The Influence of Dietary Minerals on Calcium Oxalate Kidney Stones

Calcium
About 30 to 50% of patients with kidney stones have idiopathic hypercalciuria (excessive urinary calcium). Calcium restriction is usually not indicated, however, as:

1. Chronic high calcium intake (up to 2 grams daily) in patients with normal vitamin D levels does not significantly increase urinary calcium, presumably because of a parathormone-mediated decrease in 1,25-dihydroxyvitamin D levels which, in turn, decreases the fraction of calcium absorbed.1

2. Despite a low calcium diet, some hypercalciuric patients will continue to have high urinary calcium excretion rates due to overproduction of 1,25-dihydroxyvitamin D which stimulates bone resorption along with intestinal calcium absorption.2

3. Urinary oxalate increases as dietary calcium is reduced3 — perhaps because dietary calcium precipitates oxalate in the intestines to form calcium oxalate which is not absorbed4; thus the risk of calcium oxalate stones may increase.

4. Hypercalciuria in perimenopausal women with renal calculi and osteoporosis may be due to excessive bone resorption consequent to estrogen deficiency. In that case, estrogen replacement, rather than calcium restriction, is the indicated treatment.5

In fact, there is evidence that dietary calcium intake may be inversely associated with the risk of kidney stone formation6 — although it is possible that this association is due to the presence of some other protective factor besides calcium. For example, dairy products, a major source of dietary calcium, are also a major source of phosphorus, which may reduce urinary calcium excretion and calcium oxalate supersaturation.7

Increased calcium intake in the form of supplements taken with meals may effectively reduce oxalate absorption in patients with malabsorption, yet supplemental calcium, in contrast to dietary calcium, has been found to be associated with a slightly increased risk for kidney stones. This contradiction may be because supplemental calcium is often taken away from meals. Because of this possibility, when calcium supplements are prescribed, they should be taken with meals to coincide with the time of oxalate ingestion.8

In the event that calcium supplementation is indicated to prevent bone resorption in a patient with recurrent kidney stones, it should be given in the form of carbonate, citrate, gluconate or lactate, all of which tend to alkalinize the urine which decreases urinary calcium excretion.9

A minority of patients with recurrent renal stones and idiopathic hypercalciuria will benefit from calcium restriction, and thus a trial may be worthwhile to see if calcium is significantly reduced while both urinary oxalate excretion and serum 1,25-dihydroxyvitamin D levels remain low.

Magnesium
Kidney stones have repeatedly been produced in magnesium-deficient animals.10 Total serum magnesium and erythrocyte magnesium levels may be low in recurrent stone formers.11 Perhaps 5% of stone formers have hypomagnesiuria,12 and the urine of over 25% of stone formers has a lowered magnesium to calcium ratio.13 The hypomagnesiuria appears to be due to inadequate magnesium intake, as magnesium absorption following supplementation appears to be normal.14

Supplementation with magnesium salts may inhibit stone formation, even in patients without magnesium deficiency.15 Magnesium decreases the urinary saturation of calcium oxalate by combining with urinary oxalate to form soluble magnesium oxalate16 so long as it is administered with meals.17 In some studies, magnesium has been combined with vitamin B6 with good results.18

Phosphorus
In stone formers, urinary phosphorus may be elevated, thus creating the risk of phosphate deficiency.19 Hyperphosphaturia appears to correlate with urinary calcium levels; in fact, there is evidence that patients with idiopathic hypercalciuria excrete excessive phosphate for any given serum calcium concentration.20

Loss of phosphate may increase the activation of 1,25-dihydroxyvitamin D.21 There also appears to be a failure of the kidneys to convert orthophosphate to pyrophosphate.22

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Supplementation with orthophosphate reduces urinary calcium with reduction in calcium oxalate supersaturation and stone formation. However, unless baseline phosphate levels are low, the reduction in stone formation appears to be limited, especially as compared to other treatments such as alkali citrate or magnesium.

Doctor Werbach cautions that the nutritional treatment of illness should be supervised by physicians or practitioners whose training prepares them to recognize serious illness and to integrate nutritional interventions safely into the treatment plan.

References
5. Wasserstein A. The calcium stone former with osteoporosis. JAMA 257(16):2215, 1987

In his latest book, Dr. Werbach has assembled a unique library of case reports concerning nutritional and herbal treatments for 155 different illnesses. It is available in print or on diskette from Third Line Press Inc., 4751 Viviana Drive, Tarzana, California 91356, USA. (Phone: 818-996-0076; Fax: 818-774-1575; internet: http://www.third-line.com; e-mail: tlp@third-line.com).