

The Association of Vascular Health with Cervical Paraspinal Muscle Atrophy and Disc Degeneration

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Introduction

Degeneration of paraspinal muscles and intervertebral discs has been associated with spine instability, chronic pain, and suboptimal surgical outcomes. While vascular influences on lumbar degeneration are known, cervical associations remain unclear. The objective of our study is to evaluate the relationship between carotid artery stenosis (CAS) and cervical paraspinal muscle atrophy as well as its association with intervertebral disc integrity.

Materials and Methods

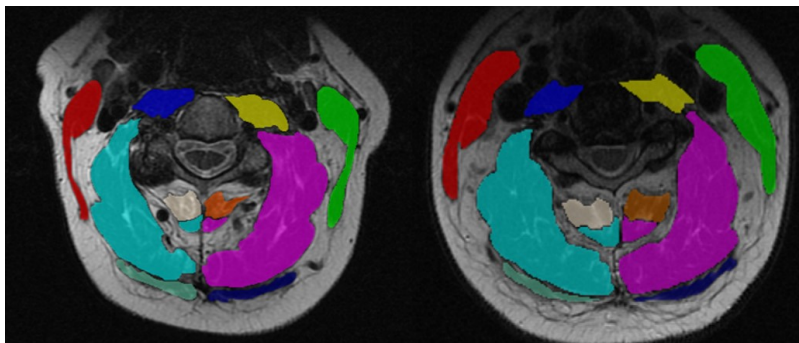
Patients undergoing primary cervical spine surgery between 2009 and 2018 with preoperative cervical MRI and CTA exams (≤ 12 months apart) were included. MRIs from C3 to C7 were used to measure fatty infiltration (FI) and functional cross-sectional area (fCSA) in six muscle groups: sternocleidomastoid (SCM), anterior group (AG), scalenus (SN), posteromedial (PM), posterolateral (PL), and trapezius (TP). Disc degeneration was evaluated using a validated Disc Signal Intensity (DSI2) Score. CAS was measured on CTA using a semi-automated software that calculated both the maximum and mean percentage of stenosis.

Results

Sixty-five patients were included. In multivariable linear regression models, higher mean stenosis was significantly associated with increased FI in the SCM, PL, PM, TP, and AG at C3, as well as the PM at C4 and SCM at C5 (all $p < 0.05$). It was also associated with reduced fCSA in the PM and SCM at C4 (both $p < 0.05$). Similarly, higher maximum stenosis was significantly associated with increased FI in the SCM and TP at C3, and the PL at C4, along with reduced fCSA in the SCM at C4 (all $p < 0.05$). No significant associations were observed between CAS and disc degeneration.

Conclusion

CAS was associated with cervical muscle atrophy pointing toward a role of vascular health in muscle degeneration. In contrast, disc degeneration showed no association with CAS, suggesting that muscle atrophy and disc degeneration may follow distinct degenerative or metabolic pathways.



Axial MRI segmented image for 2 different patients at C3. Red: right sternocleidomastoid; green: left sternocleidomastoid; blue: right anterior muscle group; yellow: left anterior muscle group; beige: right posteromedial muscle group; orange: left posteromedial muscle group; cyan: right posterolateral muscle group; magenta: left posterolateral muscle group; light green: right trapezius; dark blue: left trapezius.



Representative ROI measurements of the disc and CSF signal intensities on T2-weighted midsagittal MRI images. Illustrative images of ROI measurements of the disc and CSF signal intensities on T2-weighted midsagittal MRI. Disc signal intensities are measured three times at the C2/3 disc (arrowhead) and the ROI of CSF signal intensity measurement (arrow).