Frequency Of Different Types Of Renal Stones By Composition In Patients Reported At Tertiary Care Hospital.

Muhammad Ali Suhail[1], Nasrullah Aamer[2], Mumtaz ali chandio[3], Bhagwani[4], Aijaz Hussain Memon[5], Mujeeburehman Sahito[6],Ashok Kumar Lohano[7]

Abstract

Background: Renal stones are global health concern all over the world. **Objectives:** Analyze and checking frequency of renal stones by composition **Design: cross sectional. Sample size:** 385 **Setting:** People's medical university hospital Nawabshah**. Duration:** January 2017 to January 2019**. Methodology:** All male and female patients with history of renal stones confirmed by ultrasound, x-ray KUB and followed by stone passing by medical and removal by surgical interventions. After receiving stone sample it was sent to laboratory for composition analyses. **Results:** Regarding the assessment of different type of renal stones, calcium oxalate was 102(26.5%), uric acid stone 125(32.5%), oxalate stone 123(31.9%), phosphate stones 29(7.5%), magnesium stones 01(0.3%), ammonium stone 01(0.3%), struvate stone 01(0.3%), aspirate stone 01(0.3%) and cystine stone 05(0.5%). **Conclusions:** present study concluded that uric acid stone, oxalate, calcium oxalate and phosphate stone were common in our setup

Keywords: Renal Stones**,** Calcium Oxalate, Uric Acid.

1. Professor, urology, PUMHSW,SBA
2. Associate professor, medicine, PUMHSW,SBA
3. Assistant professor, urology, PUMHSW,SBA
4. Lecturer, communitymedicine, PUMHSW,SBA
5. Assistant professor, urology, PUMHSW,SBA
6. Assistant professor, Anatomy, PUMHSW,SBA
7. Assistant professor, medicine, PUMHSW,SBA

Correspondence: Prof. Muhammad Ali Suhail, department of urology, PUMHSW, SBA

Email: talktouroman@gmail.com

INTRODUCTION:

Nephrolithiasis or stones in the kidneys are a universal issue of public. As the incidence increases, economic burdens grow to both unindustrialized and industrialized countries. Systemic illnesses such as type 2 diabetes, obesity, dyslipidemia and hypertension have been observed to be associated with kidney stones. The surrounding environment with everyday life patterns takes an important role for the development of stones. Most common clinical scenario in these situations is kidney pain so the early management should not be too late otherwise there is chance that calculus may develop again in fifty percent of subjects. The logic behind this statement is to analyze the mechanism of stone formation due to alteration in physiology and pathology of normal mechanisms which prevent and increase the chance of stone formation and assess the different aspects of management for to prevent and treatment options for nephrolithiasis. The incidence of kidney stones is constantly increasing from the last half century in different geographical locations round the globe including the developed and developing nations[1]. Renal stones are considered to be different in the developing countries in comparison to the developed nations [2]. It can develop at any age but the highest numbers of cases are observed in subjects between the ages of 20 -49 years

and more cases are seen in male subjects. In the developed nations the incidence of stones in urinary tract ranges between 04-20%[3,4]. The prevalence of urinary tract stones in Spain, Scotland and Italy was noted as; 10%, 03.5% and 01.2% respectively [5,6]. In Greenland and sea side regions of Japan prevalence of renal stones is rare. The frequency of urinary tract stones in USA was 10.6% in males and 07.1% in females and on average one in every 11 Americans usually develops renal stones once in their life [3,7] In underdeveloped nations the urinary bladder calculi are more than the rest of the urinary tract calculi and in the developed nations upper urinary tract stones are more common. It is predicted that the prevalence of the kidney stones will rise to 40.00% to 56.00% by 2050 due to the consequences of universal warming up [7]. Subjects suffering from obesity and diabetes mellitus are at higher risk to develop renal stones than others. Recurrence of kidney stones is up to 50.00% in five years from the primary stone incident. The reasons for this high recurrence rate of kidney stones are still not well established. So it is not possible to access that in which subject will have recurrence. Natural history of renal stone ailment and higher rates of relapse necessitates vigilant diagnostic assessment and timely management. Urinary tract stones have various types and also occur with different frequencies. The commonest type is the calcium oxalate (75%) followed by calcium phosphate (15%), uric acid (8%), struvite (01%) and cysteine (<1%) respectively. For the ideal treatment of renal stones it is important to correctly identify the different nature of kidney stones.

Studies are available widely representing the different geographical areas but our setup was lacking. Proper diagnosis and timely management along with future and general preventable measures may affect the mortality and morbidity outcomes due to renal tract stones.

Rationale

The main objective of current research was to assess the different urinary system stones by their major chemical constituents.

Objectives: Analyze & checking frequency of renal stones by composition

Design: cross sectional

Sample size: 385

Setting: People's Medical University Hospital Nawabshah

Duration: January 2017 to January 2019

MATERIAL AND METHODS

Participants: All male and female patients with history of renal stones confirmed by ultrasound, x-ray KUB and followed by stone passing by medical and removal by surgical interventions. After receiving stone sample it was sent to laboratory for composition analyses.

Data collection

After permission of hospital ethical committee and taking informed written consent from patients and their next of kin data was collected on written proforma and the study was carried.

Urinary stones were diagnosed by detailed history and patient's examination with recommended investigations.

This cross-sectional study comprised of 385 subjects with calculus in renal system, between 20 - 70 years from district Shaheed Benazirabad Sindh Pakistan. Present research was carried out at PMCH Nawabshah from January 2017 to January 2019. The subjects that were attended the clinic for consultation were enrolled and included in present research.

Data was collected and entered from the department of urology and entered in predesigned proforma. Investigations in relation for the diagnosis and further management including x-rays, abdominal ultrasound and CT scan of kidney, ureter and

bladder were carried out before the interventions. The stone sample obtained for chemical analysis to the laboratory to assess the chemical nature of stone at PMCH research laboratory.

Statistical analysis

The qualitative variables like gender, age with age group and other demographic parameters were entered in proforma, the quantitative variables were also entered in data sheet after data entry it was analyzed by SPSS 20.0 version. Demographic and other parameters were checked by in terms of frequency and related percentages. Correlations of stone with gender were cross tabulated. Level of significance was assessed thru p-value if <0.05. Pearson chi square with Likelyhood ratio with other values was assessed.

Results:

In present research 385 subjects with renal stone were included, minimum age of subjects were 18 years and maximum was 66 years, mean age was 36.60±11.87 years.

Table 1.Demographic variables of study

Regarding the different age groups in Age Group 20-40 Years Young Age there were 246 (63.9%), 41-60 Years Middle Age 134 (34.8%) and >60 Years Old Age 5 (1.3%). **In relation to Gender there were**Male 265 (68.8%), Females 120 (31.2%). Married 261 (67.8%) and Unmarried 124 (32.2%). **By Occupation there was** No Occupation 88(22.9%), House Wife 93 (24.2%), Manual Worker 176(45.7%) and Office Worker 28(7.3%). Educated 277 (71.9%) and Uneducated 108(28.1%). **Address wise belonging** Rural 295(76.6%) and Urban 90(23.4%). **Socioeconomic Class** Lower Class 348(90.4%), Middle Class 29(7.5%), Upper Class 8(2.1%). **Regarding History of Addiction** there was No Addiction in 288(74.8%) Addiction in 97(25.2%).**Family History of stone was** Positive for 267(69.4%) Negative Family Hx in 118(30.6%).**Table 1.**

Table 2. X-Ray KUB, Ultrasound KUB, CT scan KUB and Location wise presence of stone

In X-Ray KUB stone shadow was seen 313(81.3%) and stone shadow not seen in 72(18.7%) patients. **On Ultrasound KUB** stone was present in 364(94.5%) and stone absent in 21(5.5%) patients. **On CT scan KUB** stone was present in 370(96.1%) patient and stone absent 15(3.9%)

The size of stone was <5mm186(48.3%), 5-10mm 59(15.3%), 10-20mm 49(12.7%), 21-30mm 15(3.9%), 31-40 mm 24(6.2%), 41-50 mm 24(6.2%), 41-50 mm 50(13.0%) and >50mm 2(.5%) patients. **Location wise presence of stone was in** Right Kidney 167(43.4%), Left Kidney 138(35.8%), Right Ureter 26(6.8%), Left Ureter 27(7.0%), and Urinary Bladder 18 (4.7%) and in the Urethra 9(2.3%).

Figure 1. Frequency and percentage of different types of stones

Regarding the laboratory assessment of different type of renal stones, calcium oxalate was 102(26.5%), uric acid stone 125(32.5%), oxalate stone 123(31.9%), phosphate stones 29(7.5%), magnesium stones 01(0.3%), ammonium stone 01(0.3%), struvate stone 01(0.3%), aspirate stone 01(0.3%) and cystine stone 05(0.5%),

Table 3. Type of stone and Gender Cross - tabulation

Regarding the assessment of different type of renal stones in male subjects a total of 265 (68.5%), calcium oxalate was 84(21.8%), uric acid stone 44(11.4%), oxalate stone 110(28.6%), phosphate stones 21(5.5%), magnesium stones 01(0.3%), ammonium stone 01(0.3%), struvate stone 01(0.3%), aspirate stone 01(0.3%) and cystine stone 02(0.5%),

Regarding the assessment of different type of renal stones in female subjects a total of 120 (31.2%), calcium oxalate was 18(4.7%), uric acid stone 81(21.0%), oxalate stone 13(3.4%), phosphate stones 8(2.1%),

magnesium stones 0 (0.0%), ammonium stone 0 (0.0%), struvate stone 0 (0.0%), aspirate stone 0 (0.0%), and cystine stone 0 (0.0%),

Chi square test for gender with type of stone Pearson chi square was 101.813[a], df 8, Asymp. sig.(2-sided) .000. Likelyhood ratio 103.345, df 8, Asymp. sig.(2-sided) .000. Linear by linear association was 5.251, df 1, Asymp. sig.(2-sided) .022.

For 385 valid cases that were patients the Interval by interval pearsons R value was -.117, Approx. Sig . .022. Ordinal by ordinal Spearman correlation value was -.116, Approx. Sig .023.

Table 1. Demographic variables of study. N=385

variable	Sub variable	Frequency	Percent
Age Group	20-40 Years Young Age	246	63.9
	41-60 Years Middle Age	134	34.8
	>60 Years Old Age	5	1.3
Gender	Male	265	68.8
	Female	120	31.2
Marital Status	Married	261	67.8
	Unmarried	124	32.2
Occupation	No Occupation	88	22.9
	House Wife	93	24.2
	Manual Worker	176	45.7
	Office Worker	28	7.3
Education	Educated	277	71.9
	Uneducated	108	28.1
Address	Rural	295	76.6
	Urban	90	23.4
Socioeconomic Class	Lower Class	348	90.4
	Middle Class	29	7.5
	Upper Class	8	2.1
Addiction	No Addiction	288	74.8
	Addiction	97	25.2
Family History	Positive Family Hx	267	69.4
	Negative Family Hx	118	30.6

Discussion

The kidney stones are common resulting in substantial morbidity and financial load. Its occurrence ranges between 04-20% in the industrialized nations. Urinary tract stones are of various types out of them the calcium oxalate stones are the most common type of stones.The stone formation is related with different urinary as well as dietary and non-dietary risk factors. The renal stones are frequently associated with systemic ailments such as obesity, diabetes mellitus and hypertension. This relationship with systemic diseases signifies the role of nutritional and lifestyle revolution in the occurrence, relapse and probable prevention. Renal stones are the most common urological disease [8]. A renal stone does not permanently remain in kidneys, they may pass to the ureters, when small stones can pass to the urinary bladder but when stones are large in size they are difficult to pass through ureter and may cause problems. During passage of stones from ureter could result in spasm, irritation, and haemeturia. Urinary obstruction could result due to the block of urinary flow. Urinary blockage may result in renal infection and impairment.

Kidneys are usually involved more by stones in comparison to the ureter and urinary bladder. Calcium, oxalate, and uric acid are the common constituents of urinary tract stones. The configuration of stones is helpful in stone prevention [9].It is a common disorder with annual prevalence of 8/1000 adults [10]. In event of renal colic first exclude the other conditions, immediately refer to the emergency department, and use NSAIDS to relieve the pain. In the diagnosis; the urinalysis, urinary culture, and imaging are carried out. In situations where the stone is more than 10mmearly removal of the stone is advised [10].

Controlling pain and using an alpha blocker as an expulsive remedy are used in

Table 2. Variables of study. N=385			
		Frequency	Percent
X-Ray Stone	Stone Shadow Seen	313	81.3
	Stone Shadow Not Seen	72	18.7
Ultrasound KUB	Stone Present	364	94.5
	Stone Absent	21	5.5
Ct Scan KUB	Stone Present	370	96.1
	Stone Absent	15	3.9
size of stone in mm	<5mm	186	48.3
	5-10mm	59	15.3
	10-20mm	49	12.7
	21-30mm	15	3.9
	31-40 mm	24	6.2
	41-50 mm	50	13.0
	>50mm	2	.5
location of stone	Right Kidney	167	43.4
	Left Kidney	138	35.8
	Right Ureter	26	6.8
	Left Ureter	27	7.0
	Urinary Bladder	18	4.7
	Urethra	9	2.3

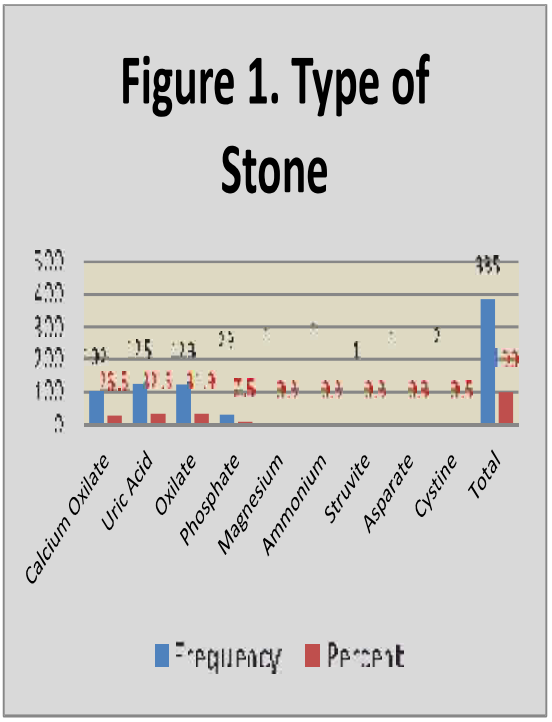

Table 3. Gender * type of stone Cross-tabulation												
			Type of Stone									Total
			Calcium Oxilate	Uric Acid	Oxilate	Phosphate	Magnesium	Ammonium	Struvite	Asparate	Cystine	
Gender	Male	Count	84	44	110	21	1	1	1	1	2	265
		% of Total	21.8%	11.4%	28.6%	5.5%	.3%	.3%	.3%	.3%	.5%	68.8%
	Female	Count	18	81	13	8	0	0	0	0	0	120
		% of Total	4.7%	21.0%	3.4%	2.1%	.0%	.0%	.0%	.0%	.0%	31.2%
Total		Count	102	125	123	29	1	1	1	1	2	385
		% of Total	26.5%	32.5%	31.9%	7.5%	.3%	.3%	.3%	.3%	.5%	100.0%

Chi-Square Tests			
	Value	df	Asymp. Sig. (2-sided)
Pearson Chi-Square	101.813[a]	8	.000
Likelihood Ratio	103.345	8	.000
Linear-by-Linear Association	5.251	1	.022

Symmetric Measures					
		Value	Asymp. Std. Error[a]	Approx. T[b]	Approx. Sig.
Interval by Interval	Pearson's R	-.117	.039	-2.304	.022[c]
Ordinal by Ordinal	Spearman Correlation	-.116	.048	-2.278	.023[c]

conservative management. To observe the location of stone and evaluate hydro-nephrosis a follow-up imaging is usually advised in two weeks.

Serial imaging is required in all subjects with asymptomatic renal stones. In case of increase in the size of stone, recurrent symptoms and infections, and lack of access to health facility are indications for stone removal.

In all subjects for evaluation of the recurrence of stones, complete medical history, essential laboratory investigations and imaging should be performed. Increased fluid intake is recommended in all all subjects with any type of renal stones. In subjects with recurrent calcium stones, thiazide diuretics, allopurinol or citrates are given. Further metabolic evaluation and modified preventive measures are advised for those subjects with high risk of stone recurrence [10].

Different authors has reported different percentages of stones as in study by Khalil et al the percentage of calcium oxalate and uric acid were 29.1% [11]. The frequency of calcium oxalate was 10.4% and that of calcium phosphate was 07.00% in study by Rafique et al [12]. Calcium phosphate in 05.00% [13], uric acid in 19.00% and 03.00% subjects were with struvite [14].

Urinary tract stones are common and have a substantial problem in the working age group; a data published by NHANES (National Health and Nutrition Examination Survey) in 1994 assessed the frequency of renal stones as 06.3% in male and 04.1% in female subjects [15]. Also new data suggest increasing consumption of health care sources for managing subjects with urinary tract stones[16,17]. Conversely in USA from 1994 onwards there had been no countrywide demonstrative calculation about the occurrence of renal stones. So it is indistinct still about the claims data reflecting the changes in pattern of caring or alteration in the renal stone epidemiology.

Current data proposes factors like diet and lifestyle as the chief risk factor in developing the urinary tract stones. Nurses' Health Study I and II and Health Professionals Follow-up Study had shown the relationship among renal stones and diabetes, BMI (Body Mass Index) and weight gain [18,19].In United States the epidemiology of renal stones has changed; the hypothesis supporting these findings collective with obesity endemic [20].

Examination of stone is done to determine their nature. For crystals, blood, bacteria and white cells urinalysis is performed. Blood tests like, calcium, phosphorus, uric acid, and electrolytes, BUN (Blood Urea Nitrogen) and creatinine for assessment of renal function.

Abdominal x-rays, IVP (intravenous pyelogram), retrograde pyelogram, renal ultrasound, MRI abdomen and kidneys, CT scan abdomen are done to rule out any obstruction. Renal function may be impaired by the use of contrast dye during CT scan and IVP, though it is not impaired in persons with normal renal function. Also few drugs can augment the kidney damage in aggregation with dyes. CT scan non-contrast is very useful investigation for identification of nearly all types of stone. Ultrasound is cost effective without radiation but is observer reliant.

CONCLUSION

The frequency of reported cases of renal stone is increasing day by day, it is matter of concern. Renal stones are responsible for disabling due to clinical problems and are responsible factor for renal failure. The modified investigating and therapeutic tools has made a better management of renal tract stones. The comorbidities associated with renal diseases directs towards diet as one of responsible factor for renal stones. On other hand the climatic changes in terms of increased heat waves in our setup by record

breaking of temperature values play vital role in development of renal stones thru disturbing the fluid and electrolyte imbalances. Increase fluid intake and dietary restriction with modification in life style is an important tool to prevent from development of renal stones.

References

1. Daudon, M., Traxer, O., Williams Jr, J. C., & Ba-zin, D. C. Randall's plaques. In Urinary Tract Stone Disease Springer London. 2011. 103-112.
2. López M and Hoppe B. History, epidemiology and regional diversities of urolithiasis. Pediatr Nephrol 2010;25:49-59.
3. Scales CD Jr et al.; Urologic Diseases in America Project. Prevalence of kidney stones in the United States. Eur Urol. 2012; 62(1):160-5.
4. Trinchieri A. Epidemiology of urolithiasis. Arch Ital Urol Androl. 1996;68:203-49.
5. Hesse A et al. Study on the prevalence and incidence of urolithiasis in Germany comparing the years 1979 vs. 2000. Eur Urol. 2003;44(6):709-13.
6. Trinchieri A et al. Increase in the prevalence of symptomatic urinary tract stones during the last ten years. Eur Urol. 2000;37(1):23-5.
7. Romero V et al. Kidney stones: a global picture of prevalence, incidence, and associated risk factors. Rev Urol. 2010; 12(2-3):e86-96.
8. Spivacow FR, Del Valle EE, Lores E, Rey PG. Kidney stones: Composition, frequency and relation to metabolic diagnosis. Medicina (B Aires). 2016;76(6):343-348.
9. Altaf J, Arain AH, Kella NL, Shafique-ur-Rehman. Chemical Analysis of Urinary Stones and its Locations Associated to Urinary Tract. JLUMHS SEPTEMBER-DECEMBER 2013; Vol 12: No. 03 JLUMHS SEPTEMBER-DECEMBER 2013; Vol 12: No. 03, 203-207
10. FONTENELLE LF, SARTI TD, Kidney Stones: Treatment and Prevention. *Am Fam Physician.* 2019 Apr 15;99(8):490-496.
11. Khalil NY, Nawaz H, Ahmed S, et al. Urinary cal-culi: preva-lence, types and distribution in urinary tract in Quetta valley and adjacent areas. The professional.1998; 2: 197-202.
12. Rafique M, Bhutta RA, Rauf A, Chaudhry IA. Che-mical composition of upper urinary tract calculi inMultan. J Pak Med Assoc 2000; 50: 145-8
13. Hashmi ZA, Bashir G and Nawaz HA. Composi-tion of Renal Stones: Calcium Oxalate are more common in the North West of Pakistan. JPMI. 2001; 15(2): 199-201.
14. Khan A S, Rai M E, Gandapur, Parvaiz A, Shah A H, Hussain AA et al. Epidemiological risk factors and composition of urinary stones in Riyadh Saudi Arabia. J Ayub Medical Coll Abbotabad. 2004 Jul-Sep; 16(3): 56-8.
15. Stamatelou KK, Francis ME, Jones CA, Nyberg LM, Curhan GC. Time trends in reported prevalence of kidney stones in the United States: 1976–1994. Kidney Int. 2003;63:1817–23. [PubMed] [Google Scholar]
16. Pearle MS, Calhoun EA, Curhan GC. Urologic Diseases in America project: urolithiasis. J Urol. 2005;173:848–57. [PubMed] [Google Scholar]
17. Scales CD, Jr, Curtis LH, Norris RD. Changing gender prevalence of stone disease. J Urol. 2007;177:979–82. [PubMed] [Google Scholar]
18. Taylor EN, Stampfer MJ, Curhan GC. Obesity, weight gain, and the risk of kidney stones.JAMA.2005;293:455–62. [PubMed] [Google Scholar]
19. Taylor EN, Stampfer MJ, Curhan GC. Diabetes mellitus and the risk of nephrolithiasis.Kidney Int. 2005;68:1230–5. [PubMed] [Google Scholar]
20. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999–2002. JAMA.2004;291:2847–50. [PubMed] [Google Scholar]