Original Research Article

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Recurrent stone formers-metabolic evaluation: a must investigation

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ABSTRACT

Background: The lifetime prevalence of kidney stone disease is estimated at 1% to 15% and the mean rate of recurrence of stone is estimated to be 30% at 5 years, 50% at 10 years and 80% at 20 years. Symptomatic urinary calculus can cause considerable discomfort to the patient. The aim of the study was to evaluate the various serum and urinary parameters.

Methods: 50 patients with history of renal stones coming to SGRDIMSR were evaluated for various serum and urinary parameters.

Results: Serum calcium, sodium, phosphorus, potassium, B. urea, S. creatinine is higher than normal in patients with recurrent renal calculi. Most of the urinary parameters were also similar to studies stating that they have a pivotal role in recurrent stone formers.

Conclusions: For the frequent stone formers and even for some first time stone formers interested in preventing future episodes of renal colic, a metabolic evaluation is necessary. Besides identifying the abnormality, the evaluation also helps determine the drug choices and dosages.

Keywords: Metabolic stone, Recurrent stone, Stone

INTRODUCTION

The lifetime prevalence of kidney stone disease is estimated at 1% to 15% with the probability of having a stone varying according to age, gender, race and geographic location.¹

Kidney stone formation is three times more common in men and although rare before 20 years of age, the frequency increased rapidly and peaks in the age group 40 to 59 years. The mean rate of recurrence of stone is estimated to be up to 30% at 5 years, 50% at 10 years and 80% at 20 years.²

Once recurrent, the subsequent relapse risk is raised and the interval between recurrences is shortened. The various types of urinary stones are calcium oxalate stones (60%), phosphate stones (30%), uric acid and urate stones (5-10%), cystine stones (1-3%), xanthene/ silicate/ matrix stones.⁵ the various risk factors responsible for stone formation are namely:

Non-dietary

Family history

The risk of becoming a stone former is more than 2.5 times greater in patients with a family history of stone disease.³

Systemic disorders

- Primary hyperparathyroidism
- Renal tubular acidosis
- Crohn's disease
- Increasing body mass index (BMI)

• Gout and diabetes mellitus type II.

Individuals working in a hot environment

Dietary factors

Nutrients

Implicated nutrients include calcium, animal protein, oxalate, sodium, sucrose, magnesium and potassium, reduced fluid intake, deficiency of vitamin A, B6, protein deficiency.⁴

Urinary factors

The 24-hour urine chemistries provide important prognostic information and direct therapeutic recommendations.

Hypercalciuria

Urine calcium excretion greater than or equal to 300 mg/d in men and 250 mg/d in women on 1000-mg/d calcium diet.⁵

Hyperoxaluria

Urinary oxalate excretion greater than 45 mg/d.⁶

Hyperuricosuria

Excretion of 800 mg/d in men or 750 mg/d in women.⁷

Hypocitraturia

24-hour excretion less than or equal to 320 mg/d increases risk for stone formation and is found in 5% to 11% of first-time stone formers.⁶

Low urine volume

When defined as 24-hour urine volume of less than 1 L/d, 12% to 25% of first-time stone formers have this abnormality. Symptomatic urinary calculus can cause considerable discomfort to the patient. Although many stones pass spontaneously, the methods used to treat calculi may cause significant morbidity. The costs associated with the treatment of nephrolithiasis are also substantial. The aim of the study was to study the specific serum and urinary parameters in patients with recurrent renal stone.

METHODS

A prospective study on a total of 50 cases of symptomatic recurrent renal calculi (both inpatients and outpatients) coming to Sri Guru Ram Das Institute of Medical Sciences and Research Vallah Amritsar, India was done from June 2014 and mid of November 2015 were

included in the study. A recurrent stone former was defined as a patient who presented to the clinic with symptomatic urinary tract stone plus the evidence of a previous stone formation, including

- History of passing a stone
- Presence of a stone on a previous KUB X-ray or ultrasound
- History of operation for urinary tract stone.

Exclusion criteria

Patients who were known cases of

- Primary hyperparathyroidism
- Chronicrenal failure
- Malignancy
- Prolonged immobility
- Drug induced stone formation
- Anatomical anomalies ie. PUJ obstruction, horseshoe shaped kidney.

Laboratory investigations

- Evaluation of serum calcium, phosphorous, sodium, potassium
- Renal function tests-Blood urea nitrogen, Serum creatinine
- Evaluation of 24- hour urine sample for volume, pH, calcium, phosphorous, magnesium, uric acid, citrate, oxalate.

Urine routine, culture and sensitivity.

Radiological investigations

Ultrasound abdomen and pelvis, KUB Plain radiograph, IVP, spiral CT. After thorough history was taken for evidence of previous stone episode, all symptomatic patients were subjected to appropriate radiological investigation. At the time of presentation blood was drawn and sent for renal function tests, serum calcium, phosphorous, sodium and potassium.

The acute renal colic episode was treated appropriately. After the pain had reduced or disappeared, patients were then asked to collect 24 hour urine without being advised any dietary restrictions. The First morning void was discarded, since this represented urine from the previous night, from that point on, all urine was collected in the appropriate laboratory-provided container. A 24 hour urine sample was collected and sent for analysis for volume, pH, calcium, phosphorous, magnesium, uric acid, citrate and oxalate.

Urine was also sent for culture sensitivity. Hospital laboratory normal ranges were used for all the investigations and results analysed.

Statistical methods

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean±SD (min-max) and results on categorical measurements are presented in number (%).

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, MedCalc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the

data and Microsoft word and Excel have been used to generate graphs, tables etc.

RESULTS

Age and sex distribution

In our study, 40% patients were in 41-50 years age group and mean age was 41.28 years. Out of 50 patients, 62% of patients were males and 38% females.

Table 1: Serum parameters of patients.

Laboratory investigations	Criteria	Number of patients (n = 50)	Percentage
BUN (mg/dl)	15-38.0	41	82
	>38.0	9	18
S. Creatinine (mg/dl)	<1.2	36	72
	>1.2	14	28
S.ca+(mg/dl)	<8.4	7	14
	8.4-10.2	35	70
	>10.2	8	16
S.po ₄ (mg/dl)	<2.7	3	06
	2.7-4.5	44	88
	>4.5	3	06
S.Na+(mEq/l)	<133	2	04
	133-145	46	92
	>145	2	04
S.k+(mEq/l)	<3.5	3	06
	3.5-5.3	45	90
	>5.3	2	04

Table 2: Urinary parameters.

Variables	Criteria	24 hour urine sample (n = 50)	Percentage
Volume(ml/d)	<1200	25	50
	1200-1800	20	40
	>1800	05	10
рН	<4.6	08	16
	4.6-8.0	36	72
	>8.0	06	12
Ca+(mg/d)	<100	01	02
	100-300	38	76
	>300	11	22
	<400	12	24
Po ₄ (mg/d)	400-1300	37	74
	>1300	01	02
Mg ²⁺ (mg/d)	<73	15	30
	73-122	26	52
	4.6-8.0 36 >8.0 06 <100	18	
Uric acid (mg/d)	<250	08	16
	250-755	35	70
	>755	07	14
Citrate (>300mg/d)	<300	06	12
	>300	44	88
Oxalate (<40mg/d)	<40	34	68
	>40	16	32

Previous episode of renal stone

Present study showed that 74% patients had recurrence within 1-5 years of previous episode, 18% more than 5 years and 8% presented within 1 year of previous episode.

Previous renal calculi diagnosis

In the study, 58% were diagnosed by USG Abdomen and pelvis, 28% by both USG ABD and KUB X- ray, (4%) by USG, CT both, (8%) patients diagnosed by only KUB X-ray and (2%) by NCCT.

Treatment for previous episode of calculi

In the study 66% of patients were treated conservatively for previous episode and 18% had ESWL, (8%) had URS, (4%) had open pyelolithotomy in the past.

Co-morbidities

In the study, (6%) had diabetes mellitus, (10%) had hypertension, and (4%) had bronchial asthma.

Urine culture

In the study, there was no growth on urine culture in 80% of patients while 12% had *E.coli* and 8% had proteus on urine culture.

DISCUSSION

Metabolic evaluation guides to make the correct diagnosis and to render either a fluid, dietary and drug therapy to achieve optimal management of patient.

Rate of recurrence

The study showed that 74% patients had recurrence within 1-5 years of previous episode, 18% more than 5 years and 8% presented within 1 year of previous episode. This is inconsistent with other studies where recurrence rate was seen after five years of initial episode. Uribarri et al found that the recurrence rate without treatment for calcium oxalate renal stones is about 10% at 1 year, 35% at 5 years, and 50% at 10 years. Johnson et al and Borghi et al reported that if left untreated the likelihood of forming another stone after the initial episode is 30% to 40% at 5 years. Asplin and Chandoke estimated the mean rate of recurrence of stone be upto 30% at 5 years, 50% at 10 years, and 80% at 20 years.

Urine culture

In present study, there was no growth on urine culture in 80% of patients while 12% had *E.coli* and 8% had Proteus. Griffith et al found *Proteus mirabilis* (86%) as the most common organism present in urine culture

associated with infection stones.¹¹ In the study only 8% cases showed proteus in urine culture so our study is not in concordance with this study.

Serum parameters

In tables, the various serum parameters were as follows

- 28% of patients had high serum creatinine levels but 18% had higher BUN
- 16% patients had hypercalcemia with mean S. Calcium levels being 9.16mg/dl. 19.3% men and 10.5% of women had hypercalcemia. Study by Hossineni et al found hypercalcemia in 11% patients with recurrent stone 14
- 6% patients had high S. PO₄ levels
- 4% of the patients had hypernatremia, 6.45% males and 5.26% females had raised serum sodium levels
- 4% of patients had hyperkalemia.

This was in accordance with Erdamar et al study who also found that the levels of serum parameters like calcium, sodium, phosphorus, potassium, B. urea, S. creatinine is higher than normal in patients with recurrent renal calculi. 12

Urinary parameters

Castle et al also advocated single 24 hour urine collection for metabolic evaluation. ¹³ In present study, on 24 hour urine sample, the following observations were made

- Most common abnormality was low urine volume with 50% patients had low urine output <1.21/day. 47.4% women and 48.4% males. In study by Hossineni et al, 58.24% patients had decreased 24-h urine volume to less than 2 1/day. 14 Curhan et al found 25% incidence of low urine output<11/d in one cohort. 6
- 22% patients had hypercalciuria on 24 hour urine sample. 16.1% males had hypercalciuria and 26.3% females had hypercalciuria. The finding is consistent with Curhan et al who also found hypercalciuria to be commonest abnormality among women. However Stitchantrakul et al found higher rate of hypercalciuria in males. 14
- Hyperphosphaturia in our study was found only in 2% of patients while Yun Sok Ha in his study reported that hyperphosphaturia is associated with recurrent renal calculi.¹⁵ His study is not in concordance with present study.
- 14% had hyperuricosuria, 9.67% of males and 21.05% of females had hyperuricosuria. However Stitchantrakul et al found that 7.2% had hyperuricosuria in their study. ¹⁶ That is inconsistent with present study.
- 24 hour urine sample picked 12% of hypocitraturia in present study. Study by Stitchantrakul et al found 69.6% hypocitraturia. It is not consistent with present study.

• In present study, hyperoxaluria was detected in only 32% of the patients but more in females (26.3%). Hossineni et al found 6% in their study but 32% hyperoxaluria was found in one study. The present study, 30% hypomagnesiuria was found, 32.3% in males and 21.05% in females. Nandwani GM et al reported hypomagnesiuria in 4.2 % of cases. This was not in concordance with the study.

CONCLUSION

The study highlights that metabolic evaluation is necessary for patient with recurrent renal stone to manage the underlying metabolic abnormalities and to prevent further chances of recurrence of renal stone.

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institutional ethics committee

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