

## **High Dose Intravenous Vitamin C (HDIVC) in Cancer Therapy**

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Research surrounding the discovery of Vitamin C (Ascorbic Acid)\* began in the 1920's. Research into this interesting molecule present in vegetables already known to have anti-scorbutic (anti-scurvy) effects, was led by nobel prize award winner, Professor Szent-Gyorgi. He deduced the following conclusions on what he was calling Hexuronic Acid, presently known today as Ascorbic Acid.

1. It is highly oxidizable.
2. It is oxidized both reversibly and irreversibly.
3. The reversible oxidation product is reduced by glutathione (our naturally occurring internal cellular anti-oxidant).

Once the compound was identified, a patent-free synthetic version was formulated and labeled Ascorbic Acid, which is what we use today in oral and intravenous application. <sup>(i)</sup>

The usage of high doses of Vitamin C (HDIVC) to treat cancer began in the 1970's. These early medical doctors observed that intravenous administration of Ascorbic Acid resulted in much higher plasma (blood) levels of Ascorbic Acid than was possible if taken in oral doses only.<sup>(ii)</sup> The clinical significance of this phenomenon, is that high plasma levels of Ascorbic Acid are necessary for the generation of hydrogen peroxide ( $H_2O_2$ ) in the space surrounding the cancer cell.  $H_2O_2$  acts as a pro-drug, crossing into the cancer cell, and killing it from the inside. Normal, healthy cells have a mechanism to break the  $H_2O_2$  down to water. Cancer cells do not have this mechanism.<sup>(ii,v)</sup> Downstream effects of Ascorbic Acid on cancer cells includes DNA damage and a reduction in the cancer cells ability to make metabolize energy.<sup>(v)</sup>

HDIVC administration to cancer patients has also been shown to correlate with a decrease of inflammation. The micro environment surrounding a cancerous tumor is highly inflamed and associates positively with elevated C-reactive protein (CRP) and various interleukins (pro-inflammatory markers). In fact, elevations of these markers are positively associated with an elevation in tumor markers and a poorer prognosis. Studies done on various types of cancer showed a decrease in these pro-inflammatory markers, as well as a decrease in tumor markers when these patients received HDIVC treatment.<sup>(iii)</sup>

Uses of HDIVC in a clinical setting focus mainly on reducing the side effects and improving the quality of life of patients undergoing concurrent conventional treatments for cancer<sup>(ii,iii,v,vi)</sup>, while also playing a role in directly targeting tumor growth. HDIVC reduces digestive related symptoms such as nausea and poor appetite, fatigue, and neurodegenerative symptoms (depression and lack of motivation) commonly associated with conventional therapies.<sup>(vi)</sup>

Prior to (HDIVC) administration, patients are screened for G6PD deficiency, and renal function. Renal function is monitored closely and treatments may vary

accordingly. Other factors affecting HDIVC treatment include concurrent radiation therapy, type of chemotherapy and type of other pharmaceuticals prescribed for by your oncological team. There are certain nutraceuticals that affect the metabolism and effectiveness of HDIVC, and will be discussed by your prescribing Naturopathic Doctor.

Treatments of HDIVC depend on the type of cancer, the above listed factors and the staging of your cancer. Most types of cancer respond favorably to HDIVC. Generally you will begin with 1-2 treatments/week, for a period of 3 months, after which time your Naturopathic Doctor will determine a longer term treatment strategy. HDIVC also shows effectiveness in the prevention of recurrence of cancer, and can be safely administered on a weekly basis.<sup>(ii)</sup>

\*The term Ascorbic acid is synonymous with Vitamin C for the purpose of clarity.

## References:

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