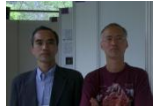


Statistical Evaluation of Subtle Effect of Continuous Low Dose Rate Gamma-Irradiation on Murine Inflammatory Reaction

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1. Introduction

Accumulation of data could increase the statistical power for low dose/low dose-rate radiation risk estimation. However, it is hard to take a large sample in the experiments with the complex biological reactions.

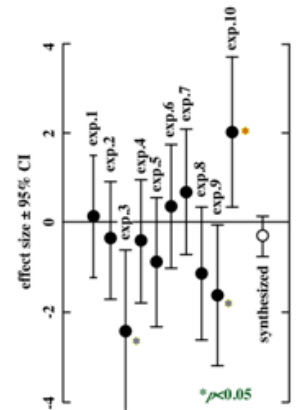
2. Objectives

Synthesizing data from identical experiments, and analyze effect of continuous low dose rate gamma-irradiation on murine immune system to detect the subtle effects that cannot be detected by usual experimental approach.

3. Methods

Splenic gene expression: Mice immunized with allogenic antigens were continuously irradiated with dose-rate between 0.003-0.2 mGy/h during the experiment for 17 days, and expression profile for 30 genes in spleen were quantified by real time PCR. Results obtained from 10 independent experiments were statistically synthesized through meta-analysis.

Foot pad swelling test: ICR female mice (10 mice/group x 5 experiments) were continuously irradiated for 21 days before foot pad swelling test. Con A (5mg/ml, 20 ml) were injected sc on right foot pad and increase in foot pad thickness compared to left foot pad was followed. Results were synthesized through meta-analysis.



Meta-Analysis

4. Results

Figure 1. Gene Expression Profile of Mice Exposed to Low Dose-Rate γ -rays Continuously.

B6 mice were continuously exposed to low dose-rate γ -rays for 17 days. Immunization were done with P815 (2×10^7 cells, ip) or Balb/c skin 7 days after the initiation of irradiation. Mean and SD are shown.

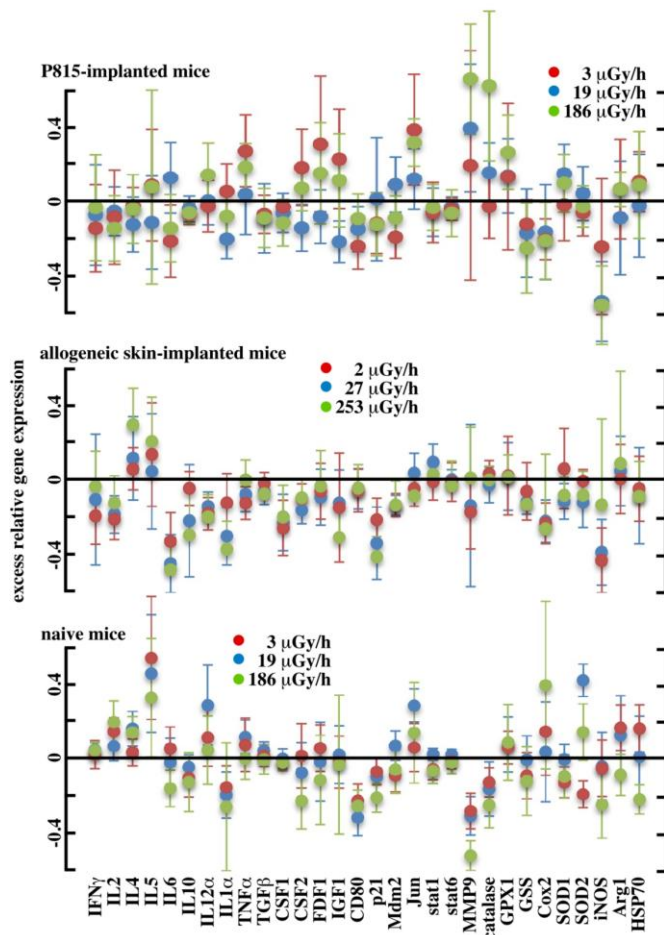


Table 1. Meta-Analysis of Effect of Continuous Low Dose Rate Irradiation on Inflammatory Reaction in Foot Pad Swelling Test

time (h)	2.2 μ Gy/h (1.1 mGy)		20 μ Gy/h (10.1 mGy)		244 μ Gy/h (123.0 mGy)	
	% \pm 95% CI	p	% \pm 95% CI	p	% \pm 95% CI	p
4	-2.40 \pm 0.80	0.592	4.00 \pm 7.73	0.399	7.47 \pm 19.47	0.073
24	-5.48 \pm 11.36	0.338	-4.26 \pm 17.65	0.635	-4.06 \pm 10.95	0.468
48	0.43 \pm 16.38	0.950	-9.48 \pm 16.81	0.278	-10.34 \pm 16.81	0.235
72	-21.58 \pm 17.99	0.019	-15.83 \pm 20.86	0.129	-25.18 \pm 19.42	0.011
body weight change	0.70 \pm 2.50	0.581	2.50 \pm 3.60	0.174	3.20 \pm 6.10	0.299

Statistically significant decrease compared to control group ($p < 0.05$)

1. Continuous irradiation with low dose rate γ -rays suppressed genes related to inflammatory responses (Figure 1).
2. Continuous irradiation with low dose rate γ -rays suppressed foot pad swelling evoked by inflammatory substance in vivo (Table 1)

5. Conclusion

1. Biological responses on continuous low dose/low dose-rate radiation have properties different from those on high dose/high dose-rate radiation.
2. Statistical strategy such as meta-analysis is necessary in the risk estimation for low dose/low dose-rate radiation even in experimental approach.