Base Deficit >6 Within 24 Hours of Injury Is a Risk Factor for Lower Extremity Fracture Nonunion in the Adult Polytraumatized Patient

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Purpose: Hemorrhagic shock causes nonunions in animal fracture models, but there have been no clinical studies performed evaluating the effect of hemorrhagic shock on fracture nonunion. We hypothesized that there is a higher incidence of lower extremity nonunion in polytraumatized patients that experienced hemorrhagic shock, as measured by base deficit (BD), compared to patients who did not.

Methods: Patients aged >16 years with ISS >16 who presented to an academic Level-I trauma center with an operative femur or tibia fracture from 2013 to 2018 were retrospectively reviewed. Clinical notes and radiographs were assessed to determine fracture union versus nonunion. Patient demographics, injury characteristics, initial BD, worst BD, and number of packed red blood cell transfusions over 24 hours were recorded. Bivariate and multivariate models, including multiple risk factors known to be associated with nonunion, were conducted to investigate the association of BD with nonunion.

Results: 647 patients were screened and 279 patients were eligible. The union group had 243 fractures, and there were 36 fractures in the nonunion group. The following predictors were associated with nonunion: smoking ($P = 0.009$), alcohol use ($P < 0.001$), open fracture ($P < 0.001$), and treatment for deep infection at fracture site ($P < 0.016$). Additionally, worst BD over 24 hours >6 ($P = 0.031$) was significant for nonunion development. A multivariate logistic regression analysis was then conducted. Worst BD >6 over 24 hours remained significantly associated with the development of nonunion (odds ratio 3.02, $P = 0.011$) when adjusting for other risk factors.

Conclusion: A BD >6 within 24 hours of admission was associated with a significantly increased risk of developing lower extremity fracture nonunion in polytrauma patients, independent of multiple other significant risk factors. This implies temporary local musculoskeletal tissue hypoperfusion may have an effect on long-term outcomes, such as impaired fracture healing.