

The Pseudo-Pelger Huët Cell as a Retrospective Dosimeter: Analysis of a Radium Dial Painter Cohort

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Recently, the pseudo-Pelger Huët anomaly in peripheral blood neutrophils has been described as a new radiation-induced, stable biomarker. In this study, pseudo-Pelger Huët anomaly was examined in peripheral blood slides from a cohort of 166 former radium dial painters and ancillary personnel in the radium dial industry, 35 of whom had a marrow dose of zero above background. Members of the radium dial painter cohort ingested ²²⁶Ra and ²²⁸Ra at an early age (average age 20.6 ± 5.4 y; range 13–40 y) during the years 1914–1955. Exposure duration ranged from 1–1,820 wk with marrow dose 1.5–6,750 mGy. Pseudo-Pelger Huët anomaly expressed as a percentage of total neutrophils in this cohort rises in a sigmoidal fashion over five decades of red marrow dose. Six subjects in this cohort eventually developed malignancies: five osteosarcomas and one mastoid cell neoplasm. The pseudo-Pelger Huët anomaly percentage in these cases of neoplasm increases with marrow dose and is best fit with a sigmoid function, suggestive of a threshold effect. No sarcomas are seen for a marrow dose under 2 Gy. These results indicate that pseudo-Pelger Huët anomaly in peripheral blood is a reasonable surrogate for the estimation of alpha dose to bone marrow in historic radiation cases. Hypotheses are discussed to explain late (months to years), early (hours to days), and intermediate (weeks to months) effects of ionizing radiation, respectively, on the expression of genes encoding inner nuclear membrane proteins and their receptors, on the structure and function of nuclear membrane proteins and lipids, and on cytokinesis through chromatin bridge formation.

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