

Is Sarcopenia a Preoperative Risk Factor for the Development of Kyphotic Deformity Following Laminoplasty

Alexa Tomlak, BS¹, Yunsoo Lee¹, MD, Rajkishen Narayanan, MD¹, Ali Farooqi, MD¹, Teeto Ezeonu, BA¹, Justin Wright, BS¹, Emerson Rowe, MS¹, Sebastian Fras, BS¹, John Mangan¹, MD, Jose Canseco¹, MD, PhD, Alexander Vaccaro¹, MD, PhD, MBA, , MBA, Gregory Schroeder¹, MD, Christopher Kepler¹, MD, Alan Hilibrand¹, MD

¹Department of Orthopaedic Surgery, Rothman Orthopaedic Institute at Thomas Jefferson University, Hospital, Philadelphia, PA

Presenting Author Email: Alexa.Tomlak@rothmanortho.com

Disclosures: A. Tomlak: None. Y. Lee: None. R. Narayanan: None. A. Farooqi: None. T. Ezeonu: None. J. Wright: None. E. Rowe: None. S. Fras: None. J. Mangan: 9; North American Spine Society. J. Canseco: 3C; PathKeeper Surgical. 4; PathKeeper Surgical. 5; Accelus. 8; Wolters Kluwer Health - Lippincott Williams & Wilkins. 9; Cervical Spine Research Society. A. Vaccaro: 4; Accelus, Advanced Spinal Intellectual Properties, Atlas Spine, Avaz Surgical, AVKN Patient Driven Care, Cytonics, Deep Health, Dimension Orthotics, Electrocore, Flagship Surgical, FlowPharma, Harvard Medtech, Innovative Surgical Design, Jushi (Haywood), Nuvasive, Orthobullets, Parvizi Surgical Innovation, Progressive Spinal Technologies, Sentryx, Stout Medical, ViewFi Health. 6; AO Spine. 7A; Atlas Spine, Elsevier, Globus Medical, Jaypee, Medtronic, Spinal Elements, SpineWave, Stryker. 7B; Taylor Francis/Hodder and Stoughton, Thieme. 9; National Spine Health Foundation. G. Schroeder: 3B; Advance Medical, Bioventus, Surgalign. 5; Cerapedics, DePuy, Medtronic Sofamor Danek. 8; Wolters Kluwer Health - Lippincott Williams & Wilkins. 9; AO Spine, Cervical Spine Research Society C. Kepler: 7A; Curetiva, Regeneration Technologies Inc.. 8; Clinical Spine Surgery. A. Hilibrand: 4; Paradigm Spine. 7A; Biomet, CTL A

INTRODUCTION:

Laminoplasty is a commonly employed procedure in addressing pathologies like ossification of the posterior ligament and cervical spondylotic myelopathy. Past research has indicated a potential risk for patients to develop kyphotic deformity after laminoplasty. This deformity is an undesirable complication as it may result in recurrent myelopathy and chronic neck pain due to inadequate decompression. While prior literature has explored preoperative risk factors for postoperative kyphotic deformity following laminoplasty, limited attention has been given to sarcopenia as a modifiable factor. Sarcopenia, characterized by the gradual loss of skeletal muscle mass, has been associated with unfavorable surgical outcomes. The principal aim of this study was to assess the impact of sternocleidomastoid muscle (SCM) mass and quality on postoperative cervical kyphosis following cervical laminoplasty.

METHODS:

After Institutional Review Board, a structured query language (SQL) search and chart review was conducted to identify patients who underwent cervical laminoplasty at our tertiary, academic institution between 2014-2022. Cross-sectional surface areas for bilateral sternocleidomastoid muscles were collected from preoperative T2-weighted MRIs at the C5-6 disk space for each patient, and muscle quality was measured using the Goutallier classification system for fatty infiltration. Pre and postoperative cervical alignment measurements were collected from sagittal radiographic images. Specifically, C2-C7 Cobb Angle (CA), C2-C7 Sagittal Vertical Axis (SVA), C2 tilt, and C2 slope were measured in neutral position. All MRIs and radiographic images were performed less than one year before or after the surgery of interest. The measurements were collected by two independent reviewers and an interrater was performed to confirm agreement. Patients were categorized into "High SCM Group" and "Low SCM Group" based on the average SCM cross-sectional area (CSA) adjusted for body mass index (BMI). Statistical analysis was performed to compare the "High" and "Low" group in terms of pre and postoperative alignment measurements and patient reported outcome measures.

RESULTS SECTION:

In total, 56 patients were identified that had preoperative T2-weighted MRIs, with 48 patients having complete pre and postoperative radiographic images. The "Low" group was found to be significantly older with a greater percentage of females than the "High" group (66.0 vs 59.7 years, $p=0.029$; 57.1% vs. 17.9%, $p=0.006$). The occurrence of inpatient complications and presence of patients who identified as current or former smokers was slightly higher in the "High" group but not statistically different. There were no significant differences in race, number of levels fused, length of stay, or rates of 90-day readmissions or 1-year revisions between groups. All radiographic parameters showed no significant differences between the groups. Furthermore, patient reported outcome measures did not exhibit statistically significant differences preoperatively or postoperatively aside from 3-month post-operative Visual Analog Scale (VAS) for arm pain with the "High" group reporting increased pain (Low: 0.00 [0.00;0.43], High: 3.36 [3.06;3.49], $p=0.032$).

DISCUSSION:

Sarcopenia has been identified as a risk factor for increased postoperative complications following spine surgery. Sarcopenic patients have been shown to experience longer hospital stays with an increased chance of being discharged to rehabilitation facilities incurring greater costs of care. Postoperative kyphotic deformity is a complication of great interest amongst laminoplasty patients as it has been linked to poorer prognoses. Our study found that decreased sternocleidomastoid muscle mass was not associated with an increased risk of post-operative kyphotic deformity following laminoplasty.

This study has multiple limitations. Namely, patients missing preoperative T2 weighted MRI images within our electronic medical record were removed from the study, limiting our cohort size and the power of this study. Additionally, the retrospective nature of our study introduces potential selection bias.

Overall, our study found that while there are some demographic differences between the two groups with low and high SCM size, muscle mass and muscle quality did not influence the risk for kyphotic deformity following laminoplasty. Future research should investigate the risks associated with cervical sarcopenia to better understand its implications on outcomes following cervical surgical procedures.

SIGNIFICANCE/CLINICAL RELEVANCE: Perioperative risk factors associated with kyphotic deformity following cervical procedures have been a topic of interest in the literature due to the negative impacts it can have on a patient's surgical and clinical course. We observed that sternocleidomastoid muscle mass is not associated with an increased risk of kyphotic deformity following laminoplasty.

ACKNOWLEDGEMENTS: None.

TABLES: Radiographic parameters between Low SCM Group (1) and High SCM Group (2)

	Group 1	Group 2	P Value
PreOp Cobb Angle	12.8 (9.11)	8.76 (9.49)	0.137
PostOp Cobb Angle	7.64 (10.6)	5.33 (9.71)	0.436
Delta Cobb Angle	-5.85 (7.25)	-3.36 (9.78)	0.322
PreOp C2-C7 SVA	33.0 [22.5;40.1]	36.0 [26.8;40.0]	0.522
PostOp C2-C7 SVA	39.7 (16.2)	40.8 (14.1)	0.802
Delta C2-C7 SVA	6.60 (9.56)	5.04 (10.3)	0.587
PreOp C2 Slope	21.4 (8.45)	21.0 (7.67)	0.850
PostOp C2 Slope	25.1 (10.2)	24.2 (7.37)	0.731
Delta C2 Slope	3.32 (7.28)	3.30 (7.35)	0.991
PreOp C2 Tilt	11.7 [6.01;18.6]	13.0 [8.69;15.3]	0.893
PostOp C2 Tilt	17.3 (11.3)	16.9 (6.17)	0.870
Delta C2 Tilt	4.35 (8.40)	4.18 (7.98)	0.943