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Medical Hypotheses

Medical Hypotheses (1995), 44, 207-213
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Intravenous Ascorbate as a Tumor Cytotoxic Chemotherapeutic Agent

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Abstract — Ascorbic acid and its salts (AA) are preferentially toxic to tumor cells in vitro and in vivo. Given in high enough doses to maintain plasma concentrations above levels that have been shown to be toxic to tumor cells in vitro, AA has the potential to selectively kill tumor cells in a manner similar to other tumor cytotoxic chemotherapeutic agents. Most studies of AA and cancer to date have not utilized high enough doses of AA to maintain tumor cytotoxic plasma concentrations of AA. Data are presented which demonstrate the ability to sustain plasma levels of AA in humans above levels which are toxic to tumor cells in vitro and suggests the feasibility of using AA as a cytotoxic chemotherapeutic agent.

Introduction

Cytotoxic drugs began to be considered consistently successful for therapy of some cancers around 1950 (1). A large jump in the cure rate for several cancer types – especially childhood, acute lymphoblastic leukemia, Hodgkin's disease, and testicular tumors – was seen between 1950 and 1990 (from 0% for all in 1950 to 75%, 80% and 90% respectively) (2). Other, relatively common, types of cancer (3), including head and neck, large bowel, stomach, pancreatic, liver, cervical, and melanoma, for the most part remain refractory to cytotoxic chemotherapy, with and without adjuvant chemotherapy, with no demonstrable prolongation of life (2).

Even though the term 'chemotherapy' generally includes hormonal and cytotoxic agents, this discussion is limited to cytotoxic agents. Whether they are alkylating agents, antimetabolites, or antibiotics, the rationale for using chemotherapeutic agents in the treatment

of malignancy is to preferentially induce cytotoxicity of malignant cells. Because of the similarities between normal and malignant cells – both being born of the same host – a chemotherapeutic dose which is cytotoxic to cancer cells can also be toxic to normal cells. Oncologists must often push the limits of acceptable toxic side effects in order to effect a remission. Ideally, there should be a large gap between the lower dose required for efficacy and the higher dose of toxicity to the patient. Adverse effects of chemotherapy include hair loss, nausea and vomiting, cardiac toxicity, and secondary cancers (4). One of the most common toxic manifestations of many cytotoxic agents is bone marrow suppression (2) which can lead to immune suppression and hematopoietic dysfunctions. Because infectious complications are one of the major causes of death in cancer patients (5), more host-non-toxic compounds – particularly compounds without immune suppressive qualities – need to be investigated for their chemotherapeutic value.

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Date received 11 May 1994
Date accepted 24 August 1994