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RESEARCH ARTICLE

KIDNEY STONE- A COMPREHENSIVE STUDY

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ABSTRACT

Kidney stones have become increasingly common in contemporary society, affecting individuals across various age groups, with a higher prevalence in regions characterized by limited access to potable water. Composed primarily of calcium and phosphate, these rigid formations arise when substances like calcium oxalate and uric acid crystallize. While kidney stones can travels the urinary tract from the kidneys to the bladder, potentially causing severe pain, many individuals may experience resolution without permanent damage. This article explores various animal models and in vitro studies used to investigate urolithiasis, detailing the types of kidney stones, their symptoms, causes, risk factors, identification methods, treatment options, and preventive measures. The types of kidney stones include calcium, struvite, uric acid, and cystine stones, each with distinct etiologies and clinical presentations. Symptoms often escalate with stone size, ranging from severe abdominal pain to nausea and fever. Contributing factors include dehydration, dietary composition, genetic predisposition, certain medical conditions, and obesity. Key diagnostic tools include imaging techniques and urine analysis. Treatment approaches consist of non-invasive techniques like extracorporeal shock wave lithotripsy, minimally invasive procedures, and medication that alters urine chemistry. Prevention strategies focus on hydration, dietary modifications, and adherence to prescribed medications. Ultimately, management of kidney stones entails a holistic approach involving symptom awareness, lifestyle adjustments, and timely medical intervention to mitigate recurrence and promote kidney health.

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INTRODUCTION

Now days kidney stone is more common and it can occur in any age. It is more common in countries where there is scarcity of water to drink. Almost kidney stones are composed of calcium and phosphate. Risk of kidney stone formation is more in male than female. Kidney stones very rigid in nature and remain hard a are caused by minerals, calcium, oxalate, and uric acidetc. If some substances like calcium oxalate and uric acid stick together and a big structure is formed, then that structure is formed into a stone which ultimately form a kidney stone. Kidney stones can affect the urinary tract. It can go from the kidney to the bladder and when it goes there it also causes pain. For someone it does not do any permanent damage, if corrects it with time, person will be will be fine.

IN VIVO ANIMAL MODEL: Following chemicals are used to induce kidney stone in animal models. Ethylene glycol, Ethylene glycol and ammonium chloride, Sodium oxalate (NaOx) Glyoxylate induced etc.

IN VITRO STUDIES ON UROLITHIASIS: Calcium oxalate crystal assay, Nucleation Assay, Calcium phosphate assay, Lactate dehydrogenase leakage assay etc.

Types of kidney stones

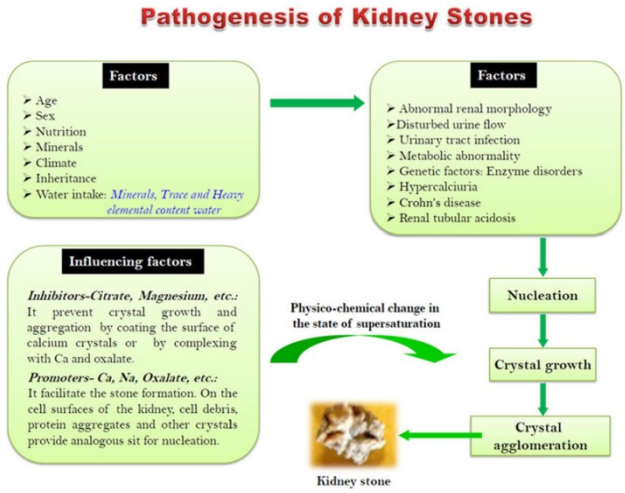
- **Calcium stone:** This is the most common type of kidney stone and it is made of calcium oxalate.
- **Struvite stone**:Struvite is a mineral which is formed by bacteria in your urinary tractand ultimately block the ureter causes severe pain and Infections of the urinary tract, blockage of the flow of urine and hydronephrosis (kidney dilation). These conditions can contribute to nausea and vomiting induced by the stone event
- **Uric acid stone**: This occurs in a person who has excessive fluid loss. And the one who eats a diet high in protein. Low urine volume, hyperuricosuria and acid urine pH (pH < are the main reasons for this type of stone)
- **Cystine stone**: This occurs in less people because it comes from heredity character. It is called cystinuria.Cystine stone is caused by cystine in the urine due to high levels of essential amino acid.

Symptom of kidney stone: Small kidney stones pass through the urinary tract very easily and do not show any symptom and are not noticed but larger stones show symptoms like.

- **Severe pain**: In this case there is pain in the stomach i.e. abdominal pain and when a kidney stone move further in the urinary tract there is spasm which also lead to more pain.
- **Blood in urine** [hematuria]: Kidney stone irritates the urinary tract and blood is visible in the urine, when we look it under microscope small particle of blood is observed.
- **Frequent urination**: This happens due to excessive urination and there is a burning sensation at the time of urination.
- **Nausea and vomiting**: Some time pain is associated with nausea and vomiting.
- **Fever and chills**: Fever can also occur in it and hence it should be checked as soon as possible.

Kidney stone causes and risk factor

- **Dehydration:** Drinking very less water produces concentrated urine and leads to kidney stones.
- **Diet:** High sodium and oxalate levels and high protein diet also lead to kidney stone formation.
- **Genetics:** Some people get kidney stones due to genetics.
- **Medical conditions:** Diseases such as hyperthyroidism, inflammatory bowel disease, and urinary tract infection can cause kidney stones.
- **Obesity:** Due to being overweight, fewer nutrients may accumulate [combine] in kidneys and this leads to kidney stones.



Ways to identify kidney stones

- **Imaging: Kidney** stones can be identified through CT scan and ultrasound.
- **Urine analysis**: The presence of blood in urine testis done and either presence of kidney stone is checked.

Main types of kidney stones

There are different types of kidney stones but based on size there are 2 main types

- **Small kidney stone**: This kidney stone is cured by drinking more water and small and saline therapy. Some stone are cured with medicine. It also contains alpha-blockers which helps in relaxing urinary muscles.
- **Large kidney stone:** If the stone is very big then medicines are given and there are some other options also.

Treatment of kidney stone

- **Extracorporeal shock wave lithotripsy [ESWL]:** In this, sound waves are used to break the stone and it breaks into small pieces.
- **Ureteroscopy:** A thin scope is passed through the urethra and the kidney stone is broken.
- **Percutaneous nephron lithotomy**: If the kidney is badly damaged then the stone can be removed through surgery or the stone can be removed directly from the kidney.
- **Medications:** In some cases, medicines change the acidity of kidney stone and new kidney stone form does not occur.

Prevention of kidney stone

- **Stay hydrated:** We should drink 2-3 liters of water so that urine remains diluted.
- **Dietary changes:** We should eat less salt and animal protein and eat more fruits and vegetables to reduce the risk of kidney stones.
- **Limit oxalates:** Some foods that have high oxalates like spinach, nuts and tea should be eaten less as this reduces the risk of kidney stones.
- **Medications:** And the medicines given by doctors should be taken time to time so that the risk of kidney stones occurring in future is reduced.

CONCLUSION

Kidney stone is a common painful condition. Kidney stone is managed by symptoms, causes, and seeking treatment and kidney stone is prevented by good diet and drinking more water and balanced diet. If kidney stone occurs then you should immediately inform the doctor and take appropriate treatment.

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