

# High-Dose Vitamin C (PDQ®)–Patient Version

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## Questions and Answers About High-Dose Vitamin C

### 1. What is high-dose vitamin C?

Vitamin C is a nutrient that is found in food, such as oranges, grapefruit, papaya, peppers, and kale, or 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 high-dose vitamin C given or taken?

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

### 3. Have any laboratory or animal studies been done using high-dose 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 high-dose vitamin C. Laboratory studies suggest that high levels of vitamin C may kill cancer cells. See the [Laboratory/Animal/Preclinical Studies](#) section of the health professional version of [High-Dose Vitamin C](#) for information on laboratory and animal studies done using high-dose vitamin C.

### 4. Have any studies of high-dose vitamin C been done in people?

Several studies of high-dose vitamin C given alone or in combination with other drugs in patients with cancer include the following:

#### Studies of IV vitamin C alone

- Two studies found that patients who received IV vitamin C had better quality of life and fewer side effects than those who did not.
- In a study of healthy volunteers and cancer patients, vitamin C was shown to be safe at doses up to 1.5 g/kg in patients 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 combined with other drugs have shown mixed results.

- In a small study of 14 patients with advanced pancreatic cancer, IV vitamin C was given along with chemotherapy and targeted therapy (erlotinib). Five patients did not complete the treatment because the tumor continued to grow during treatment. The nine patients who completed the treatment had stable disease as shown by imaging studies. Patients had very few side effects from the vitamin C treatment.
- In another small study of 9 patients with advanced pancreatic cancer, patients 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 disease did not progress over an average of 6 months in these patients. No serious side effects were reported with the combined treatment.
- In a 2014 study of 27 patients 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. Patients who received IV vitamin C had fewer side effects from the chemotherapy.
- Patients with refractory metastatic colorectal cancer or metastatic melanoma were treated with IV vitamin C combined with 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.
- Patients with non-small cell lung cancer or glioblastoma multiforme in two pilot trials were given standard therapy plus IV vitamin C. Patients had better overall survival and fewer side effects compared to the control groups.

More studies of combining IV high-dose vitamin C with other drugs are being done.

### 5. Have any side effects or risks been reported from high-dose vitamin C?

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

- In patients with a history of kidney disease, kidney failure has been reported after treatment with high-dose vitamin C. Patients who are likely to develop kidney stones should not be treated with high-dose vitamin C.
- Case reports have shown that patients with an inherited disorder called G6PD deficiency should not be given high doses of vitamin C, because it may cause hemolysis (a condition in which red blood cells are destroyed).
- Because vitamin C may make iron more easily absorbed and used by the body, high doses of vitamin C are not recommended for patients 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 high-dose 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 high-dose 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. See the [Adverse Effects](#) section of the health professional version of [High-Dose Vitamin C](#) for information on drug interactions while using high-dose vitamin C.

## **7. Is high-dose vitamin C approved by the U.S. Food and Drug Administration for use as a cancer treatment in the United States?**

The U.S. Food and Drug Administration (FDA) has not approved the use of high-dose vitamin C as a treatment for cancer. The FDA does not approve dietary supplements as safe or effective before they are sold. The company that makes the dietary supplements is responsible for making sure they are safe and that the claims on the label are true and do not mislead the public. The way that supplements are made is not regulated, so all batches and brands of high-dose vitamin C may not be the same.

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