P124

Effect of cold atmospheric pressure plasma on the control and reduction of cell growth in breast cancer

Mahdiyeh Bakhtiyari-Ramezani[1], **Mojtaba Nohekhan**[1], **Sharareh Mirshahvalad**[2]

[1] *Plasma and Nuclear Fusion Research School, Nuclear Science and Technology Research Institute (NSTRI), Atomic Energy Organization of Iran (AEOI)*
[2] *Plasma Technology Development Company, Atomic Energy Organization of Iran (AEOI)*

Introduction: Breast cancer has become the most prevalent cancer in the world since 2021. The out-of-control growth of breast cells results in breast cancer. The type of breast cancer depends on which cell in the breast becomes cancerous. Due to the high incidence and limitations of surgery, chemotherapy, and radiotherapy including non-selective and incomplete tumor ablation, non-thermal plasma (NTP) technology has been reported as a novel therapeutic way in different fields of medical science such as oncology and dermatology. In vitro and in vivo studies have reported that NTP has anticancer effects and can selectively inhibit the growth of cancer cell lines. The combination of physical and chemical factors in the interaction between NTP and cells is the basis of the anti-cancer effect [1-3]. Plasma can affect target cells and tumors in two ways, direct and indirect. In direct treatment, plasma directly interacts with cells and tumors while in indirect treatment, first a solution or medium is activated by a plasma device then the activated solution or medium is added to the cell culture medium or injected to the tumor. In this study, atmospheric pressure argon and helium plasma jets was used to investigate and compare the effect of cold plasma on the control and reduction of cell growth in breast cancer in in-vitro and in-vivo studies.
Material and method: The configuration of argon and helium plasma jets is shown in Fig1.a. 4T1 mammary carcinoma cell lines were purchased from Iranian Biological Resource Center and were cultured in DMEM medium. The culture medium containing cells (expect control) was exposed to He or Ar plasma in direct treatment and, the plasma-activated medium (PAM) was added to the cells in indirect treatment. The cell cycle and apoptotic rate were inspected using flow cytometry. Twenty female BalbC mice were randomly divided into 5 groups: breast tumor without treatment (control), breast tumor + direct He plasma, breast tumor + indirect He plasma, breast tumor + direct Ar plasma, and breast tumor + indirect Ar plasma. The treatment time was adjusted to 3 minutes. The variation of weight and H&E staining was investigated.

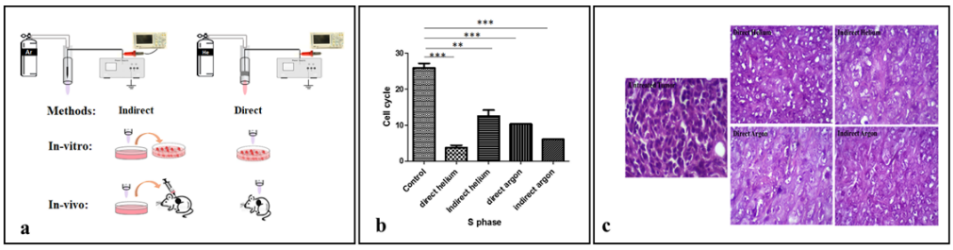

Fig. 1: a. Experimental setup, b. Cells in the S phase, c. Tumor pathology.

Conclusion: The apoptosis rate increased compared to the control group, and the presence of cells in the S phase of the cell cycle decreased in all groups except the control group (Fig1.b). The pathology images of tumors indicated that cell proliferation and angiogenesis were controlled by direct and indirect plasma treatment (Fig1.c). The results of this research provide medical experts with a clear perspective on the treatment of breast cancer.

References

1. S. Lee et al., "Epigenetic silencing of miR-19a-3p by cold atmospheric plasma contributes to proliferation inhibition of the MCF-7 breast cancer cell.", Scientific reports 6.1 (2016): 30005.
2. Y. Ma et al., "Non-thermal atmospheric pressure plasma preferentially induces apoptosis in p53-mutated cancer cells by activating ROS stress-response pathways.", PloS one 9.4 (2014): e91947.
3. Murphy, William, Caitlin Carroll, and Michael Keidar. "Simulation of the effect of plasma species on tumor growth and apoptosis." Journal of Physics D: Applied Physics 47.47 (2014): 472001.

Presenting Author Email Address: *mbakhtiyari@aeoi.org.ir*