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Paraspinal Muscle Parameters as Predictors of Postoperative Outcomes in Patients Undergoing Cervical Disc Arthroplasty: Structural Equation Model Analysis

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Background: Paraspinal muscles have been firmly established to play a critical role in the maintenance of cervical alignment, contributing significantly to cervical mobility and stabilization.

Research question: The purpose of the present study was to determine the associations of preoperative paraspinal muscle parameters and postoperative outcomes following cervical disc arthroplasty (CDA).

Design: A retrospective cohort study was conducted on 185 single-level CDA patients.

Methods: Preoperative paraspinal muscle parameters, including fatty infiltration (FI), cross-sectional area ratio (CSA r), and muscle asymmetry (ASY%), were assessed using MRI. Structural equation modeling (SEM) was employed for comprehensive analysis.

Results: The study results demonstrate that the paraspinal muscle degeneration is prevalent in the patient cohort, and there is a higher proportion of noticeable FI (Goutallier Grade > 2) from the cranial to caudal levels. For the same muscle parameters across different levels, notably in the parameters of CSA r and FI, significant moderate to strong correlations were consistently observed pairwise across all levels. In correlation analysis, postoperative cervical lordosis was most correlated with CSA r at C4/5 ($P=0.010$). The sagittal vertical alignment at the final follow-up was most related to CSA r at C5/6 ($P=0.030$). A noteworthy positive correlation was observed between preoperative VAS and FI ($P=0.035$). Comparative analysis of SEMs across different muscle variables revealed variations in the predictive factors for postoperative sagittal balance parameters, with the CSA r showing a significant influence on cervical alignment than FI or ASY% ($P=0.019$).

Conclusions: In comparison to postoperative clinical outcomes, mobility, and prosthesis stability, postoperative sagittal balance is most correlated with preoperative muscle parameters. In comparison to preoperative FI and ASY%, CSA r stands out as the most significant muscular predictor.