EDITORIAL

Cold Atmospheric Plasma Activated Solution: A New Approach for Cancer Treatment

An ideal cancer therapy would provide cure with nearly-zero adverse effects is the greatest challenges of the 21st century for scientist belonging to medicine and many related fields. Unfortunately, classical cancer treatments accessible to patients (such as chemo- and radiotherapy) show severe disadvantages in terms of both severe side effects and low efficiency. This encourages ongoing efforts for development of various experimental cancer treatments – with varied degree of success and acceptance. Among those experimental methods, cold atmospheric plasma (CAP) has been actively studied in recent years for cancer treatment. Results are promising, but the delivery method causes a problem in many cases. In an attempt to overcome this issue, the next development step was to develop Cold atmospheric plasma activated solution (PAS). Over past five years, PAS have shown its promising application in plasma medicine for treatment of cancer. Likewise, the common direct cold plasma treatment, PAS has tremendous ability for selective anti-cancer capacity in vitro and in vivo. PAS can be more easily used by directly injecting PAS into the tissue of patients in case a CAP device is not available. Therefore, the proposed special issue on PAS may bridge the gap between the scientific community unfamiliar with such treatments and also latest achievements and underlying mechanism in this area and the medical community as well.

The mini-hot topic issue include reviews as well as original research articles on use of PAS for cancer treatment. Briefly: Yan et al., [1] present an up to date review on key topics about PAS including the development, current status, as well as the main conclusions about the anti-cancer mechanism achieved in past years. The approaches to make strong and stable PAS were also summarized. Whereas, G. Bauer [2] proposed that none of the long-lived species found in plasma-activated medium, seemed to have the potential to interfere with catalase-dependent control of apoptosis-inducing signaling of tumor cells when acting alone. However, the combination of H₂O₂ and nitrite might generate peroxynitrile. The protonation of peroxynitrile to peroxynitrous acid allows for the generation of hydroxyl radicals that react with H₂O₂, leading to the formation of hydroperoxide radicals. These allow for singlet oxygen generation and inactivation of membrane-associated catalase through an autoamplificatory mechanism, followed by intercellular apoptosis-inducing signaling. On the other hand, Nofel et al., [3] demonstrate that Multi Cellular Tumor Spheroids (MCTS) models, closer to an in vivo tumor, displayed a defense response leading to a growth increase of spheroids which requires adaptation of treatment with PAS. On the other hand Bekeschus et al., [4] shows that Plasma treated PBS exhibited anticancer activity in murine and human pancreatic cancer cells. Murine fibroblasts were affected to a lesser extent, suggesting a certain degree of selectivity. By inducing apoptosis, plasma treatment also may limit inflammation that comes with tumor cell death. Boehma et al., [5] propose that using a high-voltage dielectric barrier atmospheric cold plasma (DBD-ACP) system, they can generate the plasma-activated water which has high cytotoxic potential and good storage stability. At last Attri et al., [6] reveals that reactive oxygen species (ROS) plays important role in cell death as compared with reactive nitrogen species (RNS).

I want to thank all the author who contributed to this special issue for their excellent work and very good and prompt collaboration. I consider that the information presented here will be of real practical interest for the scientist in the field. My thanks go also towards the reviewers, their critical observations led to higher quality of presented work, thank you for your time. I am very grateful to the Editor in Chief, Michelle Prudhomme and Editorial Manager Ms. Noushaba Azher for launching the invitation, for support and for accepting the publication of this issue. Thank you very much!

REFERENCES


Dr. Pankaj Attri
(Guest Editor)
Department of Electrical and Biological Physics/Plasma Bioscience Research Center
Kwangwoon University
Seoul
Korea