Original Research Article

Urinary Calculi: A Biochemical Analysis at M.G.M. Medical College and L.S.K. Hospital in Kishanganj

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Abstract

Background: Renal stones are common conditions that results in substantial morbidity and financial costs. In developing countries, the prevalence of urinary tract stones varies from 4–20 %. The urinary excretion of promoters and inhibitors of stone production, as well as the development of systemic diseases possibly linked to secondary nephrolithiasis, should be the subject of an appropriate metabolic examination. This study aimed to identify the association between the pathogens of urine and stone matrices, and to perform the biochemical analysis of stones, and assess the nature of urinary status in this part of Bihary, so that we can give appropriate dietetic advice to patients post operatively. **Methods:** A total of 100 cases of urolithiasis admitted for elective stone removal at Department of surgery, M.G.M. Medical College were enrolled during the study period of January 2019 to November 2019. Preoperative investigation and postoperative qualitative biochemical analysis of stones was also attempted. **Result:** Stones from all 100 patients were subjected to qualitative biochemical analysis. The most common type of stone was calcium oxalate 70(70.0%); others were calcium oxalate phosphate 15(15.0%), s uric acid 10(10.0%), and calcium car bonate5(5.0%). **Conclusions:** Urinary tract stones are linked to dietary patterns. Nutritional risk factors for urolithiasis include a diet with a high calorie content, as well as calcium and oxalate consumption. Diet, dehydration, and inadequate nutrition seem to be the causative factors of stone formation.

Key Word: nephrolithiasis, urolithiasis, calcium Oxalate, calcium Oxalate phosphate, calcium uric acid, calcium carbonate.

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INTRODUCTION

The research into the urinary composition of stone-forming patients is based on the hypothesis that abnormalities in urine biochemistry may play a key role in the pathogenesis of nephrolithiasis. In the pathophysiology of renal stone disease, anatomic anomalies of the kidneys and urinary tract, hereditary, environmental, and dietary factors may all play a role.[1,2]

Many substances' urinary excretions (e.g., water, electrolytes, nitrogen, acid, and alkali) are dependent on glomerular filtration and subsequent tubular treatment, which is normally modulated to maintain their external balance. In other cases (for example, fasting hypercalciuria syndromes, renal tubular acidosis, and cystinuria), genetic conditions may have a significant impact on the tubular handling of stone promoters and inhibitors, as well as their urinary pattern.[3,4] Despite the fact that nephrolithiasis is a multifactorial condition, the analysis of the susceptibility for the crystallization of stone-forming salts in urine remains the most straightforward method for a nephrologist to predict the likelihood of stone disease relapse in specific patients.[5] A appropriate metabolic review should also focus on the prevalence of systemic disorders possibly complicating secondary nephrolitiasis,

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such as endocrine disorders, intestinal malabsorption, and bone diseases, in addition to the assessment of the urinary cycle of promoters and inhibitors of stone forming.[6,7] Furthermore, metabolic investigations should provide accurate details on the patient's dietary schedule, allowing the surgeon to further identify the disease's pathophysiology and check the patient's compliance with the recommended therapies. Urinary system stone disease is one of most frequently encountered diseases in the urology practice. The stones are frequently seen in the urinary tract, and most of them require intervention. With the introduction of extracorporeal shock wave lithotripsy (ESWL) into clinical practice after 1980s, a new era had begun in the treatment of urinary system stone disease.[8] In recent years, percutaneous nephrolithotomy (PNL) in taking greater part in the treatment of stone disease with success rates nearing to 80 percent.[9] These technological advancements have decreased the role of open surgery considerably in the treatment of kidney stones. Nowadays, techniques of retrograde intrarenal surgery (RIRS), and other minimally invasive treatment modalities have found increasingly greater field of application. Subsequently, advanced technology has nearly eliminated the indication for open stone surgery. Thanks to the development of minimally invasive techniques, efficacy, and success of surgery in the management of renal stones have been more frequently questioned. Success, and complications of the surgical method to be selected should be very well known, and used in suitable indications.

Aims

Aim of this study in to assess the nature of urinary status in this part of Bihary, so that we can give appropriate dietetic advice to patients post operatively.

METHODS

This cross-sectional descriptive study was conducted in the Department of Surgery in collaboration with Department of Biochemistry. A total of 100 patients having urolithiasis, admitted at M.G.M. Medical College and L.S.K. Hospital Kishanganj, Bihar., for elective stone removal between January 2019 to November 2019 were enrolled. Informed consents were taken from the patients. The demographic details and associated factors with urolithiasis such as Hyper parathyroidism and family history of stone disease, history of hypertension, diabetes mellitus, and gout were recorded in predesigned proforma.

Sample Preparation,

The midstream urine specimen was cultured from each patient before surgical stone removal. The stone was also collected from the same patient after surgery and several biochemical tests were done in the department of biochemistry.

Preparation and Processing of Urinary Stone:

After the surgical removal, the stone sample was washed several times with sterile water and each stone was then divided into two parts, as symmetrical as possible. The stone was crushed into powder by sterilized mortar and pestle and was then used for Biochemical analysis.

Analysis of Chemical Compositions of Stones

The qualitative biochemical analysis of compositions of each stone was done for carbonate, calcium, magnesium, phosphate, oxalate, uric acid, and cysteine, using stone powder derived from of stone sections.

Statistical Analysis

All data collected were entered in MS excel 2007 and analysed using SPSS 21.0. For descriptive analysis, percentage and ratio were calculated with tabular presentation of analysis.

For inferential statistics, the unpaired *t* test was applied to find out the relationship between dependent and independent variables. values <0.05 were considered statistically significant.

RESULTS

Table 1: Age and Sex distribution among study population(n=100).

Age Group in Year	Male		Female		Total	
	No of Cases	Percentage	No of Cases	Percentage	No of Cases	Percentage
20 – 30	05	8.3	05	12.5	10	10.0
31 – 40	15	25.0	05	12.5	20	20.0
41 - 50	05	8.3	10	25.0	15	15.0
51 – 60	31	51.7	20	50.0	51	51.0
>61	04	6.7	00	00	04	4.0
Total	**60**	**100**	**40**	**100**	**20**	**100**
Mean and SD value	47.34±11.01		43.98±11.25			
	p Value -0.621					

Age and Sex distribution among study population found out of 20 cases male were 12(60%) and female were 08(40%). Male were predominately high. The male and Female ratio is 1.5:1. Mean and SD value of Male group was 47.34±11.01 and Female group was 43.98±11.25, statistically not significant p value was 0.621.

Table 2: Socio Demographical status. (n=20)

Occupation	No of Cases	Percentage
Housewives	35	35.0
Business	25	25.0
Labours	20	20.0
Service	15	15.0
Students	05	5.0
Total	**100**	**100.0**

Occupational status among study population 35% were Housewives, 25 % Business, 20% were Labours,15% were Service holders, and Student was 5 % respectively.

Table 3: Comorbidities(n=20)

Comorbidities	No of Cases	Percentage
Hypertension	25	25.0
Diabetes	15	15.0
Gout	05	5.0
No comorbidities	55	55.0
Total	**100**	**100.0**

Regarding comorbid conditions, 25 (25.0%) respondents were hypertensives and 15 (15.0%) were diabetics. while 05 had gout (5.0%).

Table: 4. Stone location. (n=20)

Stone location	No of Cases	Percentage
Nephrolithiasis	55	55.0
Ureterolithiasis	35	35.0
Urinary bladder	10	10.0
Upper urinary tract	80	80.0
Lower urinary tract	20	20.0

Regarding stone locations, in the present study, 55 (55.0%) had nephrolithiasis, 35 (35.0%) ureterolithiasis, and 10 (10.0%) had urinary bladder stones. Upper urinary tract stone constituted 80.0% and lower urinary tract stone 20.0% in the ratio of 4 : 1.

Table 5: Qualitative biochemical analysis

Biochemical analysis	No of Cases	Percentage
Calcium Oxalate	70	70.0
Calcium Oxalate Phosphate	15	15.0
Calcium Uric Acid	10	10.0
Calcium Carbonate	05	5.0
Total	**100**	**100.0**

Stones from all 100 patients were subjected to qualitative biochemical analysis. The most common type of stone was calcium oxalate 70(70.0%); others were calcium oxalate phosphate 3(15.0%), uric acid 10(10.0%), and calcium carbonate 5(5.0%).

DISCUSSION

Males accounted for 60 (60 %) of the sample population's age, while females accounted for 40. (40 %). Males were in the majority. The ratio of males to females is 1.5:1. The male group's mean and SD values were 47.34±11.01 and 43.98±11.25, respectively, with a statistically insignificant p value of 0.621.Among the study participants, 50 (56.8%) were male and 38 (43.2%) were female. Although nephrolithiasis continues to be more common in men, the male-to-female ratio with urinary tract stones has narrowed from 3.1 to 1.3 from 1970 to 2000 [10] and from 1.6: 1 to 1.2: 1 from 1998 to 2003.[11] The striking new trends of increased incidence of stone formation in women might be due to associated risk factors such as increasing obesity, dietary changes, and change in fluid intake patterns. In the context of our study, male preponderance was observed. It can be attributed to the effect of sex hormones on some lithogenic risk factors and concentration of lithogenic factors in the urine which is greater in men than that in women.[12,13] Occupational status among study population 35% were Housewives, 25 % Business, 20% were Labours,15% were Service holders, and Student was 5 % respectively. As reported by Vhlensieck *et al.*[14] and Kadir *et al.*[15], our data also showed that the frequent occupational group was prone to develop urinary stones with sedentary life styles like housewives, business (shopkeeper), and service holders. Sedentary lifestyle predisposes to sedimentation of urinary, and crystals trapped by gravity in the inferior calices of the kidney.[16] Regarding comorbid conditions, 25 (25.0%) patients were hypertensives and 15 (15.0%) were diabetics. while 5 had gout (5.0%). Several studies have established hypertension as an independent risk factor of urolithiasis[17] with a proposal that abnormalities in renal calcium metabolism exist among patients with hypertension, leading to increased urinary calcium excretion.[18] Our findings of 12 hypertensive patients having calcium oxalate stones and one with calcium uric acid stone are in concordance with the abovementioned studies. Regarding stone locations, in the present study, 55 (55.0%) (had nephrolithiasis), 35 (35.0%) ureterolithiasis, and 10 (10.0%) had urinary bladder stones. Upper urinary tract stone constituted 80.0% and lower urinary tract stone 20.0% in the ratio of 4:1. Our results have been consistent with study of Ahmed *et al.*[19] who reported increased frequency of renal stones. Kidney acts as a first barrier filter for crystals, thereby damaging tubular epithelium, which acts as a nidus for the stone formation. However, our result was different from the study of Venkatramana who observed the increased frequency of ureteric stone.[20] This variation might be due to selection of the patients irrespective of site of the stones. Stones from all 100 patients were subjected to qualitative biochemical analysis. The most common type of stone was calcium oxalate 70(70.0%); others were calcium oxalate phosphate 15(15.0%), calcium uric acid 10(10.0%), and calcium carbonate 5(5.0%). The present study supports studies from north India and Brazil, which reported calcium oxalate as the most common constituent of urinary stones.[21] As reported in literature, dietary habits are associated with urinary tract stones. Increased animal protein, high calorie content, as well as calcium and oxalate intake in the diet [22] are considered nutritional risk

factors for urolithiasis. A study from Marathwada, India, has shown that the incidence of urolithiasis increases with consumption of diet containing groundnuts, tomato, spinach, and animal proteins and with a greater use of salt. Stone composition, urinary risk factors, and dietary analysis suggest that diet, dehydration, and poor nutrition are the causative factors of stone diseases.[23]

CONCLUSION

Dietary habits are associated with urinary tract stones. Increased high calorie content, as well as calcium and oxalate intake in the diet is considered nutritional risk factors for urolithiasis. Stone composition, urinary risk factors, and dietary analysis suggest that diet, dehydration, and poor nutrition are the causative factors of stone diseases. As because the incidence of calcium oxalate stones are maximum in number in our study, so we can advice our patients post operatively to avoid those things in the diet rich in oxalate.

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