Sarcopenia Muscle Mass Score as a Predictor of Increased Hospital Costs and Postoperative Risk in Proximal Femur Fracture Patients

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INTRODUCTION: Proximal femur fractures commonly occur in patients with sarcopenia and frailty, conditions that significantly increase the risk of postoperative complications, prolonged hospital stay, and mortality. Sarcopenia, defined by reduced skeletal muscle mass and function, is challenging to assess in acute trauma settings where strength and mobility evaluations are often unreliable. Despite its prognostic value, sarcopenia remains underutilized in orthopaedic risk prediction models. This study aims to evaluate whether imaging-based sarcopenia muscle mass measures can predict postoperative complications and hospital cost burden following proximal femur fracture surgery.

METHODS:

Data relating to hip fracture patients presenting to a tertiary hospital were accessed and existing CT scans carried out within a year of presentation allowed image-based measures of sarcopenia. Four sarcopenia muscle measurements were evaluated: (i) psoas major cross sectional area (CSA), (ii) psoas muscle index (PMI), (iii) psoas muscle:L3 ratio (PML3), (iv) psoas:body surface area (PBSA) (Figure 1).

Patient demographics including sex, age and associated comorbidities were collected. Post-operative outcomes including mortality rates, postoperative hospital acquired infections, surgical site infection rates, length of hospital stay and the need to transfuse was collected. The severity of complications was graded as per Clavien-Dindo classification.

Sex-disaggregated predictive models based solely on sarcopenia muscle measures were developed to identify patients at high risk of postoperative complications. Optimal thresholds were determined to stratify patients into high- and low-risk groups. Hospital stay costs were then calculated and compared between these risk groups to evaluate the financial burden associated with sarcopenia.
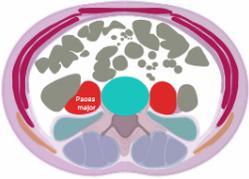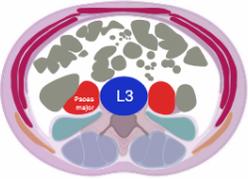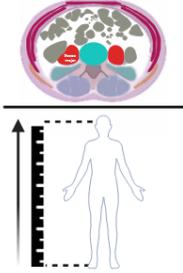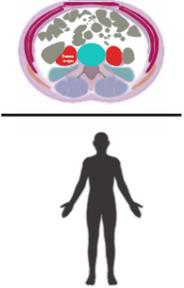
RESULTS:

A total of 301 patients (mean age 75; 61% female) were included. The 30-day survival rate was 91%, and 35% experienced postoperative complications. Among the sarcopenia indices, the Psoas Muscle Index (PMI) demonstrated the highest predictive accuracy and sensitivity for complications in both sexes. The optimal PMI thresholds associated with increased postoperative risk were 5.1 cm²/m for females and 6.8 cm²/m for males. In females, each 1-unit increase in PMI was associated with a 55% reduction in the odds of complications (OR = 0.45; 95% CI, 0.33–0.57; p = 1.3×10^{-8}). In males, a 1-unit increase in PMI was linked to a 78.5% reduction in odds (OR = 0.21; 95% CI, 0.05–0.43; p = 0.0013).

Hospital cost analysis revealed that patients with low muscle mass had a significantly higher mean hospital stay cost (26,701.63 PLN) compared to those with high muscle mass (14,992.25 PLN), representing a 78.1% increase in hospital costs for the sarcopenia high-risk group.

DISCUSSION AND CONCLUSION:

This study demonstrates that the Psoas Muscle Index (PMI) is a reliable, sex-specific predictor of postoperative complications following proximal femur fracture surgery. Thresholds of <6.8 cm²/m for males and <5.2 cm²/m for females identified patients at highest risk. The PMI-based model offers a simple, effective tool for preoperative risk stratification and can support clinical decision-making in orthopaedic and geriatric care.

In addition to clinical risk, low PMI scores were associated with a 78.1% increase in hospital stay costs, underscoring the economic impact of sarcopenia. Routine use of PMI may enable early identification of vulnerable patients, guiding resource allocation and tailored perioperative interventions to improve both outcomes and cost-efficiency.

CSA (Cross-sectional area)	PML3 (Psoas major at L3)	PMI (Psoas muscle index)	PBSA (Psoas body surface area)
 ■ Psoas major cross-sectional area (cm²)	 ■ Psoas major cross-sectional area (cm²) ■ L3 vertebral body cross-sectional area	 $$PMI = \frac{Psoas\ CSA\ (cm^2)}{Height\ (m)}$$	 $$PBSA = \frac{Psoas\ CSA\ (cm^2)}{Body\ Surface\ Area^2\ (m^2)}$$