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Pharmacy Column



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Vitamin C and coronavirus

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When deciding on a topic for this issue's column it seemed obvious to me to address some aspect of the elephant in the room... Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) or "COVID-19." There are so many aspects of the virus... which particular aspect of the topic should I address? Ultimately, the virus will only be fully-controlled when a safe and effective vaccine is available. Experts say that this will take at least 12–18 months, which is still record time for development of a vaccine. Perhaps it is wishful thinking on my part but I think such a vaccine might be available in less than one year. For what it is worth, I just heard an interview where the subject said that a vaccine may be available for first responders by this Autumn...let us hope so.

I have faith in the universities, private research laboratories and biotech companies working towards conquering this pandemic. It will be conquered and in-the-process the amazing leaps in knowledge that will come out of this will result in a much better understanding of viral infections which will help prevent a disaster like this from occurring again. In the meantime, as a stopgap measure, one or more therapeutic options may provide at least temporary control. To date there are no such proven options for prophylaxis or treatment but there are a rapidly growing number of possible therapies being discussed, researched and sometimes touted with little or no scientific rationale. Some of these potential therapies are old, perhaps repurposed pharmaceuticals, while some are high-tech, modern biologic agents that represent new approaches to control viral infections. For example, one proven approach for treating certain infectious diseases, including other coronaviruses, is the administration of convalescent plasma, collected from individuals who have recovered

from an infection and are therefore able to make the appropriate antibodies which are then collected and given to those who have not yet been infected to provide them with passive immunity.¹ It is hoped that this approach will be effective in treating coronavirus as it has been with other infectious diseases. Development of monoclonal antibodies specifically engineered to block the virus are another option as is the use of existing biologic products already indicated for conditions such as HIV and various cancers. It would be wonderful if one or more of these agents is able to block the virus to prevent infection or treat sick patients but one course of therapy from some of these biologicals may have a price tag of many thousands of dollars. This would add countless dollars to the global price tag that already amounts to trillions of dollars. Other possible therapies or adjuncts include zinc, chloroquine and hydroxychloroquine, the efficacy of which has not been proven and is less based on science than it is on "hunches and feelings" which is clearly not a scientific approach. Distressingly, to some people, the use of particular agents over others has become a partisan issue which I am having difficulty comprehending.

All this being said, I decided to focus on a product that has been proposed to prevent or treat COVID-19 and is indeed already used in clinical practice. After all, what's not to like about this popular vitamin, vitamin C? Most of the readers have a bottle of vitamin C tablets in their medicine cabinets. My Mom was a strong believer in the benefits of vitamin C and always encouraged me to take supplements or consume foods rich in the vitamin such as orange juice. Another reason for my selection of this topic is that vitamin C was made famous by Dr. Linus Pauling who graduated from the university where I am on faculty, Oregon State University. This institution houses the Linus Pauling institute.

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Vitamin C has been studied for many years and we know that it is an important cofactor involved in the formation of blood vessels, cartilage, muscle and collagen in bone and is vital for the healing process. As an anti-oxidant, the vitamin might help protect cells from damage by chemical free radicals. It is thought that these chemicals contribute to heart disease, cancer and other diseases. Possible beneficial effects attributed to vitamin C include reducing endothelial dysfunction, managing hypertension, reducing cardiovascular disease risk, and preventing stroke, certain types of cancer, diabetes, gout and possibly even Alzheimer's disease. The data on these possible uses is often controversial and/or conflicting and it is not entirely clear if benefits are at least partially the result of improved nutrition. Overall, regular use of vitamin C supplements shortens the duration of the common cold but does not reduce the risk of contracting a cold except in persons undergoing heavy physical stress (e.g. marathon runners, skiers, or soldiers in subarctic conditions) where the incidence of colds is cut in half. Taking vitamin C supplements once cold symptoms have already begun has no proven benefits.² It is likely that this antiviral effect is why vitamin C has attracted interest as a possible treatment of COVID-19.

The recommended daily allowance for vitamin C intake is 90 mg. for adult men and 75 mg. for adult women with an additional daily 35 mg. for smokers of either gender.² The Linus Pauling Institute recommends a daily vitamin C intake of at least 400 mg for adults >50 years. Dr. Pauling's dosing recommendation suggested that optimum daily intake may be about 2000 mg but he noted that the first 250 mg is most important for achieving satisfactory serum levels.³ Others recommend and are administering dosages that are much higher as discussed below. While anecdotal reports about the effects of medications are compelling, and provide what may appear to be convincing evidence that a particular medication or therapy possesses a specific therapeutic or negative effect, it is important not to get misled. It is important to re-emphasize that association does not mean causation. While anecdotal evidence is tempting to believe and may actually demonstrate an effect that is real, the proof of a drug's effect is only achieved through blinded, controlled studies published in peer-reviewed scientific journals. A recent scientific article published in 2019 before the detection of the novel coronavirus presents a meta-analysis of 18 controlled clinical trials with a total of more than 2000 patients looking at the effect of vitamin C on length of stay in the hospital intensive care unit and the duration of mechanical ventilation. Study results included the following: In 12 of the trials reviewed, length of ICU stay was reduced by 7.8% in patients receiving vitamin C. This was highly statistically significant. In six trials the length of ICU stay was reduced by 8.6% following oral administration of vitamin C in doses of 1–3 g/day. In three trials in which patients needed mechanical ventilation for over 24 h vitamin C shortened the duration of mechanical ventilation by 18.2%. All these data were highly statistically significant.⁴ This study did not include COVID-19 patients but the authors suggested that the effects of vitamin C on ICU patients should be investigated in more detail based on study results and what they refer to as the insignificant cost of vitamin C. It would be important to study this in patients with COVID-19 infection.

In a YouTube video interview, Ron Hunninghake, MD, medical director of the Riordan Clinic, a nutrition-based health facility in Kansas, stated that most doctors and medical schools are biased against nutritional medicine and that vitamin C is more likely to be adopted as a component of medical practice that could be referred to as nutritional, integrative, or wholistic medicine.⁵ Hunninghake refers the viewer to a recent study published in JAMA that showed that

intravenous administration of 1.5 GM vitamin C every 6 hours significantly decreased mortality rate of septic patients with acute respiratory distress syndrome by 30%.⁶ Dr. Hunninghake reports administering intravenous vitamin C to 250,000 patients over his 31 years of practice and describes vitamin C as "The paramount rescue molecule in nature." His current protocol is to administer 7.5 g of vitamin C in 50 cc of fluid over 3–5 min and that patients tolerate this therapy very well including virtually no development of kidney stones. At least some hospital systems have adopted administration of vitamin C in patients infected with COVID-19. A NY newspaper reports that seriously sick patients in NY City's largest hospital system are being given vitamin C. A pulmonologist and critical care specialist Dr. Andrew G. Weber said that his intensive-care patients with the coronavirus immediately receive 1500 mg of vitamin C, administered intravenously, with that dose repeated three or four times a day. Dr. Weber stated, "The patients who received vitamin C did significantly better than those who did not get vitamin C." Since vitamin C levels in the body of coronavirus patients drops dramatically when sepsis develops, Dr. Weber adds "It makes all the sense in the world to try to maintain vitamin C levels in the body." Further comment from a spokesperson from Northwell which operates 23 NY hospitals stated that vitamin C was being "widely used" throughout the system with protocols varying according to the clinician's orders.⁷ To conclusively determine whether vitamin C therapy is beneficial for treatment of COVID-19 a double-blind placebo-controlled study is needed. Indeed, such a study has been designed and recruitment of subjects began on February 14, 2020.⁸ Study design calls for intravenous administration of either 12 g of vitamin C or placebo to patients with severe pneumonia due to COVID-19 infection twice a day for 7 days. The study is projected to be completed by September 30, 2020 so, in the not-too-distant future, we should know whether this intensive high-dose vitamin C therapy is effective in treating COVID-19. Of course, question will still remain re: whether more frequent intravenous dosing is effective or whether oral vitamin C should be given as a preventive measure for COVID-19 infection and, if so, what dose should be used. Until then, individual consumers need to make their own decisions based on available data. As with all medications, a key component of this decision will be an analysis of potential risk v. potential benefit.

I know that I am going to follow Mom's advice and continue to take my vitamin C tablet every day.

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