Recurrent Kidney Stone Formers II: Medical Management

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Objectives:
- List 3 dietary interventions that can decrease recurrence of kidney stones
- For patients with calcium oxalate, uric acid, and cystine stone disease, identify specific medications used for recurrent stones
- Given a patient with recurrent calcium oxalate kidney stones and a 24 hour urinalysis, prescribe a comprehensive dietary and pharmaceutical intervention to prevent recurrent stones
Recurrent Kidney Stone Disease II: Management

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Lab Evaluation

- Serum studies: Calcium, Potassium, Bicarbonate, Creatinine, Uric acid
  - Intact PTH
  - ? 25 hydroxy vitamin D (low urine/serum ca)
- UA:
  - pH
  - specific gravity
  - protein
  - crystalluria
Metabolic Workup

- 24 hr urine collection:
  - Recurrent stone formers vs. all patients
  - No evidence that recommendations based on 24 hr collections better than general recs.
  - 2 or more collections?
  - Repeat collection 6 weeks after new therapy?

- Stone Analysis
Evaluation

- Imaging
  - Ultrasound v. CT
  - Plain Radiographs
  - Intervals??
- Stone composition
- Bone Mineral Density?
Medical Treatment

- 28 English language RCT’S

- Low Strength:
  - Increased fluid halved risk (RR 0.45, CI 0.24 to 0.84)
  - Reducing soft drink consumption RR 0.83

- Moderate strength:
  - Thiazides RR .52, CI .39-.69
  - Citrate RR .25, CI .14-.44
  - Allopurinol .59, CI .42-.84 (works only in pt with hypericemia or hypercuricosuria at baseline)
Medical Treatment

- Low strength: addition of citrate or allopurinol to thiazide did not reduce risk.
- Follow up biochemical studies: reduction in hypercalciuria was associated with fewer recurrences.
- Most patients with pharmacologic therapy were on fluid intake
- Did not address side effects
  - Thiazide side effects:
    - hypocitraturia
    - hypokalemia

Impact of Long-Term Potassium Citrate Therapy on Urinary Profiles and Recurrent Stone Formation

Marnie R. Robinson, Victor A. Leitao, George E. Halebian, Charles D. Scales, Jr.,* Aravind Chandrashekar, Sean A. Pierre and Glenn M. Preminger†

Figure 3. Change according to KCit therapy (Rx) duration. A, urinary pH. B, urinary citrate.
Barriers to fluid intake

Dietary Treatment

- Calcium:
  - Calcium restriction had been advised to lower urinary calcium
    - no evidence
  - Patients with lowest calcium intake have 34% higher rates of stones
  - Patients with high calcium diets have lowest rates of stone formation
  - Effect due to binding of oxalate in gut

Heilberg and Goldfarb, Adv Chr Kid Dis. v. 20, 2013
Dietary Treatment: Calcium

- Borghi: Randomized controlled trial:
  - grp 1: 1200 mg calcium, low animal protein, low sodium, low oxalate diet
  - grp 2: Low calcium (400 mg), low oxalate diet
- Marked decrease in urine calcium in both groups
- Oxalate: Group 1- decrease, Group 2 - increase
- Group 1: 49% reduction in stone formation after 5 years in group 1

Calcium for Recurrent Stones

- Calcium restriction is not appropriate
  - Bone health/osteopenia
  - No evidence
- 800-1200 mg/d dietary calcium is best advice
  - Best sources dairy products
    - 8 oz yogurt = 400 mg
    - 8 oz milk = 300 mg
Oxalate

- Urinary oxalate: 10-40% dietary, 60-90% endogenous
- Urinary oxalate directly increases with dietary oxalate
- Bound in gut to calcium, urinary oxalate increases with low calcium diet
- Prospective studies to lower dietary oxalate show no effect on urinary oxalate
  - Except: Bariatric surgery patients
- Gut colonized with oxalobacter formigenes
- Increase in calcium intake more helpful
Protein

- Dietary animal protein causes acid load in urine:
  - hyperuricosuria
  - hypocitraturia
  - bone absorption and lower tubular calcium reabsorption = hypercalciuria
- Epidemiologic evidence in men, BMI < 25
  - not obese men
  - not women
- Decrease in animal protein (0.8 mg/kg/d) causes lower urinary calcium, increased citrate
- Evidence: no strong evidence in RCT, except Borghi, confounded by high calcium, low salt
Diet: Sodium

- High sodium intake causes decrease in proximal tubular sodium reabsorption, reduces calcium reabsorption
- 2400 mg sodium in diet causes 25-40 mg/day increase in urinary calcium
- Epidemiologic evidence: positive correlation in women, high sodium intake associated with higher stone formation and osteoporosis
- No RCT’s investigating dietary sodium reduction and stone formation
Diet: Citrate and Potassium

- Acid loads increase reabsorption of citrate
- Alkali loads increase urinary citrate
- Systemic alkalinization from citrate supplements reduces urinary calcium excretion.
- Compliance variable due to GI side effects
- Citrus fruits may complement citrus supplements in management of hypocitraturia
- Potassium load acts as alkalinizing agent, may have independent effects on urine pH
Fluids

- Water ingestion to make 2 - 2.5 L. urine/day
  - 30 mg/kg/day urine
- Water hardness: Does not seem to have strong effect
  - Difficult to trace sources of dietary water intake
  - Some minerals protective (Calcium, bicarbonate)
- Fluids: Beer and alcohol may reduce risk
- Colas: low citrate, high acid load, but no adverse effects in observational studies
Diet: Fructose

- Positively associated with kidney stones in epidemiologic studies compare with non-fructose carbohydrates
- Overall, results equivocal
Case

- 48 year old woman
- 6 episodes of stone pain.
- 1\textsuperscript{st} during pregnancy in 2004.
- Ureteroscopy in 2006 and 2012.
- Litholink
Case

- Serum Na 136, K 3.8, Cl 100, CO2 25, BUN 14, Cre 0.8, Glu 110
- Serum Ca 10.0.
- PTH: 10, normal
- Vit D 25 hydroxy, 40 (nl 25-80)
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<th>SS CaOxalate</th>
<th>Calcium</th>
<th>Oxalate</th>
<th>Citrate</th>
<th>SS CaPhos</th>
<th>pH</th>
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