

Vitamins and Cancer: To Take or Not Take?

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Oxidative stress is involved in the development of many chronic diseases including cancer. It has been defined as an imbalance between the level of pro-oxidants (reactive oxygen species, ROS) produced during normal metabolism and the organism's endogenous antioxidant defence system. The role of various natural antioxidant defence systems to minimize oxidative damage caused by these free radicals was established using animal models in which these defence systems were knocked out [1]. This resulted in the promotion of cancer which was attributed to DNA damage by the formation of 8-hydroxy-2-deoxyguanosine (8OHdg). Consequently, a concerted effort has been made to establish the efficacy of such traditional antioxidants as vitamins A, E and C, as well as a search for new antioxidants to minimize such damage. Over 200 epidemiological studies strongly associated low consumption of fruits and vegetables with the incidence of cancer suggesting that antioxidants might be a solution [2]. Consequently, should cancer patients be encouraged to take multi-vitamin supplements as part of their therapy?

While antioxidant supplements may be a suitable strategy for the normal population, studies have shown that it could be detrimental for those suffering from cancers. However, even in the normal population excessive intake of some vitamins is undesirable. In the case of cancer patients, the solution is far from simple as the same ROS, the major cause of cell damage, also play an important physiological role in signal transduction and regulation [3]. They influence the cell's redox status, and depending on their concentration, can cause cell proliferation or cell death (apoptosis). Consequently, supplementation with such antioxidants could bring about apoptosis or actually prevent the destruction of precancerous or cancerous cells.

The question remains as to what makes an optimal vitamin intake? This is further complicated by possible interactions between the particular vitamin and the anticancer drug. For example, Wenzel and co-workers [4] found vitamin C interfered with apoptosis of HT-29 human colon carcinoma cells induced by the drug camptothecin. By reducing ROS, vitamin C prevented the disintegration of the plasma membrane of these cancer cells. In addition it also affected the stimulation of caspase 3 as well as downregulation of the mitochondrial antiapoptotic protein bcl-X_L and NF- κ B mRNA levels. It was obvious that cancer patients undergoing this type of chemotherapy should not be taking vitamin C. Another study by Frank et al. [5] also reported ascorbic acid interfered with 5-aminolevulinic-based photodynamic therapy (PDT), a technique that generates excessive amounts of ROS to eliminate malignant tumors. Using this technique, vitamin C counteracted the oxidative cell injury induced by ALA-PDT by reducing mitochondrial damage as well as oxidative cell damage in rat DS-sarcoma cancer cells. In reviewing the controversial place of vitamin C in cancer treatment, Verrax and Buc Calderon [6] reported that recent pharmacokinetic data showed that pharmacologic concentrations of vitamin C could be achieved by intravenous injections with phase I and II clinical trials in progress. However, some adverse effects were associated with high doses of vitamin C including hemolysis and hyperoxaluria. No mention was made regarding the interaction of vitamin C with anticancer drugs or therapies. An earlier report by Verrax and co-workers [7], however, showed that a combination of ascorbic acid and vitamin K3 effectively killed cancer cells by a new-type of cancer-cell death referred to as autoschizis.

Preclinical and epidemiological evidence suggested that selenium and vitamin E might reduce the risk of prostate cancer. However, a recent study by Klein et al. [8] with 35,533 men in the United States, Canada and Puerto Rico showed no reduction in the risk of prostate cancer with selenium or vitamin E supplements. However a statistically nonsignificant increase (17%) in the risk of prostate cancer was evident in healthy men taking a common dose of vitamin E (400 IU/d). An earlier study by Albright et al. [9] found a diet deplete in vitamin E and A increased tumor ROS and apoptosis resulting in a decrease both primary and metastatic mammary tumors in transgenic mice. They reported that mixed results from human intervention trials given antioxidant supplements were due to both antioxidant and prooxidant properties of these supplements as well as other properties not related to redox status.

A systematic review by Velicer and Ulrich [10] on the use of vitamin and mineral supplements among US adults after cancer diagnosis raised a number of concerns particularly the lack of understanding of the biological effects of such supplements and whether they are indeed beneficial. It would appear that, based on the mixed scientific data to-date, cancer patients should remain cautious and avoid supplementing their cancer therapy with antioxidants such as vitamin C and E. This would be consistent with the recommendation by the National Cancer Institute (NCI) which urges cancer patients to avoid both vitamin and mineral supplements while undergoing therapy and to take supplements only under their physician's guidance [11].

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