

Original Research Article

A study on renal stone about factors influencing its formation clinical scenario and urinary findings among adults aged 21-60 years in Saurashtra region

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ABSTRACT

Background: Saurashtra is claimed to be 'stone belt', even though there is paucity of epidemiological work on this issue; keeping in mind about this problem that ails most parts of the Saurashtra region, which is correctable and preventable, this study was undertaken.

Methods: Radiologically diagnosed 100 patients with renal stone were enrolled and interviewed through a proforma approved by institutional ethical committee to study risk factors, clinical scenario, and urinary findings. Urine samples were collected from all the participants of the study and analyzed for the presence of crystals, red blood cells, pus cells as well as urine pH. Data was analyzed with help of EpiInfo™ 7 (CDC Atlanta).

Results: Prevalence of renal stone was higher in males (72%); common in age group of 21-35 years. Common findings were recurrent flank pain (81%), gross hematuria (59 %) and renal colic (51%). Familial history ($p < 0.004$), improper water drinking habit ($p < 0.002$), lack of diet modification ($p < 0.001$) according to stone type and stone analysis were found probable causes for the recurrence of stone. Calcium oxalate (75%) stone being the commonest followed by calcium phosphate (15%) and uric acid (7%).

Conclusions: Results from this study can be applied in the clinical setting with the goal of reducing the likelihood of stone formation. Preventive measures such as change in diet, drinking behavior when properly addressed can ameliorate the situation in many patients with kidney stone. There is a great scope and role in finding crystals in urine with patients of kidney stone such as checking their compliance, guiding dietary therapy when stone analysis is not available, setting up a screening criteria and diagnosis of renal stone in remote settings where radio-logical investigations are not available.

Keywords: Nephrolithiasis, Renal stone, Saurashtra, Urine crystals

INTRODUCTION

Renal stones are typified by great variation along geographical and sociocultural lines. High incidence in Saurashtra region of India has led to the region being called by the eponymous term 'stone belt'.¹ Despite the fact that Saurashtra has dedicated and specialized kidney hospitals, a lack of survey in this region has led to little

availability of epidemiological data, and thus startling gap remains between the services offered and the benefits incurred. Understanding the epidemiology of stones disease is important to determine the significance of the disease at a community level, the associations and risk factors for individuals and the likelihood of stone recurrence.² Renal stones remain an entity attributed to a bludgeoning list of causations - and thus becomes more of a 'lifestyle' disease relying more on prevention for its

amelioration than advanced and specific treatment modalities. Considering that this problem which ails most parts of the Saurashtra region is both correctable and preventable and has a high social impact due to its recurrent nature, an investigative study in this matter will do much to sort it out. This study aims to find out role of urine crystal in patient with renal stone as well as to unravel various correctable factors which if dealt with can reduce the disease load in this region.

METHODS

This study was conducted in a Pandit Deendayal Upadhyay Medical College and its associated civil hospital. It is the main civil hospital in Saurashtra region with a high patient inflow from all over the region and would admirably serve as a mirror to the situation in this region. Through this population based descriptive case-series study, a total of 100 patients with a radiologically diagnosed ‘case’ of renal stone via sonography were interviewed.

Ethical clearance for the study was obtained from ‘Pandit Dindayal Upadhyay Medical College Ethical Committee on Human subject’. During May-June 2017, young aged patients between 21-60 years with radiologically diagnosed ‘case’ of renal stone either outdoor or indoor were recruited in the study from civil hospital of Pandit Deendayal Upadhyay medical college in Rajkot. In total, 100 patients were enrolled in study, to investigate the presence of risk factors, mode of presentation, and their urinary findings.

Inclusion criteria

- Age (21 - 60 yrs.)
- Only radiologically diagnosed case.
- Residing in Saurashtra region for more than 15 years.
- Who was willing to sign consent form.

Participants were interviewed using pretested semi constructed proforma approved by institutional ethical committee. The study included a valid questionnaire made with the use of references from valid sources. Proforma pretested on 10 patients who were later excluded from the study.

Urine samples were collected from all the patients who participated in the study and analyzed for the presence of crystals, red blood cells, pus cells as well as urine pH. The proper method was followed to collect and transport urine sample. Dipstick used to measure urinary pH and urine sample microscopically examined for the presence of crystals, pus cells and RBCs.

Data analysis

Data were directly taken into form prepared with help of Epi Info™ 7 (CDC Atlanta) and analyzed by the

aforementioned software for statistical significance of all variables and their relations with each other. Variables showing statistically significant association with the outcome variables ($p < 0.05$) were considered as statistically significant.

RESULTS

As noted in Table 1, kidney stone prevalence is higher in men (72%) in compare to females and common with age group 31-40 years. Family history (65%), Personal history (53%) and occupation working condition and dehydration (59%) constitute the important risk factors for kidney stone formation. Again, as recorded in Table 1, patients were found to have lack of knowledge regarding renal stone disease. Only 9 % patients were aware about stone analysis and importance, 11% were aware about important of diet and which diet to be followed and 55 % of patients were aware that they need to drink plenty of water to decrease possibility of stone formation.

Among risk factors noted in Table 1, family history of renal stone, personal history of renal stone, improper water drinking habit, non-veg diet and obesity were found commonly associated with kidney stone.

Table 1: Patient’s characteristics (N=100).

	N=100	%
Age of incidence (in years)		
Median age (onset of disease)	31	
Sex		
Males	72	72%
Females	28	28%
Risk factors		
Family history	65	65%
Personal history	53	53%
Occupation working condition and dehydration	59	59%
Repeated urinary tract infections	28	28%
Urinary tract anomalies	11	11%
Non-veg diet	21	21%
Hypertension	19	19%
Digestive disease and surgery	9	9%
Gout	2	2%
Hyperparathyroidism	3	3%
Diabetes	6	6%
Obese	13	13%
Patients knowledge about stone disease regarding	knowing	Not knowing
Stone analysis	9	91
Diet to be followed	11	89
Drinking behavior	55	45

As shown in Table 2, recurrent flank pain (81%) gross hematuria (59 %) and renal colic (51%) were found most

commonly in patient with kidney stone. As noted in Table 3, urinary crystals found in 60% of the patients. Among those patients who were found to have urine crystals, most common urine crystal was calcium oxalate (75%) followed by calcium phosphate (15%), uric acid (7%) and struvite crystal (3%).

As noted in Table 3, the average size of stone on USG findings varies accordance with the crystals found in urine. The lowest is being in patients with Calcium oxalate crystals (6 mm) and the highest being noted in patient with Struvite crystals (2.5cm) in urine.

As shown in Figure 1 which represent onset of renal stone disease across age group and different sex, peak noted among men for the age group of 31-40 years while

no peak for onset of stone disease noted in women. Additionally, as shown in Figure 2, prevalence of renal stone disease is higher among men in all age group.

Table 2: Clinical scenario among patients with renal stone.

Clinical features	(n=100)	%
Recurrent flank pain	96	96
Gravel	22	22
Gross hematuria	61	61
Renal colic	41	41
Fever, nausea, vomiting	56	56
Frequency, urgency, and dysuria	22	22
Burning micturition	24	24
Acute renal failure	8	8

Table 3. Types of crystals found characteristic and clinical association (n=100)*.

	Calcium oxalate crystals	Calcium phosphate crystals	Uric acid crystals	Struvite crystals
No. of patient show Present of crystals in urine	45 (75%)	9 (15%)	4 (7%)	2 (3%)
Average size of stone present (USG)	6 mm	9 mm	1.1 cm	2.5 cm
Clinical association	Recurrent flank pain Gross hematuria Renal colic Gravel	Recurrent flank pain Renal colic	Recurrent flank pain Frequency urgency and dysuria	Repeated Urinary tract infection Hematuria Burning micturition
Risk factors present	Men sex Family history Early onset of stone disease (age)	Female sex Onset of stone disease 4 th or 5 th decade.	Male sex Diabetes obesity	Female sex Urinary tract infection Urinary tract abnormalities
Urinary findings	Acidic urine Pus cells hematuria	Alkaline urine Hematuria	Acidic urine	Alkaline urine Pus cells

*based on Odds ratio

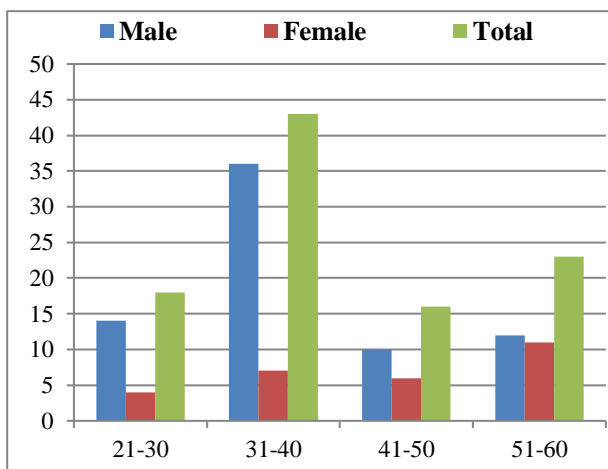


Figure 1: Distribution of according to onset of stone patient.

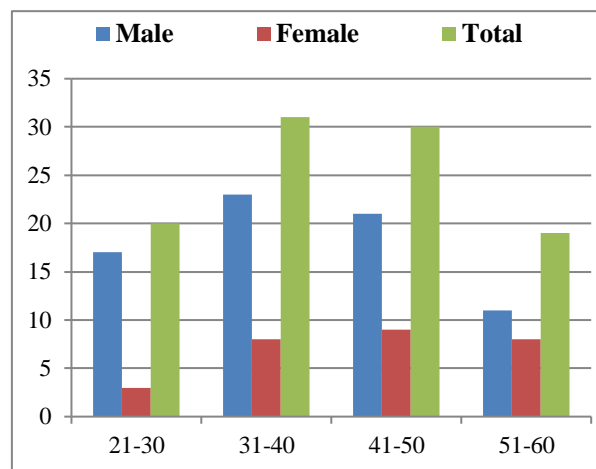


Figure 2: Distribution of patient according to prevalence of disease stone disease.

DISCUSSION

Stone and genetic factor

Patient with kidney stone experience more frequent episodes of stone formation in their family members.³ A large US cohort study found that men who had developed a kidney stone were three times more likely to have a family history of kidney stone.⁴ Our study showed that male gender is at highest risk for the development of stone compare to female and pointing towards the possibility for x-linked recessive disease but at a time study also documented male to male transmission as well as pattern did not match a recessive pattern ruled out the possibilities of X-linked loci.

Age and sex difference

Men are at greatest risk of developing kidney stones with incidence and prevalence rates between two and four times that of women.^{5,6} The preponderance of males which has been observed in other studies^{7,8} (melick and henneman 1958, clark and nordin 1969, lavman et al 1971) was again noted in Saurashtra region. The age of onset and the site of stone formation were those seen in 'developed countries'.⁹ This may be result as patient age group is restricted to 21-60 and pediatric patient are not involved which responsible for major category of bladder stone formation due to malnutrition as a cause for stone formation. The study also documented the higher recurrence rates among the patient with family history in compare to those without family history and similar to observe in other studies.^{3,10} The result of the present study shows no peak for onset of stone disease in women while in men the peak noted among age group of 31-40 years as noted in other studies.¹¹ Recurrence rates noted in study among women are less than in compare with the men in Saurashtra region. This may be attributed to higher frequency of calcium phosphate and Struvite stone which have lower recurrence rate as compared to calcium oxalate stone which is more common in men and have higher recurrence rate.¹²

Dietary aspect of renal stone

Being a disease that takes a heavy toll on both health and wallets and having a high 5-year recurrence rate of 30-50%, it is imperative to make conscious efforts to prevent stone formation, with dietary interventions being the key avenue.¹³⁻¹⁵ It is one of the most ignored aspects in management of stone patient. Since diet in itself is such a vast agenda and patients usually adhering to their own interpretations of the clinician's advices, it is better to offer a structured and personalized dietary recommendation based on the patient's individual metabolic work-up. Subsequently, it becomes necessary to evaluate any such intervention by 24 hour urine collection and stone type.^{14,15} The study showed that merely narrating diets to each patient which is to be followed by patient is not helpful. As noted in our earlier

study, barriers preventing the success of dietary modification can be aligned into 3 progressive stages as mention above and most patients appearing to move through these stages sequentially.¹⁶ And thus, the most effective approach to kidney stone prevention using dietary intervention should be tailored for individual patients. Based on study result, individual patient should be categories on the bases of perceived barriers and patient's characteristic and should be dealt accordingly. In addition to the aforementioned, motivation play vital role to keep patient stick to the diet to be followed as noted in our previous study.¹⁶

Drinking behaviour in renal stone patient

"Individuals working in a hot environment appear to be at higher risk for stone formation".¹⁷ Some of the factors which needs to be consider in a country like India are lack of availability of water or when available patients may not like the taste of water and avoid it. There is also lack of access to bathroom facilities in many places and working area and thus may lead to lower fluid intake which leads to lower urine volume and thus higher risk of stone formation.¹⁷ In addition to this, tropical countries such as India have the greater sunlight exposure, which leads to an increase in insensible losses through sweating and resulting in more concentrated urine. Thus, motivating patients with stones to maintain increased fluid intake behavior first requires an understanding of the factors influencing this behavior and approach should be tailored for individual patient.

Systemic disease

There are certain medical conditions which are associated with increased risk of kidney stone formation which includes hyperparathyroidism, diabetes, gout, malabsorption (inflammatory bowel disease, ileal resection or bypass), obesity, hypertension, renal tubular acidosis.^{18,19} They are not directly associated with stone formation in normal individual, but they increase the risk of stone formation among the stone formers.¹⁹ Individual patients who have more than one episode of stone formation should be thoroughly investigated for the presence of this risk factor and should be addressed properly to prevent recurrence.¹⁹ The present study documented lower role of systemic disease in kidney stone formation in Saurashtra region which may be attributed to the hidden nature of disease and might patients be not aware of disease due to lack of any major symptoms due to disease.

Patient knowledge about kidney stone

It has been observer that most of the patients who participated in study were lacking in knowledge regarding kidney stone disease and its prevention and responsible for higher recurrence of stone disease in them. This may be attributed to two reasons. First most of the patients participated in study (78%) were coming

from low socioeconomic status and secondly it might be because physicians are not getting time to educate patients regarding disease due to heavy inflow of patients as noted in tertiary care government hospital. In addition, as confirmed by previous studies, community programs to educate patients regarding kidney stone disease can help with reduction of healthcare cost and recurrence nature of the disease.^{20,21}

Limitation of this study had been conducted on a small group of people but provides the useful information regarding various epidemiological parameters for kidney stone.

Further studies need to be conducted to elaborate the same parameters and to find out other such as incidence and prevalence rates. Certain parameters such as digestive tract disorder, hyperthyroidism and other metabolic disorder are well known causes for kidney stone formation.

They were not reported as a possible risk factors in the study as they are hidden cause for the stone formation and patients may not aware of them due to lack of any major symptoms caused by them. Census data regarding Specific age group ratio for population is not available so specific percentage cannot be measured.

Future scope of this study revealed that there is a great scope and role in finding crystals in urine with patients of kidney stone. Further study needs to be conducted in future to elaborate its role in patients with kidney stone and they might help as follow.

- Can be used to check patient's compliance to advices and therapy in place of 24-hour urine collections which is time taking, costly as well not available at most places in our country.
- Can be consider a helpful criterion while setting screening program in future where it can be placed at first level of screening the group of population with risk factors because radiological investigation will be costly, time taking as well as not convenient to screen large number of population due limited resources.
- This may serve as probable confirmatory tool to diagnosed case of renal stone (only when its sensitivity and specificity is known) as radiological investigations are not available in villages and peripheries which constitute more than 70% area of our country.
- Detailed chart as presented in result section regarding presence of risk factors, type of crystals, size of stone in USG, clinical features and urinary findings can be prepared after large study including sufficient number of patients, which can be used by peripheral workers and doctors to guide therapy for patients with kidney stone in absence availability of knowledge regarding stone type and adequate facilities.

CONCLUSION

No doubt that kidney stone formation is multifactorial and thus multiple risk factors are responsible for kidney stone formation and interestingly the significance of these risk factors differs by age and sex. From this current study in Saurashtra region it is reasonable to conclude that Kidney stone prevalence is higher in men with age group 30-40 years. Recurrent flank pain and renal colic which were found most commonly are responsible for high morbidity in the patients. Family history, Improper water drinking habit, lack of knowledge regarding disease, lack of diet modification according to stone type and stone analysis were found probable causes for the recurrence of stone in the patients. One new post in hospital as dietary advisor or dietician should be made mandatory so that the patients should be addressed properly regarding preventive measures in an effective way. Preventive measures such as change in diet, drinking behavior and in some patient drug therapy when properly addressed can ameliorate the situation in many patients with kidney stone as for stone prevention is better than cure. Importantly, the results from epidemiologic studies can be applied in the clinical setting with the goal of reducing the likelihood of stone formation because at the end of the day, we want a treated patient - and not just a treated disease.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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