Establishing Baseline Body Composition in Elective Spine Surgery with Bioimpedance Analysis

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INTRODUCTION:
The prevalence of degenerative spinal disease continues to increase in the US population, creating an expanding number of patients that may benefit from surgical intervention. While body mass index (BMI) is commonly utilized to assess perioperative risk in this patient group, it offers an incomplete perspective on body composition and overall health status. Sarcopenia, defined as decreased skeletal muscle mass or function, is an independent predictor of perioperative complications. In conjunction with elevated BMI, this is termed 'sarcopenic obesity'. The purpose of this study is to establish the prevalence of sarcopenia and sarcopenic obesity among patients indicated for elective spine surgery at a single academic institution using bioimpedance analysis (BIA), which utilizes electrical impulses to assess several body composition variables.

METHODS:
A total of 82 patients (50 males, 42 females) were enrolled in this study and indicated for the following procedures: thoracolumbar fusion <3 levels, thoracolumbar fusion > or = 3 levels, and ACDF. Patients underwent bioimpedance analysis (BIA) scans at the preoperative visit, which collects body composition variables including weight, BMI, extracellular water to total body water (ECW/TBW) ratio, and appendicular skeletal muscle index (ASMI). Sarcopenia is defined as ASMI <8.5 kg/m2 for men and 6.3 kg/m2 for women. Normal ECW/TBW ratio is 0.260 to 0.390.

RESULTS SECTION:
Study participants averaged 62.29 years old with a BMI of 31.72 and aSMI of 8.14 kg/m². Among 82 patients, 42 were males (51%) and 50 were females (61%). 22.0% of patients fulfilled the criteria for sarcopenia, while 3.6% met the criteria for sarcopenic obesity. 17 patients (20.73%) had normal muscle mass and normal BMI. Males exhibited a higher prevalence of sarcopenia, with 87% of sarcopenic/non-obese patients and 67% of the sarcopenic/obese group being male (Figure 1). The majority of patients with normal body composition (normal BMI and aSMI) were female (77%). Regarding skeletal muscle index (SMI), non-obese patients (n=30) had an average SMI of 7.43, while obese patients (n=50) had an average SMI of 8.59 (p < 0.0001). The average age of non-sarcopenic patients was 61.0 years, while the average age of sarcopenic patients was 66.8 years (p=0.10). The average ECW/TBW for both males and females, including body and trunk, was 0.39 at the preoperative stage. Analysis of 7 patients at their initial postoperative demonstrated reduced weight (-0.39%, p=0.52) decreased skeletal muscle mass (-1.6%, p=0.05) among males, whereas females did not experience a reduction in weight or skeletal muscle mass.

DISCUSSION: Sarcopenia is prevalent among preoperative spine surgery patients at our institution, particularly among male patients of lower BMI. Prevalence of sarcopenia appears to increase with age, and although less commonly seen in the obese cohort, BMI >30 does not preclude concurrent sarcopenia. Although further data collection is needed to correlate trends in body composition with surgical and patient reported outcomes, this preliminary data identifies patients that might benefit from increased surveillance, exercise programs, and targeted nutritional intervention in the preoperative period.

SIGNIFICANCE/CLINICAL RELEVANCE: There is no gold standard assessment for sarcopenia but bioimpedance analysis provides an efficient, detailed, and cost-effective method to establish and monitor body composition. Further research and standardization of BIA testing could help identify patients at increased surgical risk in the perioperative period.
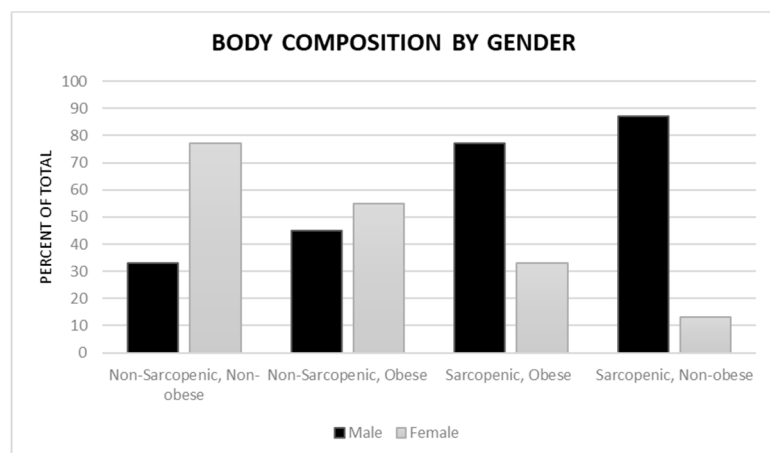

Figure 1. Categorization of BIA body composition parameters by gender