POSTER 82

Radiation Exposure and Estimation of Lifetime Malignancy Risk in US Military Personnel

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Abstract

Background: Complex polytrauma patients often receive substantive exposure to diagnostic medical radiation due to serial imaging studies for injury diagnosis and management. This cumulative radiation exposure may increase the risk of subsequent malignancy. This is particularly true for battlefield injured who receive care at a variety of facilities worldwide. There remains no coordinated effort to track the amount of radiation exposure each patient receives, nor any current surveillance program to follow such patients long-term, since it is currently unknown whether any individual patient's cumulative diagnostic radiation increases the risk of carcinogenesis.

Questions/Purposes: (1) The purpose of this study was to (1) quantify and evaluate the amount of exposure for combat wounded patients, (2) compare those exposures with a population of active duty civilian trauma patients, and (3) determine whether the cumulative dose of radiation correlates to injury severity score (ISS).

Patients and Methods: After IRB approval, we performed a retrospective study of combat wounded services members treated at Walter Reed National Military Medical Center from FY2005-2018 using the Department of Defense Joint Trauma Registry (DODTR). We calculated cumulative diagnostic radiation dose exposure one year post-traumatic injury in combat and civilian trauma. We performed analysis of variance (ANOVA) in four data subsets (battle combat trauma, non-battle civilian trauma, high ISS, and high radiation exposure) independently. To compare whether total number of imaging studies, radiation exposure, and ISS value differed among battle and non-battle patients, we performed a pairwise t-test.

Results: Our study included 3708 consecutive combat and civilian trauma patients, with a mean age at the time of injury of 25.80 (SD 6.21) and a mean ISS of 18.28 (SD 12.04) for analysis. The most common combat trauma mechanisms of injury were blast (2415 patients, 65%) followed by high-velocity gunshot wounds (815 patients, 22%). The mean total radiation dose received was 32.84 mSv and the median dose was 15.52 mSv. In the first year after trauma, 1626 patients (44%) were exposed to high levels of radiation that were greater than 20 mSv and 840 patients (23%) were exposed to very high levels of radiation that were greater than 50 mSv. We found that combat injuries had a higher ISS compared to civilian injuries (t-test: $t = 7.17$, $df = 900.13$, $p < 0.0001$). This difference in the ISS also led to a difference in total number of imaging studies so that combat injured patients had, on average, eight more imaging studies compared to civilian injuries (t-test: $t = 8.12$, $df = 1010.4$, $p < 0.0001$). The additional eight imaging studies also led to combat injury patients being exposed to more radiation by, on average, 3.63 mSv (t-test: $t = 3.35$, $df = 913.50$, $p = 0.0008$).

Conclusions: We characterized the diagnostic radiation exposure in military health care beneficiaries who sustained combat and civilian trauma. We found that nearly half of patients were subjected to high levels and nearly a quarter received very high levels of diagnostic radiation exposure, potentially increasing relative risk of fatal cancer. These data should be used during clinical decision making, patient counseling at military treatment facilities, and provide guidance to the Defense Health Agency (DHA). These recommendations will help determine whether benefits of further imaging outweigh carcinogenesis risk to implement practical measures to reduce or minimize radiation exposure.

Level of Evidence II