Variations in Anular Defect Characteristics in Herniated Lumbar Discs: A Feasibility Study of Anular Repair and an Attempt to Confirm Carragee Population Data on Defect Size

D.A. Wong1, L. Mauter2, V. Murdock2, C. Wong1
1Denver Spine, Greenwood Village, CO, United States, 2Presbyterian St. Luke's Medical Center, Denver, CO, United States

Introduction: Carragee has studied the size of the hole in the anulus and the effect of defect size on the rate of recurrent HNP and revision surgery. However, Carragee's paper did not report other characteristics such as defect location (mid annulus vs. adjacent to the inferior or superior end plate) nor tissue quality (intact/frayed/calcified). These additional characteristics (along with defect size) determine the feasibility of anular repair. Suturing (technically easiest/cheapest-and presently already on the market) applies only in situations where the anular tear is mid substance with good adjacent tissue. Defects adjacent to bone require a bone anchor for the suture (currently none available for clinical use). Large anular holes necessitate a technically challenging, expensive barrier reconstruction (technology still limited to clinical trials).

Purpose: This study had two primary research questions:
1) what is the incidence of anular defect characteristics that determine the percentage of HNP patients who might be candidates for anular repair/reconstruction? and
2) does our cohort confirm the population distribution seen in the Carragee study regarding anular defect size.

Methods: A 100 consecutive patient cohort undergoing surgery for single level, primary HNP by the senior author were prospectively studied between December 2008 and March 2009. Size and location of the anular defect (midsubstance/adjacent to superior or inferior end plate), tissue quality and Carragee Type (fragment/fissure, fragment/defect, fragment/contained, no fragment/contained) were noted.

Results: There were 68 males/ 32 females (higher risk for males p=0.0003), average age 47. There were 55 right herniations and 45 left.
64% had mid substance defects/good adjacent tissues (suture applicable). Defect adjacent inferior end plate (21%), adjacent to superior end plate (8%) - bone anchor potentially applicable (29%). Thus, total potential repair patients (93%). Repair was not feasible in 7% due to calcification of the disc. Carragee categories (% ours/Carragee), Fragment Fissure (33/49), Fragment Defect (11/18), Fragment Contained (45/23), No Fragment Contained (11/8). Significant difference between our cohort vs. Carragee all categories (chi-square test p< 0.0001).

Using presently available anular suturing technology, 64% of the patients in this study would be candidates for anular repair. If a bone anchor was developed, 93% of patients would be candidates for reconstruction.

The primary reason for inability to repair was a calcified disc. No patients had thinning or shredding of the annulus to a degree that would prohibit anular reconstruction.

The statistically significant variation in all Carragee defect size categories was a surprise. Carragee population data on defect size was not confirmed. The true population incidence remains uncertain.

Conclusions: With the available suturing techniques, more than a third of patients with a disc herniation will not be candidates for anular repair/reconstruction.

A bone anchor needs to be developed to elevate anular repair as an option for almost all lumbar HNP patients.

Additional studies of Carragee defect categories will be necessary to more accurately define the population incidence of various types of anular failure. Determining reliable population incidence is key for accurately calculating the cost effectiveness of anular repair technologies.