Advanced Immune Wellness
Revised by Ron Mariotti, ND, BI-D
(Written by Stacey Raffety, Lac, ND)

THE SKINNY ON IV VITAMIN C AND CANCER

INTRODUCTION

Vitamin C acts as an antioxidant in the body. It's a water-soluble vitamin. That means it dissolves in water and works in the water or aqueous environments within the body. Vitamin C has several actions that may offer protection against cancer and or other serious illness. It protects cellular structures, including DNA, from damage. Vitamin C also helps the body deal with environmental pollution and toxic chemicals, enhances immune function, and inhibits the formation of cancer-causing compounds such as nitrosamines, which are preservatives found in processed meats. Vitamin C preferentially kills cancer cells. It is not toxic to normal healthy cells and can be given at very high doses without harm to the patient.

Vitamin C is found naturally in the following foods: broccoli, cabbage, potatoes, peas, red peppers, brussel sprouts, kale, cauliflower, cantaloupe, strawberries, mangoes, tangerines, orange, grapefruit, lemons, and limes. We need 60 mg per day to prevent scurvy. I believe the low dose that is required to prevent scurvy is not what we should obtain on a daily basis to optimally run all functions in the body and to prevent disease from developing in the first place. The use of vitamin C as a cytotoxic agent is not new. Many doctors such as Linus Pauling have successfully utilized this therapy. Vitamin C taken orally cannot achieve high enough serum levels to be cytotoxic (kills cells) thus the use of intravenous therapy is necessary. Intravenous means to administer through a catheter directly into the vein. Therapeutic dosages of 50-100 grams have been used. It is impossible to consume that dose through an oral route. Generally people will experience diarrhea at does anywhere from 2000 mg to 10,000 mg (2-10 grams) depending on their tolerance and tissue saturation. When vitamin C is given through IV no diarrhea occurs. Serum levels of 200-400mg/dl must be maintained for therapeutic results to be achieved, preferably closer to 400mg/dl. Oral routes cannot guarantee a constant serum level. Vitamin C given through IV lends itself to controlling this vital variable in order to ensure cytotoxic levels within the blood.

To administer these high doses, some patients require special in-dwelling catheters to protect the vein while the vitamin C is infusing. These catheters can stay in place anywhere from six months and up to ten years in some cases.

HOW VITAMIN C WORKS

Vitamin C preferentially kills neoplastic or cancer cells through two mechanisms:

1. In low dosages vitamin C works as an antioxidant; in high doses, vitamin C changes roles and becomes a pro-oxidant, inducing peroxide production. Tumor cells exist in a relatively catalase-deficient state. Catalase is an enzyme that is necessary to detoxify hydrogen peroxide (convert) to water and oxygen. A 10-100 fold difference in catalase concentration exists between tumor cells and normal cells. Without the protection of catalase, peroxide accumulates in cancerous cells along with aldehydes (toxic by-product of the reaction), causing death to malignant cells. Healthy or normal cells and tissues have the protection of the detoxification enzymes and are spared destruction by peroxide and aldehyde.
2. The other way vitamin C works is to increase collagen production, the glue that holds the body together. To make collagen we require an amino acid called proline. The biochemical process called hydroxylation requires the presence of vitamin C, which renders proline available for collagen production. Vitamin C has the ability to inhibit enzymes that degrade or break down the extra cellular matrix. Research has shown that vitamin C dramatically increases the collagen within tumor cells, an act that tends to immobilize the cells, "gluing" them into place. Without mobility metastasis is blocked. None the less, intravenous vitamin C is a safe therapy. It does not have side effects such as hair loss, nausea, diarrhea, or fatigue.

CONTRADITIONS TO INTRAVENOUS VITAMIN C

There are a few contraindications to vitamin C therapy. First, it is advised that the patient seek care from a trained physician in intravenous therapy. Suitable veins for IV therapy are necessary as the concentration of the IV can be irritating to the veins causing transient pain at the IV site. Medical conditions such as kidney failure, dialysis, history of oxalate kidney stone formation, hemochromatosis and G6PD should not receive high dose vitamin C. All patients should be screened for red cell glucose-6-phosphate dehydrogenase deficiency. This rare genetic disorder can give rise to hemolysis (breaking of red blood cells) if they are put under oxidative stress. A simple inexpensive blood test can screen for G6PD.

RECOMMENDATIONS FOR FREQUENCY OF TREATMENT

If there is evidence of tumors still present as demonstrated on CT or MRI scans I recommend one 50-75 g IV of vitamin C given twice per week. If the tumors have been treated with a surgical intervention or chemotherapy I recommend that the vitamin C be given once per week for twenty treatments. The infusion takes place over one to three hours. We often will repeat the therapy in six months and then reevaluate each individual patient making appropriate recommendations. Some protocols recommend using IV vitamin C twice per week for one full year until there is no evidence of cancer. Some patients use intravenous vitamin C during chemotherapy. I recommend you discuss this with your oncologist. Studies have shown that taking alpha lipoic acid (a water soluble antioxidant that recycles vitamin C) enhances the tumor toxic effects of vitamin C. A dose of 400mg 1-2 hours before IV therapy is recommended. It is important to maintain

blood levels of vitamin C between IV treatments as well as after completion of treatments. A daily dose of 5000-10,000 mg per day will accomplish this. In addition, long-term vitamin C therapy should slowly be reduced. In other words, if vitamin C was given twice per week for an extended time then a reduction to once a week for a while is advised.

ADDITIONAL NOTES ON TREATMENT

A holistic treatment approach that includes the body, mind, and spirit can augment the effectiveness of the vitamin C therapy. In addition to high dose vitamin C I recommend several adjuncts to provide a comprehensive approach in addressing cancer. Nutritional assessments are vital to ensure that the diet provides the body with the necessary nutrients for fighting cancer as well as to support the basic physiological functions of the body. Specific oral nutrients are recommended to augment vitamin C and to support health in general. Addressing environmental toxins as the etiology of the cancer through cleansing and detoxification programs are recommended. Lab work to identify nutritional deficits, heavy metal toxicity, toxic exposure and to detect such things as anemia and other deficiencies are essential. Emotional and spiritual aspects of health and illness are individualized and considered a vital component to create health as well.

References:

1. Casciari JJ, Riordan NH, Schmidt TL, Meng XL, Jackson JA, Riordan HD. Cytotoxicity of ascorbate, lipoic acid, and other antioxidants in hollow fibre in vitro tumours. *Br J Cancer.* Jun 1 2001;84(11):1544-1550.

2. Chen Q, Espey MG, Krishna MC, et al. Pharmacologic ascorbic acid concentrations selectively kill cancer cells: action as a pro-drug to deliver hydrogen peroxide to tissues. *Proc Natl Acad Sci U S A.* Sep 20 2005;102(38):13604-13609.

3. Croix BS, Rak JW, Kapitain S, Sheehan C, Graham CH, Kerbel RS. Reversal by hyaluronidase of adhesion-dependent multicellular drug resistance in mammary carcinoma cells. *J Natl Cancer Inst.* Sep 18 1996;88(18):1285-1296.

4. Khanzode SS, Muddeshwar MG, Khanzode SD, Dakhale GN. Antioxidant enzymes and lipid peroxidation in different stages of breast cancer. *Free Radic Res.* Jan 2004;38(1):81-85.

5. Leung PY, Miyashita K, Young M, Tsao CS. Cytotoxic effect of ascorbate and its derivatives on cultured malignant and nonmalignant cell lines. *Anticancer Res.* Mar-Apr 1993;13(2):475-480.

6. Liu J, Zhang X, Yang F, Li T, Wei D, Ren Y. Antimetastatic effect of a lipophilic ascorbic acid derivative with antioxidation through inhibition of tumor invasion. *Cancer Chemother Pharmacol.* May 2006;57(5):584-590.

7. Marsh SA, Pat BK, Gobe GC, Coombes JS. Evidence for a non-antioxidant, dose-dependent role of alpha -lipoic acid in caspase-3 and ERK2 activation in endothelial cells. *Apoptosis.* May 2005;10(3):657-665.

8. Myzak MC, Carr AC. Myeloperoxidase-dependent caspase-3 activation and apoptosis in HL-60 cells: protection by the antioxidants ascorbate and (dihydro)lipoic acid. *Redox Rep.* 2002;7(1):47-53.
9. Pathak AK, Bhutani M, Guleria R, et al. Chemotherapy alone vs. chemotherapy plus high dose multiple antioxidants in patients with advanced non small cell lung cancer. *J Am Coll Nutr.* Feb 2005;24(1):16-21.
10. Riordan HD, Hunninghake RB, Riordan NH, et al. Intravenous ascorbic acid: protocol for its application and use. *P R Health Sci J.* Sep 2003;22(3):287-290.
11. Riordan N, Riordan H, Casciari JP. Clinical and Experimental Experiences with Intravenous Vitamin C: Potentiation of Preferential Toxicity of Vitamin C. Paper presented at: Vitamin C as Cancer Therapy, 2000; Montrial, Canada.
12. Riordan NH, Riordan HD, Meng X, Li Y, Jackson JA. Intravenous ascorbate as a tumor cytotoxic chemotherapeutic agent. *Med Hypotheses.* Mar 1995;44(3):207-213.
13. van de Mark K, Chen JS, Steliou K, Perrine SP, Faller DV. Alpha-lipoic acid induces p27Kip-dependent cell cycle arrest in non-transformed cell lines and apoptosis in tumor cell lines. *J Cell Physiol.* Mar 2003;194(3):325-340.
14. Vojdani A, Bazargan M, Vojdani E, Wright J. New evidence for antioxidant properties of vitamin C. *Cancer Detect Prev.* 2000;24(6):508-523.