

Impact of Obesity on Inflammatory Markers in Patients With Aseptic Nonunions

Anthony Paterno, MD; *Bradley J. Lauck, BA; Yu Min Suh, MD; Susan M. Odum, PhD; Joseph R. Hsu, MD; Rachel Seymour, PhD; Roman M. Natoli, MD, PhD; Paul E. Matuszewski, MD; William T. Obremskey, MD; Sharon N. Babcock, MD; Robert D. Zura, MD; Hassan R. Mir, MD, MBA, FIOTA; Malcolm R. DeBaun, MD; Lisa K. Cannada, MD; John D. Adams, MD; Anna N. Miller, MD, FIOTA; Michael J. Gardner, MD; Kristoff R. Reid, MD; Andrew Chen, MD; and EMIT*

Purpose: C-reactive protein (CRP), erythrocyte sedimentation rate (ESR), and white blood cell count (WBC) are inflammatory markers routinely used to help diagnose septic nonunions. Evidence suggests these inflammatory markers can be elevated in healthy patients with high body mass index (BMI) levels, decreasing their diagnostic utility and validity. The purpose of this study is to determine the association between BMI and inflammatory markers (CRP, ESR, and WBC) in patients with an aseptic nonunion.

Methods: A retrospective series of 1242 nonunions from 13 Level I trauma centers was performed. Basic demographic data, as well as CRP, ESR, and WBC, were queried. We confirmed that inflammatory markers were elevated in septic nonunions. Then, the n = 1031 aseptic nonunions were stratified by 4 BMI categories (normal: BMI<25; overweight: BMI 25-29.99; obese: BMI 30-39.99; morbidly obese: BMI>40). A Kruskal-Wallis test was performed to compare the inflammatory markers between BMI categories. Wilcoxon tests with adjusted P value compared all possible comparisons. Complications (persistent nonunion, deep vein thrombosis, hardware failure, and reoperation) were compared among BMI categories with a χ^2 test.

Results: With the aseptic nonunions median CRP values differed between BMI categories (normal 0.5 [0.5, 0.9]; overweight 0.5 [0.5, 0.7]; obese 0.5 [0.5, 1.0]; morbidly obese 0.82 [0.5, 1.6]; $P<0.0001$). Median ESR values also differed among BMI groups (normal 10 [4, 22]; overweight 11 [5, 20]; obese 16 [10, 29.5], and morbidly obese 26 [11.5, 41]; $P<0.0001$). Pairwise comparisons to normal weight patients indicate that morbidly obese patients had significantly higher CRP and ESR values ($P<0.0002$ and $P<0.0001$). There were no significant differences in WBC levels or prevalence of complications.

Conclusion: Baseline CRP and ESR were elevated in aseptic nonunion patients with high BMIs. This suggests that the higher a patient's BMI, the typical inflammatory biomarkers may not be as reliable in trying to differentiate between a septic or an aseptic nonunion.