

Sleep Disturbance Following Orthopaedic Trauma: Does it Predict Future Physical Functioning?

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Purpose: Following trauma, patients experience a variety of psychologic and somatic symptoms, as well as poor long-term functional outcomes. While sleep disturbances appear to play a role in several trauma-related conditions, including posttraumatic stress disorder and traumatic brain injury, little is known about the association of sleep with functional outcomes after orthopaedic trauma. The goal of this analysis is to describe the extent and severity of sleep disturbances 3 and 6 months following orthopaedic injury and document the relationship between sleep disturbance at 3 months and subsequent physical function measured at 6 months.

Methods: A total of 486 orthopaedic trauma patients treated at academic trauma centers were interviewed at 3 months following an orthopaedic injury (including open and closed tibia, calcaneus, pilon, ankle and foot fractures, and below-knee amputees). Of these patients, at the time of this submission 308 had also been followed up at 6 months posttrauma. The National Institutes of Health Patient Reported Outcomes Measurement Information System (PROMIS) framework is designed to improve measurement of patient-reported outcomes with greater quality and precision while reducing respondent burden using Computer Adaptive Testing (CAT) techniques. PROMIS instrument scores are normalized to the general US population. Domains are scored on a 0 to 100 scale, standardized to a mean of 50 and a standard deviation of 10. Participants were assessed using the PROMIS sleep disturbance (Sleep) and physical function (PF) domains at both 3 and 6 months. In the PROMIS PF scale, lower numbers indicate greater physical function limitations, while in the PROMIS Sleep scale, higher numbers indicate greater sleep disturbance. A multiple variable linear regression analysis was conducted to estimate the relationship between Sleep at 3 months and PF at 6 months, as we would expect sleep disturbances to be manifest in an extended period of diminished function. Covariates included PF at 3 months, patient demographics (age, sex, race, and education) and injury characteristics (polytrauma, head AIS [Abbreviated Injury Scale] >2, and Gustilo III open fractures (vs lower-severity injuries).

Results: The mean Sleep score for this group was 56.2 (SD 7.7) at 3 months and 55.2 (SD

7.0) at 6 months. The mean PF score for this group was 31.7 (SD 7.5) at 3 months and 36.2 (SD 7.9) at 6 months, indicating significant physical function limitations in this population. Thus, the mean Sleep scores were far closer to population means than the PF scores. Among 85 participants (18% of the sample) who had 3-month Sleep scores more than 1 SD above population norms, mean 6-month PF scores were 32.8 (SD 6.0), compared to 37.1 (SD 8.1) among the 386 participants with 3-month Sleep scores within 1 SD of population norms (Student's *t* test *P* value <0.001). After adjustment for demographics, severity, and PF at 3 months, a one-point increase in Sleep at 3 months was associated with a 0.11 point decrease in PF at 6 months (95% CI: -0.207, -0.004; *P* = 0.043).

Conclusion: Despite a well-documented elevated prevalence of sleep disturbances in numerous other trauma populations, the prevalence in this broad orthopaedic trauma population was only moderately higher than population norms. However, there was a significant relationship between 3-month sleep disturbance and poorer 6-month physical function, suggesting that, as has been seen in other patient populations, poor sleep is associated with worse outcomes for orthopaedic trauma patients. The magnitude of the observed effect was modest, and it is unclear if it was clinically as well as statistically significant in this longitudinal dataset. While these data do not provide definitive evidence for sleep as a major driver of outcomes, it supports the need for further research to determine if interventions to improve sleep could improve the health of this population.