Study design: Cadaveric Radiographic CT analysis of canal dimensions and foraminal area.

Background data: Lumbar spinal stenosis is a worldwide prevalent and debilitating condition. The current standard of surgical care is to perform a laminectomy with posterior spinal fusion. One alternative technique is an indirect spine decompression through an extreme lateral approach with inter-body fusion. There is paucity of reports in the literature examining the anatomical, biomechanical, radiographical and clinical changes in patients undergoing the procedure.

Objective: The purpose of this study is to report on a cadaveric model of lateral interbody fusion and standardize several pre- and post-operative radiographic variables to quantify the anatomic changes resulting from the procedure.

Methods: Eight L1 to S1 continuous vertebral fresh frozen cadaveric specimens were included in this study. All of the specimens were fixed to individual custom rigid frames. Prior to any intervention, computerized tomography (CT) scans and 3D reconstructions were obtained of each intact specimen. Analyzed variables included disc height (three measurements per level: at the level of the anterior longitudinal ligament, middle of the vertebral body, and posterior longitudinal ligament), foraminal area, foraminal height and foraminal anterior-posterior dimensions, canal area, and anterior-posterior dimensions. The L3-L4 and L4-L5 levels were then instrumented by the senior author following the same surgical technique that involved lateral discectomy, placement of two interbody cages and augmentation of the construct with two lateral plates. All of the specimens underwent a post-instrumentation CT scan. A fellowship trained musculoskeletal radiologist, a senior orthopaedic resident and a fellowship trained spine surgeon performed the radiographic measurements in a standardized radiology station using the same imaging software for each specimen. Inter-observer reliability was excellent and continuously documented during the study. Means from the three measurements were used for all statistical analyses.

Results: The evaluation of pre- and post-implantation changes in the cadaveric model at the level of L3-L4 showed a 45% increase in the mean area of the right foramen (137mm² to 200mm²), 50% increase in the mean area of the left foramen (144mm² vs 216mm²), 43% increase in the mean disc height (mid vertebral level, 5.8mm vs. 8.5mm), and 53% increase in the canal area (106.5mm² vs. 163.7mm², p=0.044). At the level of L4-L5, there was a 38% increase in the mean area of the right foramen (135mm² vs. 187.5mm²), 50% increase in the mean area of the left foramen (130mm² vs. 195.2mm²), 57% increase in the mean disc height (mid vertebral level, 5.6mm vs. 8.87mm), and 31% increase in the canal area (115mm² vs. 151.2mm²). There was an 85% increase in the posterior disc height at the level of L4-L5 (5mm vs. 9.25mm, p=0.02).

Conclusion: This is the first study to systematically evaluate radiographic changes after indirect spinal decompression using the lateral interbody fusion technique. The authors believe that the results of this cadaveric study support the clinical reports and the rationale previously described for the technique. Clinical correlation of these cadaveric radiographic results is ongoing.