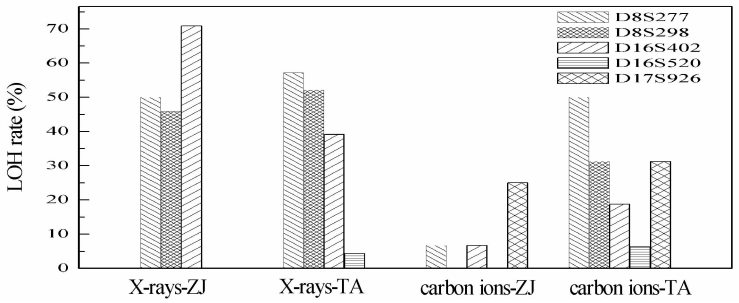

Fig. 3 LOH rates of different microsatellite sites.

References

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3 - 80 Effect of Carbon-ion Radiation on Mitochondrial DNA

Zhang Hong and Zhou Xin

Heavy-ion radiation is regarded as a significant risk during long-term manned space missions. The genetic damage induced by heavy-ion irradiation has been extensively studied. Although substantial evidence has been provided for the evaluation of mutagenetic effect of heavy-ion radiation, no report investigated mitochondrial DNA (mtDNA) damage and mutation induced by heavy-ion irradiation. MtDNA is a maternally-inheirited, closed-circle, double-strand molecule located within the mitochodnrial matrix. MtDNA encodes 2 rRNAs, 22 tRNAs, and 13 polypeptides, which are essential for nornal mitochondrial function. MtDNA is believed to be more susceptible to oxidative damage and consequently acquires mutations at a higher rate than does nuclear DNA. The differences in its susceptibility could be caused by lack of protective histones, limited DNA repair capacity, and high level of reactive oxygen species produced during oxidative phosphorylation. Heavy-ion radiation therefore could possiblely induced more severe damage in mtDNA than in nuclear DNA.

Several studies were carried out to investigate the effect of carbon-ion radiation on mitochondrial DNA in our group[1,2]. With respect to the mtDNA damage, we found that carbon-ion induced significant and irreversible mtDNA conformation change; Carbon-ion induced mtDNA was more severe than X-ray radiation. While ROS contribute to the most of the mtDNA damage induced by carbon-ion and X-ray irradiation, the direct effect of radiation on mtDNA was different. Direct effect of carbon-ion on mtDNA was irrepairable, while X-ray induced damage were not. Carbon-ion induced mtDNA mutation were investigated in both human cancer cell lines and zebrafish. We found irradiated HeLa cell accumulated D310 mutation and could habor transit mtDNA 4977 deletion. The transgeneration effect of mtDNA mutation induced by carbon-ion was investigated in zebrafish. We found that low dose carbon-ion radiation on female zebrafish could significantly elevate the mtDNA mutation rate in their off springs.

In conclusion, our current findings indicate that carbon-ion radiation could induce severe mtDNA damage and mutations. The deterious effect of carbon-ion radiation on mtDNA is different in nature to the X-ray radiation.

References

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