

Quadriceps Sarcopenia on Full-Body Standing Radiographs: a Key Predictor of Mechanical and Junctional Complications After Posterior Spinal Fusion

Joseph Elias Nassar, Michael Jeremy Farias, Manjot Singh, Mohammad Daher, Lama A Ammar, Zvipo M Chisango, Nicolas L Carayannopoulos, Gabriel A Gonzalez, Claire Lin, Marco Kaper, Anant Jhaveri, Jacob P Tiller, Jason Hwang, Bassel Diebo, Alan H Daniels

INTRODUCTION: Thigh muscle measurements on full-standing radiographs strongly correlate with CT-based psoas muscle cross-sectional area (CSA) and established sarcopenia cutoffs. Among thigh muscles, quadriceps is most prone to age-related atrophy, potentially making it a key predictor of sarcopenia-related complications after surgery.

METHODS: Adult patients undergoing multilevel posterior \pm anterior fusion with available pre- and 1-year postoperative data were included. Sarcopenia was defined using validated cutoffs for psoas muscle index (L4: males[M] \geq 7.5, females[F] \geq 5.2cm²/m², L3: M \geq 5.6, F \geq 4.2cm²/m²) and thigh muscle measurements (AP thigh thickness: M \geq 12.47, F \geq 10.68cm; LAT quadriceps thickness: M \geq 3.23, F \geq 2.20cm). Hounsfield Unit (HU) at UIV, L3 and L4 psoas CSA, and LAT quadriceps and AP thigh thickness were measured. Multivariate logistic regressions assessed sarcopenia measurements as continuous variables in predicting mechanical and junctional complications (Proximal Junctional Kyphosis, instrument failure, adjacent segment disease, and pseudoarthrosis) adjusting for age, sex, BMI, levels fused, HU at UIV, and UIV level. Finally, sarcopenia was defined using established cutoffs to evaluate its impact on complications.

RESULTS: Among 70 patients (65.3% females, mean age 64.4 years, levels fused 4.8), mean UIV HU was 168.5, L3 psoas CSA 16.7, L4 psoas CSA 20.6cm², AP thigh thickness 11.9, and LAT quadriceps thickness 3.2cm. Multivariate model identified LAT quadriceps thickness as the only significant predictor of mechanical and junctional complications, with larger quadriceps being protective (AUC=0.79, 95%CI=0.67-0.92, p=0.04). Multivariate regression showed that sarcopenic quadriceps patients had 21.6-times higher odds of developing mechanical and junctional complications compared to non-sarcopenic patients (p=0.02).

DISCUSSION AND CONCLUSION: Patients with quadriceps sarcopenia, as measured on full body standing radiographs, have a 21.6-times higher odds of mechanical and junctional complications following multilevel posterior \pm anterior spinal fusion. Assessing quadriceps thickness may serve as an early indicator of sarcopenia using standard radiographs.



Figure: Full-Body Standing Radiographs Showing AP Thigh Thickness (Left) (15 cm Proximal to the Adductor Tubercle) and LAT Quadriceps Thickness (Right) (15 cm Proximal to the Distal Terminus of the Blumensaat Line).