Minimally Invasive Surgery

and the Alleviation of Back Pain

In 2004, the office of the U.S. Surgeon General issued its first-ever report on the nation's bone health. It warned that by 2020, one in two Americans over the age of 60 would be at risk for fractures—primarily in the wrist, hip and spine—from osteoporosis or low bone mass.

While statistics about the future are alarming, even today back pain is second only to colds and upper respiratory infections as the main reason people visit a physician. And as the country's population ages, conventional surgical techniques for the treatment of chronic back pain are receiving scrutiny. Advanced technologies are facilitating new surgical methods, and more patients are now able to find relief from what had been thought to be untreatable medical problems.

Our doctors are embracing these emerging technologies and utilizing them in new and dramatic ways. When neurosurgeons and nurses speak passionately of new high-tech procedures and the stunning results they see in their patients, their enthusiasm warrants a closer look.

Here are two examples of how neurosurgeons are revolutionizing spinal surgery with minimally invasive techniques.

Balloon Kyphoplasty

Often, what people think of as everyday back pain and stooped posture that is said to be "just a normal part of aging," could actually be a compression fracture in a vertebra. This pain is now only a memory for patients who have experienced balloon kyphoplasty.

Osteoporosis, a condition in which bones become weak or brittle, and certain types of cancer can cause vertebrae to fracture and collapse. Traditional treatments for fractured vertebrae include bed rest, pain medication and back braces. While these treatments temporarily relieve some of the pain, they do not address the underlying cause of the discomfort and frequently reduce a person's ability to participate in daily activities.

Balloon kyphoplasty, in contrast, is a minimally invasive treatment that requires only two needle size incisions. The procedure usually takes less than an hour for each fractured vertebra, and most of that time is devoted to the precise positioning of equipment. Neurosurgeon James A. Killeffer, M.D., demonstrated how two X-ray cameras—a very specialized "C-Arm"—are positioned around the patient to generate 3-dimensional images on a computer to help guide precise placement of tools during the procedure.

These small incisions are made on the patient's back and needles are inserted into the site of the fracture. An orthopedic balloon is then inserted through a needle and guided into the fractured or collapsed vertebra. "When the balloon is inflated," Killeffer says, "it gently pushes the collapsed vertebra to the correct position. As the balloon is deflated and removed, the cavity in the vertebra is filled with surgical bone cement helping prevent further collapse."

According to Killeffer, most patients experience a significant reduction in back pain immediately. Because they are able to return to their normal activities, their quality of life can improve dramatically. Former back pain sufferers now can enjoy walking, shopping, working and simply enjoying life without pain thanks to balloon kyphoplasty and surgeons like Killeffer.

Dr. James Killeffer, Neurosurgeon

Balloon Kyphoplasty

Fractured Vertebra
Spinal fracture, also known as vertebral compression fracture (VCF)

IBT Insert
Through 2 small incisions, the doctor creates narrow pathways into the fractured bone and inserts 2 KyphX® balloons

IBT Inflated
The balloons are inflated to raise the collapsed vertebra, then deflated and removed, leaving a cavity in the bone

Filling the Cavity
The cavity is filled with a bone cement to support the surrounding bone and prevent further collapse

Internal Cast
The cement forms an internal cast that holds the vertebra in place

Images courtesy of Kyphon

Spinal Fusion

Back and leg pain can be linked to many different causes, including herniated discs, spinal stenosis and spondylolisthesis (instability or abnormal motion between two or more adjacent vertebrae). Spinal fusion surgery can stabilize such conditions and eliminate the patient's pain.

Traditional "open" spinal surgery for spinal fusion requires the surgeon to make a 4- to 6-inch incision over the area of instability, directly exposing the spinal vertebrae by stripping the overlying muscles away from the spine. The fusion is performed by removing bone grafts from the patient's hip (through a separate incision) and layering the graft over the unstable vertebrae. Screws are placed in the affected vertebrae and connected with rods to provide immediate stabilization of the unstable vertebrae. The bone grafts eventually fuse the two vertebrae together to provide permanent stabilization. Although this surgery proves successful in achieving stability, there can be significant blood loss and pain.

Dr. William S. Reid, Jr., Neurosurgeon

Due to recent technical advancements, UT Medical Center neurosurgeons, such as Dr. William S. Reid, Jr., are able to perform a spinal fusion through small, 1/2- to 1-inch incisions, greatly reducing surgical trauma to the back muscles and reducing blood loss. Dramatic progress in this technique has resulted in improved fusion rates, shorter hospital stays, and a more active and rapid recovery as compared to the "traditional way."

One of the most significant technical advances in this arena is frameless stereotactic imaging. Also known as surgical navigation, this technique combines the use of 3-D X-ray images and a computerized guidance system. The 3-D images are created with a specialized fluoroscope that performs a CT scan in the operating room. This fluoroscope is especially unique and is only available in Knoxville at UT Medical Center. Using the 3-D images and the image guidance system, the surgeon can precisely place bone screws through very small incisions.

"The high-resolution video monitor vividly displays the surgical site as we manipulate the precision instruments through an incision that is less than an inch long," Dr. Reid says. "During the procedure, images from repeated X-rays and CT scans help to continuously monitor the surgical site."

Another technical advance used with the image guidance system is the Sextant System, which places stabilizing rods through the tops of the bone screws to lock the screws together. This can also be performed through a 1/2-inch incision, minimizing surgical trauma.

Technical and scientific advances in radiology, computerized surgical navigation and surgical instrumentation are now making it possible for patients to undergo complex spinal surgery with less pain and a shorter recovery—great news for those hoping to find relief from pain.

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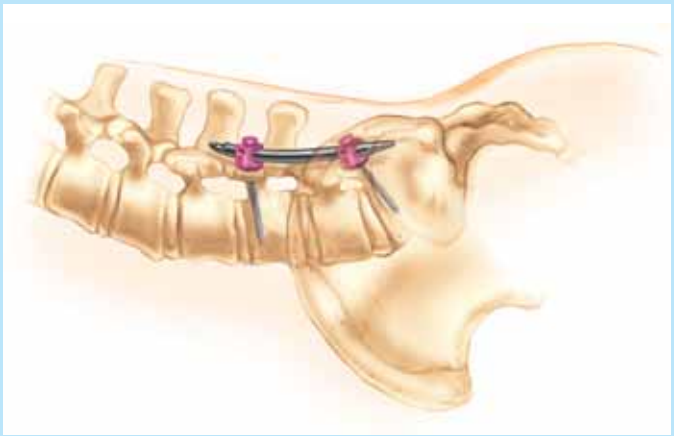
Minimally Invasive Spinal Fusion

Percutaneous placement of pedicle screws and connecting rod



Final placement of screws and rod using minimally invasive technique

Images courtesy of Medtronic, Inc.