NIH NATIONAL CANCER INSTITUTE

Intravenous Vitamin C (PDQ®)–Patient Version

Go to Health Professional Version

Overview

- Vitamin C is a nutrient found in food and dietary supplements. It is an antioxidant and also plays a key role in making collagen (see Question 1).
- Vitamin C may be taken by mouth or given by an intravenous (IV) infusion. When taken by IV infusion, vitamin C can reach higher levels in the blood than when the same amount is taken by mouth (see Question 2).
- Some studies of IV vitamin C use in people with cancer showed it improved quality of life and reduced cancer-related side effects (see Question 4).
- In general, vitamin C given by IV infusion has caused very few side effects in clinical trials. However, IV vitamin C may cause serious side effects in people with kidney disease, G6PD deficiency, or hemochromatosis (see Question 5).
- The U.S. Food and Drug Administration (FDA) has not approved the use of IV vitamin C as a treatment for cancer (see Question 7).

Questions and Answers About Intravenous Vitamin C

1. **What is vitamin C?**

   Vitamin C is a nutrient that is found in food, such as oranges, grapefruit, kiwi, peppers, and broccoli, and in dietary supplements. Vitamin C is an antioxidant and helps prevent damage to cells caused by free radicals. It also works with enzymes to play a key role in making collagen. Vitamin C is also called L-ascorbic acid or ascorbate.

2. **How is vitamin C given or taken?**

   Vitamin C may be given by intravenous (IV) infusion or taken by mouth. When given by IV infusion, vitamin C can reach much higher levels in the blood than when it is taken by mouth.

3. **Have any laboratory or animal studies been done using IV vitamin C?**

In laboratory studies, tumor cells are used to test a substance to find out if it is likely to have any anticancer effects. In animal studies, tests are done to see if a drug, procedure, or treatment is safe and effective. Laboratory and animal studies are done in animals before a substance is tested in people.

Laboratory and animal studies have tested the effects of IV vitamin C. Laboratory studies suggest that high levels of vitamin C may kill cancer cells. For information on laboratory and animal studies done using intravenous vitamin C, see the Laboratory/Animal/Preclinical Studies section of the health professional version of Intravenous Vitamin C.

4. **Have any studies of IV vitamin C been done in people with cancer?**

Several studies of IV vitamin C given alone or in combination with other drugs in people with cancer include the following:

Studies of IV vitamin C alone

- One study found that people with cancer who received IV vitamin C had better quality of life and fewer cancer-related side effects than those who did not receive it.
- In a single-arm pilot study of people with castration-resistant prostate cancer, IV vitamin C did not lower prostate-specific antigen levels or stop tumors from growing.
- In a study of healthy volunteers and people with cancer, vitamin C was shown to be safe at doses up to 1.5 g/kg in people who do not have kidney stones, other kidney diseases, or G6PD deficiency. Studies have also shown that vitamin C levels in the blood are higher when given by IV than when taken by mouth, and last for more than 4 hours.

Studies of IV vitamin C combined with other drugs

Studies of IV vitamin C given with other drugs have shown mixed results.

- In a small study of 14 people with advanced pancreatic cancer, IV vitamin C was given along with chemotherapy and targeted therapy (erlotinib). Five study participants did not complete the vitamin C treatment because the tumor continued to grow during treatment. The nine participants who completed the treatment had stable disease as shown by imaging studies. Very few side effects were reported from the vitamin C treatment.
- In a study of people newly diagnosed with pancreatic cancer, IV vitamin C did not interfere with gemcitabine.

- In another small study, 9 people with advanced pancreatic cancer were given chemotherapy once a week for 3 weeks along with IV vitamin C twice a week for 4 weeks during each treatment cycle. The cancer did not progress over an average of 6 months in these patients. No serious side effects were reported with the combined treatment.
- In a study of 27 people with advanced ovarian cancer, chemotherapy alone was compared with chemotherapy and IV vitamin C. IV vitamin C was given during chemotherapy and for 6 months after chemotherapy ended. Those who received IV vitamin C had fewer side effects from the chemotherapy.
- People with refractory metastatic colorectal cancer or metastatic melanoma were treated with IV vitamin C given along with arsenic trioxide and other drugs. The treatment had no anticancer effect, the tumor continued to grow during treatment, and patients had serious side effects. These studies did not have a comparison group, so it is unclear how much the IV vitamin C affected the side effects.
- In two pilot trials, people with non-small cell lung cancer or glioblastoma multiforme were given standard therapy plus IV vitamin C. Those who received standard therapy plus IV vitamin C had better overall survival and fewer side effects than the control groups.

More studies of combining IV vitamin C with other drugs are being done. These include a number of clinical trials combining IV vitamin C with arsenic trioxide, showing mixed results.

5. **Have any side effects or risks been reported from IV vitamin C?**

IV vitamin C has caused very few side effects in clinical trials. However, IV vitamin C may be harmful in people with certain risk factors.

- In people with a history of kidney disease, kidney failure has been reported after treatment with IV vitamin C. People who are likely to develop kidney stones should not be treated with IV vitamin C.
- One study reported too much fluid in the body (fluid overload) related to IV vitamin C. This may have been caused by the IV delivery method and not the vitamin C.
- Case reports have shown that people with an inherited disorder called G6PD deficiency should not be given high doses of vitamin C because it may cause hemolysis.
- Because vitamin C may make iron more easily absorbed and used by the body, high doses of vitamin C are not recommended for people with hemochromatosis (a condition in which the body takes up and stores more

iron than it needs).

6. **Have any drug interactions been reported from adding IV vitamin C to treatment with anticancer drugs?**

   A drug interaction is a change in the way a drug acts in the body when taken with certain other drugs. When IV vitamin C is combined with certain anticancer drugs, the anticancer drugs may not work as well. So far, these effects have been seen only in some laboratory and animal studies. For information on drug interactions while using IV vitamin C, see the Adverse Effects section of the health professional version of Intravenous Vitamin C.

7. **Is IV vitamin C approved by the FDA for use as a cancer treatment in the United States?**

   The FDA has not approved the use of IV vitamin C as a treatment for cancer.

   The FDA regulates dietary supplements separately from foods, cosmetics, and drugs. The FDA's Good Manufacturing Practices require that every finished batch of supplements is safe and that the claims on the label are true and do not mislead the consumer. However, the FDA does not regularly review the way that supplements are made, so all batches and brands of IV vitamin C may not be the same.

About This PDQ Summary

About PDQ

Physician Data Query (PDQ) is the National Cancer Institute's (NCI's) comprehensive cancer information database. The PDQ database contains summaries of the latest published information on cancer prevention, detection, genetics, treatment, supportive care, and complementary and alternative medicine. Most summaries come in two versions. The health professional versions have detailed information written in technical language. The patient versions are written in easy-to-understand, nontechnical language. Both versions have cancer information that is accurate and up to date and most versions are also available in Spanish.

PDQ is a service of the NCI. The NCI is part of the National Institutes of Health (NIH). NIH is the federal government's center of biomedical research. The PDQ summaries are based on an independent review of the medical literature. They are not policy statements of the NCI or the NIH.

Purpose of This Summary

This PDQ cancer information summary has current information about the use of intravenous vitamin C in the treatment of people with cancer. It is meant to inform and help patients, families, and caregivers. It does not give formal guidelines or recommendations for making decisions about health care.

Reviewers and Updates

Editorial Boards write the PDQ cancer information summaries and keep them up to date. These Boards are made up of experts in cancer treatment and other specialties related to cancer. The summaries are reviewed regularly and changes are made when there is new information. The date on each summary ("Updated") is the date of the most recent change.

The information in this patient summary was taken from the health professional version, which is reviewed regularly and updated as needed, by the PDQ Integrative, Alternative, and Complementary Therapies Editorial Board.

Clinical Trial Information

A clinical trial is a study to answer a scientific question, such as whether one treatment is better than another. Trials are based on past studies and what has been learned in the laboratory. Each trial answers certain scientific questions in order to find new and better ways to help cancer patients. During treatment clinical trials, information is collected about the effects of a new treatment and how well it works. If a clinical trial shows that a new treatment is better than one currently being used, the new treatment may become "standard." Patients may want to think about taking part in a clinical trial. Some clinical trials are open only to patients who have not started treatment.

Clinical trials can be found online at NCI's website. For more information, call the Cancer Information Service (CIS), NCI's contact center, at 1-800-4-CANCER (1-800-422-6237).

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Disclaimer

The information in these summaries should not be used to make decisions about insurance reimbursement. More information on insurance coverage is available on Cancer.gov on the Managing Cancer Care page.

Contact Us

More information about contacting us or receiving help with the Cancer.gov website can be found on our Contact Us for Help page. Questions can also be submitted to Cancer.gov through the website's E-mail Us.

General CAM Information

Complementary and alternative medicine (CAM)—also called integrative medicine—includes a broad range of healing philosophies, approaches, and therapies. A therapy is generally called complementary when it is used in addition to conventional treatments; it is often called alternative when it is used instead of conventional treatment. (Conventional treatments are those that are widely accepted and practiced by the mainstream medical community.) Depending on how they are used, some therapies can be considered either complementary or alternative. Complementary and alternative therapies are used in an effort to prevent illness, reduce stress, prevent or reduce side effects and symptoms, or control or cure disease.

Unlike conventional treatments for cancer, complementary and alternative therapies are often not covered by insurance companies. Patients should check with their insurance provider to find out about coverage for complementary and alternative therapies.

Cancer patients considering complementary and alternative therapies should discuss this decision with their doctor, nurse, or pharmacist as they would any type of treatment. Some complementary and alternative therapies may affect their standard treatment or may be harmful when used with conventional treatment.

Evaluation of CAM Therapies

It is important that the same scientific methods used to test conventional therapies are used to test CAM therapies. The National Cancer Institute and the National Center for Complementary and Integrative Health (NCCIH) are sponsoring a number of clinical trials (research studies) at medical centers to test CAM therapies for use in cancer.

Conventional approaches to cancer treatment have generally been studied for safety and effectiveness through a scientific process that includes clinical trials with large numbers of patients. Less is known about the safety and effectiveness of complementary and alternative methods. Few CAM therapies have been tested using demanding scientific methods. A small number of CAM therapies that were thought to be purely alternative approaches are now being used in cancer treatment—not as cures, but as complementary therapies that may help patients feel better and recover faster. One example is acupuncture. According to a panel of experts at a National Institutes of Health (NIH) meeting in November 1997, acupuncture has been found to help control nausea and vomiting caused by chemotherapy and pain related to surgery. However, some approaches, such as the use of laetrile, have been studied and found not to work and to possibly cause harm.

The NCI Best Case Series Program which was started in 1991, is one way CAM approaches that are being used in practice are being studied. The program is overseen by the NCI's Office of Cancer Complementary and Alternative Medicine (OCCAM). Health care professionals who offer alternative cancer therapies submit their patients' medical records and related materials to OCCAM. OCCAM carefully reviews these materials to see if any seem worth further research.

Questions to Ask Your Health Care Provider About CAM

When considering complementary and alternative therapies, patients should ask their health care provider the following questions:

- What side effects can be expected?
- What are the risks related to this therapy?
- What benefits can be expected from this therapy?
- Do the known benefits outweigh the risks?
- Will the therapy affect conventional treatment?
- Is this therapy part of a clinical trial?
- If so, who is the sponsor of the trial?

- Will the therapy be covered by health insurance?

To Learn More About CAM

National Center for Complementary and Integrative Health (NCCIH)

The National Center for Complementary and Integrative Health (NCCIH) at the National Institutes of Health (NIH) facilitates research and evaluation of complementary and alternative practices, and provides information about a variety of approaches to health professionals and the public.

NCCIH Clearinghouse

Post Office Box 7923 Gaithersburg, MD 20898–7923

Telephone: 1-888-644-6226 (toll free)

TTY (for deaf and hard of hearing callers): 1-866-464-3615

E-mail: info@nccih.nih.gov

Website: https://nccih.nih.gov

CAM on PubMed

NCCIH and the NIH National Library of Medicine (NLM) jointly developed CAM on PubMed, a free and easy-to-use search tool for finding CAM-related journal citations. As a subset of the NLM's PubMed bibliographic database, CAM on PubMed features more than 230,000 references and abstracts for CAM-related articles from scientific journals. This database also provides links to the websites of over 1,800 journals, allowing users to view full-text articles. (A subscription or other fee may be required to access full-text articles.)

Office of Cancer Complementary and Alternative Medicine

The NCI Office of Cancer Complementary and Alternative Medicine (OCCAM) coordinates the activities of the NCI in the area of complementary and alternative medicine (CAM). OCCAM supports CAM cancer research and provides information about cancer-related CAM to health providers and the general public via the NCI website.

National Cancer Institute (NCI) Cancer Information Service

U.S. residents may call the Cancer Information Service (CIS), NCI's contact center, toll free at 1-800-4-CANCER (1-800-422-6237) Monday through Friday from 9:00 am to 9:00 pm. A trained Cancer Information Specialist is available to answer your questions.

Food and Drug Administration

The Food and Drug Administration (FDA) regulates drugs and medical devices to ensure that they are safe and effective.

Food and Drug Administration

10903 New Hampshire Avenue

Silver Spring, MD 20993

Telephone: 1-888-463-6332 (toll free)

Website: http://www.fda.gov

Federal Trade Commission

The Federal Trade Commission (FTC) enforces consumer protection laws. Publications available from the FTC include:

- *Who Cares: Sources of Information About Health Care Products and Services*
- *Fraudulent Health Claims: Don't Be Fooled*

Consumer Response Center

Federal Trade Commission

600 Pennsylvania Avenue, NW

Washington, DC 20580

Telephone: 1-877-FTC-HELP (1-877-382-4357) (toll free)

TTY (for deaf and hard of hearing callers): 202-326-2502

Website: http://www.ftc.gov

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