Is Severe Mechanical Neck Pain a Contraindication to Performing Laminoplasty in Patients with Cervical Spondylotic Myelopathy?

Zachariah William Pinter[1], Ryder R. Reed, Anthony L Mikula, Nikita Lakomkin, Breydan Hawkins Wright, Mohamad Bydon[2], Bradford L Currier, Benjamin D Elder[2], Jeremy Lee Fogelson, Brett Freedman[2], Erick Kazarian, Giorgos D. Michalopoulos, Ahmad Nassr, Arjun Sebastian
[1]Mayo Grad School of Medicine, [2]Mayo Clinic

INTRODUCTION:
For many spine surgeons, severe neck pain remains a relative contraindication to the performance of laminoplasty in patients with cervical spondylotic myelopathy (CSM) due, primarily, to the belief that mechanical neck pain likely arises from degenerative arthropathy that would not be addressed through a motion-preserving operation such as laminoplasty. The primary purpose of the present study was to investigate whether patients with severe mechanical preoperative neck pain achieve acceptable outcomes after laminoplasty. Secondarily, this study sought to identify preoperative variables that contribute to differences in neck pain in patients with myelopathy.
METHODS:
We retrospectively reviewed a cohort of consecutive patients undergoing laminoplasty between the years 2010-2021 at a single academic institution. Patients were included if they underwent laminoplasty for cervical spondylotic myelopathy with or without radiculopathy. Patient demographics and surgical variables were collected. Patients were then subdivided into mild (VAS Neck 0-3), moderate (4-6), and severe (7-10) neck pain groups based upon accepted visual analog scale (VAS) neck cutoffs. Patient-reported outcome measures (PROMs) including neck disability index (NDI), VAS neck, and VAS arm were then compared between subgroups preoperatively, at 6 months postoperatively, and at 1 year postoperatively. Subgroups were then compared based upon baseline demographics, presenting clinical symptoms, radiographic variables, degree of qualitative paraspinal sarcopenia, and complications. Analysis of variance (ANOVA) was utilized to compare differences between subgroups, and student's t-test was utilized to compare within group changes in perioperative PROMs.
RESULTS:
We identified 91 patients for inclusion in this study. There were no differences identified in baseline demographic variables or perioperative clinical symptoms between groups (Table 1). Patients with severe neck pain (VAS neck ≥ 7) had higher preoperative VAS neck, NDI, and VAS arm scores. However, there was no difference in any of these measures at 6 months or 1 year postoperatively between subgroups subdivided according to preoperative VAS neck. The mild, moderate, and severe neck pain groups all experienced significant improvement in NDI, VAS neck, and VAS arm from preoperative to 1 year postoperatively (Table 2). There were no differences in complication rates between subgroups. Furthermore, there were no differences identified in preoperative radiographic variables between subgroups, including maximum spinal cord compression, maximum canal compromise, the presence of myelomalacia, the degree of qualitative sarcopenia, C2 sagittal vertical axis, C2 slope, C2-7 lordosis, T1 slope, C0-2 cobb angle, and C1-occiput distance.
DISCUSSION AND CONCLUSION:
Patients with severe mechanical neck pain preoperatively experience a significant postoperative improvement in reported neck disability, neck pain, and arm pain. As a result, these patients experience similar neck pain and disability at 6 months and 1 year postoperatively as their counterparts with less severe preoperative neck pain. The results of this study suggest that mechanical neck pain is not a contraindication to laminoplasty in patients with CSM. This study was unable to identify radiographic or demographic variables that may explain the etiology of severe neck pain in patients with CSM.

Table 1: Demographics and Clinical Symptoms Based upon Preoperative VAS Neck

	Mild Neck Pain (N=47)	Moderate Neck Pain (N=22)	Severe Neck Pain (N=22)	P Value
Demographics				
Age	60.7 (13.0)	62.3 (13.2)	57.1 (15.7)	0.44
Gender (Male)	11 (23.4%)	10 (45.5%)	9 (40.9%)	0.13
BMI	28.7 (4.5)	30.4 (6.4)	28.7 (6.0)	0.46
Active smoker	4 (8.5%)	3 (13.6%)	5 (22.7%)	0.27
CKD	4 (8.5%)	1 (4.5%)	2 (9.1%)	0.81
Chronic Steroid Use	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Inflammatory Arthritis	3 (6.4%)	1 (4.5%)	2 (9.1%)	0.83
mFI	10.8 (15.2)	8.7 (12.4)	13.2 (18.8)	0.63
CCI	2.6 (3.0)	2.5 (2.7)	3.0 (3.1)	0.86
Clinical Symptoms				
Lhermitte's Phenomenon				0.08
None Preop	43 (91.5%)	20 (90.9%)	16 (72.7%)	
Resolved	4 (8.5%)	2 (9.1%)	6 (27.3%)	
Upper Extremity Motor Neuron Symptoms				0.94
None Preop	5 (10.6%)	2 (9.1%)	3 (13.6%)	
Unchanged	4 (8.5%)	1 (4.5%)	2 (9.1%)	
Worse	1 (2.1%)	1 (4.5%)	0 (0.0%)	
Improved	26 (55.3%)	10 (45.5%)	11 (50.0%)	
Resolved	11 (23.4%)	8 (36.4%)	6 (27.3%)	
Gait Instability				0.53
None Preop	10 (21.3%)	10 (45.5%)	6 (27.3%)	
Unchanged	3 (6.4%)	2 (9.1%)	2 (9.1%)	
Worse	2 (4.3%)	0 (0.0%)	0 (0.0%)	
Improved	15 (31.9%)	5 (22.7%)	5 (22.7%)	
Resolved	17 (36.2%)	5 (22.7%)	9 (40.9%)	
Radiculopathy Symptoms				0.34
None Preop	21 (44.7%)	10 (45.5%)	6 (27.3%)	
Unchanged	2 (4.3%)	2 (9.1%)	0 (0.0%)	
Worse	0 (0.0%)	0 (0.0%)	0 (0.0%)	
Improved	12 (25.5%)	7 (31.8%)	7 (31.8%)	
Resolved	12 (25.5%)	3 (13.6%)	9 (40.9%)	

Table 2: Patient Reported Outcome Measures Based upon Preoperative VAS Neck

	Mild Neck Pain (N=47)	Moderate Neck Pain (N=22)	Severe Neck Pain (N=22)	P Value
Neck Disability Index				
Preoperative	10.3 (7.9)	18.1 (7.5)	17.7 (8.7)	< 0.001
6 Months Postoperative	11.9 (9.6)	12.0 (8.6)	12.7 (7.2)	0.96
Δ Preop to 6 Months Postop	1.3 (6.2)	-5.9 (7.2)	-4.4 (6.6)	< 0.001
P Value	0.23	<0.001	0.02	
1 Year Postoperative	8.3 (7.0)	8.6 (6.9)	8.6 (7.9)	0.99
Δ Preop to 1 Year Postop	-2.3 (5.5)	-10.0 (7.2)	-7.1 (8.4)	< 0.001
P Value	0.02	<0.001	0.01	
VAS Neck				
Preoperative	1.6 (1.1)	4.7 (0.7)	7.8 (1.0)	< 0.001
6 Months Postoperative	1.7 (1.9)	1.6 (1.9)	2.2 (2.4)	0.59
Δ Preop to 6 Months Postop	0.1 (2.0)	-3.1 (2.2)	-5.6 (2.8)	< 0.001
P Value	0.75	<0.01	<0.01	
1 Year Postoperative	0.9 (1.4)	1.6 (2.2)	2.1 (2.5)	0.09
Δ Preop to 1 Year Postop	-0.5 (1.3)	-3.1 (2.5)	-5.8 (2.6)	< 0.001
P Value	0.01	<0.001	<0.001	
VAS Arm				
Preoperative	1.6 (2.2)	3.5 (2.7)	6.0 (3.8)	< 0.01
6 Months Postoperative	1.4 (2.0)	1.1 (1.8)	2.5 (3.3)	0.37
Δ Preop to 6 Months Postop	-0.1 (2.4)	-2.8 (2.7)	-3.5 (3.2)	< 0.01
P Value	0.81	0.01	0.02	
1 Year Postoperative	1.0 (1.6)	1.3 (1.9)	1.1 (1.6)	0.89
Δ Preop to 1 Year Postop	-0.7 (1.9)	-2.6 (3.3)	-4.9 (3.2)	< 0.01
P Value	0.06	0.048	<0.01	