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Lethal effect of k-shell photoionization of phosphorus on radiosensitive cell lines

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Introduction

DNA is considered to be the critical target for cell killing by ionizing radiation. Therefore it is expected that the photoionization of phosphorus in DNA may cause some specific biological effects[1]. We have previously found that the K-shell photoionization of phosphorus produced unrepairable chromatin breaks in Chinese hamster V79 cells using the premature chromosome condensation technique[2].

Many radiosensitive mammalian mutant cell lines have been established in these 40 years. They lack one or the other genes which are involved in DNA repair. Some of these genes have already been cloned in these several years.

In this paper, the results concerning lethality of two rodent radiosensitive mutant cell lines by k-shell photoionization of phosphorus are reported.

Materials and Methods

Cells

Radiosensitive mutants (SX9, defective in DNA-PKcs (XRCC7) and SX10, defective in DNA ligase IV) cell lines derived from mouse mammary carcinoma FM3A cells were used. These are the important components of DNA double strand break repair. Cells were cultured in suspension with alpha-MEM medium with 10% fetal bovine serum and antibiotics.

Exposure

Monochromatic X-rays at 2.153 keV (K-shell resonance absorption peak of phosphorus), 2.146 keV and 2.160 keV (off peak) were selected for irradiation by an InSb double-crystal monochromater at BL-27A. Exponentially growing cells were placed on an isopore membrane filter (0.4 micrometer pore size, MILLIPORE). A plastic dish, in which an isopore membrane was placed, was set on a sample scanning stage to make uniform irradiation with X-rays. After irradiation, cells were plated in appropriate number and cultured in multi-well dishes for the colony formation.

Results and Discussions

Survival curves of SX9 andSX10 cells after x-rays irradiation were shown in Fig.1. Linear-quadratic survival curves were obtained for three energies. Lethal effect at 2.153 keV and 2.160 keV was larger than that at 2.146 keV in both cell lines. Lethal enhancement ratio, which was defined as the ratio of 10% survival dose at 2.153 keV and 2.160 keV to that at 2.146 keV, was 1.4 and 1.3, respectively. Lethal enhancement ratios were similar to the parent wild-type SR-1 cells reported last year[3], although they are more sensitive than the parent.

Studies on lethal effects are now going on different radiosensitive mutants.

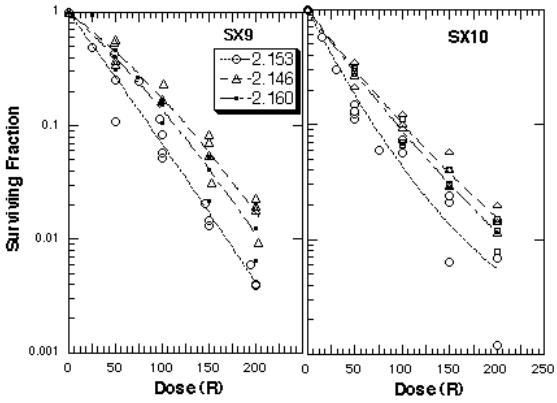

Fig.1 Survival curves of SX9 and SX10 cells. One R corresponds to 2.58 x 10^{-4} C/Kg.

References

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