

Prospective Quantification of Annual Radiation Exposure in Orthopaedic Residents

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Purpose: Radiation exposure in the general Canadian population averages 1.8 mSv per year; however, the comparative level of radiation received during orthopaedic residency training is unknown. Despite radiation protection measures, there is increasing evidence of radiation-related diseases in orthopaedic surgeons. The purpose of this study was to measure radiation exposure throughout orthopaedic residency training and determine the variability of radiation exposure in different postgraduate years (PGYs) of training.

Methods: Monthly radiation exposure was measured prospectively over a 12-month period in a single orthopaedic training program. Participants wore dosimeters both above (“head”) and underneath (“chest”) protective lead. Compliance was self-reported as dosimeter wear for greater than 80% of days spent in the operating room (OR). The primary outcome measure was the absolute value of the difference between head and chest radiation exposure in mSv. Radiation exposure and days in the OR were correlated using linear regression analysis. Multiple regression analysis was used to correlate exposure with age, gender, year of training, dosimeter compliance, and use of personalized protective equipment.

Results: 21 residents participated; however, 3 residents were removed from data analysis secondary to noncompliance with dosimeter wear, leaving 18 residents’ data available for analysis. Orthopaedic residents participating in this study received mean yearly radiation measures of 3.3 ± 0.6 mSv with a mean number of 107 ± 38 days spent in the OR. Mean exposure per day spent in the OR averaged 0.033 ± 0.008 mSv per day. There was a significant difference in mean yearly radiation exposure by year of training (PGY1, 2.95 ± 0.72 mSv; PGY2, 3.70 ± 0.28 mSv; PGY3, 4.03 ± 0.48 mSv; PGY4, 3.35 ± 0.17 mSv; PGY-5, 2.73 ± 0.51 mSv). Residents in their PGY5 year had the highest mean exposure per OR day (0.044 ± 0.009 mSv/day). Mean number of OR days was the highest in PGY3 ($116 \text{ days} \pm 16 \text{ days}$).

Conclusion: Orthopedic residents’ occupational exposure to radiation alone is nearly double the annual amount, as compared to the general population’s natural exposure. PGY5 residents had the highest mean radiation exposure per OR day, which may reflect transition of senior residents to a primary surgeon position during operative cases. Residents in their PGY2 and PGY3 years were exposed to significantly higher cumulative amounts of radiation compared to other residency years. Given that the highest overall radiation exposure was found during the junior years of residency, a clear opportunity exists to provide residents with knowledge about radiation safety and clinical practices early in their training.