STONE DISEASE

Effect of vitamin C supplements on urinary oxalate and pH in calcium stone-forming patients

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Background: The contribution of ascorbate to urinary oxalate is controversial. The present study aimed to determine whether urinary oxalate and pH may be affected by vitamin C supplementation in calcium stone-forming patients.

Methods: Forty-seven adult calcium stone-forming patients received either 1 g (N=23) or 2 g (N=24) of vitamin C supplement for 3 days and 20 healthy subjects received 1 g. A 24-hour urine sample was obtained both before and after vitamin C for calcium, oxalate, magnesium, citrate, sodium, potassium, and creatinine determination. The Tiselius index was used as a calcium oxalate crystallization index. A spot fasting morning urine sample was also obtained to determine the urinary pH before and after vitamin C.

Results: Fasting urinary pH did not change after 1 g (5.8 +/- 0.6 vs. 5.8 +/- 0.7) or 2 g vitamin C (5.8 +/- 0.8 vs. 5.8 +/- 0.7). A significant increase in mean urinary oxalate was observed in calcium stone-forming patients receiving either 1 g (50 +/- 16 vs. 31 +/- 12 mg/24 hours) or 2 g (48 +/- 21 vs. 34 +/- 12 mg/24 hours) of vitamin C and in healthy subjects (25 +/- 12 vs. 39 +/- 13 mg/24 hours). A significant increase in mean Tiselius index was observed in calcium stone-forming patients after 1 g (1.43 +/- 0.70 vs. 0.92 +/- 0.65) or 2 g vitamin C (1.61 +/- 1.05 vs. 0.99 +/- 0.55) and in healthy subjects (1.50 +/- 0.69 vs. 0.91 +/- 0.46). Ancillary analyses of spot urine obtained after vitamin C were performed in 15 control subjects in vessels with or without ethylenediaminetetraacetic acid (EDTA) with no difference in urinary oxalate between them (28 +/- 23 vs. 26 +/- 21 mg/L), suggesting that the in vitro conversion of ascorbate to oxalate did not occur.

Conclusion: These data suggest that vitamin C supplementation may increase urinary oxalate excretion and the risk of calcium oxalate crystallization in calcium stone-forming patients.

Editorial Comment

Ascorbic acid has been implicated in calcium stone formation based on its conversion to oxalate and its potential urinary acidifying properties. Numerous studies have evaluated the effect of ascorbic acid consumption on urinary oxalate and pH in normal subjects and in stone-formers. However, results have been conflicting because of inaccuracies in measuring oxalate in the presence of ascorbate, which is readily oxidized to oxalate in vitro. Historical assays involving heating or alkaline conditions favored oxidation of unmetabolized ascorbate to oxalate thereby confounding results.

These authors evaluated the effect of vitamin C supplementation on urinary oxalate and pH in healthy subjects and stone formers given 1 g (healthy subjects and stone formers) or 2 g (stone formers) of ascorbic acid daily for 3 days. Urine collected over a 24-hour period was analyzed for stone risk factors before and after the administration of vitamin C, and urine samples were acidified before processing to prevent in vitro oxidation of ascorbate. Stone formers had higher levels of urinary oxalate than healthy subjects both at baseline and after vitamin C supplementation. However, both healthy subjects and stone formers demonstrated a significant rise in urinary oxalate after 1 g vitamin C consumption, by 56% (14 g) in healthy subjects and by 61% (19 g) in stone formers. Supplementation with 2 g daily of vitamin C in stone formers resulted in a 41% increase in urinary oxalate from baseline (from 34 mg/day to 48 mg/day). No change in urine pH was seen in either group after vitamin C supplementation.

In this study, urine was collected in acid to prevent in vitro oxidation of ascorbate to oxalate, and under these assay conditions both normal subjects and stone formers demonstrated a significant increase in urinary

oxalate levels with moderate vitamin C supplementation. Consequently, the large doses of vitamin C advocated for prevention of the common cold and to promote anti-aging effects could place both normal subjects and stone formers at additional risk for calcium oxalate stone formation. Although stone formers were observed in this study to have higher baseline levels of oxalate, an observation confirmed by some other investigators, diet was not carefully controlled in this study and subjects were only instructed to avoid oxalate- and vitamin C-rich foods. Since urinary oxalate depends on calcium and oxalate intake and the state of calcium absorption, the effect of vitamin C intake may be better studied under conditions of a controlled metabolic diet.

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Pediatric staghorn calculi: the role of extracorporeal shock wave lithotripsy monotherapy with special reference to ureteral stenting

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Purpose: Treatment for staghorn calculi in children represents a unique challenge. We assessed the efficacy of extracorporeal shock wave lithotripsy (ESWL) (Dornier Medical Systems, Inc., Marietta, Georgia) monotherapy for the management of staghorn calculi in children with special reference to ureteral stenting.

Materials and Methods: From June 1992 to January 2001 we treated 42 children 9 months to 12 years old with staghorn stones using the Piezolith 2501 (Richard Wolf GmBH, Knittlingen, Germany) lithotriptor. The initial group of 19 patients underwent ESWL without prophylactic ureteral stenting, while in the latter group of 23 a Double-J (Medical Engineering Corp., New York, New York) ureteral stent was inserted immediately before the first ESWL session. Mean patient age, stone size, number of shock waves and ESWL sessions, hospital stay, stone-free rate and major complications were compared in the 2 groups.

Results: Overall 33 children (79%) were stone-free after 3 months. The 2 groups were comparable in regard to patient age, stone size, number of shock waves and ESWL sessions, and stone-free rates. Major complications developed in 21% of the unstented group, whereas none was observed in stented cases. This difference was statistically significant ($p = 0.035$). Seven post-ESWL auxiliary procedures were required in the unstented group to manage complications. Hospital stay was significantly longer in the unstented compared with the stented group ($p = 0.022$). At a follow-up of 9 to 102 months (mean 47) stones recurred in 2 children, who were treated with further ESWL.

Conclusions: ESWL monotherapy was an efficient and safe modality for the treatment of staghorn calculi in children. Stented patients had fewer major complications and a shorter hospital stay. Prophylactic ureteral stenting is advisable before ESWL for staghorn calculi in children.

Editorial Comment

The AUA Nephrolithiasis Clinical Guidelines Panel concluded that in adults, the optimal therapy for staghorn calculi is percutaneous nephrostolithotomy (PCNL) with or without adjuvant shock wave lithotripsy (SWL). Indeed, the need for additional SWL has decreased substantially as the use of flexible nephroscopy for

retrieval of residual calculi has increased. Outcomes for SWL monotherapy demonstrated low success rates with high retreatment and complication rates. However, SWL outcomes for treatment of renal calculi in children have been uniformly favorable and there is some suggestion that the ureters of children may accommodate passage of fragments better than adults.

Comprising the largest series of SWL monotherapy in children published to date, this study evaluated 42 children with partial (n = 33) or complete (n = 9) staghorn calculi treated with SWL monotherapy using a Piezolith 2501 lithotripter. The initial 19 children were treated without a ureteral stent in place while the latter 23 children underwent placement of a stent prior to treatment. Overall, a stone free rate of 79% was achieved, with 89% of children undergoing 1-3 SWL treatments. No difference in stone free rates was detected between the stented and unstented groups (78% versus 79%, respectively), although 21% of the unstented children developed obstruction requiring intervention, including 2 children with sepsis. Only 1 child in the stented group experienced a complication requiring intervention, an encrusted stent that was treated cystoscopically.

This study demonstrates that staghorn calculi can be treated effectively in children using a limited number of SWL treatments and that complications can be largely avoided with generous antibiotic usage and pre-placement of a ureteral stent. These results are all the more surprising given the use of a piezoelectric lithotripter, which has demonstrated inferior results compared with those of electrohydraulic and electromagnetic lithotripters in most series. These optimistic results underscore the difference between children and adults either in the character of the stone itself, the efficacy of SWL in fragmenting the stone or the efficiency with which the kidney discharges the fragments and the ureter accommodates them. Clearly, staghorn calculi represent a different entity in children and adults as these results are in stark contrast to adults in whom retreatment rates and complication rates are prohibitively high, without the benefit of achieving a stone free state in almost half the patients. It appears that SWL monotherapy may constitute reasonable first-line therapy in children.

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