Gas Plasma Effects on Chemoresistance Ovarian Cells

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Gas plasma has recently become a topical area of research due to widespread applications in medicine. Current promising medical applications are focused on oncotherapy, wound healing and skin diseases, ophthalmology, virus inactivation, biofilms, dentistry, and other diseases. Plasma is a cocktail of chemical and physical factors. Transferring of plasma reactive agents to the targets is the base of plasma treatment. These reactive agents, including electromagnetic radiation, reactive oxygen and nitrogen species, and charged particles. [1]

Herein, we evaluated the efficacy of plasma on ovarian normal and cancer cells. To this end, first, cisplatin-resistance ovarian cancer cells were exposed under plasma. Then, primary GCs cells were exposed under the same condition of plasma therapy. Along with the physical characterization of the plasma jet, MTT, AO/PI, HE, RT-PCR assays have been conducted. Besides, we measured the long-lived reactive oxygen and nitrogen species concentration in the culture mediums.

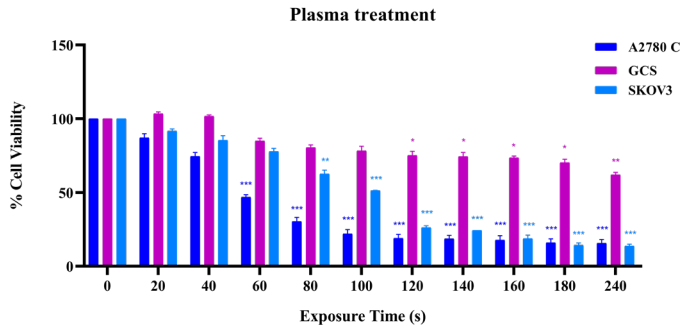

Figure 1 - Viability of GCs, SKOV-3, and A2780 CP cells treated with direct plasma treatment as measured by the cell viability assay. The percentages of surviving cells from each cell were calculated relative to controls. All experiments have replicated a minimum of three times. Data are presented as means ± S.D. (*p < 0.05, **p < 0.01, ***p < 0.001 versus control).

Our results as shown in Figure 1, revealed that the plasma has a highly selective effect of up to 120 seconds so that healthy cells have not been affected by plasma irradiation while the viability of cancer cells was significantly reduced ($P < 0.001$). From 120 seconds to 180 seconds we saw a weak selective effect of plasma. Thus, the survival of cancer cells in comparison to their control groups was significantly reduced ($P<0.001$) while healthy cells were also affected by plasma irradiation and their survival changed ($P < 0.05$). From 180 to 240 seconds, the survival of healthy cells was significantly reduced than the control group ($P < 0.01$). Also, our data confirm plasma induces apoptosis in cisplatin resistance ovarian cancer through a combination of electric field and long-lived reactive oxygen and nitrogen species such as H_2O_2, NO_2^-.

Finally, we concluded plasma as an emerging technology creates a very promising plasma-based multimodality treatment for ovarian cancer.

References

[1] Dai, Xiaofeng, et al. Trends in biotechnology **36.11**, 1183-1198 (2018).