

Degenerative Lumbar Spinal Stenosis and Paraspinal Muscles Condition

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Introduction

As life expectancy increases, degenerative lumbar spinal stenosis (DLSS) becomes a common health problem among the elderly, leading to low back pain, radiculopathy, and intermittent claudication. Spinal instability has been shown to play a role in DLSS pathogenesis. The density of the paraspinal muscles and their cross-sectional area (CSA) size are known to be associated with some variables such as age, gender and weight. Furthermore, current evidence suggests that these muscles are smaller in patients with chronic low back pain as compared to healthy individuals of a similar age. Although, the paraspinal muscles play an important role in the stability and functional movements of the lumbar vertebral column their association with DLSS remains elusive.

Aim

To shed light on the association of paravertebral muscles condition with DLSS group

Material And Methods

- **Two groups of individuals were studied:**
 1. 165 individuals with DLSS (80 males and 85 females, mean age 64.3 ± 9.9).
 2. 180 individuals without LSS related symptoms (90 males and 90 females, mean age 62.5 ± 12.6).
- CT images (Brilliance 64 Philips Medical System, Cleveland Ohio, thicknesses of the sections were 1-3 mm and MAS, 80-250) were used.
- **Para-vertebral muscles densities** (psoas= PS, multifidus= MF and erector spinae= ES) were measured in Hounsfield units (HU) on the left and right sides (Fig. 1). The value of each side (right, left) was obtained separately by calculating the mean density from measurements at three different locations (using a 50 mm^2 circle). Right and left muscles densities were then combined and the mean calculated.
- **Cross-sectional area (CSA)** of the para-vertebral muscles was measured on both sides separately and was defined by manually outlining the innermost fascial border surrounding the muscle, using the quantitative CT angiography (Q-CTA) method (Fig. 2). A threshold technique was then applied in order to eliminate the presence of other tissues such as fat

and bones. The mean values for the right and left muscles were then calculated.

- Both measurements were performed at the level of L3 vertebral mid- height.
- Analysis of Covariance (ANCOVA) was performed for each gender separately in order to determine the association between para-vertebral muscle condition and DLSS (adjusted for BMI and age).
- Logistic regression analysis was also carried out to reveal whether the paraspinal muscles are predictive for DLSS development.



Figure 1: Measurement of para-vertebral muscle density: psoas (1), multifidus (2) and erector spinae muscles (3).



Figure 2: Measurement of cross-sectional area of psoas (1), multifidus (2) and erector spinae (3) muscles.

Results

- Both males and females in the stenosis group had higher muscle`s density as compared to their counterparts in the control group (Fig. 3).
- The CSA values for the ES and PS muscles were significantly greater in stenosis males as compared to their counterparts in the control group. Yet, significant differences among females were noted only for the ES muscle (Fig. 4).
- Densities of multifidus (both sexes) and erector spinae (males) muscles were found to be significant predictors for DLSS development (Table 1).

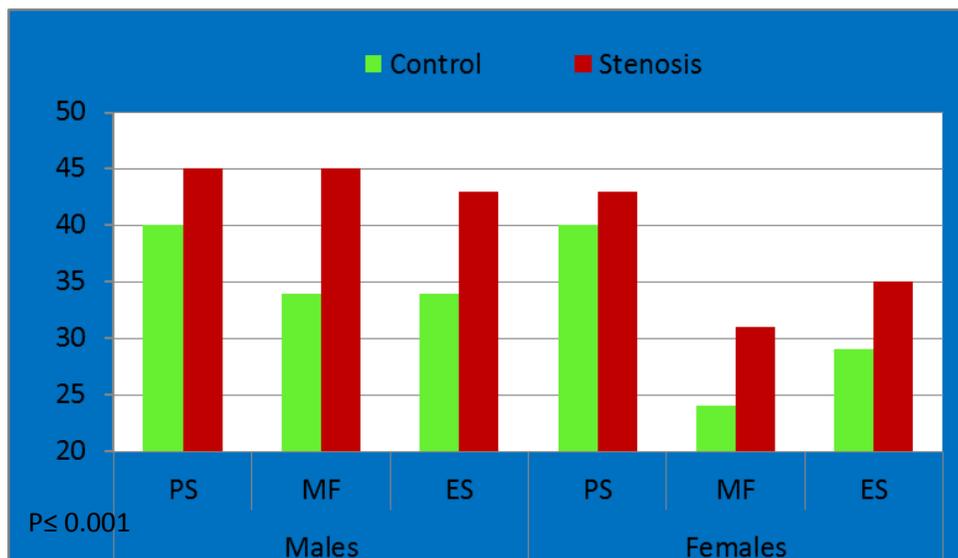


Figure 3: Mean densities of paraspinal muscles in control vs. stenosis groups (males and females). PS = psoas, MF = multifidus and ES = erector spinae.

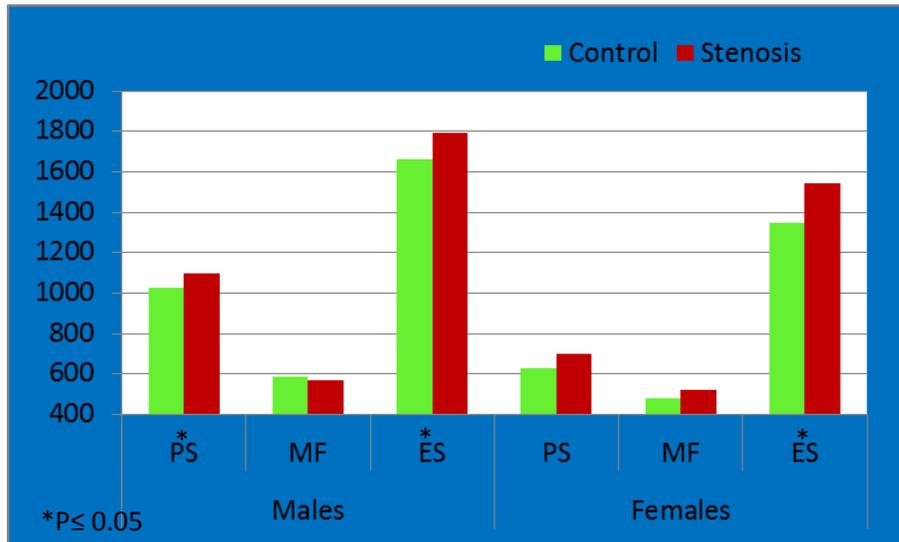


Figure 4: Mean paraspinal muscles cross-section area in the control vs. stenosis groups (males and females). PS = psoas, MF = multifidus and ES = erector spinae.

Table 1: Predicting paraspinal muscles` density for DLSS development in males and females (logistic regression analysis). MF = multifidus and ES = erector spinae.

Muscles	Odd Ratio	Confidence intervals -95%	P value
<u>Males</u>			
Density of MF	1.12	1.023-1.165	0.007
Density of ES	1.12	1.004-1.177	0.039
<u>Females</u>			
Density of MF	1.10	1.032-1.12	<0.001

Conclusions

The current study shows that individuals with DLSS manifest greater paraspinal muscles densities and CSAs (ES) as compared to the control group. Density of multifidus (both sexes) may be an indicator for the onset of symptomatic degenerative LSS.

Clinical Relevance: As the increased paraspinal density in DLSS individuals was a specific radiological finding for this disorder (not related to other degenerative lumbar spine disease), we suggest this measurement could be used as a radiological marker for detecting clinical syndrome of DLSS.

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Disclosure

None of the authors has any potential conflict of interest.