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CLINICO-EPIDEMIOLOGICAL STUDY OF URINARY CALCULI AND ITS BIOCHEMICAL ANALYSIS

Dr. Prakash Gurav, Dr. Santosh Dalavi and Dr. Anand H. D.*

Name of Institute/College: Government Medical College Miraj, Sangli.

***Corresponding Author: Dr. Anand H. D.**

Name of Institute/College: Government Medical College Miraj, Sangli.

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ABSTRACT

Introduction: Urolithiasis represents a major problem met within urological practice. Urinary calculi are the third most common affliction of the urinary tract, exceeded only by UTI and pathological conditions of prostate.[1] It is estimated that up to 5% of the world population is affected by this disease and the lifetime risk of getting urinary stone is 8-15%. Of course, this data varies from region to region depending upon the local climate and dietary habits of the local population. Even more so, fifty percent of patients will have recurrent stone disease within 5 years, so it can be considered a disease for life.[2] The knowledge of chemical composition of Urinary calculi may be of great importance both as a guide for the clinical management of urinary calculi and also for better understanding of physicochemical principles underlying the calculi formation that may help to give advice and suggestions for the people and educate patients to carry out preventive measures in reducing the risk of prevalence and mainly to lower the chance of recurrence of urolithiasis in this region. **Primary Objective**: To study the clinical profile of Urinary calculi and its biochemical analysis. **Secondary Objective**: To study the aetio-pathology of urinary calculi in this region and the management of urinary calculi. **Methods:** After admission to the hospital, a detailed clinical history and examination of the patient was done as per proforma. Routine blood and urine investigations were done. Specific investigations to confirm the diagnosis of Urolithiasis like CT IVP. Depending on the size and site of the calculus, the appropriate treatment for the patient will be decided. The treatment included both medical as well as surgical management. Among surgical management the procedures observed were Nephrolithotomy, Pyelolithotomy, URS guided lithotripsy, Cystolithotripsy and cystolithotomy. The calculi extracted from patients were analyzed by wet chemical method for composition of urinary calculi. **Observations and Results:** Renal calculus was the most common overall comprising 33.33% of total study subjects. Majority of the (90%) study subjects were consuming predominantly non vegetarian diet with staple diet being wheat more than rice. Urinary tract infection is the most commonly associated genito urinary disease in patients of urolithiasis found in 64.8% of study subjects. 88% of calculi were casting shadow on plain radiograph. 33.33% of study subjects urine was positive for calcium oxalate crystals which was found most commonly n this study, and other crystals identified on urine microscopy being struvite crystals and Urate crsytals. The commonest organism was E coli, next to E coli commonest were K. Aerogenosa, Staphylococci, Pseudomonas and Proteus Mirabilis. that Calcium was the most common basic radical and Oxalate was the most common acidic radical. Overall calcium oxalate and Phosphate stones(92.51%) were most common in our study, followed by uric acid stones(68.5%) and magnesium ammonium phosphate stones(33.33%). **Conclusion:** Dietary habits being an important etiological factor has not been studied in detail, so more studies should be taken up to analyze relationship between diet and urolithiasis in respective geographical areas. Urinary calculi analysis should be done on routine basis in every case of urolithiasis and based on composition dietary and lifestyle advices should be given to patient in order to prevent recurrences.

KEYWORDS: Urolithiasis, Biochemical analysis, Prevention, Recurrence.

INTRODUCTION

"I have removed the stone but God will cure the patient" - Frere Jacques

As the famous lithotomist, Frere Jacques once exclaimed Urinary stone disease in notorious for high recurrence even with modern medicines and surgeries.

Urolithiasis represents a major problem met within urological practice. Urinary calculi are the third most common affliction of the urinary tract, exceeded only by UTI and pathological conditions of prostate.[1] Each year, worldwide people make almost 3 million visits to health care providers and more than half a million patients go to emergency room with urolithiasis.[3] It is estimated that up to 5% of the world population is affected by this disease and the lifetime risk of getting urinary stone is 8-

15%. Of course, this data varies from region to region depending upon the local climate and dietary habits of the local population. Even more so, fifty percent of patients will have recurrent stone disease within 5 years, so it can be considered a disease for life.[2]

The etiology of the stones however remained obscure. The identification of composition of stones as a result of studies during last 2 centuries have definitely helped in investigating etiology of the urinary stones. Epidemiological studies indicate many factors like age, sex, industrialization, socioeconomic status, diet and environment, influences urolithiasis.[4]

The rationale for the investigation on the urinary composition of stone forming patients comes from the assumption that derangements of urine biochemistries may play a pivotal role in the pathogenesis of nephrolithiasis. Also, genetic, environmental, anatomic abnormalities of kidneys and urinary tract and dietary factors may cooperate in the pathophysiology of renal stone disease.[5]

Despite the fact that Maharashtra being a part of the stone belt known for higher incidence of urinary calculi, little attention has been paid to the factors that are involved in, or lead to the formation of urinary stones in this area.[6] Formation of stones within the urinary tract is a complication of varied metabolic disorders. Chemical analysis of urinary calculi is important for diagnosis, and therapy while knowledge of the composition of the stone is often the key to specific treatment.[7,8] As the composition of urinary calculi is known to differ from place to place the present work was, therefore, undertaken to investigate the common types of stones and their possible etiological factors.[9]

The knowledge of chemical composition of Urinary calculi may be of great importance both as a guide for the clinical management of urinary calculi and also for better understanding of physicochemical principles underlying the calculi formation that may help to give advice and suggestions for the people and educate patients to carry out preventive measures in reducing the risk of prevalence and mainly to lower the chance of recurrence of urolithiasis in this region.

AIM

To study the clinical profile of Urinary calculi and its biochemical analysis.

OBJECTIVES

- To study the clinical features of urinary calculi.
- To study the aetio-pathology of urinary calculi in this region.
- To study the management of urinary calculi.
- To study the Biochemical analysis of urinary calculi

MATERIALS AND METHODS

The present study "clinic-epidemiological study of urinary calculi and its biochemical analysis" is a hospital based prospective descriptive study which has been carried out under department of surgery in our institute during the period of Jan 2017 to Aug 2018.

Source of data: All cases of Urolithiasis admitted in various surgical wards of hospitals coming under our institute are included in the study.

Method of collection of data: Definition of study subject:

Patients with symptomatic urolithiasis admitted under the Department of Surgery at our institute satisfying the inclusion criteria.

Inclusion criteria

- All symptomatic cases of urolithiasis with radiological/ sonographic confirmation of the same.

Exclusion criteria

- Patients unwilling to undergo necessary investigations or surgical procedures.
- Pregnant women with Urolithiasis.
- Patients with terminal systemic diseases.

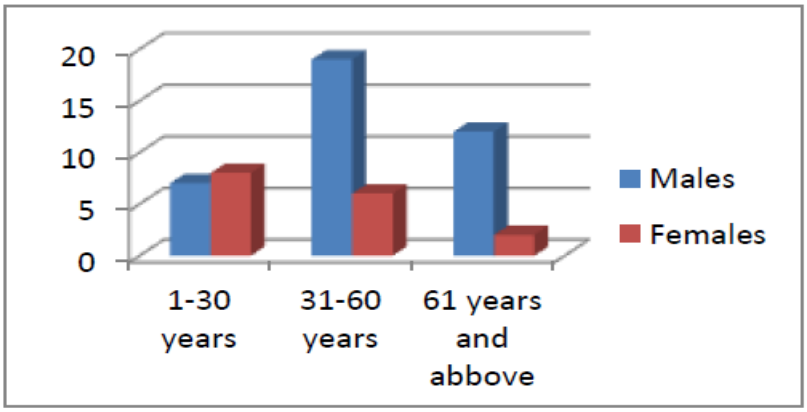
The methodology of study consists of:

- Before enrolling patients for the study, written, informed and valid consent was obtained from all patients in local vernacular. Detailed history taking and a thorough physical examination as per a proforma. Routine blood and urine investigations. Specific investigations to confirm the diagnosis of Urolithiasis. Depending on the size and site of the calculus, the appropriate treatment for the patient will be decided. The treatment included both medical as well as surgical management.

Among surgical management the procedures observed were nephrolithotomy, pyelolithotomy, URS guided lithotripsy, cystolithotripsy and cystolithotomy. All upper urinary tract calculi surgeries were followed by DJ stent insertion. Modern methods of surgical treatment like Shock wave lithotripsy and percutaneous nephrolithotomy are costly and not available in our institute. The calculi extracted from patients were analyzed by wet chemical method for composition of urinary calculi.

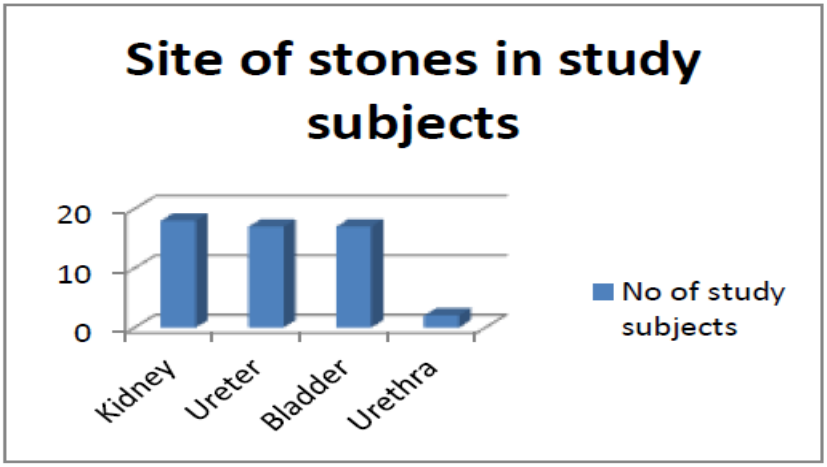
RESULTS

In the present series 54 patients of urinary calculi were studied who were admitted to the hospitals under our institute during the period of 2017 to 2018. The geopgraphical location of this hospital is such that it is the referral hospital for the area in West Maharashtra and NorthKarnataka in a radius of 50 mile covering Sangli, Kolhapur, Belagam and Satara Districts.

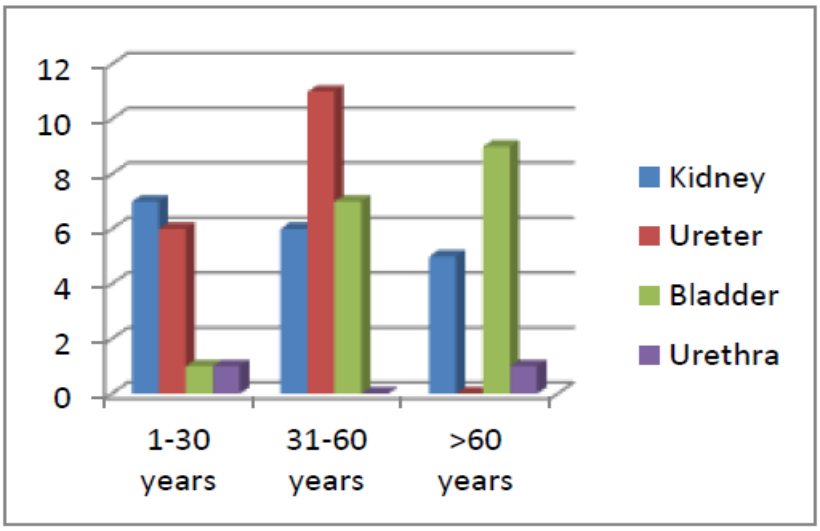


Age and Sex wise distribution: From the above table it is learnt that the incidence of urinary calculi was found maximum in the age group of 31-60 years (46.30%). In this study the youngest patient was 7 years and the oldest was 90 years. Mean age of the study group was 46.4 years. It was observed that 70.37% of the study subjects were males and only 29.63% of the study subjects were females. Male to female ratio was found to be 2.3:1.

Site of urinary stone



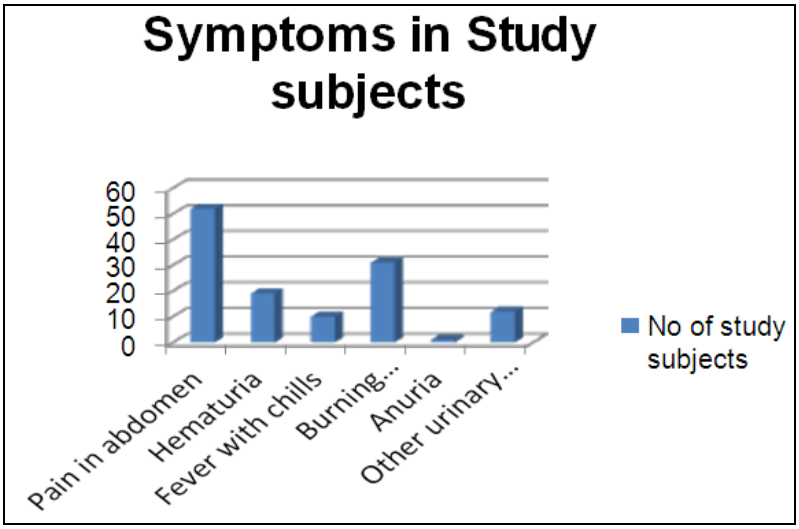
From the above tables we learnt that renal calculus was the most common overall comprising 33.33% of total study subjects. Among the 31% patients with ureteric calculi Upper ureteric calculus was found in 64.81% of patients and lower ureteric calculi in 35.19%. When observed age wise distribution betwee.



1-30 years age group renal calculi and ureteric calculi were common, between 31-60 years Ureteric calculi was most common and in age group of more than 60 years Vesical calculus was most common.

Renal calculi incidence in our study was almost same in all 3 age groups and mean age of occurrence of renal calculi being 45.11 years. Ureteric calculi were mostly in the age group of 31-60 years and mean age of occurrence of ureteric calculi was found to be 37.17 years. Vesical calculi were mostly in the age group of more than 60 years and mean age of occurrence of vesical calculi in our study was found to be 59 years.

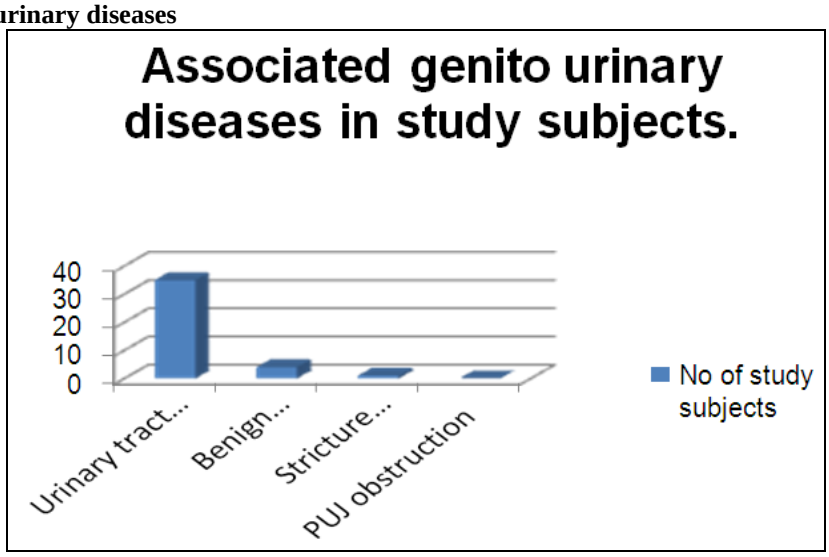
Presenting complaints: From the below table and graphs it is appreciated that Pain in abdomen is the most common complaint in patients of urolithiais (96.3%) followed by burning micturition, hematuria and fever with chills.



A majority of the patients were taking non vegetarian diet containing animal protein which was almost 81.5%, and wheat was the staple food in almost all the subjects and patients were mostly from low socio-economic status. 23% of people consumed food rich in oxalates. Average water intake was 1.2 liter.

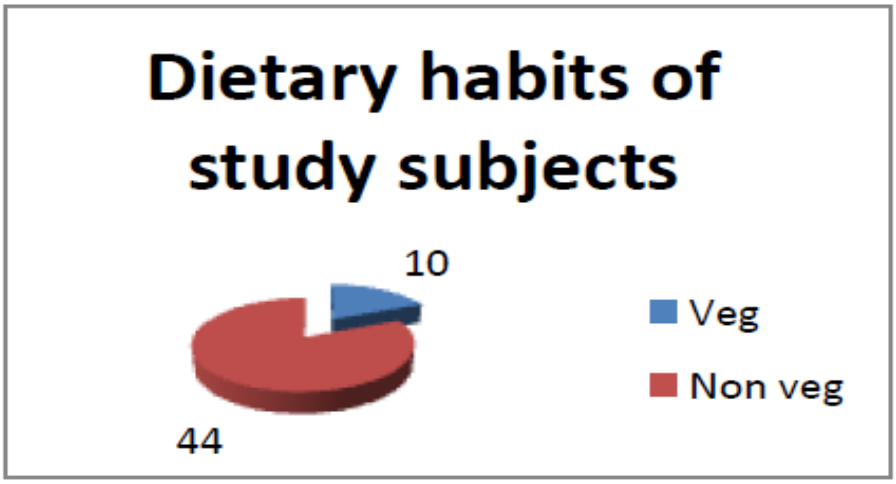
Investigations

Assosciated genito-urinary diseases



From the above table it is learnt that History of urinary tract infection is the most commonly associated genito urinary disease in patients of urolithiasis found in 64.8% of study subjects.

Dietary preferences



Haemoglobin: 14 patients had haemoglobin less than 10 gm%. **Blood Urea and Serum Creatinine:** Blood Urea and serum creatinine was above normal limit in 2 patients of renal calculi with obstructive uropathy rest of the 52 patients had blood urea and serum creatinine in normal limits **Serum calcium and Phosphorus**: The serum calcium and serum phosphorus were done in all patients in present series. The serum calcium level was above 12 g % in two patients, while rest had their serum calcium level in between 8.5 to 12 mg %. **Blood Sugar**- 3 patients were known case of diabetic milletus. The blood sugars were frequently checked in these patients. **Urine examination:** Urine examination was done in all the patients.

Urinary findings	**No of cases**	**Percentage %**
Albumin	16	29.62
Sugar	2	4
Reaction		
Acidic	44	81.48
Alkaline	10	18.51

Table showing Urine routine and microscopic analysis of study subjects

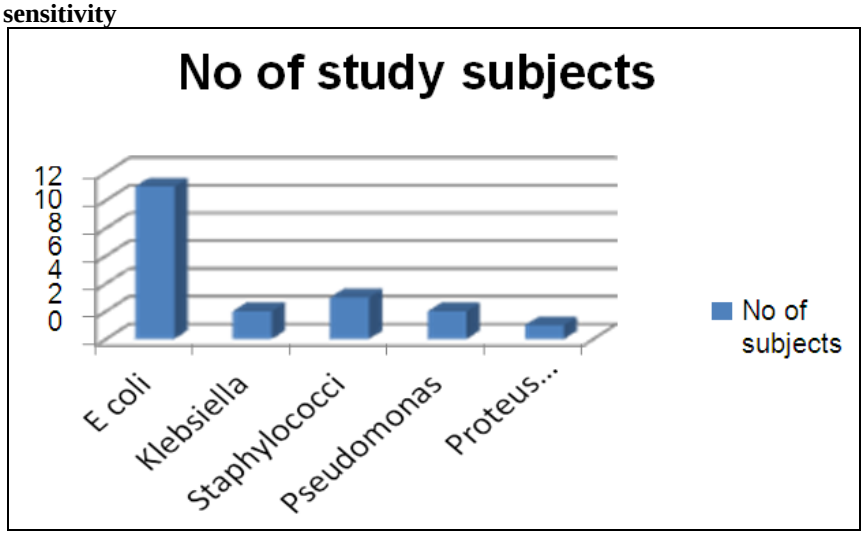
Microscopic Hematuria Pus cells	25 34	46.30 62.96
Crystals	Number	Percentage
	of	
Ca Oxalate	patients	33.33
Triple phosphate	18	5.55
Uric acid	3	7.4
	4	

commonest organism was E coli, next to E coli commonest were klebsiella, Staphylococci, Pseudomonas and Proteus Mirabilis.

24 hour urine for calcium: It was done in all subjects of which 27.7% (15) of study subjects were found to be hypercalciuric. None of these study subjects had hypercalcemia.

From the above tables and graphs it is learnt that Urine was positive for albumin in 29.62% of subjects, Urine was alkaline in 10% of subjects, Urine ws positive for red blood cells in 46.30% of patients and positive for pus cells in 62.90% of patients. 33.33% of study subjects urine was positive for calcium oxalate crystals which was found most commonly n this study, and other crystals identified on urine microscopy being struvite crystals and Urate crsytals.

Urine culture and sensitivity



Urine was cultured in all patients. The culture was positive in 19 patients and remaining patients showed negative culture. The

Imaging investigations

The number of stones are more than one in 6 patients. Some patients had unilateral or bilateral calculi, single or multiple calculi on same side, isolated renal or renal and ureteric calculi in same patient. Of 54 patients 2 were Urethral calculi hence not visualized on X ray, and rest of 3 ureteric calculi and 1 renal calculi wasn't visualized on KUB x ray.

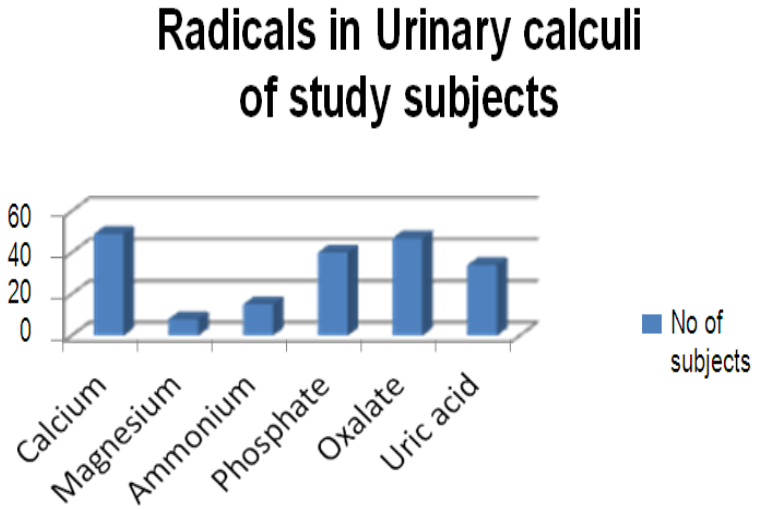
USG KUB region definitely increased the sensitivity of identification of stones as 96% of stones were identified.

Intravenous Urography was done in 18 cases of Urolithiasis out of which 1 showed poorly functioning kidney, 11 patients had back pressure changes which included 6 cases of renal calculi and 5 cases of ureteric calculi. 6 patients showed intra venous urography having normal kidneys with calculi in it.

Retrograde Urethrogram was done in 17 patients, out of which 3 showed urethral filling defects of which 2 were later confirmed to be due to urethral calculi on cystoscopy and 1 was due to stricture.

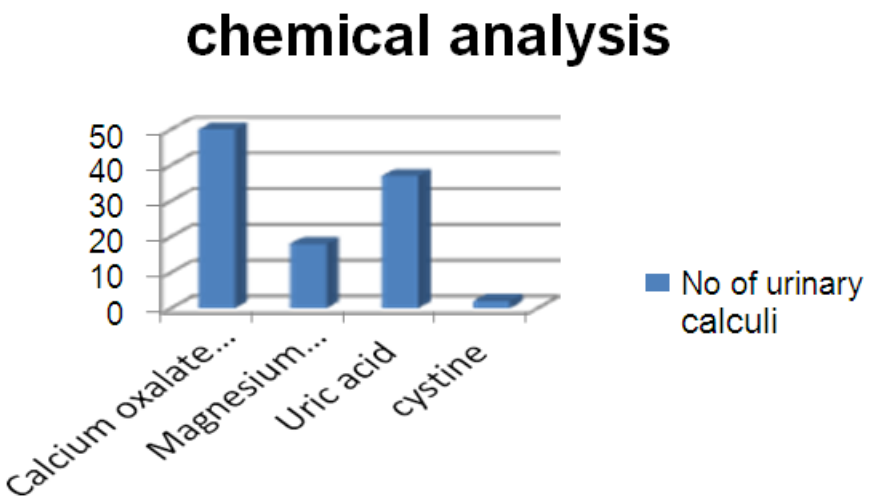
Chemical analysis of urinary calculi

In the present series the chemical study of urinary calculi from 54 patients was done. Study of each stone was done systematically. Each stone was examined macroscopically for morphology of stone, weight of stone, color, surface and measurements of stone. Maximum weight of stone was 43 gm(vesical calculi). Each stone was washed with distilled water and then dried. Chemical analysis of each stone was done by wet chemical method. Each stone was analyzed both for acidic and basic radicals. In basic radicals calcium was found in 90% of stones, Ammonia radicals found in 27% of stones while magnesium found in 14.8% stones. In acidic radicals phosphate was found in 74.8% of stones while oxalate 68.5% and uric acid radical 63%. Cystine stones were found in 2 patients in the series.



From the above table and graphs it is evident that Calcium is the most common basic radical and Oxalate is the most common acidic radical. The composition of urinary calculi in order of their occurrence in caculi in decreasing order was Calcium> Oxalate> Phosphate> Urate> Ammonium> Magnesium> Cystine. Magnesium and ammonium radicals were found more in renal calculi.

Pure calculi: There are three calcium oxalate stones, one magnesium ammonium phosphate stone, and one uric acid stone, Rest of the 49 patients had mixed calculi.



Chemical composition	No of Urinary calculi	Percentage
Calcium oxalate and calcium phosphate	50	92.59%
Magnesium ammonium phosphate	18	33.33%
Uric acid	37	68.51%
cystine	2	3.7%

Mixed Calculi: Calcium oxalate and calcium phosphate stones were found in 1 paient of renal calculi, 2 patients of ureteric calculi. Calcium oxalate, phosphate and uric acid stones were found in 9 patients of renal calculi, 9 patients of ureteric calculi, 9 patients of bladder calculi and 1 patient of urethral calculi. Calcium oxalate, magnesium ammonium phosphate with uric acid were found in 4 patients of renal calculi, 1 patient of uereteric and a patients of ureteric calculi. Calcium oxalate, magnesium ammonium phosphate stones were found in 5 patients of renal calculi, 4 patiets of bladder calculi and a patient of urethral calculi.

Magnesium was found mostly in renal and vesical calculi and always associated with ammonium and phosphate radicals.

Gross infection was present in 4 cases of renal calculi, one case of ureteric calculus and one case of bladder calculi presenting as pyuria. A case of renal calculi had frank pyonephrosis and was drained by pigtail. Ureteric and vesical patients also had positive culture with organisms being E coli, staph, pseudomonas.

The renal stone with evidence of infection showed composition of calcium phosphate, magnesium ammonium phosphate, uric acid stones while ureteric calculus with positive culture showed composition containing calcium oxalate, magnesium ammonium phosphate. In cases of vesical calculi with prostatic enlargement or urethral stricture had composition of calculi varying from calcium oxalate, calcium phosphate, uric acid to calcium oxalate with magnesium ammonium phosphate. There was no significant influence of obstruction of urine outflow on chemical composition of urinary calculi.

Stones containing calcium phosphate, calcium oxalate were mostly found between 31-60 years age group, stone containing calcium oxalate, magnesium ammonium phosphate, uric acid were mostly in first 3 decades of life. Sex of patient does not appear to have influence on typeof stones.

DISCUSSION

In present series 38 were males and 16 were female patients. Male to female ratio was 2.3:1. According to Thomas Knoll et al in a meta-analysis in which a total of 224,085 urinary stone analyses from 22 German centers, the overall male-to-female ratio was 2.4:1.[10] Male to female ratio was 3:1 according to Pushpa et al in their study in 125 patients.[11]According to the literature the

incidence in female increases with age to reach a peak during sixth decade but in our study male to female rataio was highest in sixth decade which might be attributed to the limitation of hospital based study, and females of this age group may not be having access to hospitals.

Most of our patient were from Sangli, Kolhapur,Solapur, Belgaum, Bijapur. Water in this geographical area is hard. Most recent epidemiological studies say that water hardness ranging between the values commonly reported for drinking water is not a significant factor in urolithiasis. Schwartz and coworkers (2002) found no association between water hardness and incidence of stone episodes.[12] Similarly, Abbas Basiri et al in iran and Pubin mitra et al in West Bengal conductd separate studies which proved no correlation between hardness of water and urolithiasis.[13,14]

The following were common features of the diet of present series. Majority of the (90%) study subjects were consuming predominantly non vegetarian diet with staple diet being wheat more than rice. Seema L. et al in 2013 in their series in Maharashtra showed that Urolithiasis was significantly higher in patients consuming Norther maharstrian diet consisting of Whole wheat flour with Predominant Non vegetarian diet.[15] Diet plays an important role in the pathogenesis of kidney stones. Correlation of the dietary pattern with the incidence of kidney stone disease in the Indian subcontinent had revealed that kidney stone occurred more frequently in the areas where the staple diet has been wheat than among the rice eaters.[16]

The patients in this series overall were mostly in the age group of 31-60 years age group. Pushpa et al (2010) reported that urolithiasis was more suffered by individuals between the age group of 30 to 60 years.[11] D S Qaader et al studied urolithiasis in 184 patients. Mean age was 38.3 years.[17] Francis L. Wathego et al found median age of 42 in their study of 67 patients.[18]

In the present series 35 patients of 54 gave history of urinary tract infection. Loris Broghi et al also found that nephrolithiasis was more prevalent in patients with previous history of UTIs than in patients without previous history of UTIs.[19] Huang WY et al in taiwan found that Overall, 34% of children (44% of females and 24% of males) diagnosed with urolithiasis had a history of UTIs.[20]

The present study revealed that E. coli was the predominant micro-organism recovered from mixed stones (calcium oxalate, triple phosphate and calcium phosphate). The present finding is consistent with the study of Dajani and Shahabi Bratell et al.[22,23] Golecha s et al studied urinary Ultrasonography was performed in all 54 cases and calculi were visualized in all 54 cases and also helped in evaluating hydronephrosis, hydro ureter, associated conditions like Prostatomegaly, Cystitis, etc.

Ultrasonography and KUB radiography can be performed in conjunction, enabling the higher sensitivity of ultrasonography to augment the higher specificity of KUB radiography.

In present study 31% of patients had renal calculi, 33% patients had ureteric calculi, 31% patients had bladder calculi, 1 patient had both renal and 2 patients had ureteric calculi. Upper ureteric calculi was found in 64.81% of patients and lower ureteric calculi in 35.19% of patients. Similar results were also found in study conducted by T.V.R.K Rao et al where Upper urinary tract calculi have shown up in higher percentage (60.8%) as compared to the lower 26 urinary tract ones (39.2%). No two studies had culture in 100 cases of urinary calculus and found that culture was positive in 31% of cases of which 23% was E.coli followed by pseudomonas, staphylococci which is consistent with present study.[24]

In present series 48 out of 54 cases showed radio opaque calculi on KUB. So 88% of calculi were casting shadow on plain radiograph. Rest of the 6 calculi in ureter region were not visulaised on KUB X-Ray (K-U-B) was the main investigation of choice for diagnosis of Urolithiasis in our study. All radio opaque stones (except Uric Acid stones) were diagnosed. When evaluating for new stones, KUB radiography has a sensitivity of 37.0% for stones <5 mm, but this increases to 87.5% for stones >5 mm.[25] Overall, KUB radiography is cost effective compared with other modalities for monitoring stone size in stone formers who are receiving medical therapy. similar results when it came to the incidence of stones according to different sites.

In our present study commonest basic radical was calcium and commonest acidic radical was phosphate, similar results have been obtained by studies like D. S. Qadeer et al[17], Pushpa et al[11], T.V.K.R Rao et al[26] and F. D. khan et al[27] except of Francis et al[18] attributed to less incidence of urinary tract infection with much lesser phosphate radicals. the order off incidence of radicals beings calcium>phosphate>Oxalate>urate>ammonium and magnesium in all the studies except Francis et al again probably due to lesser incidence of urinary tract infections in the study. In all the above studies calcium containing stones were found most commonly followed by uric acid stones and magnesium phosphate stones.

CONCLUSION

Dietary habits being an important etiological factor has not been studied in detail, so more studies should be taken up to analyze relationship between diet and urolithiasis in respective geographical areas. Stone composition, urinary risk factors and dietary analysis suggest that diet, dehydration and nutritional habits and urinary tract infections are the main causative factors of stone disease. Fluid intake and epidemiology of

urolithiasis suggests a sufficient intake of fluid is one of the most important preventive measures for stone formation and stone recurrence.

Urinary tract infection being an important etiology should be treated and people should be educated to get medical care in case of urinary tract infections.

Ultrasonography and KUB radiography can be performed in conjunction, enabling the higher sensitivity of ultrasonography to augment the higher specificity of KUB radiography.

Urinary calculi analysis should be done on routine basis in every case of urolithiasis and based on composition dietary and lifestyle advices should be given to patient in order to prevent recurrences not only this, there are several reasons given to pursue research into stone composition: (i) to provide an understanding of the nature of the underlying metabolic disturbances that lead to the urolithiasis; (ii) with the advent of ESWL, to be able to predict the stone fragility and hence the suitability of a given patient for a given protocol (iii) to predict the basic wavelength of laser light to be used for maximum effect in treatment; and (iv) to permit urologists to advise patients on how to prevent further recurrence.

Prevention of recurrence should be considered seriously while discharging patient and advices about change of diet with respect to calculi, about consumption of fluids and regualr follow up should be given to patients. Metabolic disorders if any underlying the urolithiasis understood wiith calculi analysis should be dealt with respectively.

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