Contribution ID: **55** Type: **Poster**

Effect of proton-beam irradiation on cell survival of MCF-7 and its chemo-resistant subgroups

Thursday, November 14, 2024 1:00 PM (1h 30m)

Proton beam (PB) therapy is gaining popularity for breast cancer treatment because of its enhanced coverage and potential to minimize late toxicities. The dose and volume of PB irradiation are closely associated with improved breast cancer survival. We aimed to investigate the impact of PB irradiation on the survival of the human breast cancer cells MCF-7 and their resistance to doxorubicin(MCF-7-DR) and paclitaxel (MCF-7-PR). Cells exposed to 0.5, 2, 4, or 8 Gy of PB irradiation showed a signifcant decrease in the survival of parent cells, even at 2 Gy, indicating therapeutic efcacy. Conversely, drug-resistant cells exhibited notable cytotoxicity at 4 and 8 Gy, which were above the daily recommended dose. Mechanistically, PB irradiation signifcantly altered the DNA repair proteins RAD51, Ku80, and survivin and cleaved PARP in MCF-7 cells compared to chemo-resistant cells, except for RAD51 and Ku80. In addition, cell-cycle regulators and MAPK expression were notably altered by PB irradiation compared to MCF-7-DR and PR cells, underscoring the importance of tailoring PB irradiation for enhanced efcacy against chemo-resistant breast cancer. These fndings suggest that PB irradiation downregulated RAD51 and Ku80, the potent DNA repair markers, underscoring its potential therapeutic efficacy in treating chemo-resistant breast cancer cells.

Keywords : Proton-beam irradiation ·Breast cancer cells ·Anticancer drug resistance ·DNA repair ·Cell death

Paper submission Plan

Best Presentation

Contribution track

KOPUA

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Session Classification: KOPUA Poster Session

Track Classification: KOPUA