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What Really Causes Kidney Stones (And Why Vitamin C Does Not)

(OMNS Feb 11, 2013) A recent widely-publicized study claimed that vitamin C supplements increased the risk of developing kidney stones by nearly a factor of two.[1] The study stated that the stones were most likely formed from calcium oxalate, which can be formed in the presence of vitamin C (ascorbate), but it did not analyze the kidney stones of participants. Instead, it relied on a different study of kidney stones where ascorbate was not tested. This type of poorly organized study does not help the medical profession or the public, but instead causes confusion.

The study followed 23,355 Swedish men for a decade. They were divided into two groups, one that did not take any supplements (22,448), and another that took supplements of vitamin C (907). The average diet for each group was tabulated, but not in much detail. Then the participants who got kidney stones in each group were tabulated, and the group that took vitamin C appeared to have a greater risk of kidney stones. The extra risk of kidney stones from ascorbate presented in the study is very low, 147 per 100,000 person-years, or only 0.15% per year.

Key points the media missed:

- The number of kidney stones in the study participants who took ascorbate was very low (31 stones in over a decade), so the odds for statistical error in the study are fairly high.
- The study was observational. It simply tabulated the intake of vitamin C and the number of kidney stones to try to find an association between them.
- This method does not imply a causative factor because it was not a randomized controlled study, that is, vitamin C was not given to a group selected at random.
- This type of observational study is fraught with limitations that make its conclusion unreliable.
- It contradicts previous studies that have clearly shown that high dose ascorbate does not cause kidney stones.[2-6]
- The study authors' conclusion that ascorbate caused the low rate of stones is likely due to a correlation between the choice of taking a vitamin C supplement with some other aspect of the participants' diet.
- The study could not determine the nature of this type of correlation, because it lacked a detailed study of each patient's diet and a chemical analysis of each stone to provide a hint about the probable cause.

So we have a poorly designed study that did not determine what kind of stone was formed, or what caused the stones that were formed. These are serious flaws. Drawing conclusions from such a study can hardly be a good example of "evidence based medicine."

Different Types of Kidney Stones (Renal Calculi)
There is a considerable variety of kidney stones. Here are five well-known ones:

1. *Calcium phosphate stones* are common and easily dissolve in urine acidified by vitamin C.

2. *Calcium oxalate stones* are also common but they do not dissolve in acid urine. We will discuss this type further below.

3. *Magnesium ammonium phosphate* (struvite) *stones* are much less common, often appearing after an infection. They dissolve in urine acidified by vitamin C.

4. *Uric acid stones* result from a problem metabolizing purines (the chemical base of adenine, xanthine, theobromine [in chocolate] and uric acid). They may form in a condition such as gout.

5. *Cystine stones* result from an hereditary inability to reabsorb cystine. Most children's stones are this type, and these are rare.

**The Oxalate Oxymoron**

The oxalate/vitamin C issue appears contradictory. Oxalate is in oxalate stones and oxalate stones are common. Ascorbate (the active ion in vitamin C) may slightly increase the body's production of oxalate. Yet, in practice, vitamin C does not increase oxalate stone formation. Emanuel Cheraskin, MD, DMD, Professor of Oral Medicine at the University of Alabama, explains why: "Vitamin C in the urine tends to bind calcium and decrease its free form. This means less chance of calcium's separating out as calcium oxalate (stones)."[7] Also, the diuretic effect of vitamin C reduces urine concentration of oxalate. Fast moving rivers deposit little silt. If on a consultation, a doctor advises that you are especially prone to forming oxalate stones, read the suggestions below before abandoning the benefits of vitamin C. Once again: vitamin C increases oxalate but inhibits the union of calcium and oxalate.

Oxalate is generated by many foods in the diet, including spinach (100-200 mg oxalate per ounce of spinach), rhubarb, and beets.[8-10] Tea and coffee are thought to be the largest source of oxalate in the diet of many people, up to 150-300 mg/day.[8,11] This is considerably more than would likely be generated by an ascorbate dose of 1000 mg/day.[5,12]

The study we are discussing didn't tabulate the participants' intake of oxalate, but on average they had relatively high intakes (several cups) of tea and coffee. It is possible that those who had kidney stones had them before the study started, or got them during the study, due to a particularly high intake of oxalate. For example, the participants that took vitamin C may have been trying to stay healthy, but the subset of those who got kidney stones might also have been trying to stay healthy by drinking a lot of tea or coffee, or eating green leafy vegetables such as spinach. Or they may have been older people who got dehydrated, which is also very common among men who are active outside during the summer. Among the most important factors in kidney stones is dehydration, especially among the elderly.[13]

Summarizing:

- Ascorbate in low or high doses generally does not cause significant increase in urinary oxalate.[2-6]
- Ascorbate tends to **prevent** formation of calcium oxalate kidney stones.[3,4]
- Risk factors for kidney stones include a history of hypertension, obesity, chronic dehydration,
poor diet, and a low dietary intake of magnesium.

**Magnesium**

Kidney stones and magnesium deficiency share the same list of causes, including a diet high in sugar, alcohol, oxalates, and coffee. Magnesium has an important role in the prevention of kidney stone formation.[14] Magnesium stimulates production of calcitonin, which draws calcium out of the blood and soft tissues back into the bones, preventing some forms of arthritis and kidney stones. Magnesium suppresses parathyroid hormone, preventing it from breaking down bone. Magnesium converts vitamin D into its active form so that it can assist in calcium absorption. Magnesium is required to activate an enzyme that is necessary to form new bone. Magnesium regulates active calcium transport. All these factors help place calcium where it needs to be, and not in kidney stones.

One of magnesium's many jobs is to keep calcium in solution to prevent it from solidifying into crystals; even at times of dehydration, if there is sufficient magnesium, calcium will stay in solution. Magnesium is a pivotal treatment for kidney stones. If you don't have enough magnesium to help dissolve calcium, you will end up with various forms of calcification. This translates into stones, muscle spasms, fibrositis, fibromyalgia, and atherosclerosis (as in calcification of the arteries). Dr. George Bunce has clinically demonstrated the relationship between kidney stones and magnesium deficiency. As early as 1964, Bunce reported the benefits of administering a 420 mg dose of magnesium oxide per day to patients who had a history of frequent stone formation.[14,15] If poorly absorbed magnesium oxide works, other forms of better-absorbed magnesium will work better.

Calcium oxalate stones can effectively be prevented by getting an adequate amount of magnesium, either through foods high in magnesium (buckwheat, green vegetables, beans, nuts), or magnesium supplements. Take a magnesium supplement of at least the US RDA of 300-400 mg/day (more may be desirable in order to maintain an ideal 1:1 balance of magnesium to calcium). To prevent a laxative effect, take a supplement that is readily absorbable, such as magnesium citrate, chelate, malate, or chloride. Magnesium oxide, mentioned above, is cheap and widely available. However, magnesium oxide is only about 5% absorbed and thus acts mostly as a laxative. [14] Milk of magnesia (magnesium hydroxide) is even more of a laxative, and unsuitable for supplementation. Magnesium citrate is a good choice: easy to find, relatively inexpensive and well absorbed.

**The Role of Vitamin C in Preventing and Dissolving Kidney Stones**

The calcium phosphate kidney stone can only exist in a urinary tract that is not acidic. Ascorbic acid (vitamin C's most common form) acidifies the urine, thereby dissolving phosphate stones and preventing their formation.

Acidic urine will also dissolve magnesium ammonium phosphate stones, which would otherwise require surgical removal. These are the same struvite stones associated with urinary tract infections. Both the infection and the stone are easily cured with vitamin C in large doses. Both are virtually 100% preventable with daily consumption of much-greater-than-RDA amounts of ascorbic acid. A gorilla gets about 4,000 mg of vitamin C a day in its natural diet. The US RDA for humans is only 90 mg. The gorillas are unlikely to all be wrong.

The common calcium oxalate stone can form in an acidic urine whether one takes vitamin C or not. However, this type of stone can be prevented by adequate quantities of B-complex vitamins and magnesium. Any common B-complex supplement, twice daily, plus about 400 milligrams of
magnesium, is usually adequate.

**A Dozen Ways to Reduce Your Risk of Kidney Stones**

1. Maximize fluid intake.[13] Especially drink fruit and vegetable juices. Orange, grape and carrot juices are high in citrates which inhibit both a buildup of uric acid and also stop calcium salts from forming. [16]

2. Control urine pH. Slightly acidic urine helps prevent urinary tract infections, dissolves both phosphate and struvite stones, and will not cause oxalate stones. And of course one way to make urine slightly acidic is to take vitamin C.

3. Avoid excessive oxalates by not eating (much) rhubarb, spinach, chocolate, or dark tea or coffee.

4. Lose weight. Being overweight is associated with substantially increased risk of kidney stones.[17]

5. Calcium is probably not the real culprit. Low calcium may itself cause calcium stones [18].

6. Most kidney stones are compounds of calcium and yet many Americans are calcium deficient. Instead of lowering calcium intake, reduce excess dietary phosphorous by avoiding carbonated soft drinks, especially colas. Cola soft drinks contain excessive quantities of phosphorous as phosphoric acid. This is the same acid that is used by dentists to dissolve tooth enamel before applying bonding resins.

7. Take a magnesium supplement of **at least** the US RDA of 300-400 mg/day. More may be desirable in order to maintain an ideal 1:1 balance of magnesium to calcium. Many people eating "modern" processed-food diets do not consume optimal quantities of magnesium.

8. Take a good B-complex vitamin supplement twice daily, which contains pyridoxine (vitamin B6). A deficiency of vitamin B6 produces kidney stones in experimental animals. Vitamin B6 deficiency is very common in humans. A vitamin B1 (thiamine) deficiency also is associated with stones. [19]

9. For uric acid/purine stones (gout), stop eating meat. Nutrition tables and textbooks indicate meats as the major dietary purine source. Natural treatment adds juice fasts and eating sour cherries. Increased vitamin C consumption helps by improving the urinary excretion of uric acid. [12]. For these stones, use buffered ascorbate "C".

10. Persons with cystine stones (only 1% of all kidney stones) should follow a low methionine diet and use buffered vitamin C.

11. Kidney stones are associated with high sugar intake, so eat less (or no) added sugar. [20]

12. Infections can cause conditions that favor stone formation, such as overly concentrated urine (from fever sweating, vomiting or diarrhea). Practice good preventive health care, and it will pay you back with interest.
References:


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