Verification of the effects of Atmospheric Low Temperature Plasma

irradiation on breast cancer cells

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ABSTRACT

Breast cancer is the disease that recorded the highest number of cases by site among women in 2019. Current breast cancer treatment methods impose a heavy burden on patients due to side effects such as nausea and psychological burden caused by loss of milk production function. Therefore, it is necessary to establish a new breast cancer treatment method that is less burdensome to patients. In this study, we focus on Atmospheric Low Temperature Plasma (ALTP), which has recently been suggested to be useful for cancer cells, and examine its effects on breast cancer. In this study, we investigated the effect of ALTP on breast cancer by focusing on ALTP. Therefore, in this study, we evaluated the irradiation of ALTP in saline solution to act on the tumor site.

ALTP generates reactive species including reactive oxygen species (ROS) and reactive nitrogen species (RNS), which are highly reactive, and we hypothesized that the reactive species generated by ALTP could induce oxidative stress and induce cell death of cancer cells. However, oxidative stress causes cellular dysfunction not only in cancer cells but also in normal cells. Therefore, we focused on the difference in sensitivity of cancer cells and normal cells to oxidative stress and hypothesized that selective apoptosis could be induced.

In this paper, we measured the concentrations of reactive species (H_2O_2, NO_2, and NO_3) in saline solution irradiated with ALTP using a digital pack test. ALTP was also applied to normal cells and to BT-20/CMV-Luc, a human breast cancer cell line. The effects of ALTP on TNBC cells were evaluated by the indirect action of ALTP on TNBC cells via Plasma Treated Mdium (PTM), which is a cell culture medium irradiated with ALTP, and by gene expression analysis. detection of apoptosis-inducing factors. As a result, the digital pack test confirmed that three active species were significantly generated by irradiation of ALTP. When PTM was exposed to normal cells, no significant change was measured in the proliferation of normal cells. On the other hand, breast cancer cells showed changes in shape and cell number: ALTP-irradiated TNBC cells were rounded and did not adhere adequately to the basal plane. On the other hand, the number of cells in the ALTP-irradiated group was about 1/3 of that in the non-ALTP-irradiated group, suggesting that ALTP has a significant inhibitory effect on proliferation. In addition, gene expression analysis by RT-qPCR was performed to investigate the cause of the growth inhibition effect. In this paper, the expression of apoptosis-inducing genes, Fas and Caspase-3, was confirmed, suggesting that ALTP induces apoptosis in breast cancer cells, and the possibility of its application to a new treatment method.