

Contribution of Hydrogen Peroxide in the Selective Aspect of Prostate Cancer Treatment by Cold Atmospheric Plasma

Authors : Maxime Moreau, Silvère Baron, Jean-Marc Lobaccaro, Karine Charlet, Sébastien Menecier, Frédéric Perisse

Abstract : Cold Atmospheric Plasma (CAP) is an ionized gas generated at atmospheric pressure with the temperature of heavy particles (molecules, ions, atoms) close to the room temperature. Recent studies have shown that both in-vitro and in-vivo plasma exposition to many cancer cell lines are efficient to induce the apoptotic way of cell death. In some other works, normal cell lines seem to be less impacted by plasma than cancer cell lines. This is called selectivity of plasma. It is highly likely that the generated RNOS (Reactive Nitrogen Oxygen Species) in the plasma jet, but also in the medium, play a key-role in this selectivity. In this study, two CAP devices will be compared to electrical power, chemical species composition and their efficiency to kill cancer cells. A particular focus on the action of hydrogen peroxide will be made. The experiments will take place as described next for both devices: electrical and spectroscopic characterization for different voltages, plasma treatment of normal and cancer cells to compare the CAP efficiency between cell lines and to show that death is induced by an oxidative stress. To enlighten the importance of hydrogen peroxide, an inhibitor of H₂O₂ will be added in cell culture medium before treatment and a comparison will be made between the results of cell viability in this case and those from a simple plasma exposition. Besides, H₂O₂ production will be measured by only treating medium with plasma. Cell lines will also be exposed to different concentrations of hydrogen peroxide in order to characterize the cytotoxic threshold for cells and to make a comparison with the quantity of H₂O₂ produced by CAP devices. Finally, the activity of catalase for different cell lines will be quantified. This enzyme is an important antioxidant agent against hydrogen peroxide. A correlation between cells response to plasma exposition and this activity could be a strong argument in favor of the predominant role of H₂O₂ to explain the selectivity of plasma cancer treatment by cold atmospheric plasma.

Keywords : cold atmospheric plasma, hydrogen peroxide, prostate cancer, selectivity

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