# IS OZONE THERAPY USEFUL FOR CANCER TREATMENT?

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## Abstract

Cancer is the second leading cause of death behind heart disease. However, deaths from heart disease have declined 45 % in the United States since 1950 and continue to decline, while cancer deaths are increasing. In this century, cancer is projected to be the leading cause of death. The development of effective cancer therapy is a major focus of biomedical research. Neoplasia is a multifactorial process that can be broadly categorized into five etiologies: genetic, viral, chemical, physical and inflammatory. Chemical, physical and inflammatory are closely linked to reactive oxygen species (ROS), which can readily induce genomic damage. Oxygen is required for respiration and the energetic processes that enable aerobic life. Costs associated with oxygen use are ROS formations, which create oxidative stress that has a complex effect on cancer development. Under normal physiological conditions, cellular ROS generation is counterbalanced by the action of antioxidant enzymes and other redox molecules. The balance between $O_2^-$ generation and elimination is important for maintaining proper cellular redox states. Excessive ROS accumulation will lead to cellular injury, such as damage to DNA, protein and lipid membrane. Because of their potential harmful effects, excessive ROS must be promptly eliminated from the cells by a variety of antioxidant defense mechanisms, including important enzymes, such as superoxide dismutase, catalase and various peroxidases. Although the precise mechanisms responsible for increased ROS stress in cancer cells have not be defined, the increase in ROS generation is attributed to active cellular metabolic activity under the influence of oncogenic signals and/or to mitochondrial malfunction in cancer cells. In this conference we reviewed the state of the art of the different ozone biological effects, that were demonstrated in different animal models, in relation with the possibility to use medical ozone as a therapeutical strategy for cancer treatment. Among these ozone biological effects are: cellular redox balance (ozone can exert its protective effects by means of an oxidative preconditioning, stimulating and/or preserving the endogenous antioxidant systems); regulation of the immunological system, increase of prostacyclin, as well as the increase of oxygenation in tumors. Also, a preclinical and clinical study, were performed. Erhlich Ascitic Tumor and Sarcoma 37 were implanted in B6D2F1 and NMRI mice. After the implantation, animals were treated with ozone, by rectal application, using different ozone concentrations. The results demonstrated that in both tumors a significant decrease in the number of metastasis was obtained. With regard to the clinical trial, 70 patients with prostatic cancer were treated with cobalt-60 therapy, but to 35 patients were added rectal ozone, 6 days per week, at a dose of 8 mg (40 mg/L and 200 ml) during the 6 weeks that lasted the radiotherapy. The appearance of side effects (radiodermatitis, cystitis, proctitis) occurred in 84 % of the patients treated only with cobalt therapy and in 52 % of the ozone group, with significant differences between both groups. Prostatic specific antigen figures decreased, less than 10 ng/mL, in 92 % of patients treated with ozone and in 52 % in control group, one month after finishing the treatment, with significant differences between both groups. In spite of the positive ozone biological effects, its potential

usefulness as an adjuvant in chemo-radiotherapy and its antimetastatic effect, further investigations are necessary to be performed, in order to be considered the ozone therapy as a future alternative therapy for cancer.