

Cumulative Radiation Exposure in Orthopaedic Trauma Patients: How Much is too Much?

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Purpose: Utilization of medical imaging continues to rise, with an almost 2000% increase over the past several decades in the number of CT scans performed. Although orthopaedic patients are known to have significant radiation exposure around the time of their injuries, the current levels of exposure are unknown. The purpose of this study was to estimate the amount of radiation exposure from imaging studies among orthopaedic patients presenting to the emergency department (ED) at an academic, tertiary care, Level I trauma center.

Methods: An institutional database was used to identify patients who presented to the ED from 2015 to 2023 with an orthopaedic injury. Records were reviewed to assess exposures to radiation (excluding fluoroscopy) in the 12 months following injury. The type and frequency of each study, the radiation dose of each study (mSv), and the cumulative dose of radiation (mSv) per patient was calculated.

Results: In total, 4203 patients were included, and 53,592 imaging studies were performed. The average age was 58 years (median: 60, [IQR 39–75]) and the number of radiologic studies per patient was 13 (median: 8, [IQR 4–16]). The most common study was chest radiograph (11,400), followed by CT scan of the abdomen and pelvis (2126), and pelvis radiograph (1702). The average total effective dose of radiation per patient was 12.052 mSv (median: 1.607, [IQR 0.010–13.44]), which is classified as moderate per the International Commission on Radiological Protection (ICRP, 2007) guidelines and is associated with increased cancer risk. Fifty-nine patients had >100 mSv of radiation associated with their ED visit, which is classified as high-dose and is associated with acute organ effects and a significant cancer risk. Of the patients who received high-dose radiation amounts (>100 mSv), the average number of studies was 65 (median: 49, [IQR 29–88.5]).

Conclusion: Orthopaedic patients presenting to the ED at an academic Level I trauma center are exposed to high levels of radiation during their evaluation and treatment. Orthopaedic surgeons should be mindful of the potential associated risks and be judicious in obtaining diagnostic studies. Additional research is underway to model the risk of development of fatal cancer based on this exposure.