

# **Classification Of Annular Tears: A Critical Prospective Study In The Surgical Treatment Of The Various Types Of Tears**

**Anthony T. Yeung, M.D.**

## **Patho-Physiology Of Low Back Pain**

The patho-anatomy and physiology of chronic back pain is thought to be due to a combination of complex conditions that result in pain from chemical as well as mechanical factors arising from the disc and annulus.

The disc is an innervated structure that is capable of pain generation from the end plate, outer one third of the annulus, and the posterior longitudinal ligament. The posterior longitudinal ligament and annulus contain unmyelinated pain nociceptors that transmit and relay afferent pain signals through the dorsal root ganglion.

Substance P is released by the degenerating disc through annular tears that can cause chemical irritation of myelinated spinal nerves, resulting in sciatica and with back pain. These annular tears allow the ingrowth of granulation tissue and small unmyelinated nerve fibers into the nucleus, theoretically differentiating the painful degenerative disc from an asymptomatic degenerative disc. However, the pain pattern, when not in a dermatomal pattern, is poorly understood, and patients with discogenic pain are frequently frustrated by their physician's focus on functional causes when their sciatica is not correlated with known dermatomal patterns.

## **Background Studies**

Pioneering work on sheep and post mortem studies on human lumbar discs by Osti and Fraser suggest that peripheral annular lesions have a role in disc degeneration and in the pathogenesis of discogenic pain. Although we now have extensive evidence of the biology of disc degeneration, very little is known about how that degenerative condition causes chronic pain in some people but not others.

Adams classified five levels of disc degeneration by its configuration on discography. From our knowledge of annular innervation, the type IV and V configurations are therefore expected to create pain due to its involvement of the outer annulus. Annular tears are currently classified by its extent and configuration. The Dallas classification grades the extent of radial tears by the degree of extension to the outer annulus. Grade III and IV tears, reaching the inner and outer annular fibers, are therefore anticipated to be painful. Annular tears are further classified by its location and configuration by Osti and Fraser as peripheral, circumferential and radiating.

Until recently no treatment modalities directly addressed annular tears, but an analysis of 80 of my patients undergoing laser aided endoscopic disc excision revealed some promising data on the ability of laser to relieve chronic back pain.

These 80 patients were independently analyzed by Farouq Al-Hamdani, MD and Alexander Hadjipavlou, MD. Al-Hamdani was able to document good back pain relief for over 2 1/2 years in patients undergoing laser assisted endoscopic disc excision. As a result, we determined and considered the thermal effects of laser as beneficial for the relief of back pain. Unfortunately, in other published papers on the treatment of contained disc herniations, the target was the intervertebral disc rather than the annulus, and the authors of many of the papers attributed the

pain relief to decrease in intradiscal pressure by small changes in intradiscal volume.

### **Current Studies**

Since November 1991, over 500 patients have undergone spinal endoscopy and selective endoscopic disc excision (using the Yeung Endoscopic Spine System) for discogenic pain from disc herniations, central disc protrusions, annular tears, and internal disc disruption. These patients were prospectively studied, correlating pain provocation with visualized abnormalities of the annulus. The majority of these patients had disc herniations disrupting the outer one third of the annulus. Annular defects were identified endoscopically and thermal energy was visualized to produce contraction of the annular fibers. Disc herniations were extracted, but the resultant annular defect was also treated by thermal modulation of the annulus. Overall results were recorded using modified MacNab criteria. The treatment protocol included an intraoperative discogram on each disc. The injectate also contained Indigocarmine dye, a vital dye used by urologists to locate the ureteral openings into the bladder.

Patterns of annular disruption were recorded and thermal energy was directed to the annulus in the area of the disc protrusion. In the first 110 patients, the energy source was the KTP(r) laser. 63% of these patients with predominant back had good to excellent improvement of chronic back pain for over two and a half years, an unanticipated outcome. When leg pain was the predominant symptom, 80% good to excellent results were obtained.

In 1997 the study was extended to specifically modulate annular collagen with a flexible radio frequency probe that contained a heat sensor to measure tissue temperature adjacent to the probe tip (Oratec Interventions, Inc.).

Discogram patterns pre op and intra-operatively were correlated with results. It was soon recognized that discography produced pain responses that did not always follow a dermatomal pattern. While the majority of abnormalities involved the posterior annulus, dye extravasation far laterally often outlined the exiting nerve root at the disc level provoking radicular pain. Annular tears ventral to the exiting nerve produced non-anatomic and non-dermatomal pain patterns, i.e., far lateral and anterior extravasation can cause groin and thigh pain at L5S1. The genital-femoral nerve in the psoas muscle is irritated by the inflammatory membrane spreading ventrally.

I was able to exam and probe annular tears in the lateral and ventral zone of the disc annulus as well as identify membranes of inflammatory tissue covering the annular fibers. By correlating endoscopic findings with its response to thermal treatment of annular collagen, I hope to be able to produce a new classification of annular disruption that will respond to new techniques that promote tissue healing.

An Institutional Review Board approved study of 50 patients treated with the endoflex probe by Oratec is being completed. The official results are not available at this time, but early responses are encouraging and may be ready to report by the end of December, 1998.

### **Conclusion**

In conclusion, with the ability to visualize anatomic structures and the ability to correlate these findings with pain provocation in a patient in an aware state, we have an opportunity to treat chronic discogenic pain with innovative new modalities that warrant further study. Hopefully, the study will allow surgeons to study annular tears that are most likely to respond to electro-thermal

therapy. We can then reserve fusion for the more appropriate indications of instability and deformity.

Posted 1/14/1999