ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

A CLINICAL STUDY ON RADIOLUCENT(URIC ACID) STONES IN TERTIARY CARE CENTER

Dr Niranjan Mohapatra[1], Dr Sridhar Panda[2], Dr Sanjay Choudhuri[3]

Assistant Professor, Department of Medicine, SCB Medical college and Hospital[1]

Assistant Professor, Department of Medicine, SCB Medical college and Hospital[2]

Assistant Professor, Department of Urology, SCB Medical college and Hospital[3]

Corresponding Author

Dr Sanjay Choudhuri

Assistant Professor, Department of Urology, SCB Medical college and Hospital

Dr-csanjay@yahoo.co.in

9337098497

Background:
Uric acid, which was originally identified in 1776, is a component of bladder stones that is regulated by metabolism, renal excretion and synthesis. Acidic urine and metabolic syndrome are associated with an increased risk of uric acid stones. The primary goals of this research are to determine the age and gender distribution, as well as the predisposing and causative variables and clinical presentation of uric acid urolithiasis.

Methods and materials:
A clinical investigation on radiolucent stones was carried out at SCB Medical college and Hospital, Cuttack from July 2021 to July 2023. Fifty examples of symptomatic uric acid calculi were chosen based on clinical symptoms and radiological findings. To collect comprehensive data on uric acid calculi, a history, physical examination, blood and urine tests, and radiographic examinations were performed.

Results
The research included 72% male and 28% female participants, with an average age of 34.5 years. A high-protein diet was connected to an increased risk of uric acid stones, with discomfort in the loin being the most often reported symptom.

Conclusion
Uric acid calculi are more common in males (M:F ratio 5.5:1) and frequently develop between the ages of 20 and 40 (mean age 34.5). Low urine pH and volume aid in their development. The stones are more prevalent in July and August. Management consists on increased fluid intake and alkalinizing procedures, ideally with potassium citrate with or without bicarbonate. Conservative treatment is beneficial for the vast majority of patients.

Keywords: Uric Acid Calculi, Radiolucent Stones, Urolithiasis.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

Introduction

In 1776, Swedish scientist Scheele isolated uric acid (2,6,8-trioxypurine) from bladder stones, coining the name "lithic acid" to characterise their acidic composition. Human purine nucleotide metabolism produces water-insoluble uric acid, which is broadly dispersed in body fluids. The quantity of uric acid in the blood is affected by the rate of its production, elimination via the kidneys and gastrointestinal system, and metabolism. Uric acid stones, the third most prevalent form of kidney stone, are caused by overly acidic urine, although hyperuricosuria and low urine volume also play a role. Uric acid urolithiasis is caused by conditions that reduce urine pH and increase urinary uric acid. [1] It has been shown that the occurrence of uric acid stones is increasing in correlation with obesity and metabolic syndrome.

Aciduria's aetiology includes both diet-dependent and diet-independent elements. The majority of persons who develop uric acid stones have metabolic syndrome, which might be accompanied with clinical gout. Low baseline urine pH and inadequate generation of urinary ammonium buffer are typical findings. Insulin resistance is hypothesised to impede ammonia genesis and excretion of ammonium, increasing the excretion of hydrogen ions in urine with non-ammonia anions and lowering urine pH. People with gastrointestinal diseases, especially those with ostomies or recurrent diarrhoea, and cancer patients with high tumour masses and fast cell turnover make up a less prevalent but substantial category. Uric acid crystal formation in the urinary system is often associated with dysuria and haematuria, and it may manifest as crystalluria, stones, or obstruction. [2].

Plain radiographs usually provide no evidence of pure uric acid stones. A CT scan with stone attenuation of 200-600 HU (x) might suggest the presence of uric acid stones. Radiolucent pure uric acid stones may be seen on renal ultrasonography. A 24-hour urine sample for stone risk analysis is required to better understand the biology of stone formation and may aid in treatment. Both fluid intake and nutrition should be modified. Uric acid stone is one of the few urinary tract stones that may be properly cleared as well as prevented.

Raising the pH of urine from 5.3 to 6.5 makes uric acid six times more soluble. Potassium citrate is necessary to alkalinize the urine to a target pH of 6.2 to 6.8 in order to successfully treat undissociated uric acid, which deprotonates into the much more soluble urate form. [3] Uric acid calculi may be avoided by utilising potassium citrate.

Material and Methods

Between July 2021 and July 2023, SCB Medical college and Hospital, Cuttack conducted a clinical research on radiolucent stones. Fifty individuals had symptomatic uric acid calculi, which cases were selected based on clinical symptoms and radiological findings and validated using radiographic and sonographic methods. All of these cases met the inclusion criteria; however, patients under the age of 20 and pregnant women with urolithiasis were excluded. A comprehensive assessment was performed, including a history, physical examination, blood and urine tests, radiological studies (X-ray, ultrasound, and plain CT KUB), and a physical

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

examination. In-depth case histories were collected, past renal calculi history was noted, and signs were found during systemic testing as part of the investigation. A complete blood profile was taken, as well as serum creatinine, electrolyte, calcium, phosphorus, and uric acid values. Urine testing assessed the pH and volume. Radiological assessments were performed, including typical ultrasound and X-ray KUBs, and calculus confirmation was achieved utilising a simple CT KUB. This extensive research comprised a number of clinical and radiographic tests to get a thorough understanding of the patients and gather detailed data on radiolucent stones, with an emphasis on uric acid calculi.

Results

Table 1: Sociodemographic and dietary pattern of the study population.

	Number	**Percentage (%)**
Gender		
Male	36	72
Femal e	14	28
Age(years)		
20-30	26	50
30-40	15	30
40-50	4	8
50-60	3	6
>60	3	6
Diet		
Vegetarian	2	4
Mixed	48	96

The table reflects the distribution of participant demographics and diets. Participants made up 72% men and 28% women. Participants' ages ranged from 20 to 30 years old for 50% of them, 30 to 40
years old for 30%, 40 to 50 years old for 8%, and 50 to 60 years old and over for 6% of them. Merely

4% of the population consumed a vegetarian diet, whilst 96% consumed a mixed diet. This data ena- bles a more thorough understanding of the sample attributes by providing details about the dietary composition, age, and gender of the study partici- pants.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

Table 2: Symptoms presented by the study population at the time of admission.

Symptom	Number	Percentage
Pain	50	100
Nausea	27	54
Vomiting	19	38
Burning micturition	18	36
Hematuria	3	6
Fever	2	4

Participants' symptom prevalence is shown in the table. All 50 individuals reported experiencing

pain, which was the most prevalent complaint overall. Of the individuals, 38% had vomiting, 36% had burning micturition, 6% had haematuria, and 4% had fever. Of these, 54% had nausea. As pain being the most frequently expressed symptom and other symptoms ranging in frequency, this data provides a thorough study of the symptoms experienced by the research participants.

Table 3: Distribution of Serum Biochemical Parameters Among Study Participants with Urolithiasis.

Parameters(mg/dl)	Number	Percentage
Serum Calcium		
8.5-10.2(Normal)	50	100
>10.2	-	-
Serum Phosphorus		
2.5-4.5(Normal)	48	96
>4.5	2	4
Serum Uric Acid		
3.5-7.2 (Normal)	50	100
>7.2	-	-
Serum Creatinine		
0.8-1.2 mg/dL (Normal)	42	84
>1.2mg/dl	8	16

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

A complete blood picture was done rule out leuke- mia and polycythemia. Complete blood picture is normal in the present study.

This table shows how serum biochemical parame- ters are distributed among urolithiasis patients. The parameters tested include serum calcium, serum phosphorus, serum uric acid, and serum creatinine. Every parameter has two categories: normal and increased ranges. The table shows the proportion of each category together with the number of partici- pants.

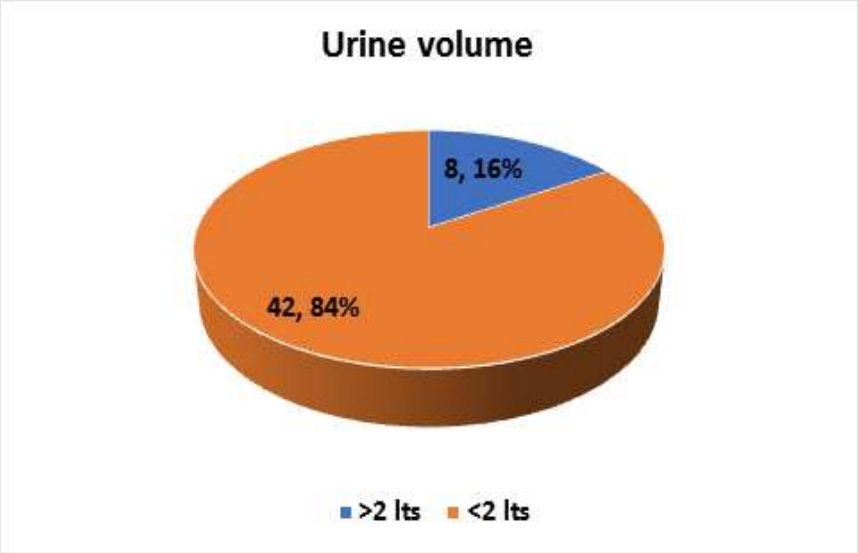
Serum Calcium: All 50 participants had values within the normal range (8.5-10.2 mg/dL).

Serum Phosphorus: Of the subjects, 2 (4%), had levels that were higher than normal (>4.5 mg/dL).

Serum Uric Acid: All 50 participants had normal values (3.5-7.2 mg/dL).

Serum creatinine: 8 subjects (16%) had high val- ues (>1.2 mg/dL).

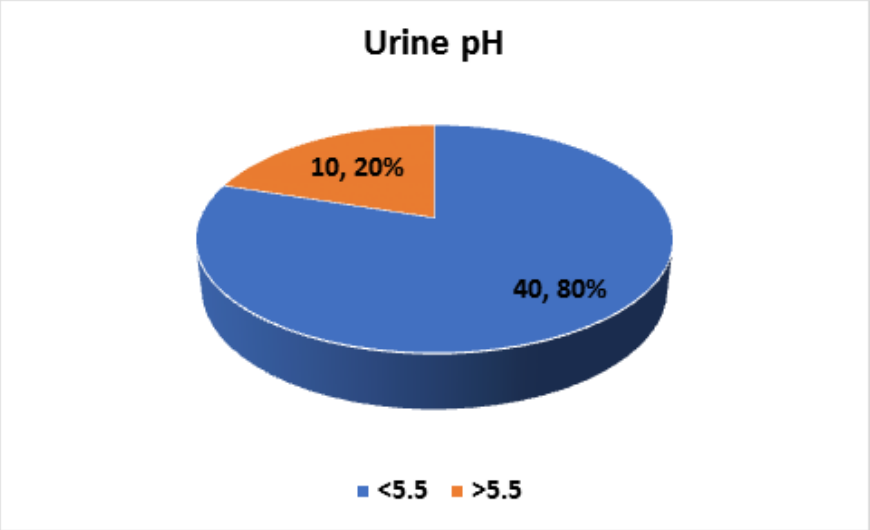
This information helps determine the biochemical profile of urolithiasis patients by illuminating the frequency of aberrant serum biochemical levels in the research population.



Graph 1: Distribution of Urine Volume Among Study Participants

This pie chart shows how urine volume is distributed among research participants. 84% (42 persons) of the total cases had urine volumes less than two litres, while 16% (8 people) had amounts greater than two litres.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024



Graph 2: Distribution of Urine pH Among Study Participants

This pie chart displays the distribution of urine pH levels among study participants. Of the samples, the urine had a pH of less than 5.5 in 80% of the cases (40 people), and higher than 5.5 in 20% of the cases (10 people). With regard to renal physiology and the potential advancement of knowledge regarding the factors influencing urolithiasis in relation to urine acidity, this data presents a clear picture of the prevalence of both acidic and non-acidic urine conditions among research participants.

In this investigation, a variety of radiographic procedures were performed, such as plain CT KUB, ultrasonography, and X-rays. Every patient with loin pain had ultrasound KUB, but the calculi's radiolucency prevented X-ray KUB from displaying them.

The existence of calculi was confirmed by plain CT KUB images.

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

Graph 3: Distribution of Management Approaches Among Study Participants

The study participants' preferred courses of treat- ment are shown in the table, with 12 (24%) select- ing surgical treatments and 38 (76%) selecting con- servative therapy. This briefly describes the general tendency for the conditions under study to be treat- ed with conservative methods rather than surgery.

Discussion

Male-to-female ratios were evaluated in numerous studies, including Baker et al [4] (2.7:1) and Lavan et al [5] (2.4:1), C. Lieske et al [6] (2:1), and the present research (2.5:1). These ratios indicate the male-to-female ratio in each study participant cohort. The data indicate to a similar pattern across the investigation, with varying ratios but an overall higher representation of males in the cohorts under consideration.

In the current research, out of 50 patients, 72% were men and 28% were females, resulting in a male to female ratio of 2.5 to 1. Typically, men are more affected than females[7].

The mean age in years was compared across multiple studies, including this one (34.6), Gyawali et al. [8] (40), and Dhanajay V. Bhale et al. [9] (40.2). According to the statistics, the average age of the research varies, with the present study having a little lower mean age than the other two referenced studies.

Age is a significant role in the presentation of uric acid calculi. The current investigation comprised 50 patients, with an average age of 34.6 years at presentation.

Nutrition is the most important driver of uric acid stone development, since the occurrence of uric acid stones is strongly linked to a high-protein diet.

An animal protein-rich diet causes greater uric acid pH and uric acid levels. 96% of the individuals in the present research had a varied diet.

Furthermore, Griffith HM et al. [10] and Safarine Jad MR et al. [11] showed that a high-protein diet is directly associated with uric acid stones.

According to the research, the majority of renal stones do not cause any symptoms. In the

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

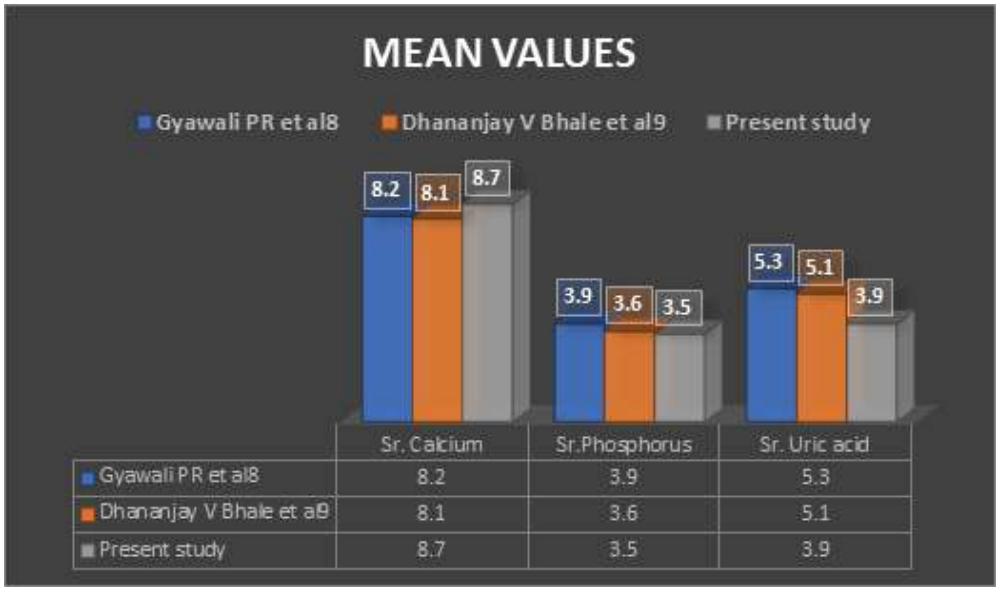
present study, all identified cases with renal colic exhibited loin discomfort; hence, 100% of the patients experienced pain.

The percentage figures of three distinct investigations comparing symptoms like nausea and vomiting—the present research (54%), C Turk et al. [12] (50%), And Evan AP et al. [13] (50%)—are compared. The figures show only minor variations in percent-age values over the research, with the present study having a little higher proportion than the prior studies. The prevalence of burning micturition is compared between the present study (36%) and Madhavi S et al.'s [14] (53.84) study. Within each research group, these percentage percentages most likely represent the frequency or incidence of burning micturition as a symptom. In contrast to the present investigation, the results of Madhavi S et al. [14] indicate a greater incidence of burning micturition.

In the pre-sen trial, 58% of individuals had past/ourolithiasis. The percentages for past medical history are based on three studies: Moe OW et al [15] (50%), Ljunghall S et al [16] (50%), and this one (58%). These percentage statistics most likely represent the frequency of a certain prior medical history or condition among the participants in each research. The statistics reveal that the prevalence of past medical history varies across research; the present study has a somewhat higher percentage than the studies referenced.

In the current research, serum calcium, serum phosphorus, serum uric acid, serum creatinine, and serum electrolytes were investigated. The readings are on the upper end of the usual range, but not elevated[17].

The graph depicts serum calcium (sr. calcium), serum phosphorus (sr. phosphorus), serum uric acid (sr. uric acid), and average values from three studies. These figures show the average levels of these biochemical parameters across the associated research groups. The data highlights discrepancies in mean ranges across the studies; in compared to the other listed research, the present study had somewhat higher mean values for blood calcium and lower mean values for serum phosphorus and uric acid.



Graph 4: Comparison of Mean Serum Calcium, Phosphorus, and Uric Acid Levels in Different Studies

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

Conclusion

Males are more prone to develop uric acid calculi (M:F ratio: 5.5:1), which often appear between the ages of 20 and 40, with an average age of 34.5 years. Low urine volume and pH are the primary factors that promote the production of insoluble uric acid. Notably, July and August are when individuals notice the stones the most regularly. To maintain a urine pH range of 6 to 6.5, treatment options include increasing fluid intake to boost urine volume and alkalinization, ideally with potassium citrate. For the majority of patients, conservative therapies that comprise these procedures are effective. Understanding seasonal and demographic changes improves clinical treatment for patients with uric acid calculi and guides personalised preventative interventions.

References

1. Balinsky JB. Phylogenetic aspects of purine metabolism. S Afr Med J. 1972;46(29):993- 997.
2. Campbell JW. Comparative biochemistry of nitrogen metabolism. In: Campbell JW, edi- tor. The vertebrates. New York: Academic Press; 1970;2.
3. Nevo A, Levi O, Sidi A, Tsivian A, Baniel J, Margel D, et al. Patients treated foruric acid stones reoccur more often and within a shorter interval compared to patients treated for calci- um stones. Can Urol Assoc J. 2020 Nov; 14(11): E555–9.
4. Baker K, Costabile RA. Demographics, stone characteristic, and treatment of urinary calculi at the 47th Combat Support Hospital during the first 6 months of Operation Iraqi Free- dom. Mil Med. 2007;172(5):498-503.
5. J. N. Lavan; F. C. Neale; S. Posen Med. J. Aust., 1971;2: 1049-1061
6. Lieske JC, de la Vega LS, Gettman MT, et al. Diabetes mellitus and the risk of urinary tract stones: a population-based case-control study. Am J Kidney Dis. 2006;48(6):897-904.
7. Kumari A, Dokwal S, Mittal P, Kumar R, Goel R, Bansal P, et al. An Increase Incidence in Uric Acid Nephrolithiasis: Changing Patterns. J Clin Diagn Res JCDR. 2016 Jul;10(7): BC01–3
8. Gyawali PR, Joshi BR et al. Correlation of calcium, phosphorous, uric acid and magnesi- um level in serum and 24 hours urine of pa- tients with Urolithiasis. Kathmandu Univ Med
   J. 2011;34(2)54- 56.
9. Dhananjay V. Bhale, et al. Study of serum calcium, phosphorus & uric acid levels in pa- tients of urinary calculi. International journal of recent trends in science & technology, 2013; 9(2): 189- 190.
10. Griffith HM, O'Shea B, Kevany JP, McCor- mick JS. A control study of dietary factors in renal stone formation. Br J Urol. 1981 Oct; 53(5):416–20.
11. Safarinejad MR. Adult urolithiasis in a popula- tion-based study in Iran: prevalence, incidence, and associated risk factors. Urol Res. 2007; 35(2):73–82.
12. Türk C, Neisius A, Petrik A, et al. Urolithiasis Guidelines [Internet]. European

ISSN: 0975-3583, 0976-2833 VOL15, ISSUE 5, 2024

Association of Urology; 2018. Available at: http://uroweb. org/guideline/urolithiasis/

13. Evan AP, Worcester EM, Coe FL, Williams J Jr, Lingeman JE. Mechanisms of human kid- ney stone formation. Urolithiasis. 2015;43 Suppl 1(01):19-32.
14. Madhavi S, Prathyusha C, Rajender S. Rela- tionship between crystalluria and urinary cal- culi and associated urinary tract infection. J Microbiol Biotechnol Res. 2012; 2:351-6.
15. Orson W Moe, Nicola Abate, Khashayar Sakhaee.
16. Pathophysiology of uric acid nephrolithiasis, Endocrinology and Metabolism Clinics of North America. 2002:31(4)895-914.
17. Ljunghall S, Danielson BG. A prospective study of renal stone recurrences. Br J Urol. 1984;56:122–24.
18. Sakhaee K. Epidemiology and Clinical Patho- physiology of Uric Acid Kidney Stones. J Nephrol. 2014 Jun;27(3):241–5.