure that I present to you the latest issue of *Clinical Neuroscience News*, with a focus on low back pain. Lower back pain is perhaps the second most common medical complaint that physicians encounter. Fortunately, the majority of cases resolve with time, pain management, physical therapy and injections. But for an important minority the disorder becomes chronic and disabling. For these patients, surgery may be the only route to sustained relief and a return to active life. While open surgery remains appropriate for certain complex conditions, we are enthusiastic about advances in minimally invasive spine surgery that permit smaller incisions and less invasive techniques and promote quicker recoveries.

Technical advances have recently made minimally invasive surgery (MIS) a viable option for spinal disorders. They include tubular access (the ability to reach the surgical field through tubular retractors), new intraoperative visualization and physiological monitoring technologies that provide the surgeon with a 3D view through every stage of the procedure and miniaturized hardware systems uniquely suited to MIS insertion and fixation. But like many other forms of surgery, these advances become meaningful only in the hands of

spine surgeons and support staff who have advanced training in this unique subspecialty and who perform MIS spine surgery with a frequency that ensures consistent success.

The Spine Center at North Shore-LIJ Health System's Cushing Neuroscience Institute offers comprehensive spine evaluations and multidisciplinary treatment plans tailored to each patient's unique needs. In this issue of *Clinical Neuroscience News*, we introduce the work of our award-winning subspecialty surgeons and support staff in providing MIS lumbar surgery for such spine disorders as herniated discs, compression fractures, spinal stenosis, spondylolisthesis and lumbar instability (fusion). For more information, or to discuss a patient referral call our hotline at (516) 562-3822 or email us at [neuro@nshs.edu](mailto:neuro@nshs.edu).

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**80**  
PERCENT

It is estimated that eight out of 10 Americans will suffer from low back pain in their lifetimes.

**67**  
PERCENT

Between 1996-1997 and 2006-2007, procedure rates for excision of intervertebral disc and spinal fusion increased 67%, for those 65 and older.

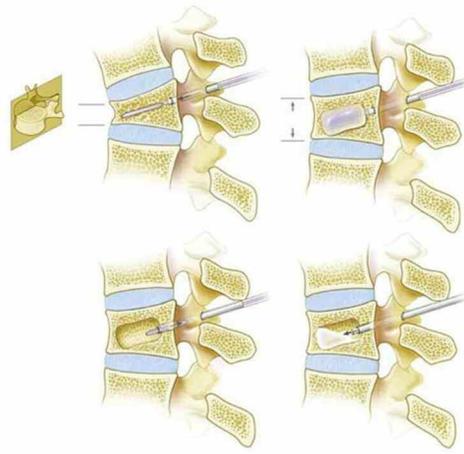
**60**  
PERCENT

Healthcare expenditures for individuals with back pain are estimated to be about 60% higher than those without.

For more content, including additional case studies and previous issues, visit [CNnewsletter.com](http://CNnewsletter.com) or scan the QR Code.



# The Vulnerable Lower Back



The lower back carries most of the torso's weight. Constantly strained by lifts and twists, the lumbar region is exceptionally vulnerable to a variety of acute and degenerative injuries. Each incident tends to be more severe and debilitating than the last, until neither simple analgesics nor steroid injections provide relief. At that point, surgical intervention is considered.

Many lower back injuries start with an acute injury, but far more cases of lower back pain are the result of cumulative damage brought on by poor posture, sedentary habits, excess body weight, osteoarthritis, sports injuries or the constant biomechanical stresses of flexing, bending, twisting and lifting.

Over time, the discs that separate and cushion the vertebral joints lose fluid and become less flexible, herniate or tear, or the foramen within the spinal canal become narrower due to osteophytes, commonly known as bone spurs. What remains are entrapped nerves and bony surfaces grinding against bony surfaces that produce excruciating pain signals, numbness, tingling and reduced mobility. These symptoms set off a vicious cycle of more physical inactivity, further loss of back muscle strength, and progressive misalignment of the vertebral column as the back adjusts to protect the weakened structure.

At the Cushing Neuroscience Institute at North Shore-LIJ, medical treatment and pain management options through drugs, epidural injections and physical therapy are exhausted before any kind of surgery is considered. Until recently, surgery involving disorders of the spinal column required major open surgery, entailing general anesthesia, deep incisions, substantial blood loss and partial immobilization of the patient during lengthy rehabilitation. While the outcomes from open surgery can be excellent; it is rarely suitable for elderly patients, and younger patients are understandably reluctant to devote the time it takes to recover from the effects of deep tissue injury that accompanies open surgery.

For these and other reasons, more patients and their referring physicians are turning to neurosurgeons and advanced medical centers that offer minimally invasive surgery (MIS) as a better alternative for most lower back pathology. The advantages of MIS are many, starting with decreased tissue trauma. Muscles can be gently separated instead of cut through to access the spine, and the one or possibly two incisions needed average one inch. Less blood loss, less pain and scarring, shorter time in the OR, fewer complications and the possibility of same-day recovery and discharge are

In a kyphoplasty, a balloon is first inserted through the needle into the fractured bone to create a cavity or space into which the biocompatible material is injected. The needle is removed and the biomaterial is allowed to harden. The small opening is covered with a bandage. This procedure can take from 1-2 hours, about a half-hour for each treated vertebra.

other persuasive considerations. Even patients in their 80s and 90s can tolerate MIS back surgery in the hands of an experienced MIS specialist.

Minimally invasive surgery is carried out by neurosurgeons with advanced subspecialty training. Our neurosurgeons are not only recognized pioneers in the development of MIS back surgery and its supportive technology, but they are consistently among some of the most active practitioners in the region.

Our MIS surgical suites are also equipped with the newest generation of technology. One of the essential new materials used in MIS surgery are osteobiologics. These include recombinant bone morphogenic protein (BMP), smaller surgical instrumentation and a remarkable selection of miniaturized stabilization hardware. Interbody spacers, made especially for MIS procedures, insert tidily between vertebrae as part of reconstruction.

We also have the newest 3D image-guided visualization systems, including intraoperative microscopes and the C-arm fluoroscope, the latter a mobile x-ray machine that provides our neurosurgeons a 360-degree view of the spine. Lastly, our MIS specialists have the newest and most sensitive devices to monitor nerve function in real time as they proceed.

Among the many advanced MIS procedures offered for lumbar surgery at the Cushing Neuroscience Institute are:

- Microdiscectomy to treat a herniated lumbar disc with radicular symptoms due to nerve compression.
- Arthrodesis or fusion for refractory pain traceable to disc degeneration, fractures, spondylolisthesis and spinal instability.
- Kyphoplasty/vertebroplasty are MIS approaches to treat and stabilize vertebral compression fractures. Primarily due to osteoporosis, VCFs occur six times more frequently in women than men. Both procedures involve injection of bone cement into the fracture to stabilize and seal the break.

# Case Study

## MIS Interbody Fusion and Bilateral Discectomy

*Peter Hollis, MD, FACS*

A 56-year-old woman was first seen in January 2011, complaining of difficulty walking due to progressive back pain, leg pain radiating down both legs and imbalance. An MRI revealed significant cervical spondylitic myelopathy and she subsequently underwent an anterior discectomy and fusion at C4-C5 and C5-C6 at North Shore-LIJ. Though the surgery was successful in relieving her cervical pain, she continued to experience intensifying lower back and leg pains, which were initially treated elsewhere with physical therapy, epidural steroids and chiropractic. Additional scans taken at North Shore-LIJ showed L4-L5 spondylolisthesis and stenosis and after discussing her options, we determined that an L4-L5 posterior interbody fusion and reduction of her spondylolisthesis via MIS would give the greatest relief.

Placed under general anesthesia, wired with neuromonitoring equipment, and under C-arm 3-D image guidance, the patient received two 1.5-inch incisions on either side of the spinal midline over the L4-L5 complexes. Following removal of a small portion of both sides of the lamina (laminotomy) and partial decompression of the corresponding nerve root (facetectomy), we prepared the disc space for insertion of an interbody prosthesis filled with a mixture of BMP and autologous bone material.

Once the prosthesis was well seated and the collapsed interior space distracted, we performed a bilateral discectomy. The space was expanded using the screw extenders of the PEEK interbody fusion system until neuromonitoring signals indicated that nerve compression was resolved. The surgical area was given a final irrigation, surgical tools removed and the anatomical layers of soft tissue closed.

Within six weeks, the patient reported that her claudication symptoms were gone, that her wounds had healed without incident, that her rehabilitation exercises were restoring muscle tone and that she was looking forward to returning to work shortly.



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## Inflammatory Mechanisms in Cartilage Degeneration

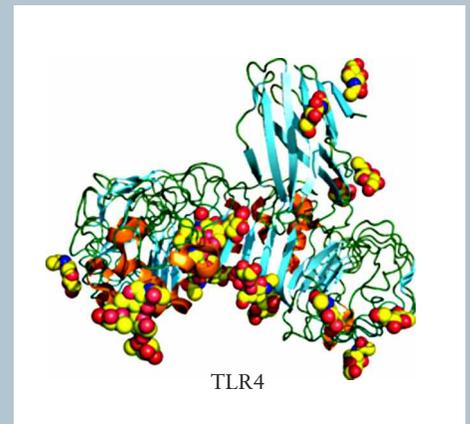
A major source of lower back pain is degeneration of cartilage within the intervertebral discs (IVDs) of the spine. While years of wear and tear, acute injuries and aging are variously cited as the triggers of degeneration and attendant pain, it has also been posited that inflammatory mechanisms may play a destructive role, independent of injury.

To test this hypothesis, neurosurgeon Mitch Levine, MD and investigator Nadeen Chahine, PhD, at The Feinstein Institute for Medical Research Biomechanics and Bioengineering Lab, set out to track the expression and responses of the Toll-Like Receptor TLR4. Though previously implicated in the disease mechanisms of cartilaginous breakdown, no detailed study had ever tested the premise in the context of IVD degeneration.

Classed as a “pattern recognition receptor,” TLR4 is a protein associated with the innate immune system, providing host defense against microbial infections. Further, TLR4 is activated by stimulation with the TLR4 ligand lipopolysaccharide, resulting in upregulation of proinflammatory cytokines; it also downregulates the synthesis of extracellular matrix which slows tissue repair.

Dr. Chahine’s study, which involved stimulating IVD cells by injecting the TLR4 ligand (LPS) in the intervertebral discs of animal subjects and measuring inflammatory cytokine levels, showed moderate degenerative changes. Drs. Levine and Chahine conclude that this study provides the first solid evidence that inflammation can exert a direct role in cartilage degeneration of the IVD.

The next step, Dr. Chahine reports, will be to examine human responses to TLR4 activation and inflammation. They plan to enroll 100 patient volunteers undergoing spinal surgery, using damaged tissue removed during their procedures for laboratory investigation. The New York State Department of Health is providing a grant to bring on board a research fellow for one year to further their work.





North Shore University Hospital ranked  
among the nation's Top 50 for Neurology and  
Neurosurgery in *U.S. News & World Report*  
Best Hospitals 2012-2013 ranking.

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