Changes in Cervical Paraspinal Muscles after Anterior Cervical Discectomy and Fusion

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INTRODUCTION:

Increasing research is being conducted on how cervical spinal stenosis affects paraspinal muscles, which are clinically important. It has been shown that increased severity of foraminal and central stenosis is associated with higher fat infiltration (FI) of the cervical multifidus and rotatores. Increased FI is associated with pain, sensorimotor deficits, and clinical disability. Anterior cervical discectomy and fusion (ACDF) is used to treat foraminal and central stenosis. This study investigated how FI changes after ACDF surgery.

METHODS:

We reviewed patients who underwent ACDF between 2015 and 2018 and had preoperative and postoperative cervical imaging performed. For each patient, the upper level was defined as the most superior segment and the lower level was defined as the most inferior segment that was fused in their ACDF surgery. The middle level consisted of all vertebrae located between the upper and lower levels. The muscles were segmented bilaterally at these levels and a custom software calculated FI and muscle area (functional cross-sectional area = fCSA). Preoperative FI and fCSA was compared with the postoperative FI and fCSA at the upper, middle, and lower levels using paired t-test or Wilcoxon signed rank test dependent on distribution. A significance level of 0.05 was used.

RESULTS:

35 patients met inclusion criteria. Statistical analyses showed a significant decrease (52.1% vs 45.0%, p = 0.013) in bilateral FI at the lower level and no significant change at the upper and middle levels from the preoperative to the postoperative period. Results also showed a significant decrease in bilateral fCSA (165.2 vs 109.4, p = 0.003) at the middle level of surgery and no significant change at the upper and lower levels.

DISCUSSION AND CONCLUSION:

Results showed a significant decrease in FI at the lower level and a significant decrease in fCSA at the middle level. ACDF surgery may promote reversal of FI at the lower level by improving innervation to and increasing mechanical load on the muscles. However, ACDF surgery may also promote muscle loss at the middle level by decreasing muscle use. Pathological changes in the cervical spine and in cervical paraspinal muscles both contribute to clinical disability in patients with cervical spinal stenosis, so it is important to assess how ACDF surgery affects both of these changes.

Table 1. Patient Demographics

	Value*
Number of Patients	35
Age	58 [48.9 - 68.5]
Sex	
Male	21
Female	14
Race	
White	31
Black or African American	1
Asian	1
Other	2
Number of Fused Levels	
1	6
2	15
3	9
4	5

Table 2. Changes in Fat Infiltration from Preoperative to Postoperative Period

	Preoperative FI (%)	Postoperative FI (%)	
Upper Level (n = 35)	33.7 [22.4 - 42.2]	32.8 [26.6 - 39.4]	p = 0.858
Lower Level (n = 35)	52.1 (15.4)	45.0 (14.8)	p = 0.013**
Middle Level (n = 29)	38.2 (16.2)	42.6 (12.9)	p = 0.236

*Values reported as Mean (Standard Deviation) or Median [Interquartile Range]

**Significant at level of 0.05

Table 3. Changes in Cross-Sectional Muscle Area from Preoperative to Postoperative Period

	Preoperative fCSA	Postoperative fCSA	
Upper Level (n = 35)	146.6 [86.0 - 174.1]	155.4 [26.6 - 39.4]	p = 0.097
Lower Level (n = 35)	98.2 [65.2 - 152.7]	92.6 [68.9 - 125.3]	p = 0.318
Middle Level (n = 29)	165.2 [119.4 - 196.25]	109.4 [92 - 171.6]	p = 0.003**

*Values reported as Median [Interquartile Range]

**Significant at level of 0.05