Semispinalis Cervicis Sarcopenia is Associated with Worsening Cervical Sagittal Balance and Junctional Alignment following Posterior Cervical Fusion for Myelopathy

Zachariah William Pinter[1], Harold I. Salmons[2], Giorgos D. Michalopoulos, Brett Freedman[2], Bradford L Currier, Benjamin D Elder[2], Ahmad Nassr, Jeremy Lee Fogelson, Arjun Sebastian
[1]Mayo Grad School of Medicine, [2]Mayo Clinic

INTRODUCTION:

No study has investigated the association between sarcopenia and postoperative alignment following cervical spine surgery. The purpose of the present study was to investigate whether cervical paraspinal sarcopenia is associated with cervicothoracic sagittal alignment parameters following posterior cervical fusion (PCF).

METHODS:

We retrospectively reviewed patients undergoing PCF from C2-T2 at a single institution between the years 2017-2020. Two independent reviewers utilized axial cuts of T2-weighted MRI sequences to perform Goutalier classification of the bilateral semispinalis cervicis (SSC) muscles (Figure 1). Cervical sagittal alignment parameters were compared between subgroups based upon severity of SSC sarcopenia.

RESULTS:

We identified 61 patients for inclusion in this study, including 19 patients with mild SSC sarcopenia and 42 patients with moderate or severe SSC sarcopenia. The moderate-severe sarcopenia subgroup demonstrated a significantly larger change in C2-7 SVA (+6.8mm) from the 3-month to 1-year postoperative follow-up in comparison to the mild sarcopenia subgroup (-2.0mm; P=0.02) (Table 2). The subgroup of patients with moderate-severe sarcopenia also demonstrated an increase in T1-4 kyphosis (10.9 to 14.2, P=0.007), T1 slope (28.2 to 32.4, P=0.003), and C2 slope (24.1 to 27.3, P=0.05) from 3 months to 1 year postoperatively and a significant decrease in C1-Occiput distance (6.3 to 4.1, P=0.002) during this same interval (Table 3).

DISCUSSION AND CONCLUSION:

In a uniform cohort of patients undergoing PCF from C2 to T2, semispinalis cervicis sarcopenia was associated with worsening cervicothoracic alignment from 3 months to 1 year postoperatively.

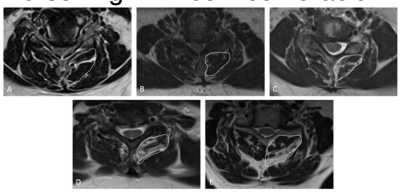

Table 2: The Impact of Semispinalis Cervicis Sarcopenia* on Global Cervical Sagittal Alignment

	Mild (n=19)	Moderate - Severe (n=42)	P Value
*C2-7 SVA**			
Preoperative	42.8 (20.3)	38.4 (17)	0.40
3 Month Postoperative	46.6 (20.1)	39.0 (17.3)	0.14
Δ Preoperative to 3 Month Postop	3.8 (12.0)	0.6 (15)	0.38
P Value	0.12	0.66	
1 Year Postoperative	44.6 (22.6)	45.8 (19.1)	0.83
Δ 3 Month Postop to 1 Year Postop	-2.0 (14.2)	6.8 (11.6)	**0.02**
P Value	0.53	**<0.001**	
# of Patients with Preoperative C2 SVA <40 >40	9 (47.4%) 10 (52.6%)	22 (52.4%) 20 (47.6%)	0.72
# of Patients with 3 Month Postop C2 SVA <40 >40	8 (42.1%) 11 (57.9%)	21 (50.0%) 21 (50.0%)	0.57
# of Patients with 1 Year Postop C2 SVA <40 >40	8 (42.1%) 11 (57.9%)	16 (38.1%) 26 (61.9%)	0.68
C2-7 Lordosis			
Preoperative	4.2 (16.6)	12.2 (14.4)	0.07
3 Month Postoperative	8.2 (11.0)	10.1 (8.4)	0.47
Δ Preoperative to 3 Month Postop	4.0 (17.9)	-2.1 (14.6)	0.24
P Value	0.43	0.42	
1 Year Postoperative	9.0 (12.1)	9.7 (11.8)	0.69
Δ 3 Month Postoperative to 1 Year Postop	0.8 (7.2)	-0.4 (9.3)	0.79
P Value	0.63	0.11	

*Abbreviations: Sagittal Vertical Axis (SVA)
*Semispinalis cervicis sarcopenia was assessed on preoperative MRI at the C5/6 interspace and is based upon the Fuchs Modification of the Goutalier grading system
Continuous variables are displayed as mean (standard deviation), categorical variables are displayed as number (percent).

Table 3: The Impact of Semispinalis Cervicis Sarcopenia* on Distal Junctional Alignment

	Mild (n=19)	Moderate - Severe (n=42)	P Value
T1 Slope			
Preoperative	27.5 (11.0)	26.9 (10.5)	0.83
3 Month Postoperative	28.6 (12.0)	28.2 (11.1)	0.91
Δ Preoperative to 3 Month Postop	1.1 (15.0)	1.3 (9.3)	0.97
P Value	0.72	0.43	
1 Year Postoperative	30.7 (12.1)	32.4 (11.7)	0.79
Δ 3 Month Postoperative to 1 Year Postop	2.1 (10.2)	4.2 (7.9)	0.45
P Value	0.41	**0.003**	
T1-4 Kyphosis			
Preoperative	10.0 (4.8)	8.9 (7.5)	0.67
3 Month Postoperative	8.6 (7.3)	10.9 (6.2)	0.20
Δ Preoperative to 3 Month Postop	-1.4 (4.6)	2.0 (6.3)	0.07
P Value	0.37	**0.04**	
1 Year Postoperative	10.9 (6.0)	14.2 (9.2)	0.89
Δ 3 Month Postoperative to 1 Year Postop	2.3 (7.7)	3.3 (6.4)	0.36
P Value	**0.02**	**0.007**	

*Semispinalis cervicis sarcopenia was assessed on preoperative MRI at the C5/6 interspace and is based upon the Fuchs Modification of the Goutalier muscle grading system
Continuous variables are displayed as mean (standard deviation), categorical variables are displayed as number (percent).