OBSERVATION OF SERUM PARATHYROID HORMONE AND SERUM IONISED CALCIUM IN PATIENTS OF RENAL STONE

Surgery

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ABSTRACT

Background: The life time prevalence of renal stone is estimated to be between 1 to 15 %. Symptomatic renal calculi pose a serious health problem to the patients and increase economic burden worldwide. The aim of the study is to observe the level of serum parathyroid hormone and serum ionised calcium in patients with renal stones.

Methods: A total of 50 patients with the diagnosis of renal stone who came to MMCH, Madhubani, were evaluated for serum parathyroid hormone and serum ionised calcium level.

Results: Serum parathyroid hormone was raised above the normal range in 2 out of 50 patients and serum calcium level was elevated in 12 patients, while phosphate, sodium, potassium, creatinine and blood urea were higher than the normal. Most of the urinary parameters were similar to other studies stating that they play an important role in renal stone formation.

Conclusions: Although the pathogenesis of renal stone is multifactorial, metabolic factors do play an important role in their formation in both groups of population; first time stone formers as well as recurrent stone formers. Parathyroid hormone level, along with other metabolic factors like serum calcium, phosphate, uric acid and others should be assessed to know the exact pathology. Besides identifying anomalies, the evaluation also helps in determining the choice of treatment.

KEYWORDS

Hyperparathyroidism, calcium, renal stone.

INTRODUCTION

The lifetime prevalence of renal stone is estimated to be 1 to 15 %, which varies according to age, sex, race, geographical location¹.

Renal stone are three times more common in men than women. The disease is rare in young age (before second decade) the frequency increases rapidly and peaks in the age group of 40 to 59 years. The mean rate of recurrence is estimated to be up to 30% at 5 years, 50 % at 10 years and 80% at twenty years².

The different types of renal stones based on their chemistry are calcium oxalate (60%), phosphate stones (30%), uric acid and urate stones (5-10%), cystine stones (1-3%), xanthine, silicate and matrix stones.

The various risk factors for the formation of renal stones are;

RISK FACTORS

- A. Non-dietary
- B. Dietary
- C. Urinary

A. Non-dietary

1. **Family history:** In patients with positive family history there is risk of more than 2.5 times to form the renal stones³.
2. **Systematic diseases:**
 - a. Primary hyperparathyroidism, Renal tubular acidosis and Crohn's disease are associated with high risks of renal stone formation.
 - b. Patients suffering from Gout may have 2 times more risks of renal stone formation.
 - c. Increased body mass index is associated with increased renal stone formation
3. **Environmental factors :** There is higher incidence of renal stone formation among the people living in hot environment.

B. DIETARY FACTORS

Higher intake of calcium, oxalate, sodium, magnesium, animal protein and potassium, reduced intake of fluid and deficiency of vitamin A and B6 are associated with renal stone formation⁴.

C. URINARY FACTORS

- a) **Hypercalciuria:** Urinary calcium excretion equal to or more than 300mg/dl in men and 250 mg /dl in women on 1000 mg/day

calcium diet is defined as hypercalciuria⁵.

- b) **Hyperoxaluria:** It is defined as urinary oxalate excretion greater than 45 mg/day⁶.
- c) **Hyperuricosuria:** It is defined as urinary excretion of uric acid more than 800mg/day in men or 750 mg/day in women⁷.
- d) **Hypocitraturia:** It is defined as urinary excretion of citrate equal to or less than 320 mg/day⁸.
- e) **Low urine output:** Low urine output defined as volume less than 1 L/day, seen in up to 25 % of first time renal stone formation⁹.

METHODS

A prospective study on a total of 50 patients of renal calculi who visited to Madhubani Medical College and Hospital, Madhubani, Bihar was done during a period of July 2018 to June 2019.

INCLUSION CRITERIA

- Patients of age group 15 to 70.
- First time stone formers as well as recurrent stone formers.
- Patients willing to give consent for research work.

Exclusion criteria

- Known malignancy.
- Anatomical anomalies of urogenital system.
- Chronic renal failure.
- Patients not willing to take part in the study.
- Laboratory investigations
- Routine blood examination including CBC, LFT, RBS and RFT.
- Serum PTH and serum Calcium.
- Serum sodium, potassium, uric acid and phosphate.
- Evaluation of 24 hour urine sample for daily volume, pH, RBC, WBC, calcium, phosphate, uric acid and culture and sensitivity for bacteria.

At the time of presentation, blood was drawn and sent for different investigations. Hospital laboratory normal ranges were used for all the investigations and results analysed.

Radiological investigations

After thorough history and examination, to confirm the diagnosis and plan of management a series of radiological investigation was conducted. It included X ray KUB, USG abdomen and pelvis and IVP.

These helped in confirming the exact site of stone, the anatomy of urinary system and physiology of kidneys.

Statistical methods

This study has been based upon descriptive statistical analysis results on continuous measurements are presented on mean $\pm$ SD and results on categorical measurements are presented in number (%).

Results

Age and sex distribution

Table 1: Age distribution

S NO	Age group	No. of patients
1	<20	10
2	21-30	13
3	31-40	15
4	41-50	06
5	51-60	06

Out of 50 patients, 24 were males and 26 were females.

Table 2: Serum parameters of patients

S NO.	LAB INVESTIGATION	CRITERIA	NO. OF PATIENT	PERCENTAGE
1.	S. PTH (pg/ml)	<8.7	00	00
		8.7-79.6	48	96
		>79.6	02	4
2.	S. Ca (mg/dl)	<8.4	05	10
		8.4-10.2	33	66
		>10.2	12	24
3.	S.Po4(mg/dl)	<2.7	05	10
		2.7-4.5	42	84
		>4.5	03	06
4.	B. Urea(mg/dl)	15-38.0	45	90
		>38.0	05	10
5.	S. Creatinine (mg/dl)	<1.2	42	84
		>1.2	08	16
6.	S. Na+ (mEq/l)	<133	02	04
		135-145	45	90
		>145	03	06
7.	S. K+(mEq/l)	<3.5	02	04
		3.5-5.3	44	88
		>5.3	04	08
8.	S. Uric acid (mg/dl)	M<3.5; F<2.6	02	04
		M 3.5-7.2	44	88
		F 2.6-6.0		
		M >7.2 F >6.0	04	08

Table 3. Urinary Parameters Of Patients.

S. NO.	Variable	Criteria	No. Of Patient	Percentage
1.	Volume (ml/d)	<1200	26	52
		1200-1800	21	42
		>1800	03	06
2.	PH	<4.6	02	04
		4.6-8.0	38	76
		>8.0	10	20
3.	Ca (mg/dl)	<100	01	02
		100-300	33	66
		>300	16	32
4.	Po4 (mg/dl)	<400	08	16
		400-1300	41	82
		>1300	01	02
5.	Uric acid(mg/d)	<250	01	02
		250-750	44	88
		>750	05	10

Previous episode of renal stone

The study shows that 8 patients (16%) had episode of recurrent renal calculi. 5 of them (62.5%) developed within 5 years and 3 patients (37.5%) developed after 5 years.

Treatment for previous episode of renal calculi

6 out of 8 patients who had recurrent calculi had undergone open surgical procedure for stone removal while 2 patients were treated with ESWL.

Co-morbidities

In the study, 4% had diabetes mellitus and 8% had hypertension.

DISCUSSION

Evaluation of serum parathyroid hormone and serum ionised calcium level, along with other metabolic factors, help in making the correct diagnosis and render the optimal therapy either conservative or surgical for the cure of renal stones.

Hyperparathyroidism and Renal stone⁸.

The study showed that parathyroid hormone level was raised in only 2 patients (4%). These patients were referred to the department of endocrinology for further evaluation and management. These two patients were also cases of recurrent renal stones, where the overall recurrent cases of renal stone were 8 (16%). In both the cases, recurrence occurred within first five years of diagnosis of the first renal stone. Both of these patients had elevated calcium level in serum as well as in urine. Uribarri et al found that recurrence rates without treatment for calcium oxalate stone are about 10% at 1 year, 35% at 5 years and 50% at 19 years⁹.

Urine Culture

In our study there was no growth on urine culture in 42 patients (84%), while 06(12%) patients had E.coli and 3 (6%) patients had Proteus in urine culture. Griffith et al found proteus mirabilis (86%) as the most common organism present in urine culture associated with infection stones¹⁰. But in our study only 4% cases showed proteus in urine culture, so our study is not in concordance with this study.

Serum parameters

The various serum parameters were as follows;

- Only 4% of patients had elevated serum parathyroid hormone.
- 24% patients had hypercalcemia and among 8 patients of recurrent stone formers, hypercalcemia was seen in 2 patients.
- S.Creatinine was raised in 16% and blood urea was raised in 10%.
- 6% patients had high S. PO4 level.
- 6% patients had hypernatremia and 8% had hyperkalemia.
- 4% had elevated serum uric acid level.

Urinary parameters

Castle et al also advocated for single 24 hour urine collection for metabolic evaluation¹¹. In our study, on 24 hour urine sample, the following observations were made;

- Low urine volume was the most common abnormality seen with 52% patients of low urine volume. 50% males and 53.8% females.
- 32 % had hypercalciuria in 24 hour urine sample. 37.5% males and 26.9% females had hypercalciuria. Curhan et al found hypercalciuria to be the commonest urine abnormality.
- Hyperphosphaturia is shown to be associated abnormality, more so ever in recurrent stones, but in our study it was insignificant.
- 10 % had hyperuricosuria, 12.5% males and 7.6% females. Stichtantrakul et al found that 7.2 % had hyperuricosuria¹².

CONCLUSION

The study highlights that evaluation of serum parathyroid hormone and serum calcium level along with other metabolic factors is important to correctly know the cause of renal stones formation, especially in recurrent renal stones and manage the underlying metabolic abnormalities and to prevent the further chances of recurrence of renal stones.

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