3 - 64 Effect of Carbon-ion Irradiation on Zebrafish Eye Development*

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Heavy ions have become potentially radiotherapeutic tools. However, studies of the effects on development of normal organs were limited. Using a zebrafish model, this study was designed to investigate the potential developmental toxicity in eyes exposed to carbon-ion irradiation. Zebrafish embryos at 12 h post-fertilization (hpf) were irradiated using $^{12}C^{6+}$ion beams at doses of 2, 4, and 8 Gy. The eye size was measurement at 144 hpf. The results suggested that irradiation at high doses may disrupt eye development of zebrafish embryos.

The mean diameter of whole eyes in the control group at 144 hpf was (318.14 ± 13.34) μm. Statistical analysis showed that the diameters of the whole eyes were significantly reduced compared to the other groups after an irradiation dose of 8 Gy (Tukey's test, $P < 0.05$), whereas the differences between the other pairwise groups were not significant. The mean diameter of the lens in the control group at 144 hpf was (118.24 ± 4.99) μm. The diameter of the lens was significantly reduced compared to the other groups after irradiation at a dose of 8 Gy (Tukey's test, $P < 0.05$), but the difference between the other pair wise groups was not significant (Fig. 1).

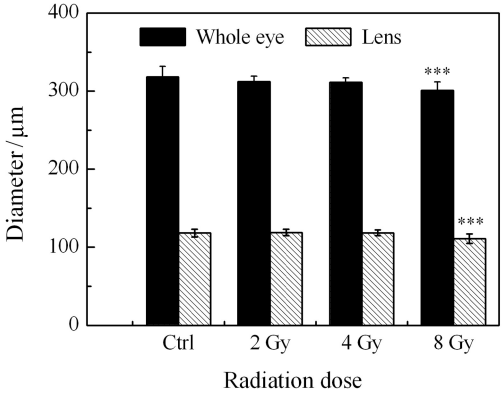

Fig. 1 (color online) $^{12}C^{6+}$ ion irradiation -induced changes in the diameters of whole eyes and lenses at 144 hpf. Each value is expressed as the mean ± SD ($N = 15$). Significant differences between the control and irradiated groups were determined using one-way ANOVA, followed by Tukey's test. $^{***}P < 0.001$ compared with the control.

In our work, significant decreases of diameters of whole eyes and lens was observed in the 8 Gy irradiated group. The developmental toxic effect of carbon-ion irradiation on development was dose-dependent. It was clear from our studies that irradiation at increased doses was a high-risk practice. Microphthalmia was also observed in the zebrafish larvae that experienced high-dose γ-rays (10 Gy) and X-ray (8 Gy) irradiation at the blastula stage and gastrula stage, respectively[1,2]. However, more investigations are needed to further determine the molecular mechanism of carbon-ion irradiation-induced microphthalmia.

References

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[2] R. Zhou, J. Si, H. Zhang, et al., Hum. Exp. Toxicol, 33(2014)1040.

3- 65 Effects of Carbon Monoxide-releasing Molecule (CORM-3) on Zebrafish Embryos Induced by X-rays**

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CO is increasingly appreciated as a signal molecule, due to its protective features, such as anti-inflammatory function[1], anti-apoptosis[2]. Carbon monoxide -releasing molecules (CORMs) represent a group of compounds that are capable of modulating physiological functions via liberating CO. Among various CORMs synthetized, CORM-3 is one of the most promising compounds because it is soluble in water and the half-life to liberate CO in saline was 10.6 h, thus imitating the action of CO more closely[3].

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