



TULANE UROLOGY

MEDICAL MANAGEMENT FOR CALCIUM STONE FORMERS



Calcium-based calculi account for nearly 80% of urolithiasis¹

ENSURE PROPER UROLITHIASIS WORK-UP^{1,3}

High-Risk 1st Time & Recurrent Stone Formers (see back of sheet) or 1st Time Formers Who Request

- PMH (hyperparathyroidism, DM, obesity, RTA, sarcoidosis, osteoporosis, IBD, immobilization, chronic pancreatitis)
- Dietary History (Vit C or D Excess, Ca⁺⁺ Supplementation, fluid intake, excess fluid losses)
- Medications (calcium, vitamin C, vitamin D, acetazolamide, steroids)
- BMP, Calcium, Intact PTH, Uric Acid
- UA, Urine Culture, 24 hour urine specimen (on random diet)
- Stone analysis if available

DIETARY RECOMMENDATIONS^{1,3}

1. Increase fluid intake to achieve urine volume of 2.5 liters/day.
2. **Hypercalciuria:** Limit sodium intake to 80-100 mEq per day and consume 1,000-1,200 mg dietary Ca⁺⁺ per day.
3. **Hyperoxaluria:** Limit intake of oxalate rich foods (see back) and maintain normal Ca⁺⁺ consumption. Oxalate is nearly completely excreted in urine & excess leads to saturation of calcium oxalate and stone formation.
4. **Hypocitraturia:** Increase intake of fruits and vegetables & limit non-dairy animal protein. Citrus juices and low-calorie citrus soda may be offered as well.
5. **Hyperuricosuria:** Limit intake of non-dairy animal protein. Uric acid increases urine levels of monosodium urate which promotes CaOx crystallization.

MEDICAL INTERVENTIONS^{1,3}

1. **Hypercalciuria:** Offer **thiazide diuretics** to patients with high or relatively high urine calcium and recurrent calcium stones. Hypercalciuria is the most common etiology of stone formation. High urinary calcium levels lead to increased urinary saturation of calcium salts.
2. **Hypocitraturia:** Offer **potassium citrate** therapy to patients with recurrent calcium stones and low or relatively low urinary citrate. Citrate complexes with calcium in the renal tubule which increases calcium solubility and reduces free calcium in the urine.
3. Offer thiazide diuretics and/or potassium citrate to patients with recurrent calcium stones in whom other metabolic abnormalities are absent or have been appropriately addressed and stone formation persists.

MEDICATION DOSING^{1,2}

1. **Potassium Citrate:** Metabolizes to bicarb in liver. Increased alkali load inhibits proximal tubular citrate reabsorption leading to increased urinary citrate.
 - >150 mg/day urinary citrate: 15mEq BID or 10 mEq TID
 - <150 mg/day urinary citrate: 30 mEq BID or 20 mEq TID
 - Potassium levels must be monitored regularly for patients with renal insufficiency and should be avoided for patients on potassium sparing diuretics
2. **Hydrochlorothiazide:** Increases Ca⁺⁺ reabsorption in distal nephron, promotes Na⁺ excretion
 - Initial dose: 25mg once daily
 - Usual effective dose: 50-100 mg/day in 1 to 2 divided doses
 - Serum potassium levels should be monitored within 1 to 2 weeks after initiating or adjusting therapy
 - Consider adding potassium citrate or potassium chloride to prevent hypokalemia, hypocitraturia

FOLLOW-UP ^{1,3}

1. If starting new medication— see medication dosing box for proper serum chemistry monitoring.
2. Obtain a single 24-hour urine specimen for stone risk factors within 6 months of initiating treatment to assess response to interventions.
3. Obtain single 24-hour urine specimen at least annually (or more often depending on stone activity) to assess patient adherence and metabolic response.
4. Periodically obtain follow-up imaging to assess for stone growth or new stone formation. Renal ultrasound, KUB, or low dose CT. Recommend US at 1 year. If negative, repeat imaging every 2 to 4 years.

Low Oxalate Foods ⁴

- Popcorn, Graham Crackers, Triscuits, Saltines
- Oatmeal Cookies, Fig Bars, Popsicles, Pudding, Jello
- Soy Milk
- Cantaloupe, Honeydew Melon, Mango, Nectarines
- Figs, Raisins
- Canned Peaches, Canned Pears
- Dried Apricots, Apples or Cranberries
- Soybeans, Mung Beans
- Lettuce, Broccoli, Brussels Sprouts
- Yellow Squash
- Broccoli, Brussels Sprouts, Cauliflower
- Kale, Mustard Greens
- White Rice, Macaroni & Cheese
- Oatmeal Cereal, Granola Bars
- Cornbread, Eggs
- Chicken Noodle Soup
- Hot Dog, Chicken Nuggets
- Macaroni & Cheese
- Apple Butter
- Cream Sauce, Olive Oil, Mozzarella Cheese
- Oat Bran Muffin, Corn Bread

High Oxalate Foods ⁴

- Spinach
- Nut Products (Almonds, Cashews, Peanuts, Pecans, Walnuts)
- Potato Chips
- Chocolate Chip Cookies
- Grapefruit, Oranges, Tangerines
- Dates
- Canned Pineapple
- Dried Figs, Dried Pineapple
- Fava, Navy or Refried Beans
- Turnip, Yams
- Asparagus
- Collards
- Potatoes
- Cream of Wheat, Corn Grits
- French Toast, Pancakes
- Clam Chowder, Lentil Soup, Miso Soup
- Cheeseburger
- Lasagna
- Peanut Butter
- Tomato Sauce
- Blueberry Muffins
- Oat Bran Muffin, Corn Bread

High Risk Formers— Indications for Metabolic Stone Evaluation ¹

- Recurrent stone formers
- Strong family history of stones
- Intestinal disease (particularly chronic diarrhea)
- Pathologic skeletal fractures
- Osteoporosis
- History of urinary tract infection with calculi
- Personal history of gout
- Infirm health (unable to tolerate repeat stone episodes)
- Solitary kidney
- Anatomic abnormalities
- Renal insufficiency
- Stones composed of cystine, uric acid, struvite

Definitions ¹

Hypercalciuria: >200 mg/day

Hypocitrauria: <500mg/day Female, <450 mg/day Male

Hyperoxaluria: >40 mg/day

Hyperuricosuria: >800mg/day

References:

1. Wein, A.J., L.R. Kavoussi, and M.F. Campbell, Campbell-Walsh urology / editor-in-chief, Alan J. Wein ; [editors, Louis R. Kavoussi ... et al.]. 10th ed. 2012, Philadelphia, PA: Elsevier Saunders.
2. Daniel A. Wollin. Medical Stone Disease Management. AUA University: Core Curriculum 2020 Feb 5, 2020 [cited 2020 April 15]; Available from: <https://university.auanet.org>
3. AUA Guidelines Medical Management of Kidney Stones (2019)
4. Harvard T.H. Chan School of Public Health: Oxalate Information Tables