Kidney stones

Kidney stones & types

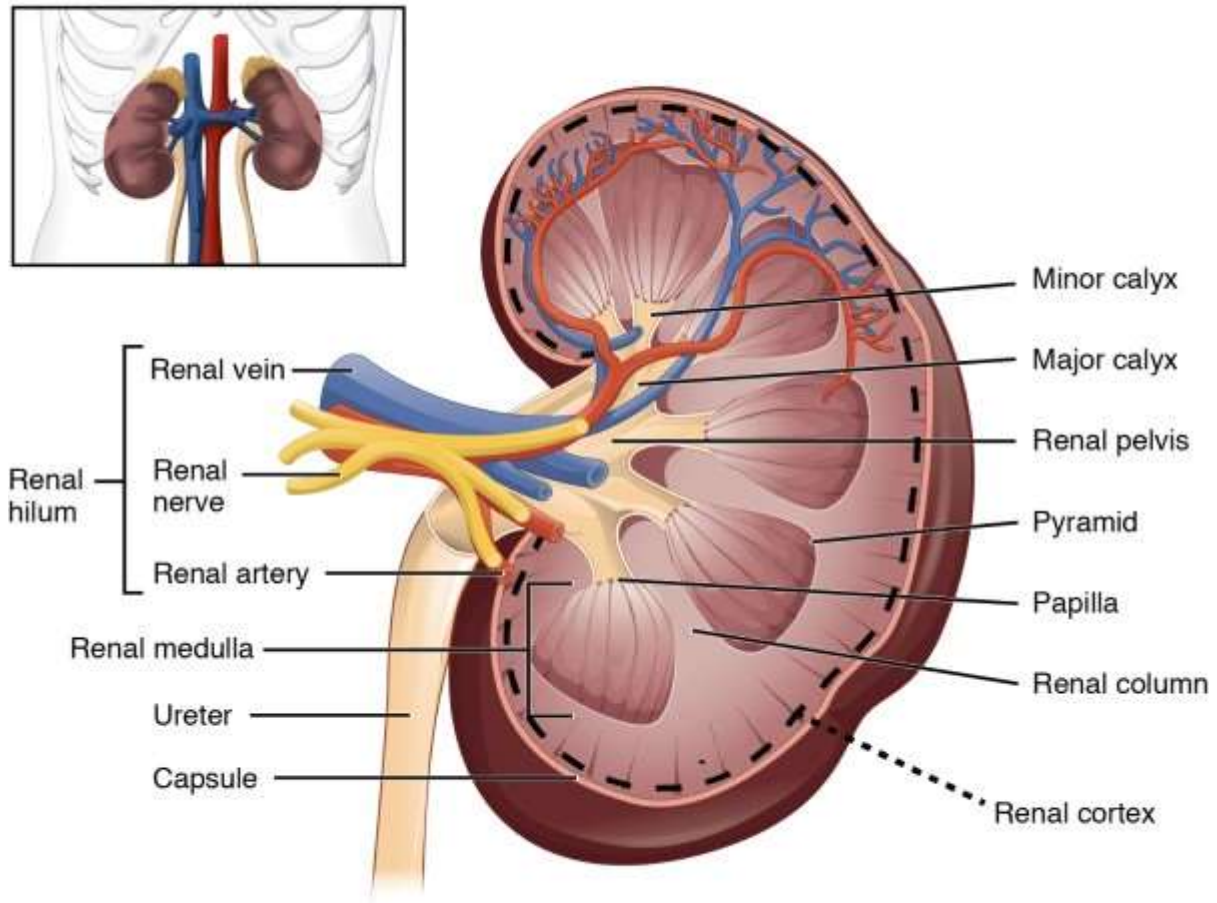
- Kidney stones(calculi) are mineral deposits in the renal calyces and pelvis that are found free or attached to the renal papillae .They contain crystalline and organic components and are formed when the urine becomes supersaturated with respect to a mineral. (Saeed R. Khan et all , 2016)

Figure 1.1

Normal anatomy of

Kidney without stone

(https://diagnosisbook.com/human-anatomy/kidney-anatomical-and-functional/amp)



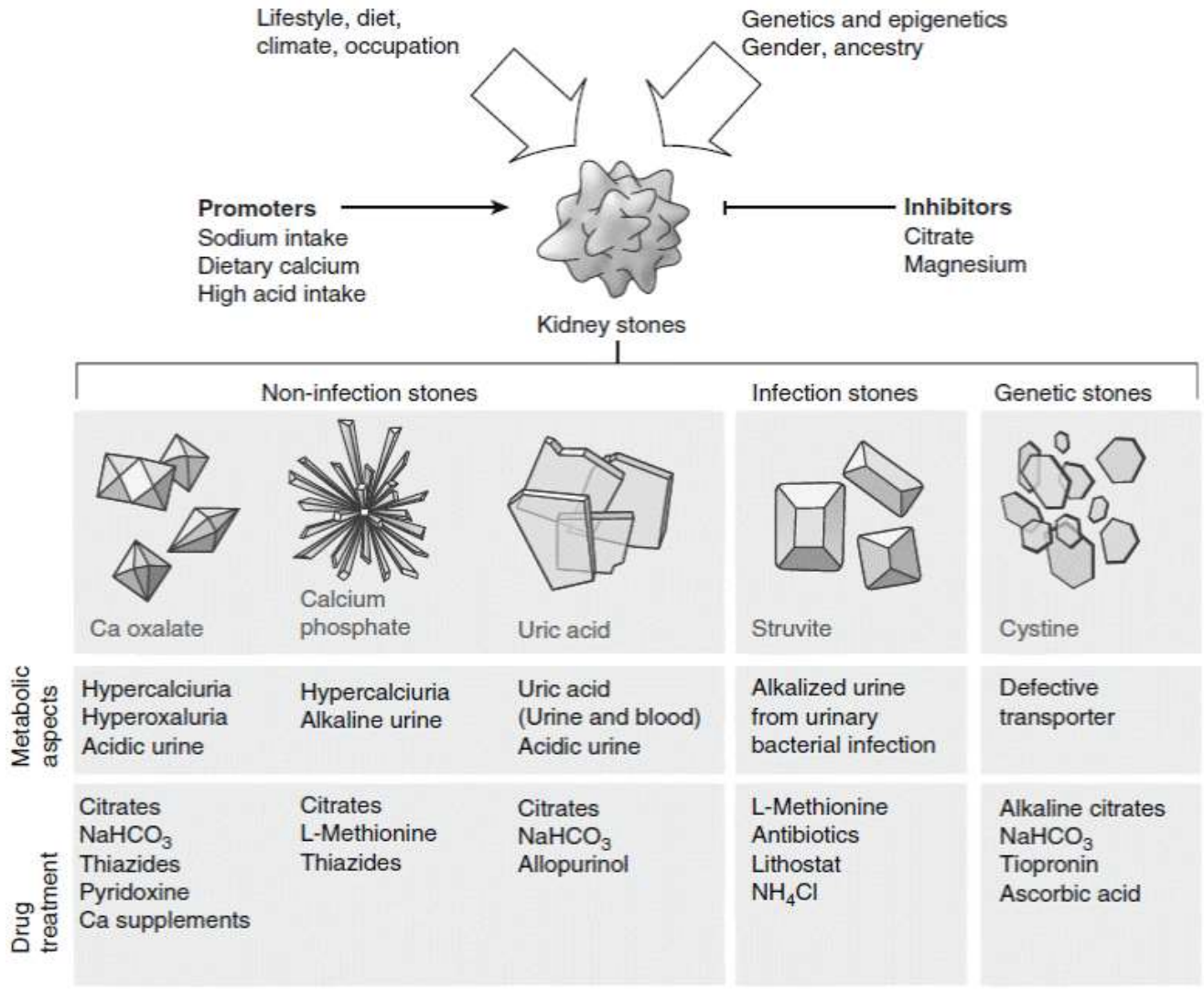
Diagnosis

- Patients with urinary stones generally present with the typical reno-ureteral colic and less frequently with loin pain ;associated manifestations could be gross hematuria ,vomiting and sometimes fever. However, patients can also be asymptomatic. (Saeed R. Khan et all , 2016)

Figure 1.2

Kidney stone(Calculi) types and their specifications

(https://ebrary.net/27232/health/kidney_stones)



Prevalence

- Stone formation is highly prevalent ,with rates up of to 14.8% and increasing ,and a recurrence rate up of to 50% with the first 5 years of initial stone episode. (Saeed R. Khan et all , 2016)

Table 2.1

kidney stones distribution and structure

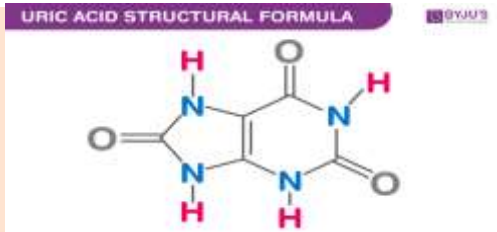
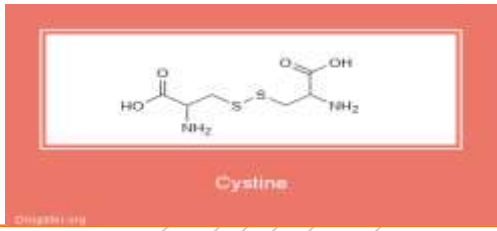
Stone type	percentage	structure
Calcium oxalate mixed with calcium phosphate	80	CaC_2O_4 or $Ca_3(PO_4)_2$
Struvite	10	$NH_4MgPO_4 \cdot 6H_2O$
Uric acid	9	
Cystine	1	

Figure 2.1

the medical costs associated with kidney stones exceed $2 billion annually, and there are additional costs because of missed work (Margaret s. pearle et all ,2005) (Christopher s. saigal et all ,2005).

(https://www.niddk.nih.gov/health-information/urologic-diseases/kidney-stones/treatment)

Chart 2.1

(Pietro Manuel Ferraro et all ,2013)

The risk of developing kidney stones in participants using these beverages one or more meal per day

Juice	Punch(Alcoholic or Non-alcoholic)	Non-cola sugar sweetened soda	Sugar sweetened soda(cola)
12%	18%	22%	23%

Chart 2.2
(Pietro Manuel Ferraro et all ,2013)

The decreased risk of developing kidney stones in participants using these beverages one or meal per day

White Wine	Red Wine	Beer	Tea	Decaffeinated Coffee	Coffee
33%	31%	41%	11%	16%	26%

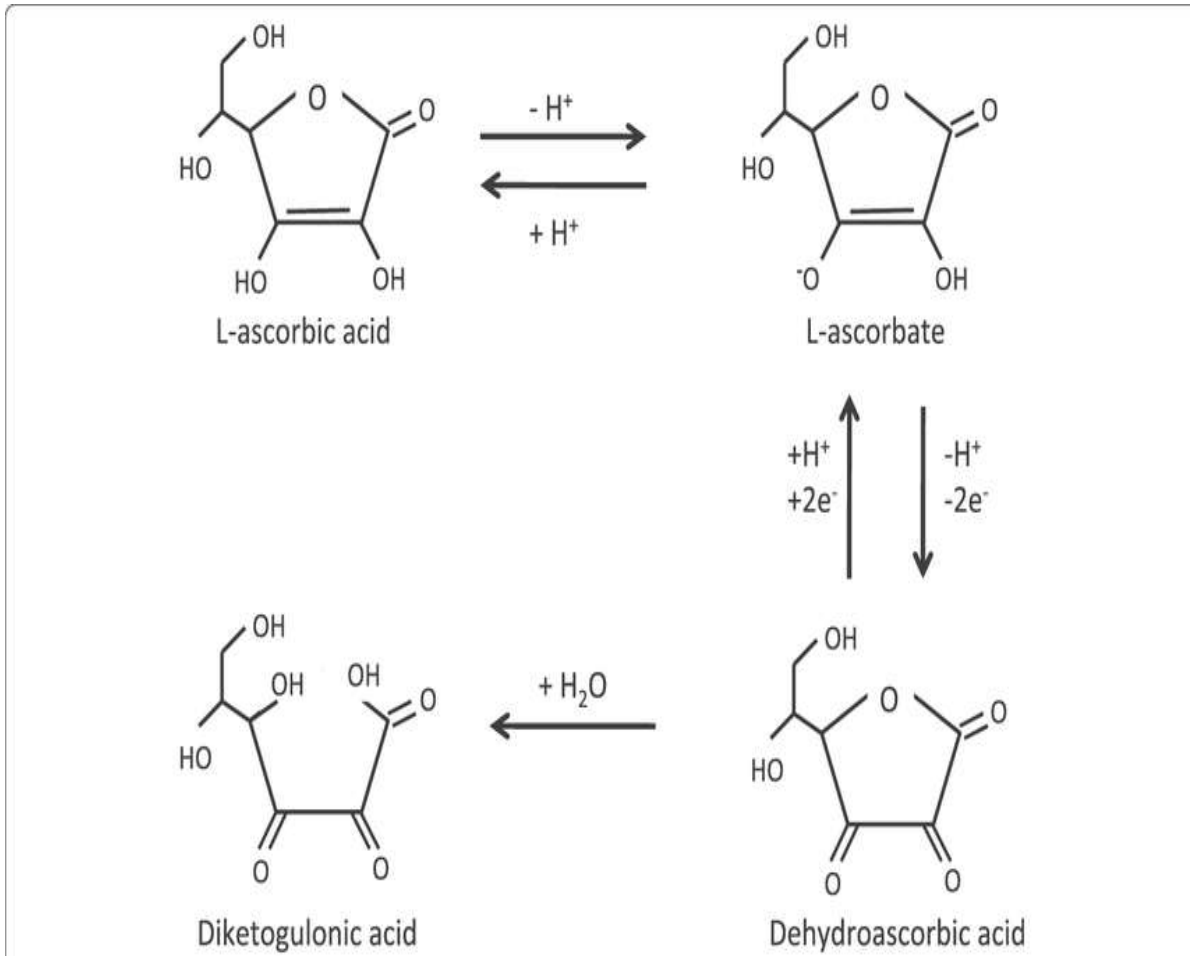
Kidney stones prevalence in COVID-19 pandemic

- First ,vitamin C is used for its antioxidative properties and functioning of immune system. Oxalate is an end product of the metabolism of vitamin C . The increase in the ingestion of ascorbic acid leads to excessive formation of oxalate.(Aya Karam et all , 2021)

Figure 2.2

Vitamin C methabolism

(https://www.researchgate.net/figure/tamin-C-metabolism-Ascorbic-acid-participates-both-in-acid-base-ascorbic_fig1_301583749)



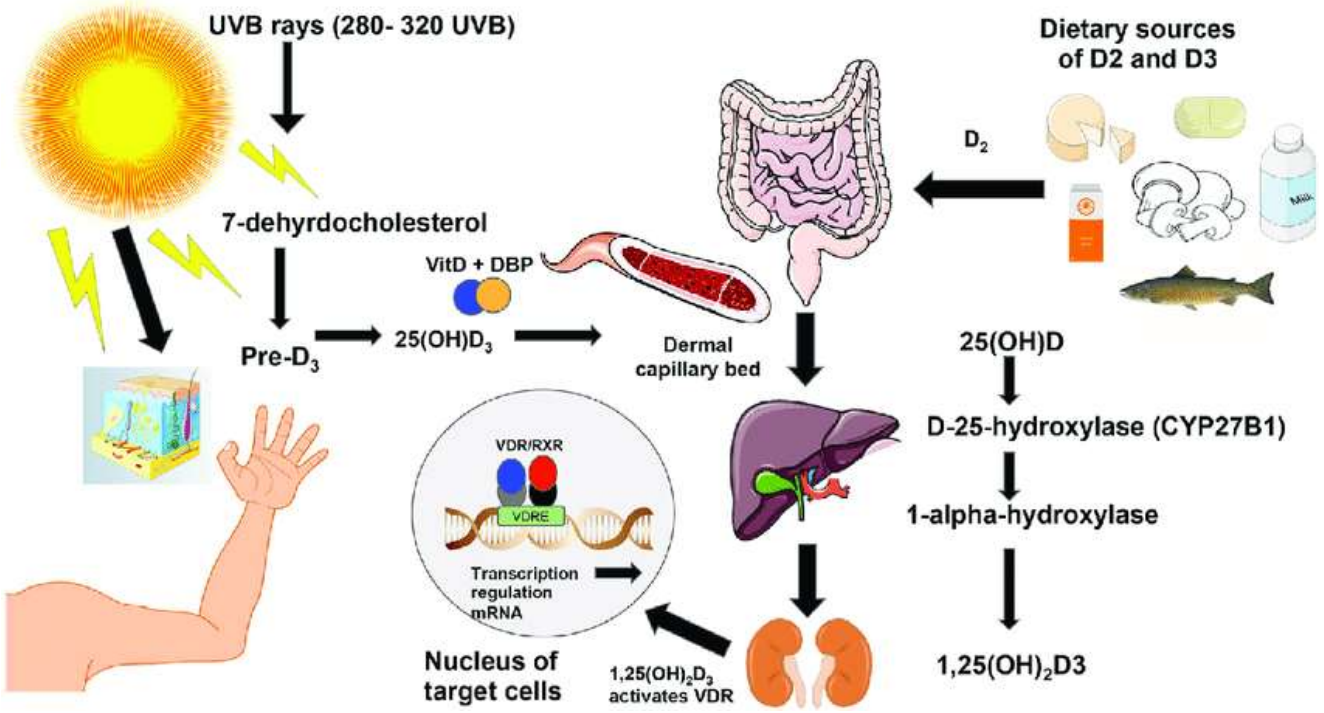
Kidney stones prevalence in COVID-19 pandemic

- Vitamin D regulates the calcium-phosphorus hemostasis and is also required for the immune system function .Calcitriol decreases the parathyroid hormone (PTH) synthesis ,subsequently increasing the excretion of calcium into urine.(Aya Karam et all , 2021)

Figure 2.3

Vitamin D absorption from sunlight

(https://medium.com/@rachou_28925/vitamin-d-the-crucial-sunshine-vitamin-e732ae758358)



Urolithiasis and vitamin C & D

- Therefore ,supplementation with vitamin C and D ,although maybe beneficial for the management of COVID-19 ,is not without risk .These molecules should be used with caution ,particularly in prior stone formers.(Aya Karam et all , 2021)

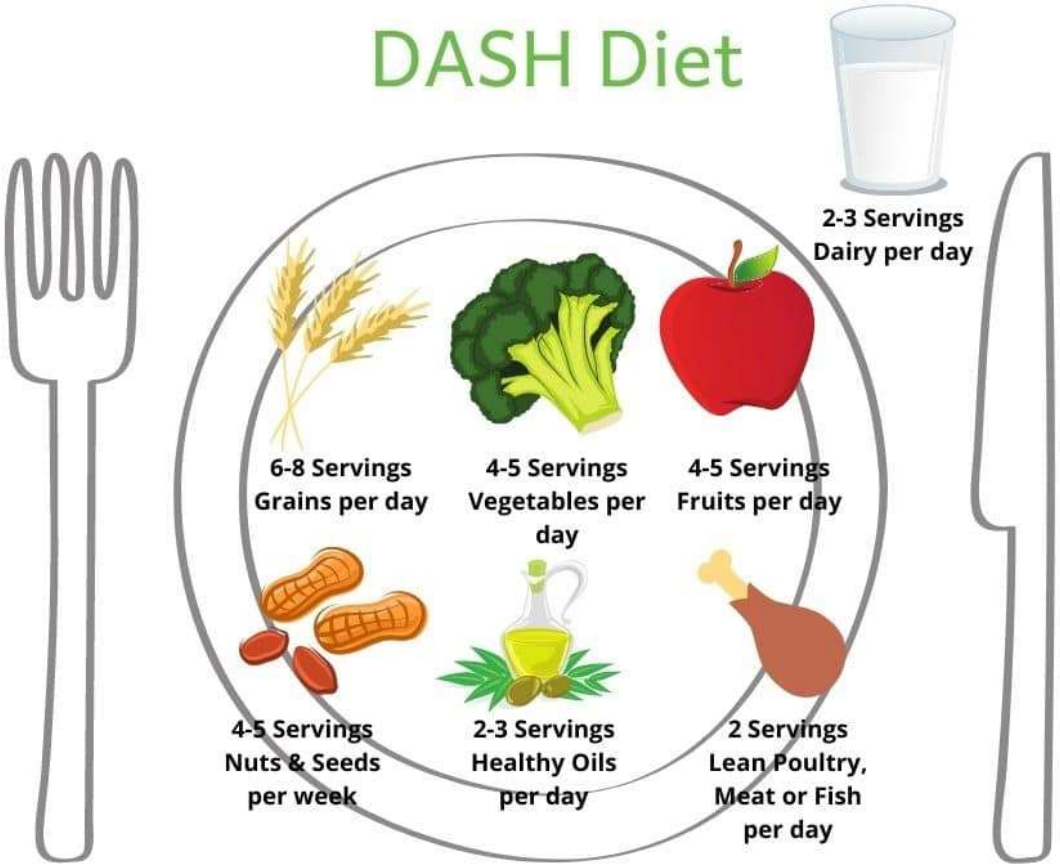
Prevention

In the majority of patients with idiopathic stone disease ,behavioral and nutritional interventions are potentially helpful and should be the first step of stone prevention. (Saeed R. Khan et all , 2016)

Figure 3.2

Kidney stones preventive diet

(https://www.vectorstock.com/royalty-free-vector/high-calcium-and-vitamins-foods-vector-6917082)



Oxalate absorption

- Low oxalate diets are difficult to attain because of presence of oxalate in many common foods. Only foods with very high oxalate content should be limited or avoided. (Saeed R. Khan et all , 2016)

Figure 3.3

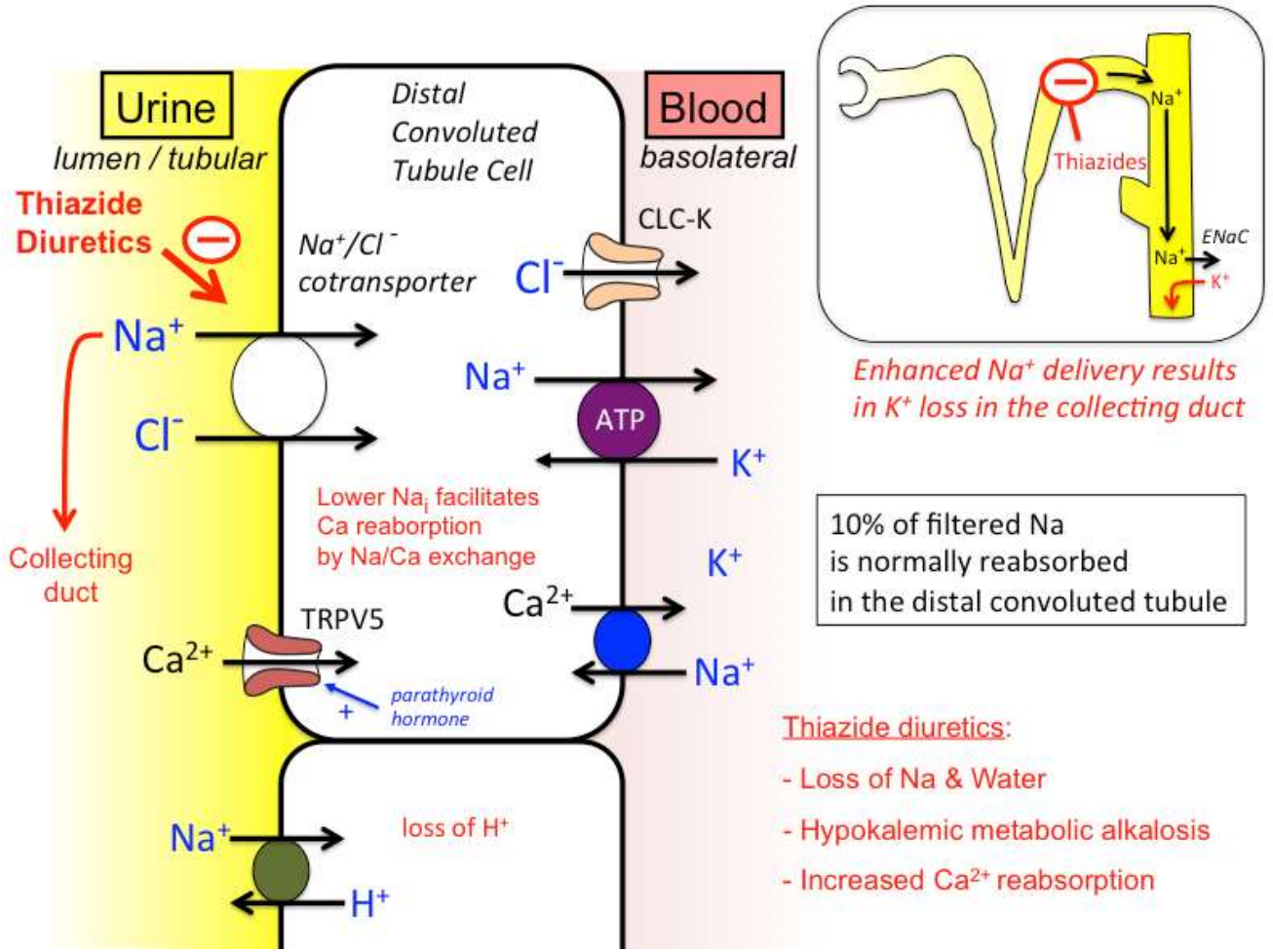
Calcium rich foods for calcium stones prevention

(https://www.organicfacts.net/15-calcium-rich-foods.html)

Figure 3.4

Thiazides function on nephrons

(https://tmedweb.tulane.edu/pharmwiki/doku.php/thiazides)



Uric acid stones prevention

- To prevent frequently occurring uric acid stones ,uric acid supersaturation in the urine must be decreased .This can be achieved by increasing urinary volume (>21 per day) ,increasing urinary pH to approximately 7.0 ,decreasing uricosuria and administering sodium bicarbonate or potassium citrate. (Saeed R. Khan et all , 2016)

Figure 3.5

Sodium bicarbonate

(https://athleticsillustrated.com/wp-content/uploads/2020/07/Soda.jpg)

Cystine stones prevention

The preventive strategy involves increasing water intake to >31 per day and the administration of sodium bicarbonate or potassium citrate to raise urinary pH and increase the solubility of cystine. The target pH is 7.0 to 8.0.(Saeed R. Khan et all , 2016)

Figure 3.6

Cystinuria

(https://en.wikipedia.org/wiki/Cystinuria)

Struvite stones prevention

Complete removal of struvite stones is a prerequisite for successful recurrence prevention .Indeed ,it is almost impossible to cure infection in the presence of the stone because it represents a microorganism reservoir.(Saeed R. Khan et all , 2016)

Figure 3.7

Coffee and tea are sources of caffeine ,which has been reported to increase diuresis moderately together with the excretion of magnesium and potassium as well as calcium and sodium.

(https://ak.picdn.net/shutterstock/videos/17073175/thumb/1.jpg)

Treatment

(https://advancedurology.com/advanced-blogging/what-is-a-swollen-kidney-a-guide-to-bilateral-hydronephrosis/)

Video 4.1

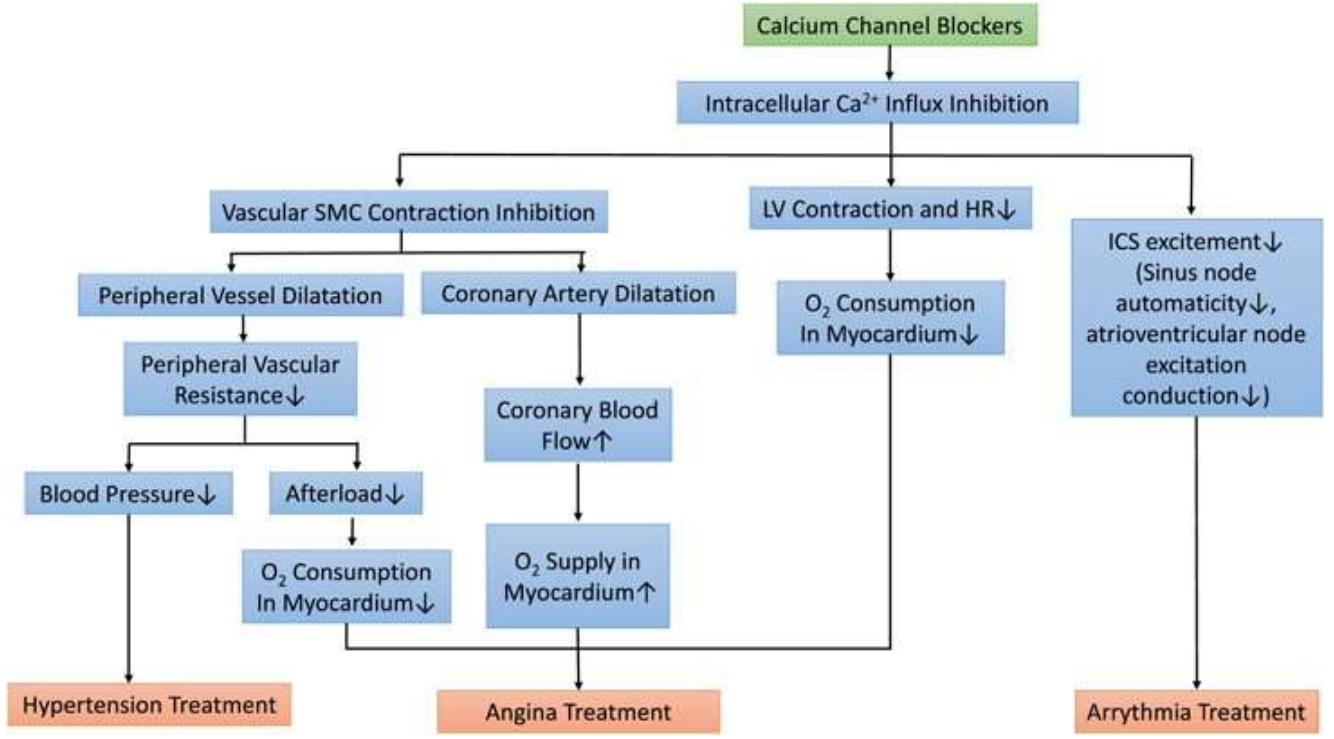
Shockwave lithotripsy

(https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/lithotripsy)

Figure 4.1

Calcium channel blockers function

(https://www.nature.com/articles/hr2016183)



References

- 1) Soda and Other Beverages and the Risk of Kidney Stones , Pietro Manuel Ferraro, Eric N. Taylor, Giovanni Gambaro, Gary C. Curhan , CJASN Aug 2013, 8 (8) 1389-1395; **DOI:** 10.2215/CJN.11661112
- 2) Khan SR, Pearle MS, Robertson WG, Gambaro G, Canales BK, Doizi S, Traxer O, Tiselius HG. Kidney stones. Nature reviews Disease primers. 2016 Feb 25;2(1):1-23.
- 3) Aya Karam, Georges Mjaess, Hadi Younes, Fouad Aoun, Increase in urolithiasis prevalence due to vitamins C and D supplementation during the COVID-19 pandemic, *Journal of Public Health*, 2021;, fdab328


THANK
YOU