The Third Face of Vitamin C

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Abstract

Bowel tolerance, the amount of ascorbic acid tolerated orally without producing diarrhea, increases with the toxicity of diseases. Bowel tolerance to ascorbic acid with a disease such as mononucleosis may reach 200 or more grams per 24 hours. A marked clinical amelioration or cure is achieved in many disease processes when threshold doses near bowel tolerance are given. In a very important sense, it is the reducing equivalents carried by free radical scavengers that quench free radicals, not the free radical scavengers themselves. Ascorbic acid can be dramatically useful in quenching free radicals because it is usually tolerated in amounts necessary to provide the reducing equivalents necessary to quench almost all the free radicals generated by severe disease processes. Vitamin C functions are incidental at these dose levels; the benefit is from the reducing equivalents carried. To the extent that free radicals are either essential to the perpetuation of a disease or just part of the cause of symptoms, the disease will be cured or just ameliorated. These effects are even more dramatic with intravenous sodium ascorbate.

Keywords

Vitamin C, ascorbate, acute induced scurvy, bowel tolerance, titrating to bowel tolerance, the ascorbate effect, free radical scavengers, reducing equivalents.

Introduction

A clinical experience prescribing doses of ascorbic acid up to 200 or more grams per 24 hours to over 20,000 patients during the past 23 year period has revealed its clinical usefulness in all diseases involving free radicals. The controversy continues over the value of vitamin C mainly because inadequate doses are used for most free radical scavenging purposes. Paradoxically, the non-controversial use of minute doses of vitamin C in the prevention and treatment of scurvy has set the minds of many against more creative uses.

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Vitamin C has differing benefits in increasing dose ranges. Its usefulness is in three such distinct realms that I will describe them as the three faces of vitamin C.

1. vitamin C to prevent scurvy (up to 65 mg/day)
2. vitamin C to prevent acute induced scurvy[1,2] and to augment vitamin C functions (1 to 20 grams/day)
3. vitamin C to provide reducing equivalents (30 to 200 or more grams/day)[3]

One might criticize the wisdom of my use of these massive doses but Klenner had previously used large doses intravenously.[4,5,6,7] The works of Irwin Stone,[8,9,10] Linus Pauling,[11,12,13] and Archie Kalokerinos[14] have supported many of my observations. In all published studies yielding negative or equivocal results, inadequate doses were used. In some studies, doses barely bordering on adequate, tease the investigator with statistically significant but not very impressive beneficial results.

My early discovery was that the *bowel tolerance* to ascorbic acid of a person with a healthy GI tract was somewhat proportional to the toxicity of their disease.[15] Bowel tolerance doses are the amounts of ascorbic acid tolerated orally that almost, but not quite, cause a marked loosening of stools. A patient who could tolerate orally 10 to 15 grams of ascorbic acid per 24 hours when well, might be able to tolerate 30 to 60 grams per 24 hours if he had a mild cold, 100 grams with a severe cold, 150 grams with influenza, and 200 grams or more per 24 hours with mononucleosis or viral pneumonia.[1,2] Marked clinical benefits in these conditions occur only at the bowel tolerance or higher levels. I named the process whereby the patient determined the proper dose as *titrating to bowel tolerance.* These increases in bowel tolerance in the vast majority of patients normally tolerant to ascorbic acid (perhaps 80% of patients) are invariable. The marked clinical benefits are noted only when a threshold dose, usually close to the bowel tolerance dose, is consumed. I call this benefit the *ascorbate effect.*

Most patients are started at first with hourly doses of ascorbic acid powder dissolved in

small amounts of water. Later, after the patient has learned to accurately estimate the dose necessary to achieve the ascorbate effect, comparable doses of ascorbic acid tablets or capsules are also used. Where patients are intolerant to adequate amounts of ascorbic acid orally and the severity of the disease warrants it, intravenous sodium ascorbate is used.

Failures are related to individual difficulties in taking the proper adequate doses. In patients who tolerate adequate doses, the results are almost invariably as described. I now have had 23 years to gather clinical experience and to reflect on this phenomenon.[16171819]

I want to emphasize the importance of this increasing bowel tolerance with increasing toxicities of diseases. The sensation of detoxification one experiences at these doses is unmistakable. The effect is so reliable and dramatic in the tolerant patient as to make obvious the fact that something very important, that has not been widely appreciated before, is going on.

The Three Faces

Vitamin C probably always functions by being an electron donor. At the lowest dose level (the first face), it is necessary as a vitamin to prevent scurvy. It is essential for certain metabolic functions which are well described and mostly non-controversial.

At a second level (the second face) vitamin C is still used as a vitamin but larger doses are necessary to maintain its basic vitamin C functions because the vitamin is destroyed rapidly in diseased or injured tissues where there is an overabundance of free radicals. When an ascorbate molecule gives up two reducing equivalents to neutralize free radicals, it becomes dehydroascorbate (DHA). If DHA (a relatively unstable form of ascorbate) is not rapidly rereduced by reducing equivalents from the mitochondria, the DHA is irreversibly lost. I described the resulting state of deficiency, if the vitamin C is not replaced, as *acute induced scurvy.*[12] There is ample evidence of this depletion of vitamin C by stress and disease as recently reviewed in the literature.[20]

Additionally, the recent extensive research on vitamin C has concerned itself with certain functions that may be augmented by higher than minimal doses of vitamin C.[20] Strangely, any usefulness of these larger than minimal doses of vitamin C remain mostly neglected by clinicians. This level is from about 1 to 20 grams a day. Benefits vary from person to person.

At this second level, as in studies reviewed by Pauling[11] and more recently by Hemila,[20] there may be expected a slight decrease in the incidence of colds but a more significant reduction in the complications and the duration of colds. Personally, I am impressed by the number of patients (but certainly not all) who tell me that they have not had a cold for years since reading Pauling's book and taking vitamin C. Patients with chronic infections frequently have their infections cured for the first time. Antibiotics work synergistically with these doses. A surprising number of elderly persons benefit from doses of this magnitude and may indeed have what Irwin Stone described as chronic subclinical scurvy.[10]

The third level of doses (the third face) is virtually undiscussed in the literature but is the most interesting. These doses range usually from 30 to 200 grams or more per 24 hours. The most important concept to understand is that while incidentally at these dose levels the vitamin C performs all the functions of levels one and two, it is mostly thrown away for the reducing equivalents it carries.[3] With these doses it is possible to saturate the body with reducing equivalents, neutralize the excessive free radicals, and drive a reducing redox potential into involved tissues. Inflammations mediated by free radicals can be eliminated or markedly reduced. In many instances patients with allergies or autoimmune diseases have their humoral immunity controlled while their cellular immunity is augmented.[19] To the extent that free radicals are either essential to the perpetuation of a disease or just part of the cause of symptoms, the disease will be cured or just ameliorated. The list of diseases involving free radicals continues to grow. Infections, cardiovascular diseases, cancer, trauma, burns both thermal and radiation, surgeries, allergies, autoimmune diseases and aging are now included. It is more difficult to think of a disease that does not involve free radicals.

Progressive nutritionists routinely give vitamin C, vitamin E, beta carotene, selenium, NAC, etc. to counter free radicals. I certainly agree with this practice. However, there is one

important concept neglected which results in these nutrients not being as effective as described.

In the spirit that if you throw a bucket of water on a fire, it is the water that puts the fire out, not the bucket; it is the reducing equivalents carried by the free radical scavengers that quench the free radicals, not the free radical scavenger itself.

Most of the reducing equivalents utilized by non-enzymatic free radical scavengers do not come from the ingested free radical scavengers but come through glycolysis, the citric acid cycle, NADPH, $FADH_2$, glutathione, etc. Dietary free radical scavengers carry in on ingestion only a small percentage of the total reducing equivalents carried by those scavengers during their lifetime in the body. After their first pass neutralizing free radicals, the free radical scavenger must be recharged with reducing equivalents made available in the mitochondria.

The problem in inflamed tissues or in patients with severe illnesses is not so much that all the free radical scavengers have been lost (although they may be lost), the problem is more that the mitochondria cannot furnish the reducing equivalents fast enough to rereduce adequate amounts of free radical scavengers. The dynamic nature of this process must be emphasized. When free radicals injure cells, particularly their mitochondria, more free radicals are formed and some injure adjacent cells. An inflammatory cascade results. Without enough reducing equivalents being provided by glycolysis in the mitochondria and the continuing rereduction of free radical scavengers, the inflammatory cascade cannot be properly contained.

Early in this study a 23-year-old, 98-pound librarian with severe mononucleosis claimed to have taken 2 heaping tablespoons every 2 hours, consuming a full pound of ascorbic in 2 days without it producing diarrhea. She felt mostly well in 3 to 4 days, although she had to continue about 20 to 30 grams a day for about 2 months. Subsequently, all my young mononucleosis patients with excellent GI tracts have responded similarly and have had equivalent increases in bowel tolerance during the acute state of the disease. What is important here is the magnitude of this increased bowel tolerance.

I believe that the loose stools caused by excessive doses of ascorbic acid orally ingested is due to a resulting hypertonicity of ascorbate in the rectum. Water is attracted into the rectum by the increased osmotic pressure and results in a loosening of the stools. With toxic illnesses, the ascorbate is destroyed rapidly in the involved tissues and this results in a rapid absorption of ascorbate from the gut. Of the ascorbate, what does not reach the rectum, does not cause diarrhea. Intravenous sodium ascorbate does not cause diarrhea and, in fact, increases bowel tolerance to orally ingested ascorbic acid while the IV is running. With hypertonicity of the ascorbate both in the blood and in the rectum, the osmotic pressure of the ascorbate is more equal on both sides of the bowel wall so no diarrhea results. If the diarrhea was caused by other metabolic processes, diarrhea would be caused by intravenous ascorbate.

It should be noted that in some cases of pathological diarrhea, ascorbic acid stops the diarrhea. Presumably in these cases some of the increased destruction of ascorbate is from free radicals in the bowel. However, in most toxic systemic diseases there is no reason to believe that the destruction of the additional ascorbate tolerated occurs directly in the bowel, so it is a safe hypothesis that this increased destruction occurs in the interior of the body. The increased tolerance to ascorbic acid orally provides an interesting and somewhat useful measure of the toxicity of a disease. Probably it is somewhat a measure of the free radicals involved in a disease. I describe a cold that at its maximum makes it possible for a patient to just tolerate per 24 hours 100 grams of ascorbic acid orally without diarrhea, a *"100 gram cold"*. Patients, appearing to be well, who have a tolerance over 20 to 25 grams per 24 hours probably have some subclinical condition which is being hidden by their own free radical scavenging system. Patients with chronic infections (and a normally strong stomach) can ingest enormous amounts of ascorbic acid. One of my chronic fatigue patients is functional only because of his ingestion of 65 pounds of ascorbic acid in the past 12 months. In 22 years, I, personally, have ingested approximately 361 kilos (797 lbs.) (4.3 times my body weight) of ascorbic acid because of chronic allergies and perhaps chronic EBV.

Considering the reducing equivalents carried

by such amounts of ascorbic acid, one can only guess at the turnover rate of the nonenzymatic free radical scavengers in a patient acutely ill with a 200 gram mononucleosis. However, one gains the impression that all the non-enzymatic free radical scavengers would have to be rereduced many times a day.

An Analogy

Suppose you owned a farm and on one end of the property there was a barn and on the other end of the property there was a water well. One day the barn catches fire and neighbors come with buckets to set up a bucket brigade between the water well and the barn and are putting out the fire when the well goes dry. My use of ascorbate is like thousands of neighbours coming from miles around, each with a bucketful of their own water, throwing their own water on your fire once, and then leaving.

Conclusion

Because of the invariable (in patients tolerant to ascorbic acid) increasing bowel tolerance to ascorbic acid in patients roughly in proportion to the toxicity of their disease, there has to be something happening to ascorbate in the sick patient other than its being used as vitamin C in the classic sense. The amelioration or sometimes cure of different diseases appears related to the importance of free radicals in the perpetuation of the particular disease.

The sudden marked benefit in many disease processes which is achieved at doses near to the bowel tolerance level suggests that a reducing redox potential is forced into the affected tissues only at those dose levels. This ascorbate effect only at the high dose levels is also suggestive that something other than classic functions of vitamin C is involved. This ascorbate effect is more compatible with principles of redox chemistry.

Only a small percentage of the total reducing equivalents donated by non-enzymatic free radical scavengers to neutralize free radicals come in on the ingested nutritional free radical scavengers. Ascorbate is unique in that the body can tolerate doses adequate to supply the necessary reducing equivalents to quench the free radicals generated by severely toxic disease processes. The vitamin C is thrown away for the reducing equivalents it carries. Only in this way can the large amounts of free radicals generated by the most toxic disease processes be rapidly quenched.

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