Psoas Cross-Sectional Area Correlates with Bone Mineral Density and Bone Microarchitecture Parameters Among Patients Undergoing Posterior Spinal Fusion

Junho Song[1], Sravisht Iyer, Han Jo Kim, Sheeraz Qureshi[2], Matthew E Cunningham[3], Frank J Schwab[4], Joseph Raphael, Shannon Clare, Emily Stein
[1]Hospital For Special Surgery, [2]Minimally Invasive Spine Surgery, [3]Hosp for Special Surg-Cornell, [4]Lenox Hill Hospital

INTRODUCTION:

Prior studies have shown that muscle and bone health are associated with better outcomes following spine surgery. However, a correlation between muscle health and bone imaging parameters among spine patients has not been previously investigated. Given the difficulty of measuring BMD in the vertebrae in certain scenarios such as during revision procedures with spondylosis, there is interest in evaluating whether muscle health could correlate to global measures of bone quality. Furthermore, the unreliability of dual-energy X-ray absorptiometry (DXA) in the spine served as another motivator for this study. Therefore, we aimed to assess the relationship between psoas CSA, an estimate of muscle mass, and bone imaging parameters among patients undergoing posterior spinal fusion.

METHODS:

Patients were enrolled prior to posterior spinal fusion. Patients less than 25 years of age were excluded. Bilateral psoas CSA was measured on axial CT lumbar spine at the L3-L4 disc space. Psoas muscle index (PMI) was defined as psoas CSA normalized by square of patient's height (mm^2/m^2). Bone health evaluation was performed using DXA and high resolution peripheral quantitative computed tomography (HRpQCT). Assessed bone imaging parameters included areal BMD (aBMD) of the forearm (proximal 1/3 radius), as well as volumetric BMD (vBMD) and microarchitecture measured at the tibia and radius by HRpQCT. Spearman correlations were performed to relate PMI and bone imaging parameters.

RESULTS:

A total of 88 patients were included in the study. The mean age was 63 years, 47 (53%) patients were female, and the average BMI was 28.3 kg/m^2.

Larger PMI was significantly associated with higher proximal 1/3 radius aBMD by DXA ($r=0.44$, $p<0.001$). Additionally, PMI was significantly associated numerous metrics measured by HRpQCT. Significant positive correlations were found between PMI and tibia vBMD, tibia trabecular bone volume fraction, tibia trabecular separation, radius vBMD, radius total area, and radius trabecular bone volume fraction. PMI was negatively correlated with tibia inhomogeneity, radius trabecular separation, and radius inhomogeneity (Table 1).

DISCUSSION AND CONCLUSION:

In a cohort of patients presenting for lumbar spine fusion, PMI was associated with higher areal and volumetric BMD and better microarchitecture. Our results demonstrate a link between muscle and bone health among patients undergoing posterior spinal fusion. These novel findings highlight the link between muscle and bone health, two factors that may be important to surgical success. Assessment of muscle parameters, such as psoas CSA, may have a potential role in preoperative screening of patients for musculoskeletal deficits.

Table 1. Correlation between psoas muscle index and HRpQCT metrics

Variable	Correlation to Psoas Muscle Index (CSA/height^2)	*p*-value
Tibia total volumetric BMD	0.48	<0.00001
Tibia total area	0.11	0.293
Tibia trabecular bone volume fraction	0.40	0.000101
Tibia trabecular separation	0.27	0.011
Tibia inhomogeneity	-0.33	0.002039
Radius total volumetric BMD	0.40	0.000097
Radius total area	0.30	0.004418
Radius trabecular bone volume fraction	0.41	0.000078
Radius trabecular separation	0.35	0.000723
Radius inhomogeneity	-0.31	0.002986