5 Year Fracture Risk in Astronauts Upon Return from Space Flight

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Purpose: Exposure to space flight and microgravity environments has been implicated in causing large reductions in bone mineral density (BMD) in astronauts. Additional evidence suggests that although BMD recovers upon return from space flight, bone health may not return to preflight levels. Although low BMD is a known risk factor for fracture, there have been no reported cases of intra-flight fracture, and very little documentation of post–space-flight fracture. With NASA plans for longer distance and duration missions such as missions to the moon and Mars, fracture upon return to gravitational environment has potential to pose significant risk to astronaut health and endanger mission success. As a result, the present study sought to review incidence of fracture within 5 years of return from space flight.

Methods: Using the Lifetime Surveillance of Astronaut Health epidemiology database at NASA, a retrospective cohort study was conducted to identify incidence of fracture in the 5-year post–space-flight period. All astronauts who participated in space flight with 5-year post-flight medical data were included for review. Patient demographics were compared between the fracture and nonfracture cohorts.

Results: In total, 242 astronauts met the inclusion criteria for review. Of the 242 astronauts, seven (2.9%) sustained fractures in the 5 years post–space flight; three of the post–space-flight fractures occurred in the hip or spine and six fractures occurred within 2 years of return from space flight. Space flight length, age, and time from space flight were not statistically significantly associated with increased risk for fracture.

Conclusion: Fracture upon return to gravitational environment is a serious risk for astronauts that has the potential to significantly jeopardize astronaut health and mission success. Fractures of the hip and spine specifically are associated with decreased BMD. Although incidence of these fractures is roughly 1%, the substantial negative implications including high 1-month and 1-year mortality rates and functional implications emphasize the need to optimize bone health and fracture treatment protocols.