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Evaluation of the Role of Metabolic Risk Factors Among Patients Presenting with Recurrent Urolithiasis in A Tertiay Care Hospital

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Abstract

The most frequent urological disease is urolithiasis, which varies significantly in frequency across different geographic regions and is observed to be common in ethnic groups. The lifetime risk of urolithiasis varies from 1%-5% in Asia, 5%-9% in Europe, 10%-15% in the USA, and 20%-25% in the Middle East, with Greenland and Japan reporting the lowest prevalence. The incidence of urinary tract stone illness is on the rise. The prevalence of the disease is lower in Asian nations and higher in the population of the West, particularly America. North India has a higher prevalence of the disease than South India. The objectives of the study was to evaluate the metabolic risk factors in patients with recurrent urolithiasis and to study the relation between epidemiological factors and 24 hour urinary metabolic abnormalities During the course of a year, a prospective observational study involving 100 patients with recurrent urolithiasis was carried out. Following pertinent history-taking, a thorough examination of each patient was performed. As needed, serum electrolytes, calcium, uric acid, phosphorus and PTH were evaluated. An analysis was conducted on the estimated 24-hour urine excretion of calcium, salt, creatinine, phosphorus, uric acid, magnesium, potassium, oxalate and citrate. A $p<0.05$ was deemed significant for the statistical analysis that was conducted using the Pearson's correlation test, the Fischer exact test and the Chi square test. The mean age of urolithiasis was 43.7±13.045 with a male to female ratio of 3.5:1. The main presenting complaint was loin pain and 45% patients were found to have calcium oxalate stones on chemical analysis. An underlying metabolic abnormality was noted in 95% patients with 5% having no abnormality. Almost 66 patients (66%) had two or more abnormalities. The metabolic abnormalities detected were: hypocitraturia (63%) hyperoxaluria (54%), hypercalciuria (28%), hypernatriuria (26%), hyperuricosuria (14%) and low urine volume (13%). Hypercalcemia was noted in 2 patients (2%) and both had raised PTH. The presence of hypocitraturia in vegetarian type of diet, and hypercalciuria in female gender correlated in a statistically significant manner ($p<0.05$). There was a significant positive correlation between the urinary excretion of sodium and calcium, as well as excretion of sodium and oxalate in urine. Recurrent urolithiasis is predominantly seen in the males and the frequency of metabolic abnormalities is very high. Hypocitraturia, hyperoxaluria, hypercalciuria and hypernatriuria are the most important metabolic abnormalities. Hypocitraturia is associated with vegetarian diet and hypercalciuria was significant in women when compared to men. Hypernatriuria has a calciuric effect. The spectrum of metabolic abnormalities is different in our population as compared to the western population.

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Key Words
Recurrent urolithiasis, metabolic abnormalities, hypocitraturia, hypercalciuria, hypernatriuria, 24 hour urine

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INTRODUCTION

The escalating incidence of urinary tract stone disease has become a global health concern, with lifetime urolithiasis risk varying significantly across regions. Asia reports a range of 1%-5%, Europe 5%-9%, the USA 10%-15% and the Middle East 20%-25%, while Greenland and Japan exhibit the lowest prevalence[1]. Primarily afflicting men[2], with a male-to-female ratio of 2~4:1, renal stone disease is on the rise, affecting 10.6% of men and 7.1% of women in the United States as of 2012[3].Recurrence rates of 50% after 10 years and 75% after 20 years have been reported[5,6]. With an 80% lifetime recurrence rate and nearly 20% developing mild renal insufficiency, there is a critical need to understand the underlying metabolic risk factors contributing to recurrent urolithiasis[4].

Known risk factors include male gender, multiple stones, stone location, residual fragments, and various urinary tract abnormalities[7-10]. Additionally, metabolic abnormalities such as low urine volume, hypercalciuria, hyperoxaluria, hyperuricosuria and hypocitraturia contribute significantly to early recurrence[11] The intricate interplay of factors promoting urinary crystallization and those inhibiting crystal formation underscores the complexity of stone formation, where the determinants of calcium oxalate super saturation involve oxalate and calcium concentrations[12].

While metabolic evaluations in Western countries reveal treatable abnormalities in over 90% of subjects[13] the situation in India presents wide regional variations, with limited data on metabolic evaluation in Indian subjects[15] Therefore, there is a critical need for comprehensive studies addressing this gap, especially considering the diversity in dietary habits and genetic predispositions.

Hence the study aimed to evaluate the metabolic risk factors in patients with recurrent urolithiasis and study the relation between epidemiological factors and 24-hour urinary metabolic abnormalities

MATERIALS AND METHODS

This prospective, observational study was conducted at the biochemistry laboratory of a tertiary care hospital in Karnataka. The study spanned one year and commenced following institutional ethical clearance. Informed consent, obtained in the local vernacular, was secured from each participant.

The study enrolled patients from the urology outpatient department at the tertiary hospital, diagnosed with urolithiasis and known to have a recurrence.

Patients were diagnosed with calculus disease using appropriate imaging studies (X-ray/USG KUB/NCCT) and were included after obtaining informed consent. During their initial visit, a comprehensive history was elicited, covering the age of first stone formation, frequency of renal colic, stone burden and interventions undergone.

A total of 100 patients were included in the study, with data collection spanning two years from July 2022 to June 2023.

Inclusion Criteria: included were recurrent calculus disease, defined as any patient with one or more prior episodes of urolithiasis.

Exclusion Criteria: were First-time stone formers, Stones in pregnant females. Stones associated with renal insufficiency (Serum creatinine >1.5mg%).

Metabolic evaluation included serum chemistry (calcium, phosphorus and uric acid), along with freshly voided morning urine for pH and basal blood gas analysis. Patients with elevated calcium levels were further evaluated for hyperparathyroidism with serum PTH assay. Stones recovered, either through intervention or spontaneous passage, underwent chemical composition analysis.

A month post-clearance, a single 24-hour urine sample was collected for the analysis of creatinine, calcium, oxalate, citrate, uric acid, phosphorus, magnesium, sodium and potassium. Urine volume and pH were also determined. Participants with active urinary tract infections (UTI) were evaluated for post-treatment and infection resolution.

The normal values for urinary metabolic factors were considered as per the specified ranges[14] Volume 1.5-2L/day., Ph5. 8-6.2 Calcium<200mg/day in women and <250mg/day in men or <140 mg/g of creatinine in both Creatinine: 20-27 mg/kg in males or 14-21 mg/kg in females. Uric acid: <800 mg/day in men and <750mg/day in women Oxalate <45 mg/day., Citrate >450 mg/day in men and >550 mg/day in women. Magnesium 30-120 mg/day Phosphorus 0.4-1.3 g/day Sodium <150 mg/day/<220 mmols/day Potassium 20-100 mmol/day

Statistical Analysis: Data analysis was conducted using proportions, with descriptive statistics computed for all biochemical variables in each diagnostic category. The Statistical Package for the Social Sciences (SPSS) was utilized for analysis. The Chi-square (X^2) test, Fisher exact test and Pearson's correlation were employed to compare the frequencies of the two categorical group variables, with a significance level set at $P<0.05$.

RESULTS AND DISCUSSIONS

This prospective observational study investigated 100 patients with recurrent urolithiasis over a one-year period in a tertiary hospital from July 2022-June 2023. The study aimed to comprehensively analyze demographic characteristics, clinical presentations, metabolic abnormalities and dietary influences on

stone formation. Our findings reveal key insights into the incidence, distribution and correlation of metabolic abnormalities associated with recurrent urolithiasis.

Table 1 represents the Distribution of Age among the study population: Age distribution ranged from 18-72 years. The 41-50 age group constituted the majority (32%).

Table 2 represents distribution of incidence among both the genders: The study showed an exclusive male representation below 30 years.

A male preponderance with a ratio of 3.5:1 (78 males to 22 females).

Table 3 represents the Location of stones at diagnosis: Renal stones were seen in 37 patients, ureteric stones in 38 and both in 25 patients.

Among the Clinical Features, Loin pain was predominant in 61%. Other presentations included hematuria, fever and scalding voiding., as represented in Fig. 1

Table 3 represents the Number of Recurrences: Most patients experienced at least two recurrences, with some having up to four episodes.

Fig. 2 shows the dietary pattern in the study subjects: 82% followed a mixed diet and 18% were vegetarians

We conducted a thorough metabolic evaluation, encompassing serum chemistry and 24-hour urine analysis, to discern patterns of metabolic abnormalities among our patient cohort.

Table4 presents the median and 25th percentile-75th percentile (P[25-75]) results of the various parameters obtained during the metabolic evaluation.

Based on the aforementioned parameters, patients were systematically classified into distinct metabolic categories:

Hyperphosphatemia, Hyperuricemia, Hypercalcemia with Hyperparathyroidism:

Further subcategorized into Resorptive Hypercalciuria (Hypercalcemic hypercalciuria) if 24-hour urine indicated hypercalciuria., Idiopathic Hypercalcuria was assigned to normocalcemic patients exhibiting hypercalciuria.

Table 5and 6 shows Type and Frequency of metabolic abnormalities

Additionally, patients were classified according to urinary excretion of metabolites: Low Urine Volume, Hyperuricosuria, Hyperoxaluria, Hyperphosphaturia, Hypernatriuria, Hypocitraturia. Prevalent findings included hyperoxaluria (54%) and hypocitraturia (63%).

Prevalence of Metabolic Abnormalities: 5% of patients exhibited no discernible metabolic abnormalities. At least one metabolic abnormality was identified in 29% of patients. A majority (41%) presented with two metabolic abnormalities. A maximum of five abnormalities was observed in 3% of patients.

Subgroup Analysis:

Serum Parameters: Hypercalcemia was noted in 2% of patients, both with elevated parathyroid hormone levels. Both cases were diagnosed with solitary parathyroid adenoma, treated successfully with surgical excision, resulting in the restoration of normal calcium levels. Hyperphosphatemia was observed in 9 patients, while Hyperuricemia was noted in 7 patients.

Urinary Parameters: Hypercalciuria was evident in 28% of cases, with subcategories of Resorptive Hypercalciuria (2 cases) and Idiopathic Hypercalciuria (26 cases). Hyperoxaluria was prevalent in 54% of patients, while Hypocitraturia was present in 63%. Hyperuricosuria was diagnosed in 14% of patients. Thirteen patients (13%) exhibited low 24-hour urine output. Hypernatriuria was present in 26% of patients, and only one patient had hyperphosphaturia. No abnormalities were detected in magnesium and potassium excretion.

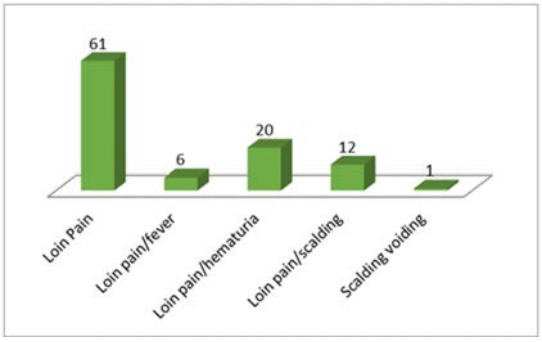

Fig. 1: Clinical features among the study subjects

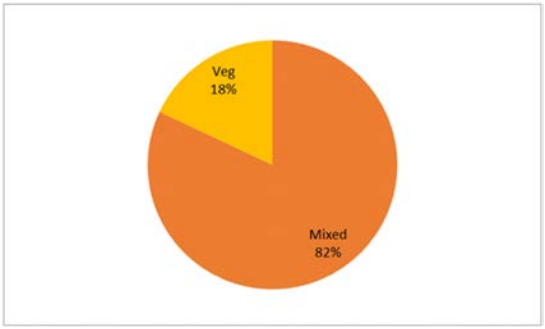

Fig. 2: Dietary pattern

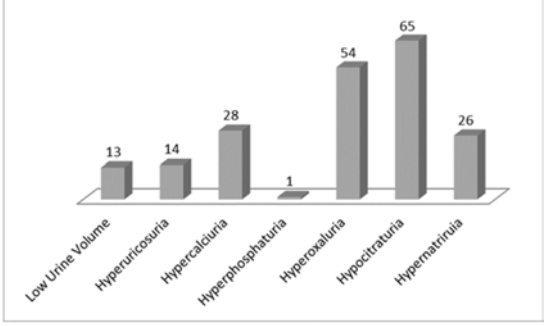

Fig. 3: Urinary metabolic abnormalities

Table 1: Distribution of Age among study population

Age in Years	Total	Percentage (%)
18-20	4	4.0
21-30	15	15.0
31-40	20	20.0
41-50	32	32.0
51-60	15	15.0
>60	14	14.0
Total	100	100.0

Table 2: Age Incidence distribution in males and females

Age in Years	Number of Cases	
	Male	Female
18-20	4	0
21-30	15	0
31-40	16	4
41-50	24	8
51-60	8	7
>60	11	3
Total	78	22

Table 3: Location of stones at diagnosis

Location of stone	Number of Cases	Percentage
Renal Stone	37	37
Ureteric Stone	38	38
Renal+Ureteric Stone	25	25
Total	100	100

Table 3: Number of recurrences

Number of recurrences	Number of Cases	Percentage
Two	64	64.0
Three	31	31.0
Four	5	5.0
Total	100	100.0

Table 4: Results of the constituents of metabolic evaluation

	N	Percentiles		
		25^{th}	50th (Median)	75^{th}
Age	100	33.250	44.000	55.000
No. of recurrences	100	2.000	2.000	3.000
Serum Calcium	100	8.600	8.900	9.300
Serum Uric Acid	100	3.625	4.700	5.500
Serum Phosphorus	100	3.025	3.600	4.075
Urine Volume	100	2300.000	2850.000	4000.000
Urine Creatinine	100	1102.200	1337.100	1730.350
Urine Uric Acid	100	389.000	492.900	661.800
Urine Sodium	100	126.250	183.500	227.775
Urine Potassium	100	32.272	44.755	61.875
Urine Calcium	100	133.500	175.000	242.500
Urine Phosphorus	100	437.450	555.000	816.600
Urine Magnesium	100	42.975	65.000	94.375
Urine Oxalate	100	38.250	48.000	67.750
Urine Citrate	100	158.500	266.500	562.750

Table 5: Type of Metabolic abnormalities

Serum parameters	Number	Percentage
Hypercalcemia (>11mg/dL)	2	2
Hyperphosphatemia (>4.4mg/dL)	9	9
Hyperuricemia (>5.8mg/dL)	7	7
Hyperparathyroidism (>45 pg/ml)	2	2

Table 6: Frequency of metabolic abnormalities

Number of metabolic abnormalities	Number of Cases	Percentage
None	5	5.0
One	29	29.0
Two	41	41.0
Three	13	13.0
Four	9	9.0
Five	3	3.0
Total	100	100.0

Table 7: Serum metabolic abnormalities

Serum parameters	Number	Percentage
Hypercalcemia (>11mg/dL)	2	2
Hyperphosphatemia (>4.4mg/dL)	9	9
Hyperuricemia (>5.8mg/dL)	7	7
Hyperparathyroidism (>45 pg/ml)	2	2

Table 8: Urinary metabolic abnormalities

Urinary parameters	Abnormality	Number of cases	% of Cases
Low Urine Volume	Less than 2 L per day	13	13
Hypercalciuria	>250mg/day in men		
	>200mg/day in women	28	28
Hyperuricosuria	>800mg/day in men		
	>750mg/day in women	14	14
Hyperoxaluria	>45mg/day	54	54
Hypernatriuria	>220mmol/		
	Day	26	26
Hyperphosphaturia	>1300mg/		
	Day	1	1
Hypocitraturia	<450mg/day in men		
	<550mg/day in women	65	65

Table 9: Type of stone

Type of Stone	Number of cases	Percentage
Calcium oxalate	45	45
Calcium Phosphate	7	7
Uric acid	23	23
Mixed Stone (Calcium, Uric acid and oxalate)	2	2
Stones not available for assessment	23	23
Total	100	100

Table 10: Comparison of Urinary metabolic parameters and dietary pattern

Urinary parameter	Type of Diet	Mixed		Vegetarian	
		No. of subjects	Frequency	No. of subjects	Frequency
Urine Volume	Normal	70	85.40%	17	94.40%
(mL/day)	Low	12	14.60%	1	5.60%
	Total	82	100.00%	18	100.00%
Urine Uric Acid	Normal	69	84.10%	17	94.40%
(mg/day)	High	13	15.90%	1	5.60%
	Total	82	100.00%	18	100.00%
Urine Calcium	Normal	60	73.20%	12	66.70%
(mg/day)	High	22	26.80%	6	33.30%
	Total	82	100.00%	18	100.00%
Urine Phosphorus	Normal	81	98.80%	18	100.00%
(mg/day)	High	1	1.20%	0	0.00%
	Total	82	100.00%	18	100.00%
Urine Oxalate	Normal	38	46.30%	8	44.40%
(mg/day)	High	44	53.70%	10	55.60%
	Total	82	100.00%	18	100.00%
Urine Citrate	Normal	33	40.20%	2	11.10%
(mg/day)	Low	49	59.80%	16	88.90%
	Total	82	100.00%	18	100.00%
Urine Sodium	Normal	61	74.40%	13	72.20%
(mmol/day)	High	21	25.60%	5	27.80%
	Total	82	100.00%	18	100.00%

Table 11: Statistical analysis values of Urinary metabolic abnormalities and dietary pattern

Abnormal Urinary Parameter	Chi-square value	p-value	
Low Urine Volume	1.076	0.300	Not Significant
Hyperuricosuria	1.300	0.254	Not Significant
Hypercalciuria	0.310	0.578	Not Significant
Hyperphosphaturia	*	0.638	Not Significant
Hyperoxaluria	0.021	0.884	Not Significant
Hypocitraturia	5.506	0.019	Highly significant
Hypernatriuria	0.036	0.849	Not Significant

* Fishers exact test

Table 12: Comparison of number of urinary metabolic abnormalities and dietary pattern

No. of metabolic abnormalities	Type of Diet		Total
	Mixed	Veg	
0	5	0	5
1	25	4	29
2	31	10	41
3	12	1	13
4	6	3	9
5	3	0	3
Total	82	18	100

Fishers exact test p=0.452

Table 13: Comparison of urinary metabolic parameters and gender distribution

Urinary parameter	Gender				
	Female	Male			
		No. of subjects	Frequency	No. of subjects	Frequency
Urine Volume	Normal	19	21.8%	68	87.2%
(mL/day)	Low	3	23.1%	10	12.8%
	Total	22	22.0%	78	100.0%
Urine Uric Acid	Normal	19	22.1%	67	85.9%
(mg/day)	High	3	21.4%	11	14.1%
	Total	22	22.0%	78	100.0%
Urine Calcium	Normal	11	15.3%	61	78.2%
(mg/day)	High	11	39.3%	17	21.8%
	Total	22	22.0%	78	100.0%
Urine Phosphorus	Normal	22	22.2%	77	98.7%
(mg/day)	High	0	.0%	1	1.3%
	Total	22	22.0%	78	100.0%
Urine Oxalate	Normal	11	23.9%	35	44.9%
(mg/day)	High	11	20.4%	43	55.1%
	Total	22	22.0%	78	100.0%
Urine Citrate	Normal	8	22.9%	27	34.6%
(mg/day)	Low	14	21.5%	51	65.4%
	Total	22	22.0%	78	100.0%
Urine Sodium	Normal	16	21.6%	58	74.4%
(mmol/day)	High	6	23.1%	20	25.6%
	Total	22	22.0%	78	100.0%

Table 14: Association between urinary metabolic abnormalities and gender.

Abnormal Urinary Parameter	Chi-square value	p-value	
Low Urine Volume	0.010	0.920	Not Significant
Hyperuricosuria	* 0.016	0.956	Not Significant
Hypercalciuria	6.771	0.009	Highly significant
Hyperphosphaturia	* 0.125	0.594	Not Significant
Hyperoxaluria	0.182	0.670	Not Significant
Hypocitraturia	0.023	0.879	Not Significant
Hypernatriuria	0.024	0.878	Not Significant

* Fishers exact test

Table 15: Logistic regression analysis of hypercalciuria and gender distribution

	OR	95% CI	
		Lower	Upper
Hypercalciuria in Females	3.588	1.328	9.692

Table 16: Comparison of number of urinary metabolic abnormalities and gender distribution

No. of metabolic abnormalities	Gender		Total
	Female	Male	
0	0	5	5
1	5	24	29
2	11	30	41
3	4	9	13
4	1	8	9
5	1	2	3
Total	22	78	100

Fishers exact test p=.613, Not Significant

Table 17: Pearson Correlation between excretion of urinary sodium with other urinary parameter

Pearson Correlation	r value	p-value
Urine Sodium vs. Urine Potassium	0.074	0.466
Urine Sodium vs. Urine calcium	0.369	0.000
Urine Sodium vs. Urine Phosphorus	0.130	0.197
Urine Sodium vs. Urine Magnesium	0.157	0.199
Urine Sodium vs. Urine Oxalate	0.219	0.028
Urine Sodium vs. Urine Citrate	0.048	0.639

Type of Stone:

- Stone composition analysis revealed calcium oxalate as the predominant component (45%), followed by uric acid (23%). Calcium phosphate constituted 7% of stones and 2 stones exhibited mixed components of calcium, uric acid and oxalate. In 23 cases, stones were not available for analysis. These findings contribute significantly to our understanding of the diverse metabolic imbalances in recurrent urolithiasis, guiding future therapeutic interventions and personalized management strategies.

Hypocitraturia was associated with an increased risk of urolithiasis (odds ratio [OR] for vegetarian diet = 5.38., 95% confidence interval [CI]=1.161-25.001).

On statistical analysis, the number of abnormal urinary parameters was not found to have any statistically significant association between the two dietary groups.

On statistical analysis, hypercalciuria was found to have significantly affected (p<0.009) the females. No other urinary parameter had any significant association between the two gender groups.

Logistic regression analysis was carried out to explore the relationship between dietary patterns and gender

Hypercalciuria was associated with an increased risk of urolithiasis (odds ratio [OR] for Females=3.588., 95% confidence interval [CI]=1.328-9.692).

Gender Distribution and Number of Urinary Metabolic Abnormalities: Statistical analysis revealed no statistically significant association between men and women in terms of the number of abnormal urinary parameters.

Correlation Between Excretion of Urinary Sodium with Other Urinary Parameters: In Pearson correlation between Urine sodium and other Urine parameters such as Urine potassium, Phosphorus, magnesium, Citrate, there were no significant correlation., however, significant positive correlations were noted between sodium and calcium and sodium and oxalate excretion (p<0.000 and p<0.028, respectively).

Urinary stone disease remains a pervasive global health concern, exhibiting an escalating incidence concurrent with the progression of modernization[15,16]

The treatment and management has undergone a transformative shift, moving away from traditional open operative procedures towards minimally invasive and endoscopic interventions. Amidst this evolution, a notable surge in concern and research efforts has been directed towards the prevention of urinary stone disease.

Multiple factors contribute to the rise in urinary stone disease, encompassing contemporary dietary habits, the burgeoning prevalence of obesity, escalating metabolic syndrome and the pervasive impact of conditions such as Diabetes mellitus and various metabolic disorders[17-19] These multifaceted influences underscore the complexity of the etiological landscape and emphasize the need for comprehensive strategies in prevention.

The consequences of urinary stone disease extend beyond mere discomfort, encompassing pain, infections and potential renal impairment, thereby necessitating some form of intervention. Furthermore, the propensity for stones to recur at intervals adds both emotional distress and financial burden to the patients' journey, underscoring the importance of proactive management.

In the context of recurrent stones, it becomes imperative for urologists to play a pivotal role in preventing such recurrences. This involves a meticulous investigative approach aimed at identifying the underlying causes of recurrence. By unraveling the different contributing factors, urologists can tailor preventive strategies, thereby alleviating the suffering and mitigating the economic burden associated with recurrent urinary stone disease. The evolving landscape of medical research and the growing emphasis on prevention underscore the commitment of the medical community to confront the challenges posed by urinary stone disease comprehensively.

Our study revealed a mean age of urolithiasis presentation as 43.7±13.045, with a notable concentration in the 41-50 age group (32%). Comparable findings were observed in literature, aligning with Ahmad I[20] series (38±7.75), Parvin[21] series (43.42±6.925) and Julka[22] series (38±10.2).

A male preponderance (3.5:1) was identified in our study, aligning with Khan[23] series (5:1).However, this ratio deviates from global studies, which often report a male-to-female ratio ranging from 1.5-2.5. It's crucial to acknowledge that the discussion on gender ratio in our study is influenced by the methods of patients' referral, impacting the outpatient clinic's representativeness of the general population. Potential environmental factors, such as outdoor work in a hot and humid climate in southwestern coastal India, may contribute to this male predominance.

Ureteric stones emerged as the most common recurrence location in our study (38%), closely followed by renal stones (37%). This distribution contrasts with Ahmad I[20] series, where renal stones dominated (63%).

Loin pain was the predominant presenting symptom (61%), consistent with Ahmad I[20] series and Elfadil *et al.* series[24]. The study also explored the number of recurrences, indicating a median of 2 recurrences, aligning with Julka S[22] series (median 3, range 1-5).

Calcium oxalate predominated in 45% of stones, followed by uric acid (23%). Our findings align with various studies globally[26,27] emphasizing the consistency of stone composition trends.

In our study series, a striking observation was the remarkably high prevalence of metabolic abnormalities, reaching 95%.

This finding aligns with several other studies emphasizing the pivotal role of metabolic abnormalities in urinary stone formation[20,21,27]

Hypocitraturia emerged as the most frequent metabolic abnormality in our cohort (detected in 63% of patients), followed by hyperoxaluria (54%), hypercalciuria(28%), hypernatriuria(26%), hyperuricosuria (14%).

However, the specific nature of these abnormalities can vary across studies, with some highlighting a predominance of hyperoxaluria, as seen in our study[20] These variations may be attributed to

diverse factors such as climate, seasonal fluctuations, dietary habits and lifestyle choices, underscoring the necessity to explore the prevalence of different metabolic changes within specific populations. This becomes particularly relevant given the modifiability of these metabolic abnormalities through preventive measures, encompassing dietary modifications and lifestyle changes.

Hypocitraturia correlated significantly ($p<0.019$) with a vegetarian diet, contradicting literature associating it with high animal protein consumption.

Hypercalciuria showed a significant correlation ($p<0.009$) in females, indicating a higher prevalence compared to males.

Positive correlations were found between sodium and calcium, as well as sodium and oxalate excretion, highlighting the interplay of dietary sodium with calcium and oxalate metabolism.

Hyperparathyroidism was identified in 2% of our study population, exclusively in females with parathyroid adenomas. This finding echoes the observations in Julka S[22] series (6%).

In line with the studies by Peres[28] Julka S[22] and the Thai[29] group, we noted that 13% of patients presented with a lower 24-hour urine output (<2 l in 24 h). Recommending increased fluid intake as an initial treatment option for these patients is a prudent approach. However, the implementation of an extensive metabolic evaluation in clinical practice remains a subject of debate. Despite the controversies, we contend that, given the high prevalence of metabolic abnormalities in our population, performing such an evaluation for all patients admitted to urolithiasis clinics in tertiary hospitals seems warranted. This approach not only prompts the prescription of preventive measures and drugs in a substantial number of patients but is also likely cost-effective, reducing stone-related events and subsequent healthcare utilization.

Nevertheless, we acknowledge certain limitations of our study. Opting for a single 24-hour urine collection was a decision made for patient convenience and adherence, although the ongoing debate regarding the need for one versus two 24-hour urine collections during the initial metabolic evaluation remains unresolved.

While our study presents a cross-sectional descriptive analysis, the patient database established provides a foundation for further exploration. Ongoing studies aim to assess initial metabolic profiles as predictors of therapeutic success and recurrence outcomes. This approach, focusing on the identification of metabolic abnormalities and the implementation of specific diet changes and pharmacological treatments when clinically indicated, should be complemented with meticulous follow-up. This follow-up will enable a comprehensive evaluation of future recurrence rates, clinical outcomes related to emergency room (ER) admissions and the necessity for surgical procedures.

CONCLUSION

Recurrent urolithiasis predominantly affects the male population, with loin pain as the prevailing presenting symptom. Patients with recurrent urolithiasis exhibit a high frequency of metabolic abnormalities. Key metabolic abnormalities identified include hypocitraturia, hyperoxaluria, hypercalciuria, and hypernatriuria. The predominant dietary pattern among urolithiasis patients is a mixed diet. Calcium oxalate constitutes the primary component of urinary stones. Vegetarian diets correlate with lower citrate excretion in urine, distinguishing them from Western populations. Women demonstrate hypercalciuria as a significant abnormality compared to men. Hypernatriuria exhibits a calciuric effect, leading to increased excretion of calcium and oxalate in patients with elevated sodium in urine. The spectrum of metabolic abnormalities in our population differs from that observed in Western populations.

Given the substantial burden of urinary stone disease in our clinical practice, coupled with the markedly high prevalence of metabolic abnormalities, we advocate for the inclusion of metabolic evaluation as an invaluable step in the clinical work-up of these patients. Conducting an immediate metabolic assessment, irrespective of the presence or absence of recurrence, is pivotal for guiding the selection of appropriate pharmacological and dietary measures. This proactive approach not only aids in preventing recurrent stone formation but also alleviates the clinical and economic burden associated with this condition. The ongoing efforts in our study pave the way for future investigations, focusing on the potential of initial metabolic profiles to serve as predictors for therapeutic success and recurrence outcomes.

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