

Chapter 9

MAKING CHEMO AND RADIATION MORE EFFECTIVE

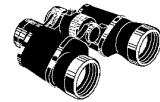


"God heals and the doctor takes the fee." Benjamin Franklin

WHAT'S AHEAD?

Nutrients can improve cancer treatment by:

- ↳ protecting the patient from the damaging effects of chemotherapy and radiation while allowing these therapies to kill the tumor
- ↳ nutrition makes chemo and radiation therapy more of a selective toxin against cancer and not a general toxin upon the patient



Cancer patients often feel like a child in a wicked divorce custody battle. The oncologist tells the patient "Don't take that nutrition therapy. It is nothing more than expensive urine. And it will reduce the effectiveness of my chemo and radiation therapies." The nutritionist tells the same patient "Don't take that poisonous chemo or radiation therapy. It will do you no good." In fact, when the oncologist and nutritionist work together, both are more successful at helping the cancer patient. Nutrients make medical therapy more toxic to the tumor and less toxic to the patient.

DOES NUTRITION THERAPY REDUCE THE EFFECTIVENESS OF CHEMO OR RAD TX?

i.e. antioxidant + prooxidant = 0?

LITERATURE REVIEWS SHOWING NUTRITION MAY HELP, BUT NEVER HINDERS CHEMO & RAD TX
Alternative Medicine Review, vol.5, no.2, p.152, 2000
J.American College of Nutrition, vol.18, no.1, p.13, 1999
J.American Nutraceutical Association, vol.4, no.1, p.11, 2001

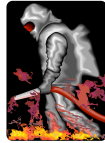
EXPLANATION: Antioxidant nutrients are best absorbed by aerobic (healthy) cells and poorly absorbed by anaerobic (sick/cancerous) cells. AOX protect healthy cells, but not cancerous cells from prooxidative therapies. Vitamin C becomes selective anti-cancer agent as "sugar feeding" cancer cells absorb excessive vit.C (similar to glucose in structure) which becomes prooxidant in anaerobic environment.

Linus Pauling, PhD, earned one of his Nobel prizes in chemistry in the 1950s by discovering how atoms bond together to become molecules. Picture the sun with Earth, Saturn, and Mars among other planets orbiting around the sun. Atoms and molecules are a tiny rendition of our solar system. Electrons orbit the nucleus of an atom just like planets orbit around the sun in our solar system. Atoms bond together, such as hydrogen with oxygen to yield water, by sharing electrons, as if two suns came close together and shared planets or moons to keep in balance and to be complete. Now imagine if a planet was missing from a solar system. There is an imbalance in forces that makes this solar system unstable. Free radicals, or pro-oxidants, are like unstable solar systems, because they lack a planet in their outer orbit. Free radicals will grab a planet from a nearby solar system to make that solar system now unstable. And on its goes in domino fashion, disrupting solar systems (or atoms and molecules) until tissue damage occurs and cancer or premature aging sets in. Though there are many variations of pro-oxidants and antioxidants (see table below), the theme is always the same: pro-oxidants can destroy tissue, while antioxidants can protect tissue.

| FREE RADICALS & ANTIOXIDANTS | |
|---|---|
| TYPE OF RADICAL "electron thief" | ANTIOXIDANT "electron donor" |
| Superoxide O ₂ ⁻ | SOD, lipoic acid |
| Hydrogen peroxide H ₂ O ₂ | Catalase, glutathione peroxidase |
| Hydroxyl radical OH ⁻ | Vit.C, lipoic acid, melatonin |
| Peroxyl radical (PUFA+O ₂) | Vit. E, CoQ, beta carot, lycopene |
| Singlet oxygen O ₂ | Lycopene, carotenes, lutein, Canthaxanthin, lipoic acid, Glutathione, vit.E |
| Hypochlorous radical OCl | Lipoic acid |
| Peroxynitrite radical ON | Lipoic acid |
| Ozone O ₃ | Vit.C |

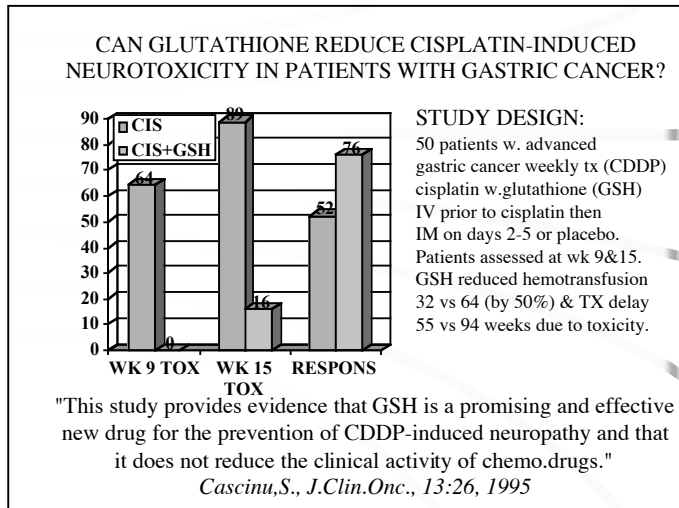
Cadenas, E. et al., HANDBOOK OF ANTIOXIDANTS, Marcel Dekker, NY, 1996
Levine, SA, et al., ANTIOXIDANT ADAPTATION, Biochemists, SF, 1985

"The amount of antioxidants that you maintain in your body is directly Proportional to how long you will live." Richard Cutler, MD, Director Anti-aging Research, National Institutes of Health



Antioxidants can protect tissue. Oxygen, hydrogen peroxide (which we constantly create inside of our bodies as part of living), air pollution (ozone), tobacco smoke, most chemotherapy drugs, radiation therapy, and

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Oxygen, hydrogen peroxide (which we constantly create inside of our bodies as part of living), air pollution (ozone), tobacco smoke, most chemotherapy drugs, radiation therapy, and

alcohol are among the more common and noteworthy free radicals in life.

Chemo and radiation are free radicals that work by, hopefully, killing more cancer cells than healthy cells.

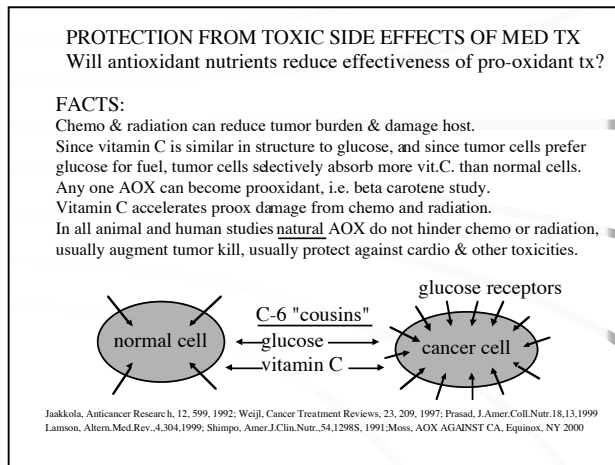
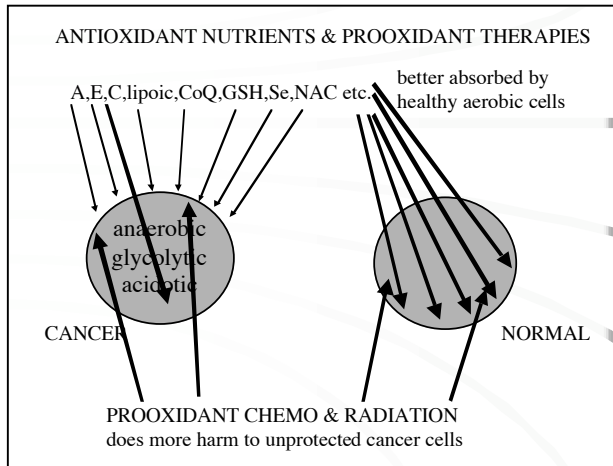
We are constantly "rusting" from within, just like a nail rusts outside. We can slow down this rusting with antioxidants, such as vitamin C and lipoic acid, but we cannot stop it. Basically, free

radicals are electron (planet) thieves, and antioxidants, such as vitamin C, are electron donors. Antioxidants perform like a sacrificial warrior, giving up their life so that your tissue is not harmed. However, in an anaerobic environment, such as cancer, antioxidants can become pro-oxidants. Vitamin C can become a targeted anti-cancer agent because it resembles the preferred fuel of cancer, glucose, and is absorbed in abundance. The ascorbic acid by itself in an anaerobic environment then becomes a powerful pro-oxidant and destroys the cancer cell--but only the cancer cells, since healthy cells have built-in mechanisms for absorbing the right amount of vitamin C along with the entire "symphony" of other antioxidants.

Researchers "assume" that antioxidant nutrients (such as coenzyme Q, glutathione, and vitamin E) will reduce the tumor kill rate from chemo and radiation.

In simplistic chemistry, one might think this

to be true. However, in test tubes (in vitro), in animals, and in human cancer patients, such is not the case. Since cancer is usually an oxygen-deprived



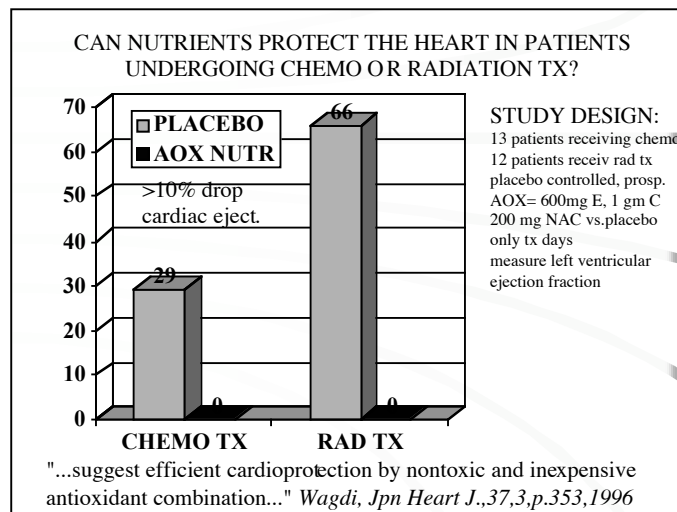
tissue, or anaerobic cell, the cancer cell has very poor mechanisms for absorbing proper amounts of antioxidants. A cancer cell has no more use for antioxidants than a gopher needs sunglasses. The exception is vitamin C, which is remarkably similar in chemical structure to glucose, the favorite fuel for cancer cells.

Antioxidants have been shown to dramatically improve the tumor kill from pro-oxidative chemo and radiation, while protecting the host tissue from damage. Cancer cells are primarily anaerobic (meaning "without oxygen") cells. With the exception of vitamin C, cancer cells do not absorb nor use antioxidants the same way that healthy aerobic cells do. Vitamin C (ascorbic acid) is nearly identical in chemical structure to glucose, which is the favored fuel for cancer cells.

When researchers found that radioactively labeled ascorbic acid was preferentially absorbed by implanted tumors in animals, they admitted that this effect takes place because cancer has many more glucose receptors

on the cell surface than healthy normal cells. Antioxidants protect healthy tissue, but leave the cancer cells more vulnerable to the damage from chemo or radiation.

VITAMIN K. While in simplistic theory, vitamin K might inhibit the effectiveness of anticoagulant therapy (coumadin), actually vitamin K seems to augment the anti-neoplastic activity of coumadin. In a study with human rheumatoid arthritis patients being given methotrexate, folic acid supplements did not reduce the antiproliferative therapeutic value of methotrexate.¹ In one study, patients with mouth cancer who were pre-treated with injections of K-3 prior to radiation therapy doubled their odds (20% vs. 39%) for 5-year survival and disease-free status.² Animals with implanted tumors had greatly improved anti-cancer effects from all chemotherapy drugs tested when vitamins K and C were given in combination.³ In cultured leukemia cells, vitamins K and E added to the chemotherapy drugs of 5FU (fluorouracil) and leucovorin provided a 300%



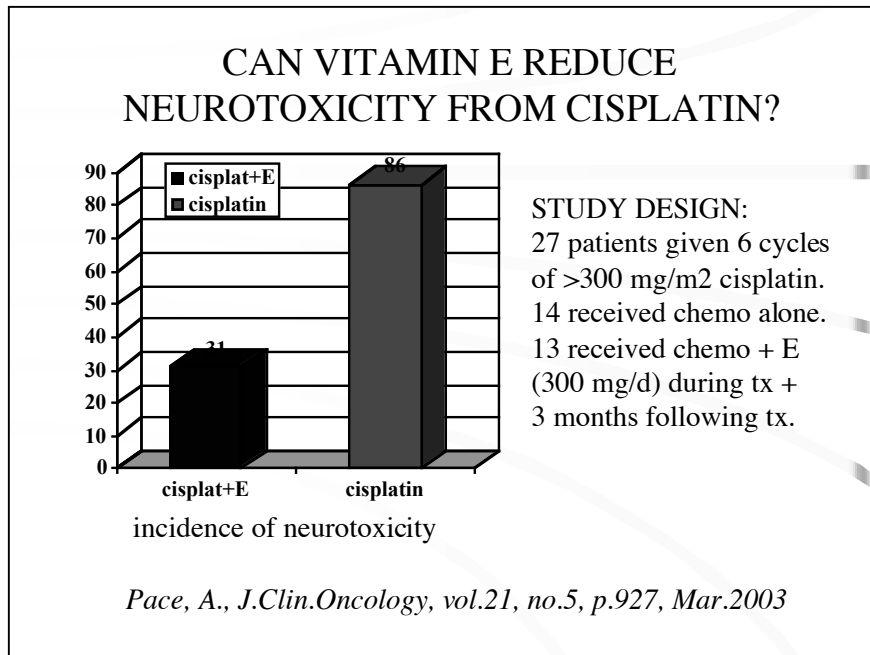
improvement in growth inhibition when compared to 5FU by itself.⁴ Animals given methotrexate and K-3 had improvements in cancer reversal, with no increase in toxicity to the host tissue.⁵

VITAMIN C. Tumor-bearing mice fed high doses of vitamin C (antioxidant) along with adriamycin (pro-oxidant) had a prolonged life and no reduction in the tumor-killing capacity of adriamycin.⁶ Lung cancer patients who were provided antioxidant nutrients prior to, during, and after radiation and chemotherapy had enhanced tumor destruction and significantly longer life span.⁷ Tumor-bearing mice fed high doses of vitamin C experienced an increased tolerance to radiation therapy without reduction in the tumor-killing capacity of the radiation.⁸

FISH OIL. A special fat in fish (eicosapentaenoic acid, EPA) improves tumor kill in hyperthermia and chemotherapy by altering cancer cell membranes for increased vulnerability.⁹ EPA increases the ability of adriamycin to kill cultured leukemia cells.¹⁰ Tumors in EPA-fed animals are more responsive to Mitomycin C and doxorubicin (chemo drugs).¹¹ EPA and another special fat from plants (gamma linolenic acid, GLA) were selectively toxic to human tumor cell lines while also enhancing the cytotoxic effects of chemotherapy.¹²

VITAMIN A & BETA-CAROTENE. There is a synergistic benefit of using vitamin A with carotenoids in patients who are being treated with chemo, radiation, and surgery for common malignancies.¹³ Beta-carotene and vitamin A together provided a significant improvement in outcome in animals treated with radiation for induced cancers.¹⁴

VITAMIN E. Vitamin E protects the body against the potentially damaging effects of iron (pro-oxidant) and fish oil. Vitamin E deficiency, which is common in cancer patients, will accentuate the cardiotoxic effects of adriamycin.¹⁵ The worse the vitamin E deficiency in animals, the greater the heart damage from adriamycin.¹⁶ Patients undergoing chemo, radiation, and bone marrow transplant for cancer treatment had markedly depressed levels of serum antioxidants, including vitamin E.¹⁷ Vitamin E protects animals against a potent carcinogen, DMBA.¹⁸ Vitamin E supplements prevented the glucose-raising effects of a chemo drug, doxorubicin,¹⁹ while improving the tumor-kill rate of doxorubicin.²⁰ Vitamin E modifies the carcinogenic effect of daunomycin (chemo drug) in animals.²¹ One study found that vitamin E supplements (300 mg/day) could reduce the neurotoxicity commonly caused by cisplatin (a chemo drug) from 86% of patients getting the placebo and cisplatin down to 31% of the patients getting vitamin E and cisplatin, which is a 55% reduction in tingling and painful nerves. There was no loss in tumor kill rate from the cisplatin.



NIACIN. Niacin supplements in animals were able to reduce the cardiotoxicity of adriamycin while not interfering with its tumor-killing capacity.²² Niacin combined with aspirin in 106 bladder cancer patients receiving surgery and radiation therapy provided for a substantial improvement in 5-year survival (72% vs. 27%) over the control group.²³ Niacin seems to make radiation therapy more effective at killing hypoxic cancer cells.²⁴ Loading radiation patients with 500 mg to 6,000 mg of niacin has been shown to be safe and is one of the most effective agents known to eliminate acute hypoxia in solid malignancies.²⁵

SELENIUM. Selenium-deficient animals have more heart damage from the chemo drug, adriamycin.²⁶ Supplements of selenium and vitamin E in humans did not reduce the efficacy of the chemo drugs against ovarian and cervical cancer.²⁷ Animals with implanted tumors who were then treated with selenium and cisplatin (chemo drug) had reduced toxicity to the drug with no change in anti-cancer activity.²⁸ Selenium supplements helped repair DNA damage from a carcinogen in animals.²⁹ Selenium was selectively toxic to human leukemia cells in culture.³⁰

CARNITINE. Carnitine may help the cancer patient by protecting the heart against the damaging effects of adriamycin.³¹

QUERCETIN. Quercetin reduces the toxicity and carcinogenic capacity of substances in the body³², yet at the same time may enhance the

tumor-killing capacity of cisplatin.³³ Quercetin significantly increased the tumor-kill rate of hyperthermia (heat therapy) in cultured cancer cells.³⁴

GINSENG. Panax ginseng was able to enhance the uptake of mitomycin (an antibiotic and anti-cancer drug) into the cancer cells for increased tumor kill.³⁵

PATIENT PROFILE: REVERSING PRE-CANCER OF CERVIX

M.M. was a 46 year old female with excessive pain and discharge in the vaginal region. Metrogel and Diflucan were prescribed with no improvement. Gynecologist scheduled cryosurgery (removal) of entire cervix due to benign tumor (leiomyoma). M.M. followed principles in this book along with colloidal silver-soaked tampon inserted twice daily. All inflammation and discharge cleared up within one week. Ultrasound showed decrease in leiomyoma. Doctor states "no surgery warranted at present."

ENDNOTES

- ¹ . Leeb, BF, Clin.Exper.Rheum, 13,459,1995
- ² . Krishnamurthi, S., et al., Radiology, vol.99, p.409, 1971
- ³ . Taper, HS, et al., Int.J.Cancer, vol.40, p.575, 1987
- ⁴ . Waxman, S., et al., Eur.J.Cancer Clin.Oncol., vol.18, p.685, 1982
- ⁵ . Gold, J., Cancer Treatment Reports, vol.70, p.1433, Dec.1986
- ⁶ . Shimpko, K., Am.J.Clin.Nutr.54,1298S,1991
- ⁷ . Jaakkola, K. Anticancer Res., 12, 599, 1992
- ⁸ . Okunieff, P, Am.J.Clin.Nutr.54, 1281S, 1991
- ⁹ . Burns, CP, et al., Nutrition Reviews, vol.48, p.233, June 1990
- ¹⁰ . Guffy, MM, et al., Cancer Research, vol.44, p.1863, 1984
- ¹¹ . Cannizzo, F., et al., Cancer Research, vol.49, p.3961, 1981
- ¹² . Begin, ME, et al., J.Nat.Cancer Inst., vol.77, p.1053, 1986
- ¹³ . Santamaria, L., et al., Nutrients and Cancer Prevention, p.299, Prasad, Humana Press, 1990
- ¹⁴ . Seifter, E., et al., J.Nat.Cancer Inst., vol.71, p.409, 1983
- ¹⁵ . Singal, PK, et al., Mol.Cell.Biochem., vol.84, p.163, 1988
- ¹⁶ . Singal, PK, et al., Molecular Cellular Biochem., vol.84, p.163, 1988
- ¹⁷ . Clemens, MR, et al., Am.J.Clin.Nutr., vol.51, p.216, 1990
- ¹⁸ . Shklar, G., et al., J.Oral Pathol.Med., vol.19, p.60, 1990
- ¹⁹ . Geetha, A., et al., J.Biosci., vol.14, p.243, 1989
- ²⁰ . Geetha, A., et al., Current Science, vol.64, p.318, Mar.1993
- ²¹ . Wang, YM, Molecular Inter Nutr.Cancer, p.369, , Arnott, MS, (eds), Raven Press, NY, 1982
- ²² . Schmitt-Graff, A., et al, Pathol.Res.Pract., vol.181, p.168, 1986
- ²³ . Popov, AI, Med.Radiol. Mosk., vol.32, p.42, 1987
- ²⁴ . Kjellen, E., et al., Radiother.Oncol., vol.22, p.81, 1991
- ²⁵ . Horsman, MR, Radiotherapy Oncology, vol.22, p.79, 1991
- ²⁶ . Coudray, C., et al., Basic Res.Cardiol., vol.87, p.173, 1992
- ²⁷ . Sundstrom, H., et al., Carcinogenesis, vol.10, p.273, 1989
- ²⁸ . Ohkawa, K., et al., Br.J.Cancer, vol.58, p.38, 1988
- ²⁹ . Lawson, T., et al., Chem.Biol.Interactions, vol.45, p.95, 1983
- ³⁰ . Milner, JA, et al., Cancer Research, vol.41, p.1652, 1981
- ³¹ . Furitano, G, et al., Drugs Exp.Clin.Res., vol.10, p.107, 1984
- ³² . Wood, AW, et al., in PLANT FLAVONOIDS IN BIOLOGY, p.197, Cody, V. (eds), Liss, NY, 1986
- ³³ . Scambia, G., et al., Anticancer Drugs, vol.1, p.45, 1990
- ³⁴ . Kim, JH, et al., Cancer Research, vol.44, p.102, Jan.1984
- ³⁵ . Kubo, M., et al., Planta Med, vol.58, p.424, 1992