International Journal of Medical and Health Research
ISSN: 2454-9142
Received: 16-11-2018; Accepted: 18-12-2018
www.medicalsciencejournal.com
Volume 5; Issue 1; January 2019; Page No. 136-138

Assessment on risk factors and incidence of renal stones

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Abstract
Renal stone is a common and a major cause of morbidity worldwide including India. In general, urinary stones may contain various combinations of chemicals that become concentrated enough in the urine to form crystals. A stone may also result in blood in the urine, vomiting, or painful urination. About half of people will have another stone within ten years. Hence from the above literature findings the present study was planned to know the understanding of the prevalence risk factor of renal stones, to correlate the renal stone with demographic data.
The study had been conducted in the Indira Gandhi Institute of Medical Sciences, on total 50 patients who were referred to Out-Patient Department (OPD) and in-patient department (IPD). The 50 patients were enrolled in study groups as case that are under treatment of urinary track calculi.
From the above data generated it can be concluded that the prevalence of renal stones is rising worldwide, especially in men and with increasing age. Also, absence of health attention for risk factors that cause renal stone formation and education regarding renal dissolved agents use lead to overuse of such medications and could be one of the reasons. Calcium oxalate stones remain the most frequent components followed immediately by uric acid. Management of renal calculi can be achieved by focusing on proper diet, exercise and adequate fluid intake.

Keywords: kidney stones, renal, stone, prevalence

Introduction
Kidney stone disease, also known as urolithiasis, is when a solid piece of material (kidney stone) occurs in the urinary tract. Kidney stones typically form in the kidney and leave the body in the urine stream. A small stone may pass without causing symptoms. If a stone grows to more than 5 millimeters (0.2 in) it can cause blockage of the ureter resulting in severe pain in the lower back or abdomen. A stone may also result in blood in the urine, vomiting, or painful urination. About half of people will have another stone within ten years [1].
Most stones form due to a combination of genetics and environmental factors. Risk factors include high urine calcium levels, obesity, certain foods, some medications, calcium supplements, hyperparathyroidism, gout and not drinking enough fluids. Stones form in the kidney when minerals in urine are at high concentration. The diagnosis is usually based on symptoms, urine testing, and medical imaging. Blood tests may also be useful. Stones are typically classified by their location: nephrolithiasis (in the kidney), ureterolithiasis (in the ureter), cystolithiasis (in the bladder), or by what they are made of (calcium oxalate, uric acid, struvite, cystine). In those who have had stones, prevention is by drinking fluids such that more than two litters of urine are produced per day. If this is not effective enough, thiazide diuretic, citrate, or allopurinol may be taken. It is recommended that soft drinks containing phosphoric acid (typically colas) be avoided. When a stone causes no symptoms, no treatment is needed. Otherwise pain control is usually the first measure, using medications such as nonsteroidal anti-inflammatory drugs or opioids. Larger stones may be helped to pass with the medication tamsulosin or may require procedures such as extracorporeal shock wave lithotripsy, ureteroscopy, or percutaneous nephrolithotomy [2].
Between 1% and 15% of people globally are affected by kidney stones at some point in their lives. In 2015, 22.1 million cases occurred, resulting in about 16,100 deaths. They have become more common in the Western world since the 1970s. Generally, more men are affected than women. Kidney stones have affected humans throughout history with descriptions of surgery to remove them dating from as early as 600 BC.
Dehydration from low fluid intake is a major factor in stone formation. Obesity is a leading risk factor as well. High dietary intake of animal protein, sodium, sugars including honey, refined sugars, fructose and high fructose corn syrup, oxalate, grapefruit juice, and apple juice may increase the risk of kidney stone formation. Kidney stones can result from an underlying metabolic condition, such as distal renal tubular acidosis, Dent's disease, hyperparathyroidism, primary hyperoxaluria, or medullary sponge kidney. 3–20% of people who form kidney stones have medullary sponge kidney [3]. Kidney stones are more common in people with Crohn's disease; Crohn's disease is associated with hyperoxaluria and mal absorption of magnesium. A person with recurrent kidney stones may be screened for such disorders. This is typically done with a 24-hour urine collection. The urine is analysed for features that promote stone formation [4].

Calcium oxalate
A kidney stone (yellow) composed of calcium oxalate. Calcium is one component of the most common type of human kidney stones, calcium oxalate. Some studies

[which?] suggest that people who take calcium or vitamin D as a dietary supplement have a higher risk of developing kidney stones. In the United States, kidney stone formation was used as an indicator of excess calcium intake by the Reference Daily Intake committee for calcium in adults [5]. In the early 1990s, a study conducted for the Women's Health Initiative in the US found that postmenopausal women who consumed 1000 mg of supplemental calcium and 400 international units of vitamin D per day for seven years had a 17% higher risk of developing kidney stones than subjects taking a placebo [27]. The Nurses' Health Study also showed an association between supplemental calcium intake and kidney stone formation [6].

Unlike supplemental calcium, high intakes of dietary calcium do not appear to cause kidney stones and may actually protect against their development. This is perhaps related to the role of calcium in binding ingested oxalate in the gastrointestinal tract. As the amount of calcium intake decreases, the amount of oxalate available for absorption into the bloodstream increases; this oxalate is then excreted in greater amounts into the urine by the kidneys. In the urine, oxalate is a very strong promoter of calcium oxalate precipitation—about 15 times stronger than calcium. A 2004 study found that diets low in calcium are associated with a higher overall risk for kidney stone formation. For most individuals, other risk factors for kidney stones, such as high intakes of dietary oxalates and low fluid intake, play a greater role than calcium intake [7].

Other electrolytes

Calcium is not the only electrolyte that influences the formation of kidney stones. For example, by increasing urinary calcium excretion, high dietary sodium may increase the risk of stone formation. Drinking fluoridated tap water may increase the risk of kidney stone formation by a similar mechanism, though further epidemiologic studies are warranted to determine whether fluoride in drinking water is associated with an increased incidence of kidney stones. High dietary intake of potassium appears to reduce the risk of stone formation because potassium promotes the urinary excretion of citrate, an inhibitor of calcium crystal formation. Kidney stones are more likely to develop, and to grow larger, if a person has low dietary magnesium. Magnesium inhibits stone formation [8].

Animal protein

Diets in Western nations typically contain a large proportion of animal protein. Consumption of animal protein creates an acid load that increases urinary excretion of calcium and uric acid and reduced citrate. Urinary excretion of excess sulfurous amino acids (e.g., cysteine and methionine), uric acid, and other acidic metabolites from animal protein acidifies the urine, which promotes the formation of kidney stones. Low urinary-citrate excretion is also commonly found in those with a high dietary intake of animal protein, whereas vegetarians tend to have higher levels of citrate excretion. Low urinary citrate, too, promotes stone formation [9].

Vitamins

The evidence linking vitamin C supplements with an increased rate of kidney stones is inconclusive [33, 34]. The excess dietary intake of vitamin C might increase the risk of calcium-oxalate stone formation; in practice, this is rarely encountered [35]. The link between vitamin D intake and kidney stones is also tenuous. Excessive vitamin D supplementation may increase the risk of stone formation by increasing the intestinal absorption of calcium; correction of a deficiency does not [6].

Other

There are no conclusive data demonstrating a cause-and-effect relationship between alcoholic beverage consumption and kidney stones. However, some people have theorized that certain behaviors associated with frequent and binge drinking can lead to dehydration, which can, in turn, lead to the development of kidney stones. The American Urological Association has projected that global warming will lead to an increased incidence of kidney stones in the United States by expanding the "kidney stone belt" of the southern United States. In one study, people with lymph proliferative/myeloproliferative disorders who were treated with chemotherapy developed symptomatic kidney stones 1.8% of the time [10].

Hence from the above literature findings the present study was planned to know the understanding of the prevalence risk factor of renal stones, to correlate the renal stone with demographic data.

Methodology

The study had been conducted in the Indira Gandhi Institute of Medical Sciences, Patna on total 50 patients who were referred to Out-Patient Department (OPD) and in-patient department (IPD). The 50 patients were enrolled in study groups as case that are under treatment of urinary track calculi.

All the patients are informed consent and the permission of the institutional ethical committee was taken prior to conduct of study.

The study was planned with the Inclusion and Exclusion criteria as follows:

Inclusion criteria

1. Patients positive for symptoms of Urolithiasis diseases.
2. Patients with calcium oxalate calculi or radiopaque calculi

Exclusion criteria

1. Patients with urinary tract infection, urinary tract obstruction, or metabolic abnormalities
2. Patients having coagulation and haematological disorders.

Data was gathered by interview technique method on a valid questionnaire and anthropometric measurements were also used for data collection. Prior to filling out the questionnaire, the subjects were informed about the study and were given instructions on how to fill out the questionnaire completely and truthfully. Data collection was done on a standardized survey questionnaire with information related to demographic and socioeconomic details, physical activity, sign and symptoms of renal calculi, fluid intake another related diseases increasing the severity of renal calculi.

Results & Discussion

The data from the 50 patients identified with the urinary track calculi or renal stones were collected and presented as below. Table 1 indicates the demographic data of the selected population.

Table 1: Demographic data

Characteristic		No. of Cases
Gender	Male	26
	Female	24
Age (Years)		28 – 68
Education	Illiterate	12
	Elementary School	14
	Secondary school	14
	Graduate	10
Rural		35
Urban		15
Monthly Income	Low: Less than Rs 10000	22
	Medium: Between Rs 10,000 to 20,000	15
	High: More than 20,000	13

Table 2: Type of Calculi and BMI groups

Parameters	Factor	No. of Cases
Type of Calculi	Calcium oxalate	16
	Uric acid	18
	Phosphate	6
	Magnesium	10
BMI Groups	Underweight	4
	Normal BMI	34
	Overweight	5
	Obese	7

Table 3: Common risk factors cause renal stone and salts

Characteristic	No. of Cases
Dehydration	**36**
Nutrition	31
Family history of kidney stone	28
Sweat a lot every day	29
Used NSAID frequently	29
Higher sodium intake	27
Lacks of physical activity	35

Generally, recurrence of most types of stone should now be preventable with dietary and medical measures [11]. Recent study published entitled kidney stones: an update on current pharmacological management and future directions. Medical treatment of kidney stones includes dietary management, disease-specific therapies, and medical expulsion therapy (MET) of stones.

Fluid intake to promote urine volume of atleast 2.5 L each day. Dietary recommendations should be adjusted based on individual metabolic abnormalities. Reduction of animal protein and salt intake, higher fluid intake and potassium consumption should be implemented.

Changes in diet, life-style and obesity increase the incidence of nephrolithiasis. Now far *et al*. reported that a significant positive correlation exists between obesity and nephrolithiasis for both genders; however, obese females were more likely to develop stones than obese males. Patients with central adiposity or high waist-to-hip ratios appear to have the highest risk. Curhan *et al*. found that the prevalence and incidence of calcium oxalate stone disease was directly associated with body mass index (BMI) [12].

Increased sodium intake will increase sodium and calcium excretion, increase monosodium urate saturation (that can act as a nidus for stone growth), increase the relative saturation of calcium phosphate, and decrease urinary citrate excretion. All of these factors encourage stone growth. According to the World Health Organization, the daily consumption of salt should not exceed 5 grams or one teaspoon. The average Indian salt consumption is 9 to 10grams per day. This must be reduced in to <2300mg sodium/day. Reduction in dietary sodium helps to reduce recurrent calcium nephrolithiasis.

Fluids intake and urinary output may have an effect of urinary stone disease. The average daily urinary output in stone formers is 1.6 L/d. Alow fluid intake, with a subsequent low volume of urine production, produces high concentrations of stone forming solutes in the urine. High fluid intake may be beneficial not only to prevent Ca Ox overgrowth, but also to reduce plaque formation itself. One of the goals of kidney stone treatment is to keep your urine as dilute as possible.

Conclusion

From the above data generated it can be concluded that the prevalence of renal stones is rising worldwide, especially in men and with increasing age. Also, absence of health attention for risk factors that cause renal stone formation and education regarding renal dissolved agents use lead to overuse of such medications and could be one of the reasons. Calcium oxalate stones remain the most frequent components followed immediately by uric acid. Management of renal calculi can be achieved by focusing on proper diet, exercise and adequate fluid intake.

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