

Significant Loss of Skeletal Muscle Mass Occurs after High-Energy Polytrauma in Young Adults

John Davison, Aspen Miller¹, Natalie Ann Glass, Jason M Wilken², Lisa Reider, Ruth E Grossmann, Tessa Kirkpatrick³, Cindy Lynn Headlee, Daniel C Fitzpatrick, Erin C Owen⁴, J Lawrence Marsh⁵, Michael C Willey⁶

¹University of Iowa Hospitals and Clinics, ²University of Iowa, ³Slocum Research and Education Foundation, ⁴Slocum Research & Education Foundation, ⁵Dept Of Orthopaedics, ⁶University Of Iowa Hospitals

INTRODUCTION: Significant loss of skeletal muscle mass occurs early after high-energy polytrauma leading to prolonged functional limitations. Factors that drive muscle loss are physical inactivity and nutrition deficiencies. As we investigate rehabilitative and nutrition interventions to reduce loss of muscle mass, we need to quantify changes in muscle mass after these devastating injuries. The aim of this study was to characterize baseline nutrition status and changes in muscle mass after high-energy polytrauma in a young adult population.

METHODS: A prospective observational study at a Level 1 trauma center enrolled individuals aged 18-55 years indicated for operative fixation of either an open long bone/pelvic fracture or 2+ long bone/pelvic fractures due to a high-energy mechanism. Baseline assessment of body composition (Lean Body Mass [LBM], Skeletal Muscle Mass [SMM], Body Fat Percent [BFP]), was measured within 72 hours of admission using multifrequency bioelectrical impedance analysis (BIA) and repeated 6 weeks after injury. Results are reported as median (IQR). Sarcopenia was defined by gender-specific cut-offs for the appendicular skeletal mass index (ASMI), <6.3 ASMI for females and <8.5 ASMI for males. Baseline nutrition status was evaluated using food frequency questionnaires. Inadequate protein intake was evaluated using the Estimated Average Requirement (EAR) cut-point method, while inadequate caloric intake was defined as intake below basal metabolic rate. Change in body composition from baseline to 6 weeks was evaluated using Wilcoxon Signed Rank tests. Change in body composition in those with versus without inadequate protein/caloric intake was compared using Wilcoxon Rank Sum test.

RESULTS: Sixteen subjects (14 male) age 38.4±9.6 years were enrolled. The prevalence of inadequate protein and caloric intake was 3/16 and 5/16, respectively. Six weeks after injury participants experienced significant losses in LBM (-4.5kg (-8.8 to -1.4), p=0.019) and SMM (-3.1kg (-5.6 to -0.3), p=0.043), as well as significant increases in BFP (6.7% (2.3 to 9.3), p=0.044). The injured extremity had significantly greater loss of lean mass compared to the uninjured extremity (-4.0 (-17.1-3.5), p=0.0495). Five (31%) participants were baseline sarcopenic, and one additional participant met the criteria for sarcopenia by 6 weeks. Baseline protein and calorie deficiency were not significantly associated with muscle loss.

DISCUSSION AND CONCLUSION: This study of young adults documented devastating loss of lean body mass and skeletal muscle mass six weeks after high-energy polytrauma. These losses are likely a combination of immobilization and catabolic response for wound and fracture healing. This study also found baseline protein and calorie deficits in 19% and 31% of subjects, respectively. Understanding baseline nutrition status and loss of muscle mass after injury are important to design impactful rehabilitative and nutrition interventions in this complicated patient population.