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COMMENTARY ARTICLE

ASCORBIC ACID – A MYSTICAL CHEMOTHERAPEUTIC DRUG

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ABSTRACT

Cancer is one of the five main causes of death in all over the world. There are various ongoing studies in the field of oncology. One such advancement in oncology is the use of ascorbic acid as a chemotherapeutic agent. Recent studies claim that ascorbic acid is a potential chemotherapeutic agent. Studies show that vitamin C was preferentially toxic to tumor cells. High doses of intravenous ascorbates have shown positive results in complete remission of cancer using this modality. This article comments on such studies conducted in end stage cancer patients.

INTRODUCTION

Cancer is one of the five main causes of death in all over the world. Cancer results from a series of molecular events that fundamentally alter the normal properties. The abnormalities in cancer cells usually result from mutations in protein-encoding genes that regulate cell divisions. Carcinogenesis is a multi step process leading to invasive cancer as its final stage. Carcinogenesis involves several sequential stages: Initiation, promotion & progression[1].

There are various ongoing research studies in the field of oncology. One such advance is the use of ascorbic acid as a chemotherapeutic agent.

Vitamin C (Ascorbic acid)

Ascorbic acid is a water soluble vitamin. It was first isolated in 1923 by Hungarian biochemist and Nobel laureate Szent-Gyorgyi and synthesized by Howarth and Hirst[2]. Since the discovery of vitamin C, the number of its known biological functions is expanding.

The body requires ascorbic acid for normal physiological functions. It increases the absorption of iron in the gut by reducing ferric to ferrous state. It is a strong antioxidant. It protects the body from various toxic effects of free radicals. The recommended dietary intake for ascorbic acid is 75-125 mg daily. Ascorbate is essential for the full function of an array of enzymes. Adequate intake of ascorbic acid will optimize the metabolism and prevent cancer and other degenerative diseases. The concentration of ascorbate in plasma of healthy humans is about 40-80muM. These levels of ascorbates functions as an endogenous antioxidant. It acts as co-antioxidant with vitamin E to protect low density-lipoprotein (LDL) from oxidative damage induced by aqueous peroxyl radicals.

Food Source includes mainly fruits and vegetables like Citrus fruits and juices, such as orange, grapefruit, Mango, Papaya, Pineapple, Strawberries, raspberries, blueberries, cranberries, Watermelon., Broccoli Brussels sprouts, cauliflower, Green and red peppers.

Role of ascorbic acid in chemotherapy

The chemo preventive role of vitamin C was 1st proposed by Cameron *etal* in 1949. Vitamin C is also known to inhibit N-Nitroso compounds which are known to induce carcinogenesis[3]. Various studies showed that consumption of vitamin C rich foods reduces the risk of developing cancer. Plasma concentrations of ascorbate have been shown to be inversely associated with risk for developing cancer.

Recent studies claim that ascorbic acid is a potential chemotherapeutic agent. Rather than possessing adverse side effects as most chemotherapeutic drugs, vitamin C has side benefits such as increasing collagen production, and enhancing immune function.

Linus Pauling 1976 and Ewan Cameron published a trial of 100 cancer patients which suggested that treatment with intravenous vitamin C significantly increased lifespan.

Studies shows that vitamin C was preferentially toxic to tumor cells. This was first described by Benade *et al* in 1969[3].

Further studies by Neil H Riordan 2000 described the similar properties of ascorbic acid in cultured tumor cells. They theorized that the preferential toxicity was due to the relative deficiency of catalase in tumor cells[4].

Theory of chemotherapic properties of ascorbic acid

Ascorbic acid is a simple glucose in structure. In case of insufficient glucose, cells take up ascorbic acid for metabolism.

In increased amount of ascorbic acid (intravenous infusion) it reaches tumor cells, so it reacts with the molecular oxygen within tumors and generates large amounts of hydrogen peroxide, which is lethal to tumor cells that lack catalase enzyme, hence failing to neutralize hydrogen peroxide. These hydrogen peroxide kills the tumor cells. The normal surrounding cells are spared because they neutralize the hydrogen peroxide with the help of enzyme catalase.

To increase the tumor cell specificity of ascorbic acid, a compound which has affinity to tumor cells are used. These compound combines with ascorbic acid and target the tumor cells. Lipoic acid and Dimethylsulfoxide were tried in different studies. Lipoic acid was found to be effective in decreasing the dose of ascorbates needed to suppress the tumor. Lipoic acid decreased the dose of ascorbic acid required to kill 50% of the tumor cells from 700 mg/dL to 120 mg/dL.

Dimethylsulfoxide is a solvent which has a very high affinity for cancer cells[5]. In other words, DMSO targets cancer cells. Despite of DMSO could bind to other substances, it still target cancer cells. It is the most powerful carrier/solvent known to science. It is able to bind certain types of molecules, and then carry these molecules inside cancer cells. DMSO passes through cellular membranes and tissues. It is invariably able to penetrate endothelial coatings of the arterial walls, meninges of the brain, healthy skin, mucous membranes and other tissues.

Commonly used route of administration are oral, parentral and transdermalElimination half-time is about four days. Cutaneous application prolongs elimination by about one third. Excretion of DMSO is primarily via urine. The topical application is not likely to cause serious side effects; the oral ingestion has limits. Orally (2-3 table-spoonfuls) causes nausea or cramps. For maximum and fastest results, DMSO should be administered oral as well transdermal.

Treatment regime used in the studies

Most of the studies were conducting in end stage diseases were patients were reluctant to take standard modality of treatment. During the study no adverse effects of ascorbic acids were noted. All patients were prescreened for Glucose 6 – Phosphate deficiency.

In vivo study conducted by Neil H. Riordan showed that ascorbic acid's chemo toxicity was reduced by the presence of human serum ("Serum effect"). Serum's inhibitory effects led them to the conclusion that the concentrations of vitamin C which were toxic to tumor cells in their cell culture studies (5 to 50 mg/dL) would not be necessarily toxic in vivo. Higher concentrations of ascorbates were required to become cytotoxic to tumor cells.

In their study on a 70 year old male with adenocarcinoma of the right kidney with metastatic cancer of lungs and liver, it was found that the metastatic lesions were shrunk and patient was feeling better with the ascorbic acid treatment. It is mentioned that the patient was reluctant to take standard treatment modalities, and upon patient request the ascorbic acid regime was initiated. Intravenous infusion of ascorbic acid 30 grams twice a week was the regime followed. The patient survived free of cancer for 14 years.

Another case study which was published in 1998 described the case of a renal cell carcinoma with metastasis to lungs which resolved after a mega dose infusion of ascorbic acid (15-65grams).

The regime was followed for one year. Two years of follow up showed no evidence of lung mass.

Further they claim that Combined Intravenous Vitamin C and Chemotherapy in a Patient with Carcinoma of the Pancreas and End-Stage Metastatic Breast Carcinoma increased the survival rate of the patients. Resolution of non-Hodgkin's Lymphoma was also achieved in a 73 year old male with Intravenous Vitamin C. Renal Cell Carcinoma has also been treated with Intravenous Vitamin C.

CONCLUSION

With these evidence based studies, it may be concluded that the ascorbic acid has a mystical property of healing cancer. High doses of intravenous ascorbates have shown positive results. Complete remission of cancer using this modality has been documented. Remissions of these cancers may be due to the biological respose modification effects or by the direct chemo toxic effects of ascorbates. Further advanced studies may reveal the cryptical chemotherapeutic property of ascorbic acid.

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