Arginine in the Treatment of Cancerous Tumors

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Cancer is a systemic disease that causes severe wasting, metabolic disturbances, and often induces anorexia. More than 40% of cancer patients die from malnutrition and not from the cancer ("For the Technically Oriented Reader," Quillin, Patrick, pg.1).

All cells in the body have the ability to become cancerous and many do so on a daily basis. The immune system, if functioning properly, is able to destroy these cells or reprogram them back into normally functioning cells. Cancer can manifest itself as tumorous growths and the disease is able to proliferate in the body when the immune defense has become inadequate and unable to deal with the various stresses put on it.

When the cell's metabolism is effected and the normal cycle of cell regeneration and death is interrupted, changes occur in the DNA and cells become mutated. The mutated cells begin to multiply uncontrollably, dividing when they are not needed and forming a mass of excess tissue, which can develop its own network of blood vessels. This mass will draw nourishment away from the body's blood supply to feed itself, and if left unchecked can develop into a cancerous tumor. Cells from malignant tumors can invade nearby tissues and organs causing damage and can also break away from the tumor and enter the bloodstream causing the cancer to spread and tumors to grow in other areas of the body. The spread of cancer is called metastasis.

Though there are many different types of cancer, there are five basic categories:

- *Carcinomas* – the most common cancers, which are those that originate in the tissues which cover a surface or line internal organs. Carcinomas include lung, breast, prostate, skin, and intestinal cancers.
- *Sarcomas* – cancers which originate in the connective and muscle tissue, attacking bones, muscles, cartilage, or the lymph system. These are considered to be the rarest and also the most deadly types of cancer.
- *Myelomas* – these tumors are also rare and originate in the plasma cells, which are found in bone marrow.
- *Lymphoma* – these are cancers of the lymph system. The two most prevalent types in the U.S. are Hodgkin's disease and non-Hodgkin's lymphoma.
- *Leukemias* – this type of cancer originates in the tissues of the bone marrow, spleen, and the lymph nodes. Leukemia manifests itself as an overproduction of white blood cells and is not a cancer that forms solid tumors.

Risk factors for cancer include overexposure to toxins such as pollution, chemicals and drugs, improper diet and lifestyle, malnutrition, and/or emotional and physical trauma. These factors contribute directly to diminished immune function, thus increasing cancer risk. Hereditary influences may also be a factor.
Considering the relationship between cancer and impaired immune function, the need to support, build, and stimulate the immune system of those with the disease is obvious. The amino acid L-arginine has been proven to be helpful in enabling the immune system to be more proficient in fighting cancer in the body and has shown promise in the treatment of cancer.

What is Arginine?

Arginine is a complex amino acid and is considered to be conditionally essential. It does not fall perfectly into the essential or non-essential categories, due to the fact that arginine can be synthesized in the body at adequate levels for maintenance in normal adults. The body needs higher levels of arginine when it is under conditions of stress, illness, malnutrition or injury. When these conditions are present arginine is essential. There are also some rare genetic disorders in which the synthesis of arginine is impaired; in these conditions supplemental arginine is necessary. It is interesting that even in those not deficient in arginine, beneficial effects were realized by supplementation. In the human body arginine is most concentrated in skin and connective tissue.

Arginine has many benefits:

- Aids in liver detoxification
- Detoxifies ammonia
- Increases sperm count in males
- Aids in kidney disorders and trauma
- Maximizes protein synthesis
- Helps lower cholesterol
- Stimulates blood flow
- Stimulates cerebral circulation
- Promotes optimum growth
- Helps to reduce body fat and increase lean muscle mass
- Assists the body in collagen production
- Assists in the release of growth hormones
- Enhances immune system function
- Causes retardation of tumor growth
- The actions of L-arginine which are related to its use in cancer treatment are:
- Inhibits cellular replication of tumors
- Assists in the release of growth hormones
- Enhances immune response
- Improves rate of wound healing (in cases of surgical intervention)

Arginine retards the growth of tumors and cancer by enhancing immune function. The thymus gland is the "director" of the immune system and plays a key role in determining the effectiveness of the immune response to cancer. When the body is under attack from cancer, protein loss causes the thymus to shrink, drastically reducing the strength of the body's immune response. Supplements of free-form arginine, acting as the precursor of growth hormone, have shown the ability to increase the size and health of the thymus gland. The immune response becomes more vigorous as the thymus gland produces more of its enzyme, thymosin, which in turn stimulates the spleen and lymph nodes to manufacture higher levels of T lymphocytes (T-cells). The T-cells are not only increased in number, but also become more active and effective. T-cells aid in the destruction of pathogens, including cancerous cells, either by digesting the invading agents or by sending out toxic compounds to destroy them.

A correlation has been seen between the excess of an enzyme, ornithine decarboxylase, and increased tumor growth. Arginine supplementation has been shown to decrease the activity of ornithine decarboxylase and aid in slowing tumor development in this manner also (*The Healing Nutrients Within*, Braverman, Eric, and pg. 222). It is also believed that the by-products of normal arginine metabolism produce anti-tumor activity resulting in lowering polyamines, which are elevated in many cancer patients.

Food Sources:
Foods high in arginine include carob, chocolate, coconut, dairy products, gelatin, fish, poultry, meat, oats, peanuts, soybeans, walnuts, brown rice, wheat, wheat germ, sesame and sunflower seeds, popcorn, and raisins.

Symptoms of Arginine Deficiency:

- Rash
- Hair loss and breakage
- Poor wound healing
- Constipation
- Fatty liver
- Hepatic cirrhosis
- Hepatic coma

Protocols:
Practitioners and clinics such as Patrick Quillin Ph.D., N.D., Eric R. Braverman, M.D., Center for Holistic Life Extension in San Ysidro, CA, and The Edelson Center in Atlanta, GA use arginine for treatment of cancer in various dosages and protocols. Arginine is used in conjunction with proper nutrition (usually a whole food, vegetarian diet), other adjuncts, and other types of alternative and/or allopathic therapies.

A cancer prevention/treatment protocol suggested in *The Amino Revolution* include the aminos and cofactors directly related to them but does not include dosages.

Aminos:
Complete blend
Arginine
Cysteine }
Glutamic acid } components of glutathione
Glycine }

Cofactors:
Vitamin A
Vitamin B complex
Vitamin C
Vitamin D
Magnesium
Calcium
Selenium

These supplements must be taken in fairly high doses to combat cancer's ability to consume protein. The components of glutathione are used rather than the glutathione itself, due to the fact that it is made up of the three amino acids (cysteine, glutamic acid, and glycine) and therefore tends to be attacked by digestive enzymes in the stomach. Nutritionists believe that supplements of the three constituent components would be more effective in fighting cancer (*The Amino Acid Revolution*, Erdman, Robert, pgs 132-133).

Patrick Quillin suggests the following aminos be included in a cancer treatment protocol:

Arginine – up to 12 grams daily
Carnitine – 1.5 grams
Glutamine – 5 grams
N-acetylcysteine – 1 to 2 grams or 200 mg of glutathione

Though a therapeutic dose of glutamine is considered to be 5 grams or more per day, there is controversy concerning "optimum doses" for arginine in cancer treatment. It is a complex question depending on many variables including the patient's condition and response to the treatment. A recommendation for optimum dosing is to dose at a therapeutic level then raise the dosage until the desired effect is observed. After this, raising the dosage further will not produce a greater or more sustained effect. Monitoring plasma arginine levels may be important as well.

Arginine is most effective if taken on an empty stomach at least one hour before or three hours after a meal. It can be taken easily by mixing with water. It has also been administered intravenously in dosages up to 25 to 30 grams in hospitals and clinics.

It is suggested that a dosage of up to 1.5 grams per day would be safe and effective for the average person.

Note: Comments were found stating that arginine might cause tumor growth by feeding the cancer. The theory is that cancer needs protein so ingesting arginine (a protein) could cause cancer growth. I found no research to back this up, only opinion and theory.

Contraindications / Side Effects:
L-arginine supplements should not be taken by pregnant and lactating women, unless under the care of a health professional. It should be avoided by those with viral infections such as herpes and those with liver diseases that cause an excess of ammonia in the system (some liver disorders are benefited from arginine) or who have kidney failure. Schizophrenics should not take more that 30 milligrams per day. Children who have not completed bone growth should avoid arginine supplementation but eat arginine rich foods.

Arginine has been shown to be remarkably free of side effects for the vast majority of people who have taken it, even in large therapeutic doses. Some have experienced diarrhea and/or nausea when taking high therapeutic doses and one study found that several weeks of large doses might result in thickening and coarsening of the skin in some people.

Research Supporting the Use of Arginine in Cancer Treatment:

Animals fed arginine rich diets (5%) had considerably fewer and more benign tumors when later treated with the carcinogen DMDA (Takeda, Y., et al, Cancer Research, vol. 35, p.2390, Sept. 1975).

Arginine added to drinking water in animals was able to inhibit subcutaneous tumor growth (Pryme, If, Cancer Letters, Vol5, p. 19, 1978).

Arginine added to diet of mice (5% of wt.) produced fewer tumors, slower growing tumors, and twice the mean survival time as compared to untreated mice (Milner, JA, et al., Journal of Nutrition, vol.109, p.489, 1979).

Via animal studies, researchers have speculated on two primary functions of arginine in the body; essential for the synthesis of reparative collagen in wound recovery, decreases some of the negative aspects of metabolic responses to injury (Seifter, E., et al., Surgery, vol.84, no.2, p.224, 1978).

Arginine supplements in animals stimulated thymus activity which resulted in reduced tumor growth (Critselis, AN, et al., Federation Proceedings, vol.36, p.1163, 1977). Arginine also dramatically improves wound healing.

Arginine stimulates lymphocyte immune response in 21 healthy human volunteers Barbul, A., et al., Surgery, vol.90, no.2, p.244, 1981).

Arginine supplements in tumor-bearing mice provided enhanced T-cell function, increased response to autologous tumors, retarded tumor growth, and prolonged median survival time (Reynolds, JV, et al., Annals of Surgery, p.202, Feb.1990).

In mice with neuroblastomas, arginine supplements provided significant tumor retardation in the ummunogenic group (Reynolds, JV, et al., Journal of Surgical Research, vol.45, p.513, 1988). Arginine's tumoricidal abilities go beyond its protein sparing abilities or immune stimulation.

Arginine supplements in mice provided significant enhancement of cytotoxic T-lymphocytes, natural killer cell activity, interleukin-2 receptors and general immune improvements (Reynolds, JV, et al., Surgery, vol.104, no.2, p.142, Aug.1988).

Accelerates protein synthesis and elevates albumin synthesis from 8.5% to 19.7% when used in TPN formula in 10 malnourished cancer patients (Tayek, JA, et al., Clinical Research, vol.33, no.1, p.72A, 1985).

Volunteers with breast cancer were given 10 milligrams a day for three days, which significantly enhanced several measures of immune function.. The mitogenic responses of peripheral blood lymphocytes were increased approximately 60%, while NK and LAK cytotoxicity were increased by 81 and 107%.