

Prevalence of Urolithiasis and Chemical Composition of Uroliths in Bhagalpur Division of Bihar, India

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ABSTRACT

It is common to get urinary stones. Geographical, ecological, and environmental factors all have a role in urolithiasis. It has been determined that certain geographic areas are endemic stone belts. Urolithiasis is a common health problem across the globe. Prevalence of urolithiasis in Bhagalpur division has steadily increasing. Knowing the chemical makeup of uroliths can help patient with management and recurrence prevention. Study depicts that improper water intake play an important role in urolithiasis apart from dietary sources. Improper water intake allow calcium oxalate to stick together in urinary system. Our objective is to determine anatomical distribution, chemical composition and abundance of uroliths. A descriptive study of about 97 uroliths were collected (from surgically treated patient) sent to laboratory for chemical analysis. Sample were analysed using qualitative test. Calcium containing uroliths like calcium oxalate and calcium phosphate were predominant. Cystine was rarely found. This study provide an important information about uroliths in Bhagalpur division. This can provide an excellent summary of stone morphology and the potential to identify certain metabolic conditions and specific chemical kinds with their many crystalline phases are illustrated in relation to their various- aetiologies.

KEYWORDS: Uroliths, Urolithiasis, Calcium oxalate, Bhagalpur.

INTRODUCTION

Urolithiasis is one of the most common urologic illnesses worldwide, with an estimated frequency varying from 1% to 13% in different countries around the world [1] [2]. In India, approximately 12% of persons suffer from urinary stones, with 50% experiencing kidney loss or injury. Additionally, approximately 15% of persons in northern India suffer from urinary stones [3] [4]. In Asia, the stone belt countries are India, Pakistan, and Southern China. According to reports, this condition affects approximately 15% of the Indian population. The Northern, Western, and Central regions of the country have the highest occurrence of this condition. The incidence of this disorder is modest in the Deccan Plateau and very low in the country's southern coastal regions [5]. Kidney stones were first mentioned in ancient Mesopotamian medical books between 3200 and 1200 BC [6]. Age, gender, geographical location, family history, and dietary status have been suggested to be the primary causes of urinary stone formation. Because urinary stone disease is complex, it is nearly

impossible to identify a single etiological factor. The situation is further aggravated by its high frequency of recurrence, which has been found to be 35, 74, and 98 percent between 1-3, 1-10, and 1-25 years correspondingly [7]. Regardless of treatment, kidney stones have a high recurrence rate. Approximately 98% of people get second stone within 25 years of the initial event [8] [9]. Analysing the physicochemical features and chemical makeup of kidney stones can provide valuable insights into the stone development process. Understanding this mechanism can aid in medical treatment and prevention of future stone development [10] [11].

The northern state of Bihar having its capital at Patna was carved out from the state of Bengal on 22 march 1912. The retrospective, epidemiological studies in Bhagalpur in the state of Bihar assumes significance as a sea change has taken place in the living conditions, working habits and the nutritional status of the population over last 20 years. The present study was conducted, as no significant study has yet been

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reported in literature on the urinary stone disease prevalence in the Bhagalpur division.

Materials and Methods

The work was carried out over a period of three years, from July 2021 to Aug 2024. A month-wise data of Urolithiasis cases were collected, reported and diagnosed during the period of work from the government hospitals, private nursing homes and diagnostic centres located within division. A systematic questionnaire was used to collect the data. Age, sex and stone location site wise breakup of Urolithiasis cases were assessed. Urolithiasis cases were broken down based on age, gender, and stone placement site. The study included one hundred and twenty eight uroliths obtained by surgical intervention of Urolithiasis patients clinically and radiographically diagnosed from the different Hospital and research centre of Bhagalpur division of Bihar (India), during a period of 2021-2024. A total of 128 surgically removed urinary stones, 92 upper and 36 lower, were gathered from hospitals and nursing homes. The data of Urolithiasis cases was collected with the help of structured questionnaire proforma. The stones obtained from Surgery department to clinical Biochemistry laboratory were washed with distilled water to remove the debris, dried completely and weighed. For the chemical content of the stones, it was sent to lab for further analysed procedures. Distribution of chemical composition of stones according to site of location in the urinary tract was assessed.

Analysis is carried out using both chemical and physical approaches. Unfortunately, chemical approaches are frequently insufficient to adequately analyse urinary calculi and may fail to detect some constituents within the stone. In contrast, physical approaches are increasingly being applied in large-scale laboratories. For this first of all we washed all the stones with water and then wipe with cloth and make it dry. After that we collect these stone on a box. The box was labelled with the location from where the stone had and then sent it to the Dr Lals patho labs for its analysis. The current manuscript will provide a review on on the chemical composition of calculi.

Results & Discussion

Stone formation inside the kidneys of the human body is a very painful nephro logical disorder that is prevalent worldwide. It is also known as renal calculi and more broadly as urinary stones. Kidney stones are solid concretions (crystal aggregations) of dissolved minerals in urine [14, 15]. Kidney stones range in size from a few millimetres to several centimetres. They normally exit the body through the urine stream, and

many stones form and pass without producing symptoms [16].

Urinary stone illness has an impact on both patients' health and the country's economy. As the highest frequency of occurrence and recurrence of this disease is present in people when they are in their most productive age group of 21-40 years, thus, the effective management of the disease assumes significance particularly in areas that fall in the high incidence stone belt region of the country[12] [13]. Complete illness management comprises thorough evaluation, preventative steps to prevent recurrence, and therapy. For effective management, it is necessary to conduct an epidemiological study on the composition and location of stone for diagnosis, and also to compare its frequency of occurrence in different age groups in order to determine prevalence. Study reveals that stones can form in any section of the urinary tract, but the kidney stone have the highest prevalence in males (93%) than females (83%). Interestingly, the largest male/female ratio was discovered in the case of ureteric stones as compared to stones appearing in other places in the urinary tract, and this ratio compared favourably to the overall ratio of 2:1 between males and females. The left side {kidney, ureter, UVJ(Ureteropelvic Junction) , and PUJ(Pelvi-Ureteric Junction)} had the highest proportion (44.5%) of urinary stones retrieved, followed by the right side (kidney, ureter, UVJ, and PUJ) (35.3%), bladder (2.9%), and urethral (0.6%). The proportion of bilateral and recurring stones was found to be 15% and 1.7%, respectively.

Urolithiasis is the production of calculus in the urinary system, which can affect both sexes. The study examined uroliths weighing between 10 gms to 170 gms, primarily in males and situated in the chemical composition of the ureter is predominantly heterogeneous. Calculi that cause urinary blockages are more common in males, possibly due to their smaller size. The urethra's diameter and length grew. Calculi outcomes. The precipitation of stone components could be Urine oversaturation. The presence of mixed stone suggests a multifactorial aetiology.

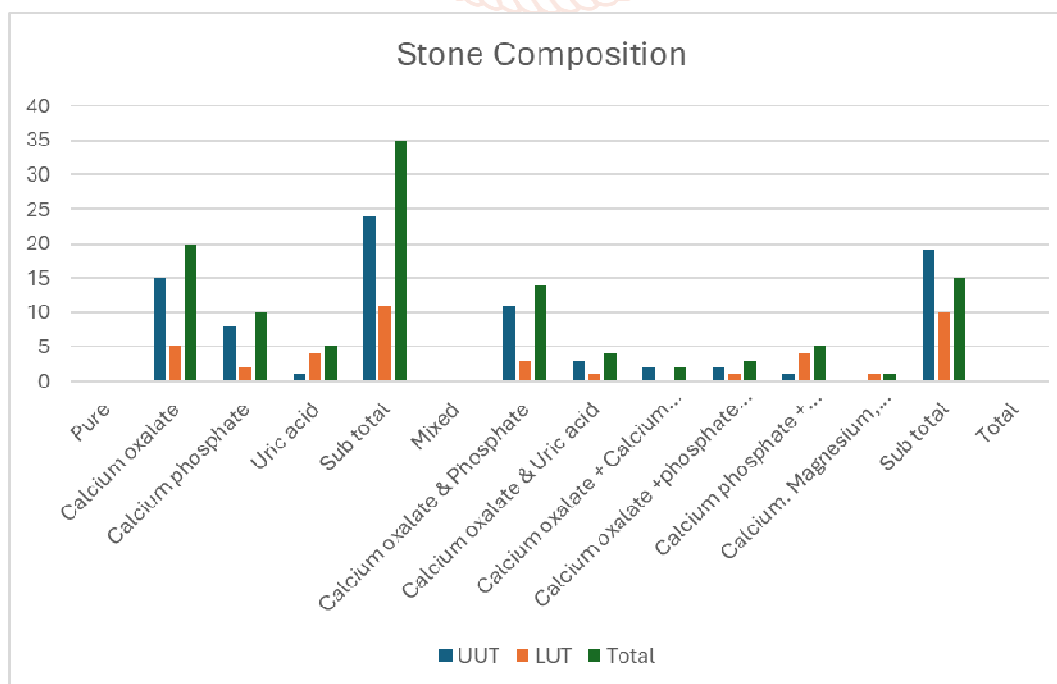
Majority of uroliths were located in the upper urinary tract. The ratio of upper urinary tract stone were common among both sexes. Urinary stone placement is somewhat influenced by the chemical makeup of the stone. A total of 64 surgically removed urinary stones, analysed presently, 43 uroliths were of upper urinary tract and the remaining 21 belonged to the lower urinary tract. The composition of uroliths in this study shows predominance of calcium oxalate followed by calcium phosphate.



Fig1: Showing Different types of Stones

Table 1: Chemical composition of stones and their site of location in the urinary tract.

Types of stone and chemical composition	UUT	LUT	Total
Pure			
Calcium oxalate	15	5	20
Calcium phosphate	8	2	10
Uric acid	1	4	5
Sub total	24	11	35
Mixed			
Calcium oxalate & Phosphate	11	3	14
Calcium oxalate & Uric acid	3	1	4
Calcium oxalate + Calcium phosphate and ammonium urate	2	0	2
Calcium oxalate +phosphate +magnesium and ammonium	2	1	3
Calcium phosphate + magnesium ,Ammonium phosphate (Struvite)	1	4	5
Calcium. Magnesium, Ammonium, phosphate & carbonate	0	1	1
Sub total	19	10	15
Total			



In our study the whole stone were categorized on the basis of pure form and mixed form. The maximum stones were obtained from the upper urinary tract. The pure form of stones were comparatively higher than of the mixed type. Among pure form the calcium oxalate stones were dominating one. They are about 20 in number, 15 were obtained from the upper urinary tract (UUT) and 5 from the lower urinary tract (LUT). Next pure form of stones are calcium phosphate that were 10 in number, eight from the upper urinary tract and 2 from lower urinary tract. The third type of stone that was among pure form were uric acid stones. Uric acid stone were 5 in number, one from the UUT and four from the LUT.

In the second mixed type, a total seven type mixed composition that were found. Type I was the combination of calcium oxalate and calcium phosphate. Such stones are about 14 in number. Eleven were collected from the upper urinary tract and three from the lower one. Group II stones were in the composition of Calcium oxalate & Uric acid. These were 4 in number, among them three were collected from the UUT and one from the LUT. Third group were the composition of Calcium oxalate, Calcium phosphate and ammonium urate. These are second least stones that were found. Only two stones were obtained and both from the upper urinary tract. Fourth group include those stones that's mineral constituent were Calcium oxalate, phosphate, magnesium and ammonium. Such mineral constituents were three in number, two obtained from the UUT and one obtained from the LUT. Fifth group stones were those that have mineral constituent Calcium phosphate, magnesium and ammonium phosphate. Stones having such combination are commonly called as Struvite. These were five in number. One obtained from the UUT and the other four obtained from the LUT. Last group stones were chemical constituents having Calcium. Magnesium, Ammonium, phosphate & carbonate. These stones were the least in number. We found only a single stone of such composition that were collected from clinics.

Conclusion

The prevalence of kidney stone is highest in male than female. Calcium containing uroliths like calcium oxalate and calcium phosphate were predominant in pure form. Cystine was rarely found. Among the mixed the highest stones were collected having mixture of calcium oxalate and phosphate followed by calcium oxalate and uric acid. Where as in pure form uric acid stones were minimally found. The proportion of bilateral and recurring stones was found to be 15% and 1.7%, respectively.

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