

Analysis of the Dose-rate Effect of Radiation on Chromosome Aberrations at Intermediate Dose-rates

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Abstract

In our previous study, we analyzed the frequencies of chromosome aberrations (translocations and dicentric chromosomes) in splenocytes of mice exposed to high dose-rate (HDR, 890 mGy/min) or to low dose-rate (LDR, 20 and 1 mGy/day) gamma-rays. Our results showed a large disparity between the effect of HDR radiation and that of LDR. In the present study, we have examined the dose and dose-rate dependency of the frequency of chromosome aberrations in the intermediate dose-rate range (135 – 0.3 mGy/min) between HDR and LDR to determine the boundary region where the dose-rate effect appears. We estimated the frequency of the chromosome aberrations in mice exposed to total accumulated doses from 0 to 1000 mGy at two dose-rates (33.3 and 1.5 mGy/min) in the previous year, and at other four dose-rates [135, 8 and 0.3 mGy/min (436 mGy/24 h/day and 400 mGy/22 h/day)] this year. The dose-response relationships at the dose rates of 135, 33.3 and 8 mGy/min seem to be described by linear-quadratic functions, while the relationships at the dose-rates of 1.5 and 0.3 mGy/min seem to be almost linear. The results are consistent with a gradual change between an HDR-type response and an LDR-type response throughout the entire range of dose-rates we examined.

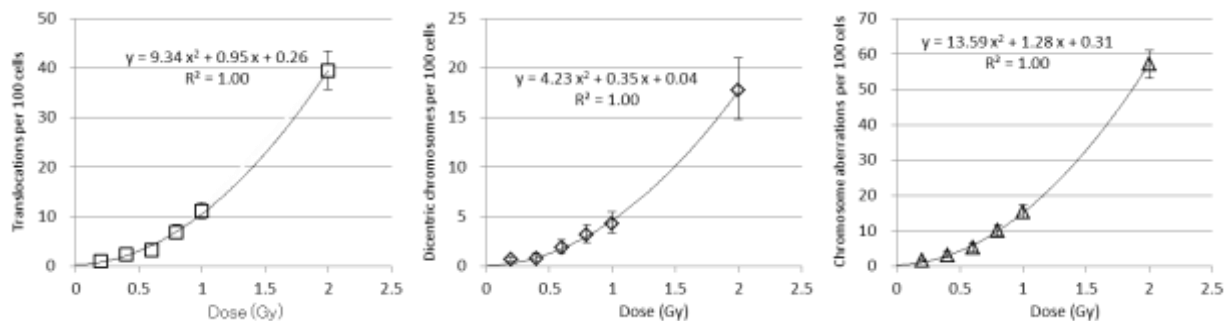


Fig. 1 Frequency of chromosome aberrations (translocations and dicentric chromosomes) in mice irradiated at the dose-rates of 135 mGy/min. Each point is the average of 3 mice.

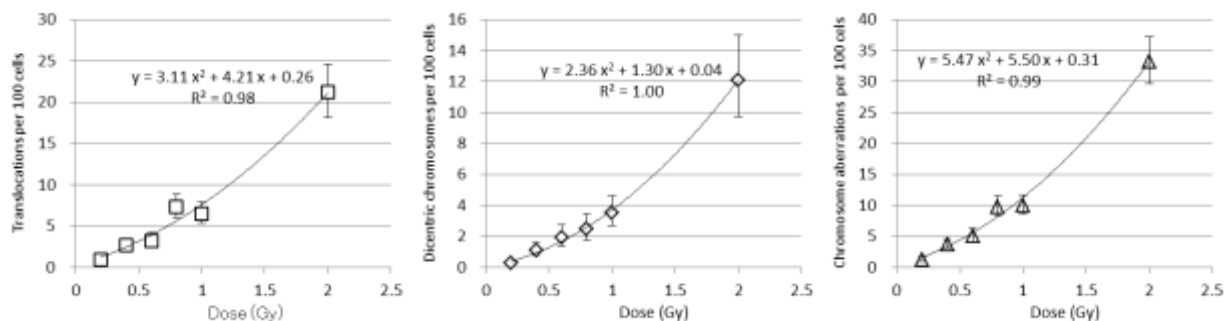


Fig. 2 Frequency of chromosome aberrations (translocations and dicentric chromosomes) in mice irradiated at the dose-rates of 8 mGy/min. Each point is the average of 3 mice.

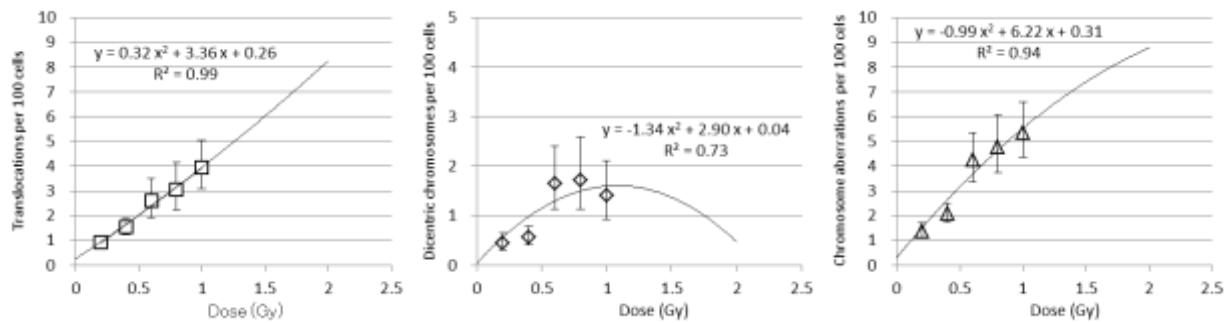


Fig. 3 Frequency of chromosome aberrations (translocations and dicentric chromosomes) in mice irradiated at the dose-rates of 0.3mGy/min (436 mGy/day). Each point is the average of 3 mice.

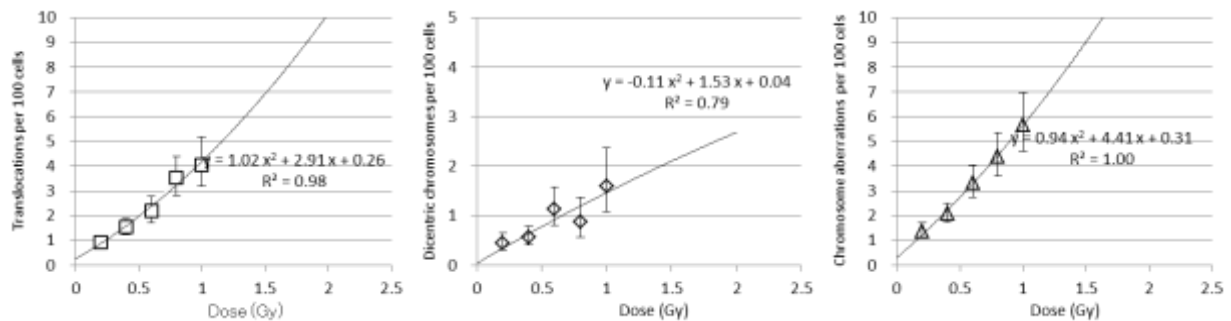


Fig. 4 Frequency of chromosome aberrations (translocations and dicentric chromosomes) in mice irradiated at the dose-rates of 0.3mGy/min (400 mGy/day). Each point is the average of 3 mice.

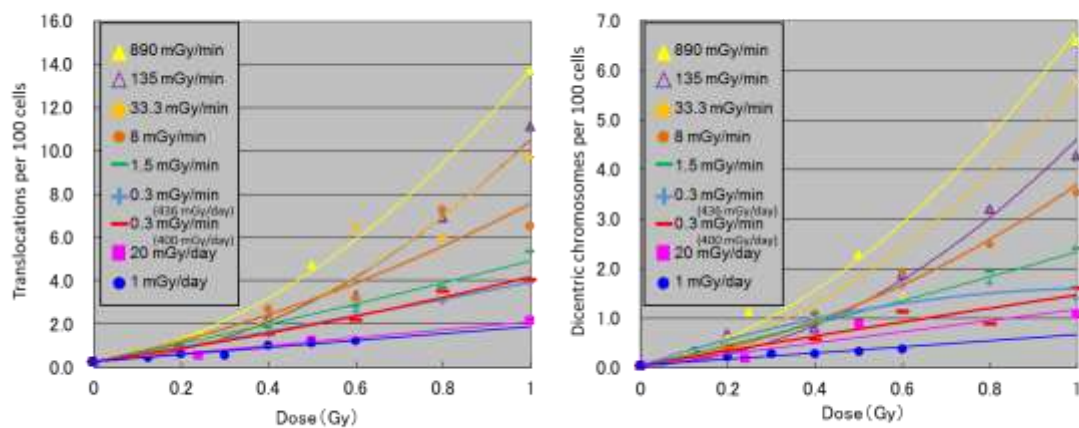


Fig. 5 Comparison of the dose-response relationships for chromosome aberrations (translocations and dicentric chromosomes) in mice irradiated at various dose-rates between HDR and LDR.