

## How Vitamin C Is Administered Affects How Much Reaches the Bloodstream and May Affect the Results of Studies of Its Potential Effect on Cancer

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The full report is titled "Vitamin C Pharmacokinetics: Implications for Oral and Intravenous Use." It is in the 6 April 2004 issue of *Annals of Internal Medicine* (volume 140, pages 533-537). The authors are S.J. Padayatty, H. Sun, Y. Wang, H.D. Riordan, S.M. Hewitt, A. Katz, R.A. Wesley, and M. Levine.

### What is the problem and what is known about it so far?

Some scientists and medical practitioners have suggested that vitamin C may have a role in the treatment of advanced cancer. Scientists know that high concentrations of vitamin C can kill cancer cells, at least in laboratory test tubes. However, studies of its effectiveness in people have been inconclusive. To help interpret future studies, researchers must determine whether the way vitamin C is administered affects the results. Previous studies have used vitamin C given by mouth (oral administration) or by injection into a vein (intravenous administration). The potential effect of vitamin C on cancer is probably greater if more of the vitamin reaches the bloodstream and produces a higher concentration, or "blood level," of the drug.

### Why did the researchers do this particular study?

To determine whether giving vitamin C orally produced different blood levels than if it was given intravenously.

### Who was studied?

17 healthy volunteers who agreed to be hospitalized for 3 to 6 months.

### How did the researchers do the study?

The researchers first controlled the starting blood level of vitamin C by using a diet containing very little of the vitamin. They then gave gradually increasing daily doses and measured the blood level of vitamin C at each dose. The same doses that had been given orally were then given intravenously, and blood levels were again measured.

### What did the researchers find?

Intravenous doses of vitamin C consistently produced a higher blood level than did oral doses. Increasing the oral dose (particularly at high doses) did not always produce a higher blood level because the body may control how much is absorbed from the intestine. By using the measurements at each dose level, the researchers predicted what the blood levels of vitamin C would have been if the volunteers had been given very high oral doses. They found that intravenous doses of vitamin C could produce blood levels about 70 times higher than those that could be achieved by the highest oral dose tolerated by humans.

### What are the limitations of this study?

This study was done in healthy young persons. The results may not be the same in older patients or those with other serious illnesses.

### What are the implications of the study?

This study evaluated only the blood levels that could be achieved by oral versus intravenous doses of vitamin C. It was not designed to determine whether vitamin C has any effect on cancer. Future research on the effects of vitamin C on cancer needs to recognize that much higher blood levels can be achieved when the drug is given intravenously rather than orally.