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Orthopedics This Week

The Endoscopic Band of Brothers

By Robin R. Young

For 20 years, this particular band of brothers has worked its way through a variety of endoscopic tools and strategies to treat spine disease. Some of these treatments soared and crashed in popularity (e.g., chymopapain), others (like the Yeung Endoscopic Spine System) have a growing band of adherents. But every year, this small group assembles to compare studies, talk about the their latest cases, and, as happened a couple weeks ago in Albi, France, trot patients up to give testimony. It was almost like being in church.

Albi Cathedral / Source: Wikimedia Commons and ByacC

Since the late 1980s, these have been spine surgery's outsiders. Can they ever become the mainstream? Or, perhaps more importantly, should they? Sometimes an industry needs the outliers to continue to push whatever envelope catches their fancy. By definition, they will never be in the mainstream. But they will gather information, develop approaches, and learn lessons that can eventually help every spine surgeon one way or another.

Minimally invasive surgery (MIS) in the spine has a strong past and, if Kyphon, NuVasive, Zimmer, and Medtronic are right, an even brighter future. Kyphon, in fact, defines itself as a "global leader in restoring spinal function through minimally invasive therapies" and only offers products that address spine surgery through a keyhole. Today, Kyphon is one of the most expensive medical technology companies in the world.

NuVasive, a company whose market value is fully 8x its annual sales, pioneered a concept called minimally disruptive surgery and developed an entire product line and concept around a different and less invasive approach.

Typical spinal implant manufacturers focus primarily on discrete things—screws, plates, nuts, and bolts. Kyphon and NuVasive, while they certainly sell implants and instruments, start with the procedure, establish a base of surgeons who use and are successful with the procedure, then use instrumentation to drive surgeon adoption.

It was, therefore, surprising and instructive that none of the major spine companies was at the International Intradiscal Therapy Society (IITS) meeting. If anyone wanted ideas about leading-edge MIS and endoscopic procedures and techniques, that was the place to be.

This year's meeting was held in a modest, cavern-like steel-sided building on the outskirts of Albi, France. Albi is a small medieval town approximately an hour's drive from Toulouse which itself is an hour's flight from Paris which is an overnight flight from anywhere on America's East Coast. You really have to want to get here.

Eight hundred years ago, Albi was caught up in the brutal repression of the Cathars by the Pope and the French king. The Cathars challenged church orthodoxy and were crushed because of it. Today, Albi's charm belies its nonconformist past.

Perhaps channeling this past, IITS' leadership chose this remote town to host its meeting. A number of interesting topics were discussed including:

- Plasma disc decompression
- Percutaneous radio frequency for disc nucleoplasty
- Full endoscopic lumbar disc herniation surgery
- Full endoscopic treatment of spinal stenosis
- Medical oxygen-ozone therapy for radicular disc pain

After sitting through several of the presentations and talking to IITS' leadership, here are our hand-picked papers to share with you:

Restoring the Kinematics of Spine Motion With a New Nuclear Replacement Device: A Comparative Study Using a Kangaroo Spine Model

Ashish D. Diwan, S. Sabet, Ronald Ho, and Jonathan Choi from The Orthopaedic Research Institute, St George Hospital Campus, The University of New South Wales

Can researchers find a way to restore the kinematic motion (a way to describe the motion of objects and to see how their positions change over time) of a diseased spine? Given the complexity of the spine, this study using an elastomeric nucleus implant and a kangaroo spine model was interesting. The authors asked the question: Do kinematic variables differ when treating a motion segment with; 1) a nucleotomy or 2) a nucleotomy followed by implantation of an elastomeric artificial nucleus (in this study, the Columna disc device)?

The authors operated on 10 kangaroo spine lumbar motion segments (L3–L4 and L5–L6) and removed all musculature, ligamentous tissue, and posterior elements. The spines were then separated into two equal groups. Each group was first tested in an intact state (pretreatment). Then each underwent either a nucleotomy alone or a nucleotomy with implantation of the Columna conformable elastomeric nucleus replacement device. Finally, following their respective procedures, each spine was retested.

The testing was lateral bending and flexion-extension on a custom-built jig. The kinematic data that Dr. Diwan collected included neutral zone, range of motion, and hysteresis.

The results of the testing showed that, compared with the range of motion of the control group, the implant group had 24% better flexion and extension. The neutral zone in the nucleotomy plus implant group increased by 124%. compared with pretreatment. In lateral bending, the range of motion of the nucleotomy plus implant group increased by 35%. The neutral zone in the nucleotomy plus implant group increased by 69.8% compared with pretreatment.

The authors concluded that there is an increase in motion segment laxity after nucleotomy during sagittal and coronal movements of flexion-extension and lateral bending, which is reversed with implantation of the nuclear replacement device. Bottom line, for kangaroo spine segments, the Columna disc device can restore the biomechanical changes in a denucleated spine motion segment

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Using Autologous Chondrocytes to Repair the Spine Disc

Filippo Pineto and D. Lucantoni from the Department of Neurosurgery, Civic Hospital of Teramo

Assuming, as a starting point, that disc degeneration begins in the nucleus pulposus, the authors tackled the question of whether transplanted disc cells could stop or reverse degenerative disc disease. Intervertebral discs have limited intrinsic capacity for repair, so most customary treatments for disc degeneration are, essentially, pain management strategies which, whether it is years of pain relieving drugs or surgery, are expensive and do not succeed for a fair percentage of patients.

Harvesting and then re-implanting disc cells has shown promise in other preclinical and clinical studies. However, the authors note, it will no doubt improve transplant success if the practitioner first restores the physiological status of the affected disc—specifically, to take steps to

ensure that nutrition in the avascular disc space (which depends on osmotic diffusion of water and nutrients through direct channels in the annulus and end plate) is restored.

The authors found that lowering intradiscal pressure greatly facilitated this process and permitted disc metabolism. By distracting the disc, practitioners have a chance to restore physiological internal pressure and nutrition which, in turn, should have positive effects on the course of disc degeneration. So, the goal of this study was to test the effects of a combined approach using both mechanical devices and intradiscal therapy.

The authors transplanted autologous disc cells into two patients (males 21 and 33 years of age, respectively). The patients had previously undergone open microdiscectomy for disc prolapse, both at the L5–S1 level. During surgery (in May 2005) the samples of the excised nucleus fragments were expanded in tissue culture by Verigen A/S, Kastrup, Denmark. Four months later, 0.5 ml of suspension containing 13–15 million living disc cells were injected in the disc nucleus.

The second phase of treatment entailed a course of 20 daily sessions of disc decompression therapy on the SpineMED® Table (CERT Health Sciences LLC, Baltimore, Md), and a second injection of cells was administered one year later.

The authors report that neither patient had an adverse reaction, and both are presently symptom free. MRI images show an increased signal intensity of the nucleus, associated with substantial matrix enhancement in both cases. The MRI images of the older patient showed a Modic change that could be retained as a regression from a preexisting Modic 2 to Modic 1, compatible with an improvement of biomechanical properties of the disc.

The authors' conclusions are that autologous disc chondrocyte transplants, when combined with external disc decompression therapy, offer promising results and were, in these two cases, safe and effective. More work to do, for sure.

Using Just One Implant (Expandable B-Twin) When Two Are Recommended

Rudolf Morgenstern from Centro Médico Teknon, Barcelona, Spain
In cases of spondylolisthesis, when the disc collapse is superior to 20%, a common surgical solution is to implant two intersomatic implants in order to restore disc height and to block intersomatic movement. What if, the author asks, a single implant is placed into the existing space in those cases of spondylolisthesis in the transforaminal approach or the unilateral sciatica due to unilateral foraminal stenosis?

Certainly, one point to consider is that a single-piece implant can be less disruptive to the patient. So, the author presented a comparison of two approaches—10 cases of the standard double implant and 16 cases of a single implant.

The author tested each patient postoperatively using the Oswestry Disability Index and Visual Analog scores and found that there was no difference between the groups of patients with one or two inserted implants.

The author posits that the reason a single implant had an outcome equivalent to that of a double implant is that the center of gravity (vertical force) is located at the anterior third of the disc, while the highest part of the trapezoidal implant is on the anterior third and passes through this center of gravity, due to the foraminal angle of the endoscopic approach.

If two implants are used, then the posterior parallel implant approach somehow does not allow a single implant disposition, because it generates a moment of force that will compress the opposite disc side. Going into the patient using the transforaminal endoscopical approach allows the surgeon to implant a single device with an approach angle that creates a zero moment of force. This is an easier technique for the surgeon and avoids the space problems of the double implant technique.

(It also represents less aggression than the open surgical technique with parallel disposition of the implants).

Interesting. ♦

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