Intravenous Vitamin C (IVC) Therapy

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Vitamin C is an essential water-soluble vitamin and antioxidant that plays a crucial role in many bodily functions, including immune cell function, collagen formation, and metabolism of certain substances like cholesterol and neurotransmitters. Unlike most animals, humans cannot produce vitamin C internally and must obtain it from their diet or supplements.

A balanced diet rich in fruits and vegetables typically provides enough vitamin C to meet the daily requirement of 75-90 mg. Early research by Ewan Cameron and Linus Pauling in the 1970s suggested that cancer patients have a higher need for vitamin C and that high doses could be achieved through intravenous (IV) infusion. They conducted a study with terminal cancer patients, giving them high-dose (10 grams/day) vitamin C intravenously for 10 days followed by oral supplementation. They matched each person that received the IV Vitamin C with 100 other patients matched in terms of type of cancer, stage, age, gender etc. and followed both groups. The study found that 90% of the vitamin C group experienced a three-fold increase in survival compared to matched controls.[1]

This research sparked interest in using vitamin C as a therapeutic agent for cancer. Laboratory studies have shown that high concentrations of vitamin C have anti-tumor and chemo sensitizing effects.[2-4] Some human studies have also demonstrated improvements in quality of life and cancer-related symptoms.[5-6] High doses of vitamin C can affect healthy and cancer cells differently. In cancer cells, the high concentration of vitamin C leads to the production of hydrogen peroxide, which becomes toxic to the cancer cells. This effect is amplified in cancer cells because they contain more iron, which reacts with hydrogen peroxide to create a damaging hydroxyl radical (OH). Additionally, cancer cells have a higher metabolic rate, leading to increased oxidative stress. Unlike healthy cells, cancer cells lack the enzyme catalase, which would normally help reduce this stress. Overall, high dose vitamin C is more harmful to cancer cells due to these factors.[7-8]

Cancer cells also have a unique ability to absorb more vitamin C than normal cells because they have more glucose transporters (GLUT), which are used to bring in glucose. Vitamin C's structure is like glucose, allowing it to be taken up by cancer cells. However, vitamin C cannot be used as a fuel source like glucose. Instead, it acts as a pro-oxidant within the cell, increasing oxidative stress specifically within cancer cells.[9]

What are some of the studies and their outcomes on the use of Intravenous Vitamin C in Cancer patients?

1. Intravenous Vitamin C and cancer patients on a Ketogenic diet[9]

In a small study involving 15 cancer patients on a ketogenic diet, IV Vitamin C was given twice a week with an average dose of 29.5 grams per infusion. The patients followed the diet throughout the study, as indicated by an increase in B-hydroxybutyrate levels in nine patients. Hemoglobin, C-Reactive Protein (CRP), and erythrocyte sedimentation rate (ESR) were measured. By the end of the study, CRP and ESR levels were reduced, suggesting

that vitamin C might have helped reduce inflammation. Additionally, three-quarters of the patients showed an increase in hemoglobin levels.

2. IVC's impact on symptom severity[10]

In a study of 350 women with stage 2A to 3B breast cancer, researchers investigated the effects of IV Vitamin C on symptoms and side effects of breast cancer treatment. Participants were randomly assigned to receive either weekly doses of 25 grams of vitamin C or a saline solution alongside their regular treatment. At the end of the study, symptom severity scores were evaluated. The study found that the treatment group experienced a significant reduction in the severity of symptoms such as nausea, loss of appetite, tumor pain, fatigue, and insomnia compared to the control group.

3. IVC and Impact on Neutrophil to Lymphocyte ratio, a marker of inflammation[11]

In a study of 424 breast cancer patients who received radiation therapy after surgery, researchers examined the impact of IV Vitamin C on the neutrophil to lymphocyte ratio (NLR), a marker of inflammation and cancer prognosis. Among the patients, 70 also received IVC twice a week for at least 4 weeks. NLR levels were measured before, after, and 3 months post-radiation therapy. The 70 IVC patients were split into low-dose (less than 1g/kg) and high-dose (greater than 1g/kg) groups.

Results showed that NLR increased at 3 months post-radiation in the untreated and low-dose IVC groups but significantly decreased in the high-dose IVC group. NLR is linked to cancer patient mortality, so reducing it could be beneficial. The study suggests that high-dose vitamin C may help decrease NLR during radiation therapy.

4. IVC during Chemotherapy[12]

In a pilot phase 1/2a clinical trial for newly diagnosed stage III or IV ovarian cancer patients, researchers added high-dose IV Vitamin C to standard paclitaxel/carboplatin therapy. They evaluated toxicity in 27 participants, randomly assigning them to either the standard therapy group (Cp + Pax) or the group receiving IVC (Cp + Pax + IVC). Two participants from the standard group withdrew because they wanted IVC and were excluded from analysis. The remaining 25 participants (12 in Cp + Pax, 13 in Cp + Pax + IVC) were evaluated for adverse events using standard criteria. No treatment-related deaths occurred, and IVC did not increase severe toxicity. Participants in the Cp + Pax + IVC group had lower rates of mild to moderate toxicity compared to those in the Cp + Pax group. Although not statistically significant, there was a trend towards improved overall survival and a longer time to disease progression/relapse in the Cp + Pax + IVC group.

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