Transgenerational Effects in the Progeny of Mice Exposed to Acute High and Chronic Low Dose-rate Gamma-rays
– Germ Cell Mutation Analyses –

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Abstract

Transgenerational effects of low dose-rate (LDR) radiation have not been well studied. We have been estimating the incidence of copy number mutations in the progeny of male C57BL/6J mice continuously exposed to LDR (20 mGy/day, 1mGy/day, 0.05mGy/day) gamma-rays for 400 days (total respective doses: 8000 mGy, 400 mGy, 20 mGy) and to high dose-rate (HDR, 770 mGy/min) gamma-rays (total dose: 3000 mGy). This year, we analyzed 22 F1 mice from the parents in the HDR-irradiated group by use of oligo-microarray CGH to screen for copy number mutations, resulting in a total of 59 F1 mice being analyzed in this group. Using quantitative PCR, we tested all of the candidate mutations found in these 59 F1 mice to identify "real new mutations". The frequency of F1 mice containing mutations in this group was estimated to be 11.9%.

Table 1 Number of F1 mice with mutations screened by oligo-microarray CGH and confirmed by quantitative PCR

		No. of mice analyzed	No. of mice with mutation(s) Type L	Type S	Type L+S
770 mGy/min (3000 mGy)	male	31	3 (9.7 %)	2 (6.5 %)	5 (16.1 %)
	female	28	2 (7.1 %)	0 (0.0 %)	2 (7.1 %)
	Total	59	5 (8.5 %)	2 (3.4 %)	7 (11.9 %)
20 mGy/day (8000 mGy)	male	75	13 (17.3 %)	4 (5.3 %)	17 (22.7 %)*
	female	67	9 (13.4 %)	8 (11.9 %)	17 (25.4 %)*
	Total	142	22 (15.5 %)*	12 (8.5 %)	34 (23.9 %)**
Non-irradiated	male	75	4 (5.3 %)	2 (2.7 %)	6 (8.0 %)
	female	81	5 (6.2 %)	5 (6.2 %)	10 (12.3 %)
	Total	156	9 (5.8 %)	7 (4.5 %)	16 (10.3 %)

*P<0.05, **P<0.01

Table 2 Types of mutations (deletions and duplications; the number of mutations per mouse)

		770 mGy/min	P	20 mGy/day	P	Non-irradiated
No. of mice analyzed	male	31		75		75
	female	28		67		81
	Total	59		142		156
No. of mice with mutation(s)	male	5 (16.1 %)	0.37	17 (22.7 %)	0.01	6 (8.0 %)
	female	2 (7.1 %)	0.68	17 (25.4 %)	0.04	10 (12.4 %)
	Total	7 (11.9 %)	0.92	34 (23.9 %)	<0.01	16 (10.3 %)
with 4 or more mutations	male	1		3		1
	female	1		2		2
	total	2		5		3
with one or two mutation(s)	male	4		14		5
	female	1		15		8
	Total	5		29		13
with deletion(s)	male	4 (12.9 %)	0.81	14 (18.7 %)	0.01	4 (5.3 %)
	female	1 (3.6 %)	0.79	13 (19.4 %)	0.03	6 (7.4 %)
	Total	5 (8.5 %)	0.34	27 (19.0 %)	<0.01	10 (6.4 %)
with duplication(s)	male	0		0 (0.0 %)		1 (1.3 %)
	female	0		1 (1.5 %)		2 (2.5 %)
	Total	0		1 (0.7 %)		3 (1.9 %)