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PHARMACOLOGICAL DIGNOSIS AND MANAGEMENT OF KIDNEY STONES

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Abstract:

Kidney stones means deposition of minerals in the different parts of kidney may in calyces, pelvis or attached to renal papillae. Kidney stone is made up of calcium oxalate mainly. Also contains crystalline and organic compounds obtained from supersaturation of urine. Randall's plaques (calcium phosphate) present on surface of renal papillary. Different risk factors like hypertension, obesity, diabetes, metabolic syndrome are responsible for stone formation. There is need to prevention by better understanding of stone formation mechanism. Due to that risk factors may leads to chronic kidney disease and end stage disease. Different diagnosis method and treatments are available to treat this kidney stone.

Keywords: *Kidney stone, AFM, Crystal , Hydxoxycitrate, Calcium Oxalate,*

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INTRODUCTION:

History of kidney stone-The history of urinary stone disease and the root of science go back to the ancient Egyptians and mesopotamia.The history of kidney stone and history of civilization goes parallel. The English archeologist E.Smith in 1901 found a bladder stone from a 4500-5000 years old mummy in El-Amrah, Egypt.In the United State population the kidney stones is currently at 6-10% with lifetime risk. Nephrolithiasis increasingly known as the systematic disorder. Bone disease included in the nephrolithiasis. The systematic disorder associated with chronic kidney disease. So that increased risk of type-2 diabetes mellitus, coronary artery disease and the Metabolic Syndrome (MS).Nephrolithiasis without medical treatment is a chronic illness over10 years with a reoccurence rate greater than 50%. The incidence of nephrolithiasis is reported to be increasing across the world. About 410% of world population affected by theurological disorder. Most common kidney stone type is calcium **What are Kidneys-**

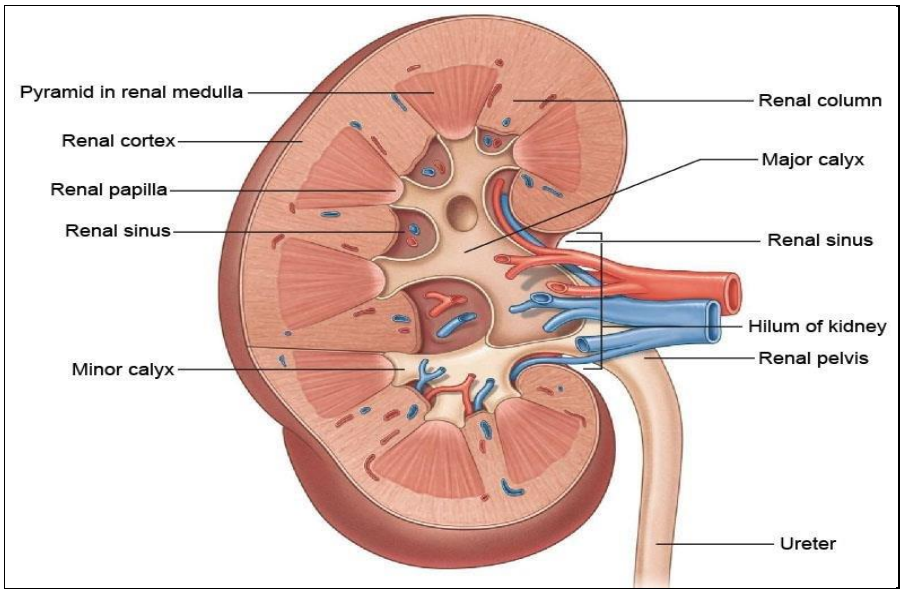

Fig.1.Anatomy of Kidney

kidneys are the bean shaped paired organ in the renal system. The location of kidneys at the level of 12th thoracic vertebra to the 3rd lumbar vertebra. They are the reddish brown in color. The left kidney is closer to the midline longer and mores lender than the right. They help the removal of nitrogenous waste material from the body. The average Size of the adult kidney is about 10-13cm long, approximately 5-7.5cm wide and about 2-2.5cm thick. The average weigh of kidney is about 150-160gm both kidneys weigh about 0.5% total body weight.

Nephron:

The basic structural and functional unite of the kidney is the nephron. It iscomposed of a renal corpuscles and renal tubules. The renal corpuscles consists of atuft of capillaries called a glomerulus and an encompassing bowman's capsule. Therenal tubule extends from the capsules. The capsules and tubules are connected andare composed of epithelial cells with a lumen. A healthy adult has 0.8-1.5millionnephron in each kidney. Blood is filtered as it passes through three layers :- theendothelial cells of the capillary wall, its basement membrane and between the footprocesses of the podocytes of the of the lining of the corpuscles.

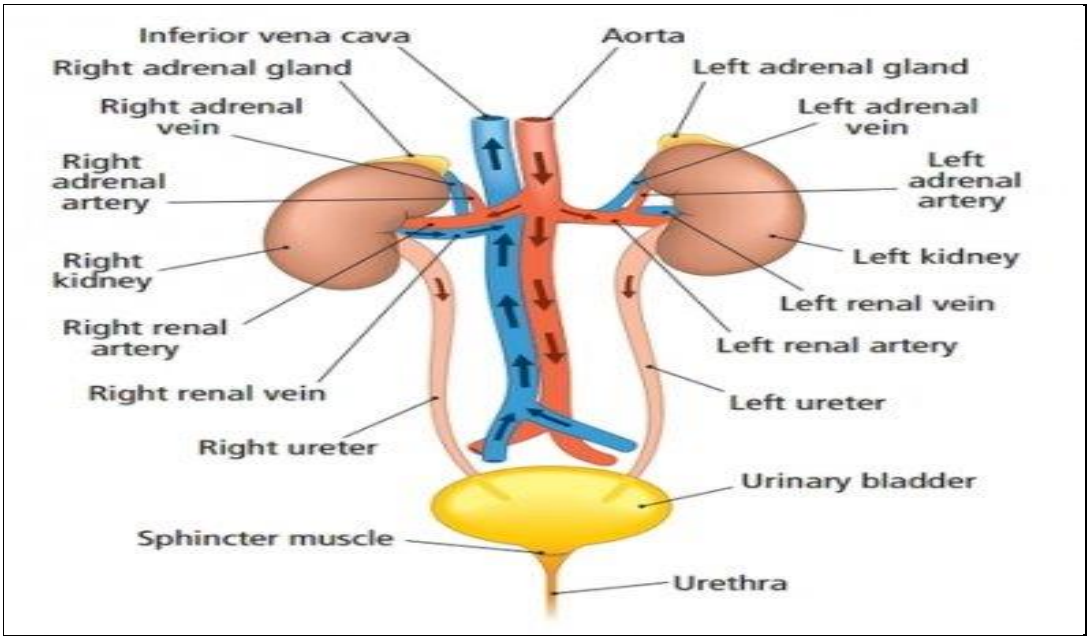

Fig.2 .Urinary System

Parts of the nephron:

1. Renal corpuscles
2. Glomerulus-
3. Bowman's capsule-
4. Renal tubules-
5. Loop of Henle-
6. Proximal convoluted tubule-
7. Distal convoluted tubule-

Functions of the kidney:

The primary function of the kidney is to remove nitrogenous waste (mainly urea) from the body. This is an extremely important kidney function, since toxic buildup of nitrogenous

Wastes in the body can lead to like threatening diseases and eventually death.

While filtering the blood is an essential function, the kidney do much more than this.

Did you know that the kidneys are also responsible for regulating blood volume and blood pressure? And that they also produce certain hormones and regulate blood PH. Following are the

Some functions of the kidneys:

1. Removing waste from blood-
2. Urine formation another vital function of the kidney-
3. Regulate water volume-
4. Regulate body's salt content-
5. Regulate blood pressure-
6. Regulate PH balance-
7. Production of hormones is the another function of the kidney-
8. Processing vitamin-D.

Mechanism of Kidney Stone Formation:

Crystal starts to form when Calcium Oxalate concentration is 4 times above the normal solubility. If the CaOx concentration is higher 7-11 times than normal solubility it starts nucleation. Supersaturation of CaOx is increased with high calcium and oxalate in low volume .Citrate in urine forms soluble complex with urinary Ca. If urine has low citrate concentration is promoted to form CaOx stone. If urine PH is >6.5, proportional of divalent and trivalent ions are increased then SSCaP is favorable. Different solutes supersaturation level in urinary volume determines specific type of stones.

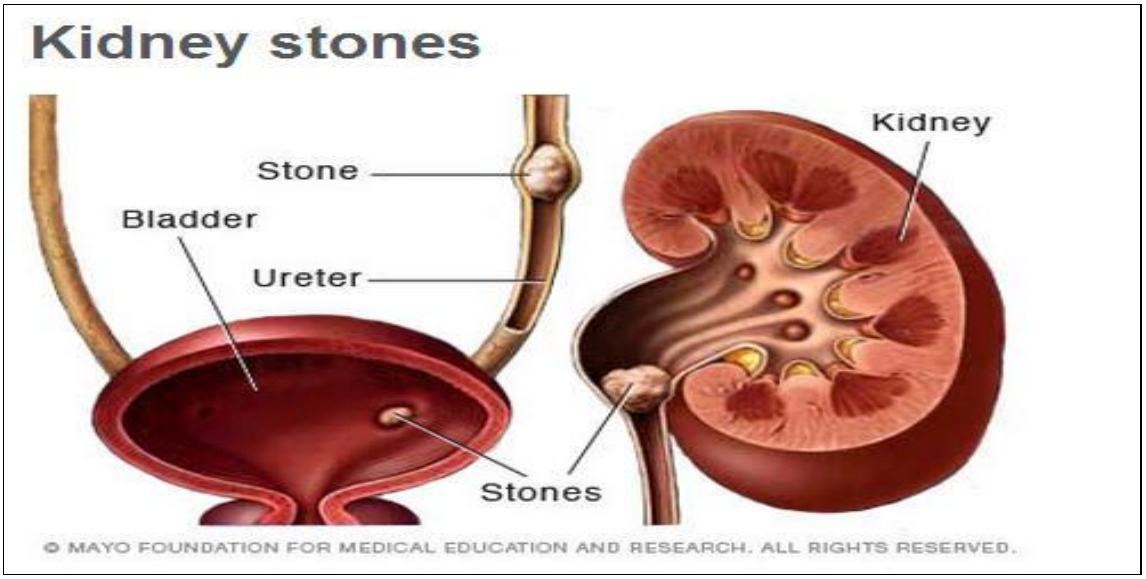

Fig.no.3 Kidney stones [9]

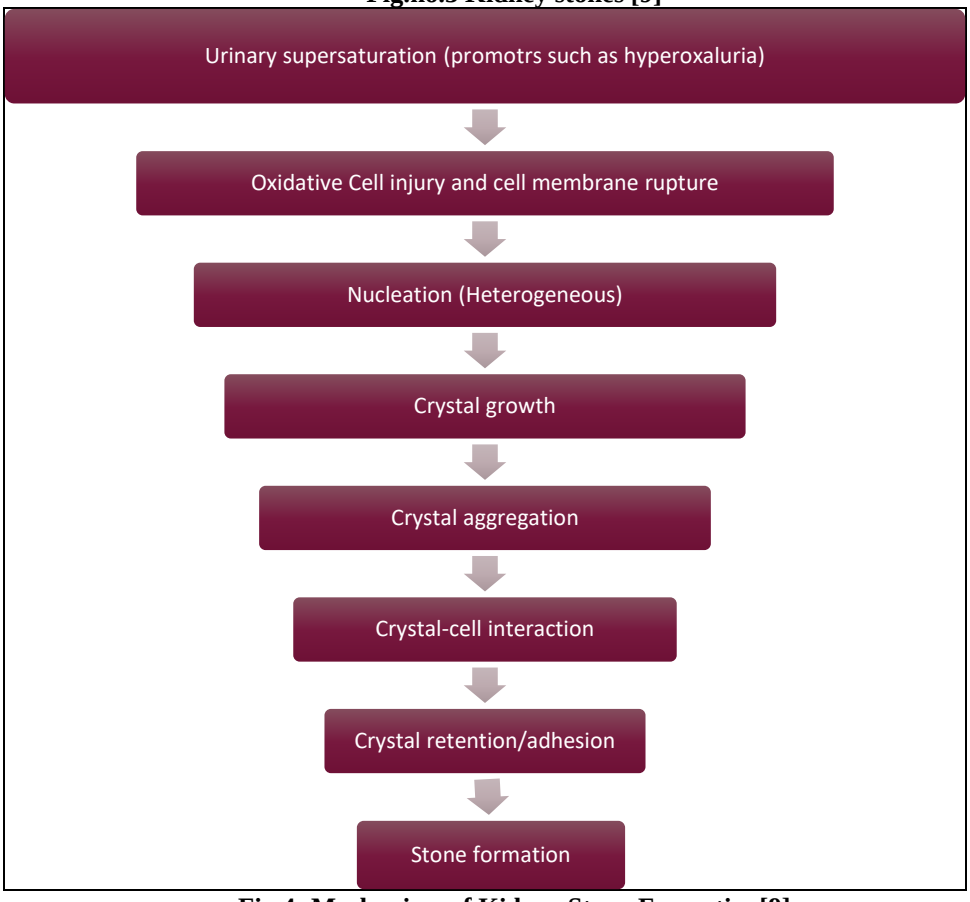

Fig.4: Mechanism of Kidney Stone Formation[9]

TYPES OF CRYSTALS:

Sr. No.	Type of Crystal	Radiographic Observation	Percent
1	Calcium oxalate /mix	Round, Radiodense	75%
2	Calcium Phosphate (Brushite)	Small, Radiodense	5%
3	Uric acid	Round, Staghorn	5-15%
4	Struvite (Mg Ammonium Phospsphate	Staghorn	10-20%
5	Cystine	Staghorn	1%

Common Symptoms of Kidney stone-

- Severe pain in side and back below ribs
- Pain that radiates to the lower abdomen and groin
- Pain that comes in waves and fluctuates in intensity
- Pain on Urination
- Pink - red or brown urine
- Cloudy or foul smelling of urine
- Nausea or Vomiting
- Persistent need to urinate
- Fever and chills if infection is present
- Urinating in small amounts

TREATMENT FOR KIDNEY STONE:

ATOMIC FORCE MICROSCOPE (AFM) technique for kidney stone:

Mechanism of AFM-A crystal of calcium oxalate monohydrate is dissolve when it exposed to solution of HCA- Hydroxy citrate- Kidney stone is crystal of calcium oxalate. Kidney stone are small, hard mineral deposited and forms crystals inside the kidney. Up to 12% affecting in to men and 7% in women. High blood pressure, obesity, diabetes may increases the risk of kidney stones. It can be avoided by drinking lots of water, by avoiding oxalate , iron riched food like as spinach, almonds, okra. S this crystals get dissolve in natural fruit extract. Jeffrey Rimer ,professor of chemical engineering ,Houston University ,studied and his work offers first evidence that the HCA –Hydxoxycitrate is effective inhibitor of calcium oxalate crystal .Under the certain conditions HCA able to dissolve this crystals. John Asplin , Nephrologist at Litholink corporation, suggested HCA is similar to CA -potassium citrate ,and is available as a dietary supplements. potassium citrate is supplement that can slow crystal growth, but some people are anable to tolerate side effect.

Michael G.Taylor ,student of Pittsburgh university studies ,both compound HCA and CA are inhibit the growth of calcium crystals, but HCA is more potent and shows unique qualities to develop new therapies.

Dissolution of crystal-AFM shows the interactions between Crystal, HCA and CA under relastic gowth conditions. This technique records crystal growth in real time with near molecular resolution. AFM images recoreded the crystal of calcium oxalate exposed to specific concentration of HCA, it get dissolve by shrinking.it is rare to see actual dissolution of crystals in highly supersaturated solution .dissolution of crystal in supersaturated solution is possible on the basic of Density Function Theory-DFT. With the help of computational method structure and properties of material is studied.

Dissolution of crystal in supersaturated solution HCA and CA forming stronger bond with surface of crystal oxalate. It inducing strain that releve calcium and oxalat , so crystal get dissolve.

As per the Rimer research HCA is excreted through urine, when it tested in human subject, as 7 people took supplements for 3 days. On the basic of his laboratory trials, HCA has potential to reduce incidence rate of people in chronic kidney stone disease .there is need to design effective drug. [32]

DIETARY SOURCE TO PREVENT KIDNEY STONE FORMATION:

Sr.No.	Common name	Biological Name	Family	Part use
1	Dudhi Bhopla	*Lagenaria Siceraria Standl*	Cucurbitaceae	Fruit juice
2	Mula	*Raphanus sativus(L) Domin*	Brassicaceae	Root , leaf, seed juice
3	Dalimb,anar	*Punica granatum L.Anar,Dalimb*	Punciaceae	seed
4	Lemon juice	*Citrus limon*	Rutaceae	Fruit juice
5	Ginger	*Zingiber officinale*	Zingiberaceae	Fruit juice
6	Watermelon	*Citrullus lanatus*	Cucurbitaceae	Fruit juice
7	Turmeric	*Curcuma longa L.*	Zingiberaceae	powder
8	Panphuti	*Kalanchoe pinnata L.*	Craussulaceae	Leaf juice
9	Apta	*Bauninia racemosal Lam*	Caesalpiniaceae	Stem bark
10	Bhokar	*Cordia dichotoma L.*	Boraginaceae	Stem bark

REFERENCES:

1. Ralph C. Wang, Managing Urolithiasis, General Medicine/Expert Clinical Management, Ann Emerg Med. 2015; 1-6.
2. Anna Holdgate, Tamara Pollock, Systematic review of the relative efficacy of non-steroidal anti-inflammatory drugs and opioids in the treatment of acute renal colic, BMJ, June .2004; 1-8.
3. Makasanaa A., Ranpariyab V., Desaia D., Mendparaa J., Parekha V., Evaluation for the anti-urolithiatic activity of Launaea procumbensagainst ethylene glycol-induced renal calculi in rats. Toxicology Reports, 1, 2014; 46–52.
4. Rathod N, Chitme H. R., Chandra R., In Vivo And In Vitro Models For Evaluating Anti-Urolithiasis Activity Of HerbalDrugs. International Journal of Pharmaceutical Research and Bio-Science. 3(5): 309-329.
5. Borghi L, Meschi T, Maggiore U, Prati B. Dietary therapy in idiopathic nephrolithiasis. Nutr Rev. 64, 2006;301-312.
6. Asplin JR, Coe FL. Hyperoxaluria in kidney stone formers treated with modern bariatric surgery. The Journal of Urology. 177, 2007;565-569.
7. sharma N., Tanwer B. S., Vijayvergia R., Study of medicinal plants in Aravali regions of Rajasthan for treatment of Kidney stone and Urinary tract troubles. International Journal of PharmTech Research, 3 (1); 110-113.
8. Dhande R. S., Folk Medicinal Therapy Used in thetreatment of Renal Calculi (Kidney Stone) In Maharashtra: A Review. International Journal of Researches In Biosciences, Agriculture And Technology. IV (3), 2016; 24-30.
9. Pravin Vasantrao Gomase1*, Sunil P. Pawar2 Urolithiasis (Kidney Stones): Current Pharmacological Diagnosis and Management Journal of Drug Delivery and Therapeutics * 2019; 9(4):726-737.
10. Pocock, Gillian; Richards, Christopher D. (2006). Human physiology : the basis of medicine (3rd ed.). Oxford: Oxford University Press. p. 349. ISBN 978-0-19-856878-0.
11. J., Tortora, Gerard (2010). Principles of anatomy and physiology. Derrickson, Bryan. (12th ed.). Hoboken, NJ: John Wiley & Sons. p. 1024. ISBN 9780470233474. OCLC 192027371.
12. J., Tortora, Gerard (2010). Principles of anatomy and physiology. Derrickson, Bryan. (12th ed.). Hoboken, NJ: John Wiley & Sons. p. 1027. ISBN 9780470233474. OCLC 192027371.
13. Ecology & Evolutionary Biology - University of Colorado at Boulder. "The Kidney Tubule I: Urine Production." URL: http://www.colorado.edu/eeb/web_resources/cartoons/nephrex1.html. Accessed on: March 6, 2007. Archived October 2, 2007, at the Wayback Machine
14. Hook, Jerry B. & Goldstein, Robin S. (1993). Toxicology of the Kidney. Raven Press. p. 8. ISBN 0-88167-885-6.
15. Nosek, Thomas M. Essentials of Human Physiology. Section 7/7ch03/7ch03p16
16. Jameson, J. Larry & Loscalzo, Joseph (2010). Harrison's Nephrology and Acid-Base Disorders. McGraw-Hill Professional. p. 3. ISBN 978-0-07-166339-7.
17. "Regulation of Urine Concentration". Anatomy & Physiology. CliffsNotes. Archived from the original on 25 October 2012. Retrieved 27 November 2012.
18. Walter F. Boron. Medical Physiology: A Cellular And Molecular Approaoch. Elsevier/Saunders. p. 743. ISBN 1-4160-2328-3.
19. Küpeli B et al. Does tamsulosin enhance lower ureteral stone clearance with or

without shock wave lithotripsy. Urology. 2004;64(6):1111-5.
20. Yilmaz E et al. The comparison and efficacy of 3 different alpha1-adrenergic blockers for distal ureteral stones. J Urol. 2005;173(6):2010-2.
21. Lindell A. Clinical course and cystine stone formation during tiopronin treatment. Urol Res. 1995;23(2):111-7.
22. Smith-Bindman R et al. Ultrasonography versus computed tomography for suspected nephrolithiasis. N Engl J Med. 2014;371(12):1100-10.
23. Brisbane W et al. An overview of kidney stone imaging techniques. Nat Rev Urol. 2016;13(11):654-62.
24. Pearle MS et al. Medical management of kidney stones: AUA guideline. J Urol. 2014;192(2):316-24.
25. Assimos D et al. Surgical Management of Stones: American Urological Association Endourological Society Guideline, PART I. J Urol. 2016;196(4):1153-60.
26. Morgan MS et al. Medical management of renal stones BMJ. 2016;352:i52.
27. Trinchieri A. Epidemiology of urolithiasis. Arch Ital Urol Androl. 1996;68:203-49.
28. Hesse A et al. Study on the prevalence and incidence of urolithiasis in Germany comparing the years 1979 vs. 2000. Eur Urol. 2003;44(6):709-13.
29. Trinchieri A et al. Increase in the prevalence of symptomatic urinary tract stones during the last ten years. Eur Urol. 2000;37(1):23-5.
30. Romero V et al. Kidney stones: a global picture of prevalence, incidence, and associated risk factors. Rev Urol. 2010; 12(2-3):e86-96.
31. Coe FL et al. The pathogenesis and treatment of kidney stones. N Engl J Med. 1992;327(16):1141-52.
32. Evan AP et al. Mechanism of formation of human calcium oxalate renal stones on Randall's plaque. Anat Rec (Hoboken). 2007;290(10):1315-23. 32.https://medicalxpress.com/news/2016-08-treatment-kidney-stones.html.