Association Between History of Lumbar Spine Surgery and Paralumbar Muscle Health

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INTRODUCTION: Prior studies have suggested that muscle strength and quality may be associated with low back pain. Recently, a novel magnetic resonance imaging (MRI)-based lumbar muscle health grade was shown to correlate with health-related quality of life scores after spine surgery. However, the potential association between history of lumbar spine surgery and paralumbar muscle health requires further investigation.

METHODS: A retrospective analysis was performed on a consecutive series of patients of a single surgeon, and patients were included based on availability of lumbar MRI. Axial T2-weighted lumbar MRIs were analyzed for paralumbar cross-sectional area (PL-CSA), Goutallier classification, and lumbar indentation value (LIV). Measurements were performed at the center of disc spaces from L1 to L5. Patients with and without history of spine surgery were matched based on age, sex, race, ethnicity, and body mass index (BMI) via propensity score matching. Normality of each muscle health variable was assessed using Kolmogorov-Smirnov test. Mann-Whitney U test or independent t-test performed to compare the matched cohorts, as appropriate.

RESULTS SECTION: A total of 615 patients were assessed. For final analysis, 89 patients with a history of previous spine surgery were matched with 89 patients without a history of spine surgery. There were no statistically significant differences in age, sex, race, ethnicity, or BMI between the matched cohorts. History of spine surgery was generally associated with worse lumbar muscle health. At all 4 intervertebral levels between L1- L5, PL-CSA was significantly smaller among patients with history of spine surgery. At L4-L5, patients with prior spine surgery had significantly smaller PL-CSA/BMI. Patients with prior spine surgery were found to have greater fatty infiltration of the muscles, with higher average Goutallier grades at levels L1-L2, L2-L3, and L4-L5. In addition, history of spine surgery was associated with smaller LIV at L1-L2, L3-L4, and L4-L5.

DISCUSSION: The current study demonstrates that history of lumbar spine surgery is associated with worse paralumbar muscle health based on quantitative and qualitative measurements on MRI. On average, patients with history of spine surgery were found to have smaller cross-sectional areas of the paralumbar muscles, greater amounts of fatty infiltration based on Goutallier classification, and smaller lumbar indentation values.

SIGNIFICANCE/CLINICAL RELEVANCE: These findings help to better characterize the changes in quantitative and qualitative paralumbar muscle health parameters that may be associated with prior lumbar spine surgery. Thus, it is crucial to consider the effects of lumbar spinal surgery on muscle health.

Table 1. Baseline Patient Characteristics

	Total Cohort	History of Spine Surgery	No History of Spine Surgery	*p*-value
N of subjects	178	89	89	
Mean age (years)	65.3 ± 12.7	65.7 ± 12.3	64.9 ± 13.1	0.644
Female sex	94 (52.8%)	53 (60.7%)	41 (46.1%)	0.073
African American race	29 (16.3%)	15 (16.9%)	14 (15.7%)	0.839
Hispanic ethnicity	20 (11.2%)	9 (10.1%)	11 (12.4%)	0.635
BMI (kg/m^2)	29.4 ± 5.0	29.1 ± 5.6	29.7 ± 4.3	0.439
Mean duration of symptoms (weeks)	70.5 ± 120.6	79.9 ± 138.1	61.6 ± 101.4	0.351
Mean time between surgery and MRI (years)	-	7.9 ± 5.4	-	-

Categorical variables are represented as *N* (%). Continuous variables are represented as mean ± standard deviation. BMI, body mass index.

Table 2. Muscle Health Parameters in Patients With vs. Without History of Spine Surgery

	Total Cohort	History of Spine Surgery	No History of Spine Surgery	*p*-value
Goutallier Grade				
L1-L2	1.2 ± 0.8	**1.4 ± 0.8**	**1.1 ± 0.9**	**0.004**
L2-L3	1.5 ± 0.9	**1.6 ± 0.9**	**1.3 ± 1.0**	**0.013**
L3-L4	1.8 ± 1.0	1.9 ± 1.0	1.6 ± 1.0	0.131
L4-L5	1.9 ± 1.1	**2.1 ± 1.1**	**1.7 ± 1.1**	**0.029**
PL-CSA (mm^2)				
L1-L2	4192.9 ± 1512.6	**4007.2 ± 1651.8**	**4378.5 ± 1343.1**	**0.027**
L2-L3	4298.7 ± 1432.0	**4111.6 ± 1492.7**	**4485.9 ± 1351.1**	**0.035**
L3-L4	4103.9 ± 1336.0	**3888.1 ± 1356.3**	**4319.7 ± 1286.9**	**0.030**
L4-L5	3680.5 ± 1315.7	**3307.7 ± 1282.4**	**4040.8 ± 1251.8**	**<0.001**
PL-CSA/BMI				
L1-L2	143.4 ± 45.5	138.2 ± 47.3	148.6 ± 43.2	0.086
L2-L3	147.4 ± 44.8	142.6 ± 45.8	152.3 ± 43.4	0.123
L3-L4	141.3 ± 43.9	135.4 ± 44.0	147.2 ± 73.3	0.073
L4-L5	127.6 ± 45.5	**116.9 ± 44.0**	**138.0 ± 47.3**	**0.007**
LIV (mm)				
L1-L2	14.0 ± 6.9	**12.5 ± 6.7**	**15.5 ± 6.8**	**0.003**
L2-L3	14.0 ± 6.9	13.1 ± 7.2	14.8 ± 6.6	0.056
L3-L4	15.7 ± 7.5	**14.0 ± 7.5**	**17.3 ± 7.2**	**0.004**
L4-L5	19.0 ± 8.6	**14.3 ± 7.3**	**22.9 ± 7.7**	**<0.001**

Values represented as mean ± standard deviation. Bold indicates statistical significance (p<0.05). PL-CSA, paralumbar cross-sectional area. PL-CSA/BMI, PL-CSA normalized by BMI. LIV, lumbar indentation value.