

Maintenance Supplementation: Vitamin C

Hey, everyone. In this presentation, we're going to talk about supplementing with vitamin C.

Vitamin C Facts

- 1
Antioxidant
- 2
Cofactor for **enzymatic reactions**
- 3
Helps production of **collagen and catecholamines**
- 4
Helps maintain proper levels of **glutathione**

Vitamin C cannot be made by humans, unlike most other mammals. We have to get it from the diet. Vitamin C is an antioxidant. It's a cofactor for many enzymatic reactions, for example, helping to produce collagen and catecholamines. It also helps to maintain proper levels of glutathione.

Vitamin C RDA



The RDA for vitamin C is 90 mg per day for men and 75 mg per day for women, and you would add 35 mg per day for smokers, since they're under significant oxidative stress. Insufficient intake of vitamin C even at these meager levels is common; 34 percent of men and 27 percent of women don't get enough from their diet. Keep in mind that the RDA is just the amount that has been determined to be needed to avoid acute deficiency symptoms, so we're not talking about optimal levels here.

Low intake is even more common in the elderly and those struggling with chronic disease, so I would recommend at least 150 mg a day for optimal health and even higher for those who are struggling with some kind of chronic disease.

Symptoms of insufficient vitamin C intake can vary, but the most common symptoms would be poor wound healing and fatigue. These are due to vitamin C's role in collagen production and catecholamines. You can screen patients for these symptoms in your intake, especially those with chronic illness or those who are elderly.

Vitamin C Benefits



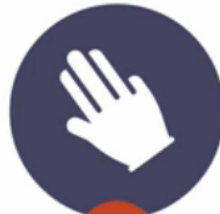
1

Lowers
CVD risk



2

Lowers
**blood
pressure**



3

Reduces
**gout
incidence**



4

Reduces
**all-cause
mortality risk**

Higher vitamin C intake has a lot of proven benefits. There is an inverse association between higher vitamin C intake and cardiovascular disease risk. Plasma vitamin C concentrations are inversely associated with blood pressure, so higher vitamin C equals lower blood pressure. Higher vitamin C intake is inversely associated with incidents of gout, and then there is a strong inverse association found between plasma ascorbic acid and mortality from all causes. Each 20 $\mu\text{mol/L}$ increase in plasma ascorbic acid is associated with about a 20 percent risk reduction in all-cause mortality, so these are some pretty significant effects.

Those who need higher vitamin C intakes include all the conditions I just mentioned as well as women on estrogen-containing birth control, since birth control pills lower plasma vitamin C. Chronic aspirin use can lower vitamin C levels. One study showed that taking aspirin every six hours for two weeks showed 50 percent lower vitamin C levels and white blood cells. Be cautious with large doses of vitamin C for those on anticoagulant drugs. The evidence is controversial, but vitamin C may block the action of these drugs, which would necessitate a higher dose, so you can monitor prothrombin time to get a sense of that.

Food sources of vitamin C are plentiful. Red peppers, one of the highest sources, have 95 mg per half-cup. One orange has 70 mg. A medium kiwi has 64 mg. A half-cup of cooked broccoli has 51 mg. One cup of fresh strawberries has 49 mg. A half grapefruit has 38 mg. So, we're talking about mostly citrus fruits and then some vegetables such as broccoli and peppers. Encourage patients again to get at least 150 mg per day, which should be relatively easy for those who are eating plenty of fruits and vegetables.

Combining vitamin C with iron-containing foods will increase the absorption of iron. This can be something that is useful in cases of iron deficiency, but it's something that is potentially harmful in

cases of iron overload, so it's just something that you need to be aware of as a clinician when you're treating patients because iron imbalances are very common, as we're going to discuss when we talk about iron deficiency and iron overload in the functional blood chemistry section of the training.

If you have a patient with iron deficiency and you want to utilize this effect of vitamin C, you have them eat vitamin C-rich foods with meals or even supplement with vitamin C during meals that contain heme sources of iron such as clams, venison, oysters, liver, or red meat, and that will enhance the absorption. If you have a patient with iron overload and he needs vitamin C for any reason, you want to have him take the vitamin C away from meals and limit the dose of supplement that he takes per dose to 200 mg because you don't want him to be absorbing any additional iron above and beyond what he is already absorbing.

For those with chronic illness who would like to prevent some of the conditions I mentioned earlier that benefit from higher vitamin C intake, I recommend about 500 to 1,000 mg per day. This is usually achieved by adding in a supplement. You can dose up to 10 g per day, and that has shown no toxic or adverse effects, so like B12 and K2, even really high doses don't cause any serious effects. The only effect that you will see with some forms of vitamin C, such as ascorbic acid, at higher doses is loose stool and abdominal discomfort. So what you can do is dose vitamin C to bowel tolerance, so if you hit a dose where the patient starts to have loose stools, then you would back down from that. This depends somewhat on the form of vitamin C that you use. The liposomal form that is pictured here on this slide in liquid form does not tend to cause this loose stool at doses as low as the standard oral preparations would, so you can often get a higher dose into your patients with the liposomal form than you can with the standard encapsulated tablet or oral forms of ascorbic acid.

Another trick is to spread the dose of vitamin C out through the day to reduce the likelihood of digestive discomfort, and then also don't pair it with high doses of magnesium, since high doses of magnesium can have the same stool-softening effect.

Finally, if you need a very high dose of vitamin C, and the patient has low bowel tolerance, you can use an intravenous form to bypass the GI system entirely.

Here are some examples where using supplemental vitamin C can be beneficial for a variety of conditions. Supplementation at 500 mg a day reduces blood pressure in both normotensive and hypertensive adults. IV vitamin C has been used in cancer treatment with good results. One study showed that 10 g a day intravenously for 10 days and then 10 g a day orally increased survival time and quality of life in a group of cancer patients. Vitamin C has also been shown to reduce the side effects of chemotherapy. Vitamin C supplementation of at least 500 mg a day reduces exercise-induced asthma, and it can be useful in HPA axis dysregulation given that the highest concentration of vitamin C in any tissue is found in the adrenal glands. Vitamin C is depleted quickly in cases where stress is present.

All right, thanks for watching. In the next presentation, we'll talk about iodine.