Questionable Methods of Cancer Management: Hydrogen Peroxide and Other 'Hyperoxygenation' Therapies

After studying the literature and other available information, the American Cancer Society has found no evidence that treatment with hydrogen peroxide or other "hyperoxygenating" compounds is safe or results in objective benefit in the treatment of cancer. Lacking such evidence, the American Cancer Society strongly urges individuals with cancer not to seek such treatment.

The following is a summary of the material on hydrogen peroxide and other "hyperoxygenation" therapies in the American Cancer Society files as of February 1992. Reference to proponent materials should not be interpreted to mean that the Society agrees with their contents.

Abstract

"Hyperoxygenation" therapy — also called "oxymedicine," "bio-oxidative therapy," "oxidative therapy," and "oxidology"—is a method of cancer management based on the erroneous concept that cancer is caused by oxygen deficiency and can be cured by exposing cancer cells to more oxygen than they can tolerate. The most highly touted "hyperoxygenating" agents are hydrogen peroxide, germanium sesquioxide, and ozone.

Although these compounds have been the subject of legitimate research, there is little or no evidence that they are effective for the treatment of any serious disease, and each has demonstrated potential for harm. Therefore, the American Cancer Society recommends that individuals with cancer not seek treatment from individuals promoting any form of hyperoxygenation therapy as an "alternative" to proven medical modalities.

Background

During the past decade, highly reactive, oxygen-rich compounds have been utilized by many promoters of questionable cancer regimens. The promoters refer to their practices as "oxymedicine," "bio-oxidative therapy," "oxidology," "oxidative therapy," and "hyper-oxygenation" therapy. The most highly touted "hyperoxygenating" agents are hydrogen peroxide (H_2O_2),[1] germanium sesquioxide,[2] and ozone (O_3).[3] These substances supposedly kill cancer cells by supplying more oxygen than they can tolerate.

Proponent Claims

Hyperoxygenation regimens are claimed to be effective against most types of cancer as well as against migraines, colds and flu, deafness, blood pressure irregularities, skin rashes, earaches, "softening of the brain," cirrhosis of the liver, gum disease, Down's syndrome, Alzheimer's disease, Parkinson's disease, AIDS, herpes, hepatitis, chronic fatigue syndrome, cytomegalovirus, arthritis, and systemic candidiasis.[2,4,5] Some promoters also claim that the substances can prevent damage from radioactivity, retard aging, and restore sexual function.[2,3] Hydrogen peroxide has even been touted as a cure for stupidity.[5]

Oxymedicinal therapies generally are promoted as "natural and nontoxic." Some advocates assert that oxygenation therapy can cause tumors to decrease rapidly in size or disappear altogether. Some claim that soaking an affected body part in peroxide can cause tumors to separate from the body so that they can be "wiped away" and that drinking H_2O_2 can reduce the size of throat tumors.[6]

Proponents claim that oxymedicine works for the following reasons:

1. Many diseases are caused by oxygen deficiency in the body.[2,5] This supposedly occurs because: (a) weather conditions and pollutants deplete oxygen from the air we breathe;[2,4-8] (b) depleted soils rob the body of oxygen-carrying nutrients;[7] (c) overeating and loading the body with "toxins and impurities" reduce the blood's ability to pick up and distribute oxygen;[2,5,7] (d) emotional distress and unhealthy mental attitudes rob the body of oxygen and may poison the blood stream directly;[2,5,7] (e) abscesses and other infections divert oxygen to "counteract their venom";[7] and (f) water fluoridation slows the production of adenosine triphosphate, thereby inhibiting proper utilization of oxygen.[7]

2. Malignant cells are anaerobic and prosper when tissue oxygen levels are low.[6,9] Oxymedicinal products restore proper oxygen balance and produce free radicals that selectively attack cancer cells.[7]

3. When oxygen levels fall too low, toxins accumulate due to a buildup of incompletely metabolized compounds. Oxygen-producing substances can raise O_2 levels back to normal, thereby helping to remove debris from the system. Free radicals selectively destroy toxins and remove them from the cells and blood stream by converting incompletely metabolized or oxidized materials to "mostly carbon dioxide and water."[7]

4. Pathogenic organisms, which are primitive, supposedly evolved when there was less oxygen on the earth. Under low oxygen pressure they reproduce rapidly, causing serious illness.[5] Oxymedicine raises the O_2 pressure to levels favoring the patient rather than the microorganisms, and free radicals then kill "the bacteria, viruses, and/or parasites associated with most serious diseases."[6]

5. When oxygen levels are too low, the acidic or "stable form of the body" takes over. This happens because the anabolic, concentrating effects of hydrogen diminish the "housecleaning" functions that require oxygen. Excess anabolic products then cause congestion of the organs and tissues. Restoring adequate oxygen levels provides "vital energy" that reestablishes the pH level necessary for good health.[2,7]

Germanium

Bis-carboxyethyl germanium sesquioxide—$(GeCH_2CH_2COOH)_2O_3$—most commonly sold in health food stores as "organic germanium," is touted as a major oxygenator. It was first synthesized in 1967 by Kazuhiko Asai, PhD, a Japanese scientist who was trained in metallurgy during World War II.[2] Most "organic germanium" used in the United States is is made in Japan under the approval of the Asai Germanium Research Institute, which holds US patents on the manufacturing procedure. Tokai Sangyo Co., Ltd., of Tokyo provides the remainder of the Japanese supply, while several US companies produce small quantities domestically.[10] In 1988 the Food and Drug Administration issued an Import Alert authorizing detention of germanium labeled for food or drug use.[11] Tokai Sangyo, however, continued to market the substance.[12]

Germanium's leading publicists are Paris Kidd, PhD, Steven A. Levine, PhD, and Karl Loren. Dr. Kidd received his PhD in zoology from the University of California at Berkeley. He founded and is executive director of the Germanium Institute of North America (GINA), in

Berkeley, California, which he describes as a for-profit clearinghouse for information on germanium. GINA's goal, according to Dr. Kidd, is to promote safe, scientific, responsible, and effective use of germanium-containing compounds. Nevertheless, the information he provides, especially in his newsletter *Gina Speaks*, contains anecdotes and testimonials claiming that cancers and many other diseases can be cured or helped by germanium.[10]

Dr. Levine, a graduate of the University of California, Berkeley, with a degree in genetics, is Research Director of Nutri-Cology Inc. of San Leandro, California. The company, which does business as the Allergy Research Group, sells germanium-containing supplements. Dr. Levine lectures widely on the attributes of germanium and has published articles on the subject for the *Journal of Orthomolecular Medicine* and the *Journal of Orthomolecular Psychology*, both of which are outside the scientific mainstream.[10]

Karl Loren, a graduate of the Harvard School of Business, has written a booklet called *The Report on Germanium, Has the Cure for Cancer and AIDS Finally Arrived?* He also has been active in promoting the questionable cancer therapy provided at the St. Jude International Clinic in Tijuana.[10] Jimmy Keller, who administered the clinic until his recent arrest for wire fraud, claimed to use "electrolytes of oxygen" as an oxygenator during his treatments.[13]

Most data relating to the effectiveness of germanium as a therapeutic agent are contained in a 1984 report titled *GE-132 Outline* published by the Asai Germanium Research Institute.[14] This 65-page report describes studies on the use of germanium against collagen disease, osteoporosis, and other conditions, but most of the studies were done in animals. The report provides no persuasive evidence that germanium is effective against any human ailment.

In early studies, germanium dioxide was implicated in kidney failure in patients who received doses over prolonged periods of time. Studies conducted in 1980 found that injections of germanium sesquioxide (100 mg/kg of body weight) had an antitumor effect on mice. Oral doses (100 mg/kg) were also found to be effective.[14] Additional data published in 1987 suggested that germanium could induce T-cells to produce gamma interferon, thereby activating macrophages to destroy some types of tumor cells.[15] It has not been demonstrated, however, that any germanium compound is effective against cancer in humans.

Hydrogen Peroxide

Hydrogen peroxide is promoted for everything from cleansing the digestive tract to curing cancer. Taken by mouth, the substance is said to be useful for general cleansing and health maintenance, as well as for curing arthritis and destroying digestive tract tumors by increasing the oxygen content in the body so "anaerobic life cannot flourish." Some proponents advocate adding peroxide to baths and for cleaning foods with it prior to eating.

Most promoters relate their claims for the efficacy of oxymedicine to the work of Otto Warburg, MD, twice recipient of the Nobel Prize in Medicine. Dr. Warburg's theory, based on his observation that aerobic respiration rates were below normal level in neoplasms, postulated that cancer cells grow better under hypoxic conditions.[16] Contemporary researchers, however, attribute the reduced respiration rate to poorly vascularized tissue surrounding tumors.[17]

Recent efforts to popularize hydrogen peroxide as an "alternative therapy" are due largely to the activity of Father Richard Wilhelm, a retired high school teacher and former Army chaplain. Proponents also describe him as head of the "Catholic Health Organization." Rep-

resentatives of the Roman Catholic Church, however, state that he is not listed as a priest in the official Catholic directory and that the Catholic Health Organization is not affiliated with the church[18]—nor is it listed in the *Encyclopedia of Associations*.[19]

Father Wilhelm claims to have discovered the healing potential of H_2O_2 through acquaintance with Edward Carl Rosenow, MD, a physician who headed the Mayo Clinic's division of experimental bacteriology from 1915 until 1944, when he retired.[20,21] Dr. Rosenow, who died in 1966, was a prominent experimental bacteriologist who devoted considerable research time to the study of streptococci. According to Father Wilhelm, Dr. Rosenow discovered that some 35 diseases, including mental illness, were caused by a specific streptococcus that could be killed by hydrogen peroxide. His papers, however, contain no evidence that he promoted the internal use of hydrogen peroxide for the control of cancer, arthritis, or any other degenerative disease.[22,23]

Other active promoters of hydrogen peroxide therapy are Kurt Donsbach, PhD, Walter Grotz, George Borell, Ed McCabe, and Charles Farr, MD, PhD.

Dr. Donsbach has touted H_2O_2 infusions since the mid-1980s as part of "holistic" cancer therapy at his Mexican clinics. His infusions may contain amino acids, vitamins and minerals, laetrile, dimethylsulfoxide, thymosin, cesium chloride, hydrazine sulfate, and various other substances. Dr. Donsbach says, however, that all his cancer patients are given both oral and infused 35% hydrogen peroxide (about 4 ml diluted per infusion) and 750 mg per day of germanium.[7] He also markets a line of peroxide-containing sundries—mouthwash, tooth gel, pain gel, ear drops, nasal spray, and deodorant. He has also marketed "Superoxy Concentrate"—a product said to have been "designed for his patients in Mexico," which supposedly can "increase the oxygen concentration in the body" when ingested.[24]

Dr. Donsbach, a chiropractor, has a "PhD in nutrition" from Union University, a nonaccredited school in Los Angeles that is now defunct. He obtained a naturopathy license from Oregon after submitting what appeared to be a photocopy of a diploma from the Hollywood College School of Naturopathy in Los Angeles, but the document was recently proven to be counterfeit.[25] He has marketed supplements through a myriad of companies and has operated unaccredited correspondence schools that issued "degrees" in nutrition.[26] During 1988, the US Postal Service charged him with falsely representing that hydrogen peroxide is effective against cancer and arthritis.[27] Without admitting liability, he signed a consent agreement pledging not to make such representations in mail-order sales. He continues to make such claims, however, through speeches and publications.

Walter Grotz, a retired postmaster in Delano, Minnesota, believes that he was cured of arthritis by a hydrogen peroxide regimen recommended by Father Wilhelm.[20] Mr. Grotz lectures widely at meetings sponsored by groups that promote dubious cancer therapy, such as the Cancer Control Society, the International Association of Cancer Victors and Friends, and the National Health Federation. He also publishes *ECHO*, a newsletter on the topic.

George Borell, a colleague of Mr. Grotz from southern California, is also touted an expert on hydrogen peroxide therapy and has written a book, *The Peroxide Story*.

Ed McCabe, who has a degree in educational media from the University of Massachusetts, describes himself as a public speaker, radio announcer, and television host. His book, *Oxygen Therapies: A New Way of Approaching Disease*,[28] includes his personal experiences with a wide variety of products.

Charles Farr, MD, PhD, of Oklahoma City, is author of *The Therapeutic Use of Intravenous Hydrogen Peroxide.* In 1986 he organized the International Bio-Oxidative Medicine Foundation (IBOM), which sponsors conferences, sells tapes and reprints, and publishes a newsletter. IBOM is open to both professionals and laypersons. For a $10 "donation," it will provide a regional list of physicians who practice oxymedicine. In 1989, the referral list contained about 90 physicians worldwide.[29] Dr. Farr also founded the now-defunct International Academy of Bio-Oxidative Medicine (IABOM).

Some promoters claim that the 3% H_2O_2 product available in pharmacies is contaminated, so they recommend either reagent-grade (30%) or the 35% variety most commonly sold in health food stores. Proponents refer to the 35% version as "food-grade peroxide," although this is not a scientifically recognized term. For oral ingestion, 0.5% solutions are made from concentrated stocks. Occasionally, solutions of higher concentrations are used. Mr. Grotz, for example, recommends starting with one ounce of the 0.5% solution the first day, gradually increasing to five ounces taken two to three times a day. Thereafter, the maintenance dose is varied with the patient's symptoms.[8] Dr. Donsbach recommends drinking 3 to 75 drops of 35% H_2O_2 a day after diluting it with water.[7] His booklet on hydrogen peroxide states: "Due to pressure from the FDA and American Cancer Society, suppliers will no longer sell 35% food grade hydrogen peroxide for internal use. Tell them you wish to use it for your swimming pool."[7]

Intravenous injection is used for what proponents consider to be serious conditions. Dr. Farr, for example, recommends a 1:2,000 dilution of 3% hydrogen peroxide to produce a 0.15% stock solution with a pH of 4.0 to 5.0. Immediately before usage he buffers the solution with 0.1 meq of sodium bicarbonate/ml. This stock is then added to a carrier of glucose or saline for a final concentration of 0.0375 percent or less. The resultant mixture has a pH of 8.0 to 8.5, which gradually decreases as the peroxide breaks down. The infusion is given when the pH is 7.0 to 7.5. He recommends that practitioners without pH meters use swimming pool test kits for pH determinations. Doses of the 0.15% solution range from 50 to 500 ml per day. Some patients receive as much as 3,200 ml over a 10-day period.[30,31]

Dr. Farr claims to determine the metabolic activity of the peroxide solution by measuring the patient's axillary or skin temperature immediately after infusion. A temperature rise suggests that the patient's metabolic activity has increased and that the peroxide is active, but if several consecutive patients show no temperature increase, the peroxide probably has lost its potency.[30,31]

Hydrogen peroxide has received significant attention from the scientific community. One of the earliest accounts was a brief article by I.N. Love, MD, in 1888 in the *Journal of the American Medical Association.*[32] Dr. Love stated that the peroxide of hydrogen was useful against scarlet fever, diphtheria, atonic dyspepsia, and cancer of the womb.

In 1920, intravenous applications of hydrogen peroxide were used to treat patients during an epidemic of influenzal pneumonia.[33] In the 1940s, animals were used to test hydrogen peroxide's efficacy against carbon monoxide poisoning, hemorrhage, and chemical toxic shock, but no noteworthy benefit was obtained for any of these conditions.[34]

During the next three decades, many investigators studied the effects of hydrogen peroxide infusion on tumors in laboratory animals. When used alone, H_2O_2 did not appear to be effective. Some investigators reported that intra-arterial infusion made certain tumors more radiosensitive,[35-38] but others found no benefit.[39] Regional infusion

was also investigated as an adjuvant to radiotherapy in humans.[40] Although some patients appeared to benefit,[41,42] others did not,[39] and some researchers expressed concern about air emboli.[43,44] Current medical applications of hydrogen peroxide are limited to 1.5% to 3% solutions used as surface disinfectants and wound cleansers. Dentists also use dilute solutions to irrigate root canals and treat some forms of gingivitis.[45]

Infusion with H_2O_2 can result in increased oxygenation of tissues, although the farther from the infusion site, the lower the concentration achieved.[46] However, when high blood levels of peroxide (above 0.007 vol. percent) are achieved in animal models, oxygen bubbles can cause capillary and arteriole blockage.[43] In test animals, this has caused digital gangrene and death.[39,47] Rogers and Manguikian found that tissues were oxygenated less effectively with concentrations above 0.12 percent than with lower concentrations and thought the reason might be regional capillary blockage by bubbles.[35] Oxymedicine promoters claim that the bubbles dissolve in the blood and are not of concern.

Attempts to treat patients with H_2O_2 injections directly into solid tumors or into the circulation have generally been ineffective, but certain lines of laboratory research have shown promise. Nathan and Cohn treated mice by subcutaneous and peritoneal cavity injections of glucose oxidase coupled to polystyrene microspheres. The microspheres caused the glucose oxidase to be retained at the sites of the malignancy where it produced a flux of H_2O_2 *in situ* from the breakdown of glucose in the presence of oxygen. Survival time was significantly increased over that of controls, and the authors concluded that H_2O_2 should be studied further, especially against certain tumor types (like P388 lymphoma) and combined with other antitumor drugs already in clinical use.[38]

Other studies have indicated that certain cell types—that is, nodular sclerosis Hodgkin's disease and mixed cellularity Hodgkin's disease—may be more sensitive than others.[48] Although the use of hydrogen peroxide to treat tumors remains an area for responsible research, there is no scientific basis for the regimens utilized by the oxymedicine promoters.

Research on oxygen radicals indicates that cells of most organisms normally produce oxygen in potentially toxic forms such as H_2O_2, O_2^-, $HO_2\cdot$, singlet oxygen O_2^1, and $\cdot OH$.[49] These reactive intermediates are involved in mutations, DNA breakage, sister chromatid exchanges, chromosomal aberrations, cytotoxicity, promotion of carcinogenesis, and cellular degradation related to aging. Although most are handled by natural defense systems (i.e. catalases, peroxidases, superdismutases, etc.), recent investigations suggest that hyperoxygenation can cause chromosomal damage and promote neoplastic growth.[50]

Promoters of hydrogen peroxide tend to downplay its potential for harm. For example, although Dr. Donsbach does not recommend ingesting concentrated solutions of hydrogen peroxide, he does note anecdotal information about patients who suffered no ill effects after accidental ingestion of 35% hydrogen peroxide. In fact, however, during the past three years, six children have been seriously poisoned and one died as a result of accidentally drinking the concentrated solution stored in their refrigerator.[51] The product in the fatal case had been obtained by mail order as an alternative medicine. A near-fatal case of ingestion by an adult also has been reported.[52]

Although 3% hydrogen peroxide is commonly used to irrigate and cleanse wounds, cases of oxygen emboli and surgical emphysema have been reported

due to irrigation under pressure.[44,53,54] The authors warn that using hydrogen peroxide under pressure or in a closed space can be harmful. No such warning, however, appears in the promotional literature for hydrogen peroxide. In fact, in a promotional tape, Dr. Donsbach recommends the occasional external use of 30% H_2O_2. At such a high concentration, peroxide is a strong irritant.[55]

Ozone

Treatment with ozone is claimed to be effective against cancer and many other conditions. The ozone is administered in at least five ways:[56]

1. For external application, a stream of ozone is passed over open lesions or tumors inside an ozone-resistant plastic hood. This is supposed to help promote healing of ulcerations and destroy infections. Some promoters claim it will heal and dissolve tumors.

2. Injections of 20 to 50 ml of an ozone/oxygen mixture are given intramuscularly or subcutaneously. The injection may be made into the immediate vicinity of a tumor. This method is used primarily for allergic diseases and inflammatory infections.

3. Intra-arterial or intravenous injections may also be utilized. Promoters claim that only unhealthy or diseased tissue is affected and that there are no deleterious side effects, because bubbles in the blood dissolve readily. Up to 20 ml of spinal fluid may also be removed and replaced with an ozone/oxygen mixture as a treatment for meningitis.

4. Rectal administration utilizes up to one liter of an ozone/oxygen mixture, introduced in less than one minute. The treatment may be as often as daily over a period of two to three weeks. According to proponents, the mixture is absorbed through the large intestine in about 20 minutes and oxygenates the blood and destroys pathogens. Promoters of the Gerson method claim success in treating cancers by combining these "ozone enemas" with hydrogen peroxide and the other aspects of their regimen.

5. "Autohemotherapy" using ozone is a procedure in which blood is removed from a patient, exposed to ozone produced by passing oxygen through an electrically charged metal tube, and then returned to the patient. The treatment is given twice a day to twice a week until the patient shows improvement.

Two Germans, Seigfried Rilling, MD, and Renate Viebahn, PhD, have written many papers on ozone therapy, as well as a book, *The Use of Ozone in Medicine*, the most recent and complete treatise on the topic.[56]

Joachim Varro, MD, another German physician, has used ozone as an adjunct to conventional treatment of cancer. In 1983, Dr. Varro reported "the most noticeable result was significantly improved well-being of the patient." He also claimed that side effects of chemotherapy and radiation therapy can frequently be diminished or eliminated and that "patients are free of metastasis and tumor relapses for remarkably long periods of time." He pointed out, however, that his data were anecdotal, that he was unable to do a controlled study, and that he was leaving that task to "science and research with responsibility for such methods."[3]

Robert Mayer, MD, a pediatrician from Miami, uses direct venous injection and rectal insufflation of ozone and oxygen mixtures. Dr. Mayer has reported that intravenous injections of medical ozone were effective against mammary adenocarcinoma in mice. His data, however, do not support this conclusion.[57] According to promoters, Dr. Mayer's approach is an element of the Gerson regimen.[7]

The Ozone Institute, located in Miami, maintains a nationwide network of physicians who treat cancer and other diseases with oxymedicine. The institute

is headed by Lucas Boeve, a former US Army major who has an engineering degree from West Point and an MBA from Adelphi University. Mr. Boeve spoke on "Ozone Therapy in the Treatment of Cancer" at the 1990 convention of the Cancer Control Society, a group that promotes dubious therapies.

Another organization involved with ozone therapy is Medizone International, headquartered in New York City. The company's manufacturing arm, Medizone Technologies, is located in Tucson. In 1987, Medizone acquired a patent covering "the use of ozone to inactivate lipid envelope group viruses (which include HIV . . . herpes, hepatitis, Epstein-Barr virus and cytomegalovirus) in blood and blood products normally returned to a mammalian host."[58] To administer treatment, 300 cc of blood are removed from the patient, ozonated with a device developed by the company and returned to the patient.[4] Although Medizone's literature does not mention cancer, several of the viruses it mentions have oncogenic properties.

A Medizone press release about its ozone devices referred to unidentified studies at Syracuse University and the College of Pharmacy at Long Island University.[58] Although the studies were done in vitro, Medizone said it "feels honored to manufacture the instruments that can begin to eradicate not only the dreaded plague of AIDS but also other viruses."

Medizone's medical director is Jeffrey S. Freed, MD, Assistant Clinical Professor at Mount Sinai School of Medicine in New York City. Dr. Freed has said that Medizone's data were confidential but did not fully support all the claims in the company's literature.[59]

Two other organizations that promote ozone therapy are the International Ozone Association and the Medical Society for Ozone Therapy. Their members include individuals with earned degrees who are conducting research—of varying quality—on the medicinal uses of ozone. According to its brochure, the International Ozone Association is concerned with water purification, odor control, air purification, and agricultural and marine uses of ozone, in addition to medical applications. Membership is "open to any individual or corporation having a direct or indirect interest in the development and advancement of ozone therapy."[60]

Claims that ozone is effective against cancer are contained mainly in the promotional literature of proponents or in reports that have not been published in peer-reviewed journals. Rilling and Viebahn, for example, list studies of several researchers who they claim were successful in treating various type of cancers with ozone injections or autohematology.[56]

In another study, Puharich and two colleagues injected an O_3/O_2 mixture into the mammary neoplasms of 100 mice. The researchers claimed that although the mice died, this was due to invasion of bacteria and that the ozone itself was successful. The authors postulate that ozone is effective because in neoplastic cells the "terminal respiratory chain flow of electrons is reversed," as it is in photosynthesis. They claimed to have confirmed this theory by finding "chlorophyll bodies" in the cytoplasm of neoplastic tissue.[61] In photosynthesis, however, electron transport parallels respiration.

Well-designed studies by two research teams have found that a variety of tumor cell types exposed to ozone in vitro were more susceptible than healthy cells to damage and destruction. Both groups suggest possible mechanisms and state that they believe further research is indicated.[62,63]

Since ozone, like hydrogen peroxide, produces highly reactive, oxygen-containing radicals, the same cautions should apply as with peroxide compounds.

Conclusion

The claims made for "oxymedicine" far exceed any demonstrated efficacy. Germanium, hydrogen peroxide, and ozone have been the subject of legitimate research. There is little or no evidence, however, that these substances are effective for the treatment of any serious disease, and each has demonstrated potential for harm. The American Cancer Society therefore recommends that individuals with cancer not seek treatment from individuals promoting oxymedicine as an "alternative" to proven medical modalities.

This recommendation, however, is not intended to preclude the use of oxygen-rich compounds or hyperbaric oxygen therapy in situations for which efficacy has been demonstrated. Nor is it meant to discourage responsible study of these methods by the scientific community. CA

References

1. Donsbach KW: Hydrogen peroxide. Health Freedom News 1986;6(1):23–24.
2. Asai K: Miracle Cure Organic Germanium. Tokyo, Japan Publications, 1980.
3. Varro J: Ozone application in cancer cases. Presented in May 1983 at the 6th World Congress on Ozone in Washington, DC. Published in LaRaus J: Medical Applications of Ozone. Norwalk, Connecticut, Pan American Committee, International Ozone Association, 1985.
4. Thomson B: Do oxygen therapies work? East West, September 1990, pp 70–75, 110–111.
5. Forest W: AIDS, cancer cured by hyper-oxygenation. Health Freedom News 1988;7(5):17–36.
6. Fritz N: Gerson Institute, Progress Report. Letter to members, August 1983. Tijuana, Gerson Institute.
7. Donsbach KW: Dr. Donsbach Tells You What You Always Wanted To Know About Hydrogen Peroxide "H_2O_2." Rosarito Beach, Mexico, Wholistic Publishers, 1987.
8. Grotz WO: ECHO Progress Report, Oxygen Therapy. Delano, Minnesota, ECHO, 1984.
9. Donsbach KW: Dr. Donsbach Tells You: Holistic Cancer Therapy. Rosarito Beach, Mexico, Wholistic Publishers, 1988.
10. Lowell JA: Organic germanium: another health food store junk food. Nutrition Forum 1988;5(7): 53–58.
11. FDA Import Alert #62–02, June 28, 1988.
12. Ads appeared monthly in *Natural Foods Merchandiser* through December 1990.
13. Keller J: St. Jude's International Clinic. Promotional flier, undated. Tijuana, St. Jude's International Clinic.
14. Asai Germanium Research Institute: Ge-132 Outline. Izumihoucho, Tokyo, Asai Germamium Research Institute, 1984.
15. Suzuki F: Antitumor mechanisms of carboxyethyl-germanium sesquioxide (Ge-132) in mice bearing Ehrlich ascites tumors. Gan-To-Kagaku-Ryoho 1987;14:127–134.
16. Warburg O: The Prime Cause and Prevention of Cancer. Wurzburg, Germany, Konrad Triltsch, 1969.
17. Hall EJ: Radiobiology for the Radiologist, ed 3. Philadelphia, J.B. Lippincott Company, 1987.
18. Lowell JA: Personal communication from Father Alt, Diocese of Tucson. July 30, 1990.
19. Encyclopedia of Associations, editions 22, 26. Detroit, Gale Research Co., 1988, 1992.
20. Grotz WO: ECHO notes. International Bio-Oxidative Medicine Foundation Newsletter 1987;1 (2):8.
21. Eckman J: In memoriam, Edward Carl Rosenow, MD. Am J Clin Pathol 1966;46:123–124.
22. Rosenow EC: Specific types of alpha streptococci and streptococcal antigen in unpotable water and water supplies. Am J Clin Pathol 1946;15:513–528.
23. Rosenow EC: Studies on specific prevention and treatment of diverse diseases shown due to specific types of nonhemolytic streptococci. AP-DT 1958;9:755–761.
24. Donsbach KW: The use of superoxy concentrate. Promotional literature, undated.
25. Wilson B: Dubious degrees and spurious science, in Barrett S, Cassileth BR (eds.): Dubious Cancer Treatment. Tampa, Florida, American Cancer Society, Florida Division, 1990, p 46.
26. Barrett S: The mercurial Kurt Donsbach. Nutrition Forum 1987;4:65–68.
27. Barrett S: Bogus claims for H_2O_2 stopped. Nutrition Forum 1988;5:50.
28. McCabe E: Oxygen Therapies. Morrisville, NY, Energy Publications, 1988.
29. Baker DB: Letter to prospective donor, Dallas/Ft. Worth, Texas, August 1989.
30. Farr CH: Hydrogen peroxide. International Academy of Bio-Oxidative Medicine Newsletter 1987;1(1):1–5.
31. International Bio-Oxidative Medicine Foundation: Oxidative Therapy Consumer Information (promotional pamphlet). Dallas/Fort Worth Texas,

International Bio-Oxidative Medicine Foundation, undated.
32. Love IN: Peroxide of hydrogen as a remedial agent. JAMA 1888;10:262–265.
33. Oliver TH, Murphy DV: Influenzal pneumonia: The intravenous injection of hydrogen peroxide. Lancet 1920;1:432–433.
34. Lorincz AL, Jacoby JJ, Livingstone HM: Studies on the parenteral administration of hydrogen peroxide. Anesthesiology 1948;9:162–174.
35. Rogers LS, Manguikian B: Intra-arterial hydrogen peroxide and tissue oxygenation. J Surg Res 1965;5:463–470.
36. Mallams JT, Balla GA, Finney JW, Aranoff BL: Regional oxygenation and irradiation: Head and neck. Arch Otolar 1964;79:155–67.
37. Corgill DA: Arterial anticancer drug infusion therapy. Laryngoscope 1962;72:1158–1178.
38. Nathan CF, Cohn ZA: Antitumor effects of hydrogen peroxide in vivo. J Exp Med 1981;154:1539–1553.
39. Chasin WD, Gross CC, Wang CC, Miller D: Hydrogen peroxide and irradiation of tumors. Arch Otolaryng 1967;85:151–155.
40. MacNaughton JI: Regional oxygenation and radiotherapy: A study of the degradation of infused hydrogen peroxide. II. Measurement of decomposition of H_2O_2 infused into flowing blood. Int J Radiat Biol 1971;19:415–426.
41. Urschel HC, Jr: Cardiovascular effects of hydrogen peroxide: Current status. Dis Chest 1967;51:180–192.
42. Mallams JT, Balla GA, Finney JW: The use of hydrogen peroxide as a source of oxygen in a regional intra-arterial infusion system. Southern Med J 1962;55:230–232.
43. Johnson JRJ, Froese G, Khodadad M: Hydrogen peroxide and radiotherapy: Bubble formation in blood. Br J Radiol 1968;41:749–754.
44. Bassan MM, Duday M, Shalev MD: Near-fatal oxygen embolism due to wound irrigation with hydrogen peroxide. Postgrad Med 1982;58:448–460.
45. International Agency for Research on Cancer: IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans: Allyl Compounds, Aldehydes, Epoxides and Peroxides, Vol 36. Lyon, France, International Agency for Research on Cancer, 1985.
46. Germon PA: Comparison of arterial and tissue oxygen measurements in humans receiving regional hydrogen peroxide infusions and oxygen inhalation. Radiology 1968;91:669–672.
47. Smith AG, Brown D, Willis R, et al: Effects of increased oxygen tension on tumor response to an alkylating agent. Surg Forum 1963;14:135–136.
48. Samoszuk MK, Rietveld C, Gidanian F, Petersen A: In-vitro sensitivity of Hodgkin's disease to hydrogen peroxide toxicity, correlation with peroxidase activity. Cancer 1989;63:2111–2114.
49. Fridovich I: The biology of oxygen radicals: General concepts, in Halliwell B (ed): Oxygen Radicals and Tissue Injury. Bethesda, Maryland, Federation of American Societies for Experimental Biology, 1988.
50. Cerutti PA: Prooxidant states and tumor promotion. Science 1985;227:375–381.
51. Jarvis W: Hydrogen peroxide poisonings. NCAHF Newsletter 1989;12(3):5.
52. Giberson TP, Kern JD, Pettigrew DW III, et al: Near-fatal hydrogen peroxide ingestion. Ann Emer Med 1989;18:778–779.
53. Danis RK, Brodeur AE, Shields J: The danger of hydrogen peroxide as colonic irrigating solution. J Pediatr Surg 1967;3:131–133.
54. Sleigh JW, Linter SPK: Hazards of hydrogen peroxide. Br Med J 1985;291:1706.
55. Jarvis W: Toxicity of hydrogen peroxide. NCAHF Newsletter 1989;12(3):5.
56. Rilling S, Viebahn R: The Use of Ozone in Medicine. Heidelberg, West Germany, Karl F. Haug Publishers, 1987.
57. Mayer RA: Ozone a chemotherapeutic agent for the treatment of acute monocytic leukemia in rats and mammary adenocarcinoma in mice, in LaRaus J: Medical Applications of Ozone, Norwalk, Connecticut, Pan American Committee, International Ozone Association, 1985.
58. Medizone Technologies: Undated press release. New York City, Medizone International.
59. Freed, JA: Personal communication to Lowell JA, March 28, 1988.
60. International Ozone Association, Pan American Committee: Need 3 Good Reasons to Join IO_3A?. Norwalk, Connecticut, International Ozone Association, Pan American Committee, undated brochure distributed in 1991.
61. Puharich A, Arnan M, deVries L: Successful treatment of neoplasms in mice with gaseous superoxide anion and ozone with a theoretical discussion of the data, in LaRaus J: Medical Applications of Ozone. Norwalk, Connecticut, Pan American Committee, International Ozone Association, 1985.
62. Washüttl J, Steiner I, Salzer H: Reaction of an O_2/O_3 mixture on tumor tissue and healthy tissue in vitro, in LaRaus J: Medical Applications of Ozone. Norwalk, Connecticut, Pan American Committee, International Ozone Association, 1985.
63. Sweet F, Kao MS, Lee SC, et al: Ozone selectively inhibits growth of human cancer cells. Science 1980;209:931–932.