

BIOMECHANICAL COMPARISON BETWEEN LAMINECTOMY AND UNILATERAL LAMINOTOMY, BILATERAL LAMINOTOMY, BILATERAL LAMINOTOMY WITH POSTERIOR LIGAMENT COMPLEX RESECTION IN CADAVERIC CALF SPINE MODEL

BACKGROUND: Many soft tissue preserving procedures have been proposed as an alternative to conventional laminectomy for decompression of lumbar canal stenosis. Previous studies have found that laminectomy is comparable to these alternative procedures and also these comparative studies are of low quality.

PURPOSE: To quantify surgery induced spinal instability (SISI) caused by unilateral laminotomy, bilateral laminotomy, bilateral laminotomy with posterior ligament complex resection and laminectomy in terms of intradiscal pressure and range of motion.

STUDY DESIGN: Biomechanical study of cadaveric calf lumbar spine.

METHODS: Six calf spines of age 6-12 months were tested at the level of L3-L4 in all six degrees of motion—flexion, extension, lateral bending and axial rotations. Initially the intact specimen was tested and then the other 4 procedures—unilateral laminotomy, bilateral laminotomy, bilateral laminotomy with posterior ligament complex resection and laminectomy, were tested in sequence. Intradiscal pressures were also measured at the same setting using a miniature pressure transducer, which was introduced into the nucleus pulposus. A constant pressure of 7.5Nm was applied using a universal testing machine and range of motion was measured using a 3D motion sensor.

RESULTS: All 4 procedures were compared with the intact specimen and we found that laminectomy and bilateral laminotomy with posterior ligament complex resection showed significant increase in all 6 degrees of motion as against unilateral laminotomy which had significance in right lateral bending ($p=0.028$) in terms of segmental motion. Bilateral laminotomy showed significance in left lateral bending ($p=0.046$), clockwise rotation ($p=0.028$) and counter clockwise rotation ($p=0.028$). In terms of stress at the nucleus pulposus, the values of the intradiscal pressure were found to be significant in laminectomy under all 6 degrees of motion. No significance was found in the unilateral laminotomy group but bilateral laminotomy showed higher stress in right lateral bending ($p=0.028$) and laminotomy with ligament resection in extension ($p=0.028$) and clockwise rotation ($p=0.046$).

CONCLUSION: Laminectomy causes more surgery induced spinal instability (SISI) of the lumbar motion segment as compared to laminotomy in terms of range of motion and intradiscal pressure. We also found that posterior ligament complex placed an integral part of structural stability of spine.

KEYWORDS

Surgery induced spinal instability (SISI), Lumbar canal stenosis, Biomechanical study