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# MEDICAL MANAGEMENT OF PEDIATRIC UROLITHISIS

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- Kidney stone disease is a common condition
- 70% increase over the last reported prevalence
- Stones are also likely to recur
- Overweight/obesity , hypertension and diabetes have all been shown to be associated with an increased risk of stone disease.

- Diet and lifestyle affect the risk of developing  stones.
- randomized controlled trials (RCTs) evaluating  drug treatments are relatively sparse.
- Diet therapy  has never been compared head-to-head with pharmacologic  therapy.

# Diet Therapies

- *Clinicians should recommend to all stone formers a fluid intake that will achieve a urine volume of at least 2.5 liters daily. (standard ;Evidence Strength: Grade B)*

- Target urine output in children:
- Infants :750 ml/day
- <5 yr.  : > 1 lit /day
- 5-10 yr. : > 1.5 lit/day
- > 10 yr. : >  2lit/day

- risk of stone formation beyond their impact on urine volume :

  ↓ Tea, Coffee, Orange juice

  ↑ Sugar sweetened beverages

- *Clinicians should counsel patients with calcium stones and relatively high urinary calcium to limit sodium intake and consume 1,000-1,200 mg per day of dietary calcium. (Standard; Evidence Strength: Grade B)*

- Prospective observational studies consistently show an independent reduced risk of stone formation with higher dietary calcium intake. ( 51% reduced risk)
- Dietary salt (sodium chloride) has also been linked to urinary calcium excretion
- Supplemental calcium, in contrast, may be associated with an increased risk of stone formation.( 20% increased risk)

- *Clinicians should counsel patients with calcium oxalate stones and relatively high urinary oxalate to limit intake of oxalate-rich foods and maintain normal calcium consumption.*

  *(Expert Opinion)*

- Restricting oxalate-rich foods has generally been recommended for calcium stone formers.
- Urinary oxalate is also modulated by calcium intake, which influences intestinal oxalate absorption.

- Patients with hyperoxaluria and a history of calcium oxalate stones should be advised to consume calcium from foods and beverages primarily at meals to enhance gastrointestinal binding of oxalate, but total calcium intake should not exceed 1,000e1,200 mg daily.

- Patients with enteric hyperoxaluria and high levels of urinary oxalate, such as those with malabsorptive conditions (e.g., inflammatory bowel disease ) may benefit from more restrictive oxalate diets as well as from higher calcium intakes.

- Other factors that may contribute to higher urinary oxalate include vitamin C and other over the-counter nutrition supplements.
- Increased magnesium intake was significantly associated with decreased hyperoxaluria.

- *Clinicians should encourage patients with calcium stones and relatively low urinary citrate to increase their intake of fruits and vegetables and limit non-dairy animal protein.*
- *(Expert Opinion)*

- Various citrus juices can be utilized to induce citraturia. However, whether this approach can reduce calcium stone recurrence is still under investigation.
- Grapefruit juice not only increases urinary citrate, but also increases oxalate excretion, so its protective effect is offset.

- Metabolic acidosis or dietary acid loads enhance renal citrate reabsorption, thereby reducing urinary excretion
- RTA ,chronic diarrhea ,medications (CAHI)

- *Clinicians should counsel patients with cystine stones to limit sodium and protein  intake.*
- *(Expert Opinion)*

- Dietary therapy should be offered in combination with pharmacological therapy.
- The target for urine volume is typically higher than that recommended to other stone formers.
- Cystine concentration below 250 mg/L.
- Lower sodium intake has been shown to reduce cystine excretion.
- All foods of animal origin are rich in cystine and methionine, which is metabolized to cystine.

# *Pharmacologic Therapies*

- *Clinicians should offer thiazide diuretics to patients with high or relatively high urine calcium and recurrent calcium stones.*

  *(Standard; Evidence Strength: Grade B)*

- 1-4 mg/kg
- Dietary prescription, especially restriction of sodium intake, should be continued when thiazides are prescribed, in order to maximize the hypocalciuric effect an limit potassium wasting
- Potassium supplementation (either potassium citrate or chloride) may be needed

- *Clinicians should offer potassium citrate therapy to patients with recurrent calcium stones and low or relatively low urinary citrate. (Standard; Evidence Strength: Grade B)*

- Calcium stone-forming patients with normal citrate excretion but low urinary pH may also benefit from citrate therapy.
- Potassium citrate is preferred over sodium citrate, as the sodium load in the latter may increase urine calcium excretion.

- *Clinicians should offer allopurinol to patients with recurrent calcium oxalate stones who have hyperuricosuria and normal urinary calcium (Standard; Evidence Strength: Grade B)*

- *Clinicians should 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.*

  *(Standard; Evidence Strength: Grade B)*

- It may be appropriate to utilize these therapies for patients with recurrent stones who do not demonstrate specific urinary abnormalities.
- For patients with no identified risk factors for nephrolithiasis, potassium citrate may be the preferred first-line therapy, given its relatively low side effect profile

- *Clinicians should offer potassium citrate to patients with uric acid and cystine stones to raise urinary pH to an optimal level. (Expert Opinion)*

- The solubility of uric acid and cystine is increased at higher urinary pH values.
- For uric acid stone formers , urine pH should be increased to 6.0, and for cystine stone formers , a urine pH of 7.0 should be achieved.
- A combination of alkalinisation with tamsulosin can increase the frequency of spontaneous passage of distal ureteral uric acid stones as shown in one RCT for stones > 5 mm.

- *Clinicians should not routinely offer allopurinol as first-line therapy to patients with uric acid stones.*

  *(Expert Opinion)*

- Most patients with uric acid stones have low urinary pH rather than hyperuricosuria as the predominant risk factor.
- Reduction of urinary uric acid excretion with the use of allopurinol in patients with uric acid stones will not prevent stones in those with unduly acidic urine.

- Therefore, first-line therapy for patients with uric acid stones is alkalinization  of the urine with potassium citrate.

- *Clinicians should offer cystine-binding thiol drugs, such as alpha mercaptopropyl onylglycine - (tiopronin), to patients with cystine stones who are unresponsive to dietary modifications and urinary alkalinization, or have large recurrent stone burdens (Expert Opinion)*

- First-line therapy for patients with cystine stones is increased fluid intake , restriction of sodium and protein intake , and urinary alkalinization.
- If these modifications are not sufficient, cystine-binding thiol drugs constitute the next line of therapy.

- Tiopronin is possibly more effective and associated with fewer adverse events than d-penicillamine and should be considered first.

- *Clinicians may offer acetohydroxamic acid to patients with residual or recurrent struvite stones only after surgical options have been exhausted*

  *(Option; Evidence Strength: Grade B)*

- Struvite stones occur as a consequence of urinary infection with a urease-producing organism.
- Patients treated for struvite stones may still be at risk for recurrent UTI after stone removal, and in some patients surgical stone removal is not feasible.

- The use of a urease inhibitor, AHA, may be beneficial in these patients, although the extensive side effect profile may limit its use.