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Use of Topical Vitamin C Reduces Damage to Eyes After Laser Surgery

A topical solution of vitamin C can prevent free radical damage and inflammation resulting from laser surgery to the eyes, according to a recent study.

Laser surgery to correct myopia, astigmatism, and corneal scars is becoming increasingly popular. However, researchers have found that the procedure generates hazardous free radicals, which promote inflammation that can cause complications and damage the eyes. In addition laser surgery increases the infiltration of white blood cells in the cornea, which further promotes inflammation.

"The eye protects itself from radical injury by two major protective mechanisms: the endogenous antioxidant enzyme systems, such as superoxide dismutase, catalase, and glutathione peroxidase, and the free radical scavengers, such as ascorbate [vitamin C] and vitamin E," wrote Peter J. McDonnell, MD, and his colleagues in *Archives of Ophthalmology*. "The presence of excessive amounts of free radicals that break through these defense systems leads to oxidative damage of the corneal tissue and further corneal inflammation through proinflammatory, modulatory, and toxic effects as well."

To test the protective effects of vitamin C, McDonnell, of the University of Southern California School of Medicine, conducted laser surgery on the eyes of five rabbits. He applied vitamin C because it is well established as an antioxidant and is known to inhibit the inflammatory activity of white blood cells. In addition, eye tissues contain vitamin C levels seven times higher than those in the blood, suggesting a high requirement for it.

Following laser treatment, McDonnell and his colleagues treated the right eye of each rabbit every three hours with a topical solution containing 10 percent vitamin C. The left eyes of the animals served as the "control," or nontreated group.

Analysis showed that free radical damage in the vitamin C-treated eyes was significantly reduced, compared with the untreated eyes. In addition, vitamin C reduced the inflammatory reaction after laser surgery. "This suggests that topical ascorbic acid could be considered a complementary treatment... after laser corneal surgery," McDonnell wrote.

He also noted that antioxidant therapy may speed

the healing of corneal tissues after laser surgery.

Reference: Kasetsuwan N, Wu FM, Hsieh F, "Effect of topical ascorbic acid on free radical tissue damage and inflammatory cell influx in the cornea after excimer laser corneal surgery," *Archives of Ophthalmology*, 1999;117:649-652. □

Multiple Antioxidants Reduce Complications in Trauma Patients

The use of supplemental antioxidants can reduce the likelihood of multiple organ failure and life-threatening infection in severely injured trauma patients.

Antioxidant levels in trauma patients are seriously compromised, the result of a sharp increase in free radicals. These free radicals are produced during "ischemia-reperfusion injury," in which blood flow to organs is interrupted and then restored during resuscitation. Free radicals are highly toxic and can result in "multiorgan dysfunction syndrome (MODS) and impaired immunity."

John M. Porter, MD, currently of St. Elizabeth's Health Center, Youngstown, Ohio, used multiple antioxidants as part of the treatment of nine male patients who had suffered either gunshot or stab wounds. Another nine patients with comparable wounds were treated, but did not receive antioxidants. Informed consent was obtained either from the patients or their family members.

The antioxidants included: 50 mcg of selenium intravenously every six hours; and 400 IU of vitamin E every eight hours, 100 mg of vitamin C every eight hours, and 8 grams of N-acetylcysteine (NAC) every six hours (either orally or via a nasogastric tube). Selenium and NAC are precursors to glutathione, the body's principal endogenous antioxidant.

Administration of the antioxidants began within eight hours of injury and continued for seven days.

Patients receiving antioxidants suffered no organ dysfunction; those not receiving antioxidants suffered nine episodes of organ failure. Similarly, patients receiving antioxidants had only eight infectious complications from their injuries; the other group had 18 infections.

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"We conclude that these preliminary data may support a role for the use of this antioxidant mixture to decrease the incidence of multiorgan dysfunction syndrome and infectious complications in the severely injured patient," Porter wrote.

Reference: Porter JM, Ivatury RR, Azimuddin K, et al., "Antioxidant therapy in the prevention of organ dysfunction syndrome and infectious complications after trauma: early results of a prospective randomized study," *American Surgeon*, 1999;65:478-483. □

Nurses Study Finds Fiber Lowers Heart Disease Risk in Women

Diets high in fiber, particularly cereal fiber, can reduce the long-term risk of heart attack, according to a study of more than 68,000 women in the ongoing Nurses Health Study.

Alicja Wolk, DMSc, of the Karolinska Institute, Sweden, and colleagues at Harvard University, analyzed the diets of women and their risk of heart disease over a 10-year period. Women consuming the largest amount of fiber—an average of 22.9 grams daily—had a 47 percent lower risk of heart attack, compared with women eating little or no fiber.

However, after analyzing vegetable, fruit, and cereal fiber, Wolk and her colleagues found that only cereal fiber "was strongly associated with a reduced risk of coronary heart disease."

Women consuming the largest amounts of cereal fiber had a 34 percent lower risk of heart disease, compared with women consumed the least amount.

"Women with a higher intake of fiber were more likely to have a higher intake of vitamin E, vitamin B6, vitamin C, folate, beta carotene, and magnesium, and a lower intake of saturated and trans fats," Wolk and her colleagues wrote. "However, adjustments for those nutrients one at a time as well as simultaneously did not change estimates [of risk] appreciably."

Wolk suggested that delayed absorption of carbohydrates might account for some of the benefits of fiber. Fiber improves insulin function and lowers triglyceride levels. "This provides further reason to replace refined forms of starch with whole-grain products," Wolk wrote.

Reference: Wolk A, Manson JE, Stampfer MJ, et al., "Long-term intake of dietary fiber and decreased risk of coronary heart disease among women," *JAMA*, 1999;281:1998-2004. □

Vitamin E Reduces Chromosomal Damage in Down's Syndrome

Down's syndrome is a common chromosomal disorder resulting from an extra 21st chromosome. The disorder results in characteristic physical

features and mental retardation, and it increases the risk of Alzheimer's disease and leukemia. Although Down's syndrome cannot be reversed, a recent study has found that vitamin E may slow subsequent damage to chromosomes.

A number of studies have shown that people with Down's syndrome produce very high levels of superoxide dismutase, which may increase production of hydrogen peroxide. Hydrogen peroxide is a potent generator of hydroxyl free radicals, which can damage chromosomes. Therefore, researchers at the University of Chile, Santiago tested whether vitamin E, the body's principal fat-soluble antioxidant, might protect against free radical damage.

The researchers obtained lymphocytes from 14 subjects with Down's syndrome and from 10 control subjects. Next, they exposed the lymphocytes to caffeine, which increased the number of "chromosomal aberrations." Lymphocytes from subjects with Down's syndrome suffered a higher number of chromosomal aberrations compared with lymphocytes from healthy subjects.

Following this, the researchers exposed lymphocytes to vitamin E. The vitamin reduced chromosomal damage by 50 percent in lymphocytes from people with Down's syndrome and by 30 percent in lymphocytes from healthy control subjects.

The researchers wrote that people with Down's syndrome have a weakened ability to repair damaged deoxyribonucleic acid (DNA), the molecule that forms chromosomes. This poorer DNA repair ability may be further compromised by substances, such as caffeine, that damage DNA.

Vitamin E, the researchers wrote, may protect cells or improve DNA's ability to repair damage.

Reference: Pincheira J, Navarrete MH, de la Torre C, et al., "Effect of vitamin E on chromosomal aberrations in lymphocytes from patients with Down's syndrome," *Clinical Genetics*, 1999;55:192-197. □

Arginine Supplements Found Helpful in Intractable Angina

Supplements of the amino acid arginine may benefit patients with hard-to-treat angina pectoris, according to a pilot study published in the *American Journal of Cardiology*. Angina causes pain in the heart, usually after exertion.

Hylton Miller, MB, of the Tel-Aviv Medical Center, Israel, gave 9 grams of arginine supplements to 10 men with severe angina. All of the patients had frequent attacks of angina while resting and at night, despite being prescribed high doses of beta-blockers, calcium-channel blockers, or aspirin.

During the three-month study, seven patients

improved significantly and consistently as long as they took the arginine supplements. When supplementation was discontinued, the men suffered a "rebound" effect and deteriorated.

The arginine supplements also reduced levels of cell adhesion molecules and cytokine levels, demonstrating that it also had an antiinflammatory effect.

Reference: Blum A, Porat R, Rosenschein U, et al., "Clinical and inflammatory effects of dietary L-arginine in patients with intractable angina pectoris," *American Journal of Cardiology*, 1999;83:1488-1490. □

Disease of Rapid Aging Related to Low Antioxidant Levels

Low levels of antioxidant enzymes may partly account for a devastating disease that rapidly ages the body.

Progeria is a rare disease that accelerates the aging process. Children with it typically look, at age six, as though they were 60 years old and they usually die of cardiovascular complications of old age by 13.

Because free radicals are involved in the aging process, Larry W. Oberley, PhD, of the University of Iowa, Iowa City, analyzed levels of antioxidant enzymes in skin cells from people with and without progeria.

Catalase, glutathione peroxidase, and two forms of superoxide dismutase are the body's first line of defense against free radicals. Superoxide dismutase (SOD) occurs as a manganese SOD (MnSOD) compound and as a copper-zinc SOD (CuZnSOD) compound.

In the first study to assess antioxidant levels in progeria, Oberley found that three of the four antioxidant enzymes were below normal. Catalase levels were 50 percent below normal, and glutathione peroxidase levels were only 30 percent of normal. MnSOD levels were also below normal, though CuZnSOD levels were not affected.

Reference: Yan T, Li S, Jiang X, et al., "Altered levels of primary antioxidant enzymes in progeria skin fibroblasts," *Biochemical and Biophysical Research Communications*, 1999;257:163-167. □

Low Potassium Levels Set Stage for Arrhythmias in Heart Patients

Patients who have low blood levels of potassium and undergo coronary artery bypass surgery have about twice the risk of developing arrhythmias, compared with patients with normal potassium levels.

Potassium, an essential dietary mineral, is needed for the transmission of electrical signals in the heart muscle and normal heartbeat.

Joyce A. Wahr, MD, of the University of Michigan,

Ann Arbor, led a study of 2,402 bypass patients at 24 U.S. medical centers. Of the patients, 1,432 suffered some type of arrhythmia before, during, or after surgery. The risk of arrhythmia was greatest among patients with the lowest potassium levels.

Wahr recommended that bypass patients be routinely screened for potassium levels and, if low, be given the mineral before surgery. She described potassium as "low-risk, low-cost prophylaxis."

Wahr JA, Parks R, Boisvert D, et al., "Preoperative serum potassium levels and perioperative outcomes in cardiac surgery patients," *JAMA*, 1999;281:2203-2210. □

Alpha-Lipoic Acid Protects Against Exercise-Induced Free Radicals

Exercise has its down side: it increases levels of free radicals as a byproduct of energy-producing chemical reactions. However, alpha-lipoic acid, can bolster the body's protective antioxidant network to minimize exercise-induced free radical damage.

One of the principal defenses against free radicals is glutathione, an antioxidant made by the body. Alpha-lipoic acid can increase levels of cysteine, an amino acid precursor to glutathione.

So Chandan K. Sen, PhD, of the University of California, Berkeley, measured levels of alpha-lipoic acid, glutathione, and free radicals in laboratory rats after they exercised on a treadmill.

When the animals received alpha-lipoic acid, levels of the antioxidant increased in muscle tissues and slightly in the liver. Alpha-lipoic acid also boosted glutathione levels in the liver and blood.

In addition, animals receiving alpha-lipoic acid benefited from lower levels of free radicals in muscle tissues and the liver, compared with unsupplemented animals.

Sen and his colleagues also studied the effect of alpha-lipoic acid on the animals' hearts. Although alpha-lipoic acid did not increase glutathione levels in the heart, supplemented animals were far more resistant to free radical stresses. Animals receiving alpha-lipoic acid lost only 3.6 percent glutathione, compared with a 23.1 percent loss of heart glutathione in unsupplemented animals.

"We observed that exhaustive exercise decreased the activity of glutathione in the heart," wrote Sen and his colleagues. "Supplementation of rats with alpha-lipoic acid abolished the exercise-induced decrease of glutathione activity in the heart."

Reference: Khanna S, Atalay M, Laaksonen DE, et al., "alpha-lipoic acid supplementation: tissue glutathione homeostasis at rest and after exercise," *Journal of Applied Physiology*, 1999;86:1191-1196. □

Quick Reviews of Recent Research

• Preeclampsia linked to low vitamin E

Preeclampsia, characterized by hypertension and headaches, is a serious complication of pregnancy. It may progress to eclampsia, which can result in death. Researchers compared levels of vitamin E and free radicals among 18 women with preeclampsia, 15 with eclampsia, and 25 without these conditions. Women with preeclampsia and eclampsia had higher levels of free radicals and lower levels of vitamin E.

Yanik FF, et al., *International Journal of Gynecology and Obstetrics*, 1999;64:27-33.

• Vitamin supplements reduce risk of stroke

Researchers analyzed the use of multivitamins and homocysteine levels in patients who had suffered strokes, as well as in nonstroke patients with risk factors and healthy subjects. Significantly fewer stroke patients were taking vitamin supplements. In addition, levels of homocysteine (a risk factor for stroke and heart disease) were lower among patients taking vitamin supplements.

Beamer NB, et al., *Neurology*, 1999;52 (Suppl 2): A64 (Abstr P01.077).

• Calcium supplements increase bone density

Researchers studied 50 healthy girls, 25 of whom were given a 500 mg calcium supplement daily for 10 months. Forearm bone density was measured and found to increase significantly in the girls taking calcium supplements, but not in the unsupplemented group. According to the researchers, developing peak bone mass at an early age can reduce the risk of osteoporosis later in life.

Fischer S, et al., *Revista Medica de Chile*, 1999;127: 23-27.

• Arginine may help in sickle-cell anemia

Sickle-cell anemia is an inherited blood-cell disorder affecting people of African descent. Researchers analyzed arginine, hemoglobin, and arginase activity in 19 African-American children and young adults, comparing them to 16 African-American children without the disorder. Based on their findings, the researchers concluded that arginine dependency is a factor in sickle-cell anemia. They recommended that correcting arginine deficiency would lead to greater protein synthesis, better immune responses, and improved health.

Waugh WH, et al., *Nutrition Research*, 1999;19:501-518.

• Vitamin E protects against aflatoxin damage

Aflatoxin is a cancer-causing toxin found in some peanuts and other foods. In an animal study, researchers found that aflatoxin resulted in a significant increase in lipid peroxidation—that is, free

radical damage—to liver and kidney cells. As a result of aflatoxin exposure, levels of glutathione and vitamin C declined significantly. Pretreatment with vitamin E prevented these changes.

Verma RJ and Nair A, *Medical Science Research*, 1999;27:223-226.

• Chromium improves insulin sensitivity

Reduced insulin sensitivity increases the risk of diabetes and heart disease. Researchers gave either 1,000 mcg of chromium picolinate or placebo daily for eight months to 29 obese men and women with a high risk of diabetes. Subjects taking chromium benefited from significantly improved insulin sensitivity. However, the subjects had no change in body weight, fat, or body mass.

Cefalu WT, et al., *Journal of Trace Elements in Experimental Medicine*, 1999;12:71-83.

• Pyruvate aids loss of body fat

Researchers placed 26 overweight men and women on an exercise program and gave them either 6 grams daily of pyruvate or placebo for six weeks. Subjects taking pyruvate supplements had statistically significant decreases in body weight, fat and percent of body fat. However, there was no significant change in lean body mass in either group.

Kalman D, et al., *Nutrition*, 1999;15:337-340.

• Lutein reduces free radical damage to retina

The carotenoid lutein is deposited in the macular pigment, which aids fine vision. It is also an antioxidant that may protect the retina against free radical damage. In an experiment, researchers induced free radical damage in retinas from laboratory rats. The damage resulted in a 42 percent reduction of eye retinal phospholipid. When lutein was added to the retinas, free radical damage was reduced by only 17 percent.

Rapp LM, Choi JH, *Investigative Ophthalmology and Visual Science*, 1999;40:S164 (Abs #880-B840).

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Post Office Box 5505
Aloha, OR 97006-5505 USA

Editor and Publisher: **Jack ChalleM**

Medical Advisors:

London H. Smith, MD Portland, Oregon • Richard P. Huemer, MD Lancaster, California
Ralph K. Campbell, MD Polson, Montana • Peter Langsjoen, MD Tyler, Texas
G. Edward Desaulniers, MD The Shute Institute Medical Clinic London, Ontario
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