Infective Urolithiasis: A Descriptive Study

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Abstract:

Objective: To demonstrate the relation between the type of calculi and the presence of pathogenic bacteria.

Patients and methods: A group of 53 patients (35 males & 18 females) with urolithiasis were studied from January 2009 to January 2011. Their age ranged (13 – 69 years) with a mean age of 36.5 years. Calculi were obtained by different means & then submitted to chemical analysis. Cultures of pre-operative mid stream urine samples for bacteria were performed in all patients.

Results: The overall incidence of renal stone was more in males (66%) in comparison to females (34%); however the rate of infection stones was more in females (83.33%). Chemical analysis revealed that calcium oxalate was the most common & frequently occurring calculi (54.7% pure & 9.5% mixed) while triple phosphate stones were only (11.3%). The commonest pathogen recovered from pre-operative urine culture was E-coli (40%) followed by Proteus (30%). Out of 20 infection stones, 5 stones which were composed of triple phosphate showed the highest incidence of infection (83.33%).

Conclusion: Despite overall increased incidence of renal stones in men, women are more prone to struvite stones than men due to chronic bacterial infection in the urinary tract which women are more prone to get.

Key words: Renal calculi, chemical analysis, urinary tract infection

Introduction:

Urolithiasis is one of the most common diseases with worldwide increasing prevalence and incidence [(1)]. It affects approximately (5 – 12 %) of the population at sometime during their lives [(2-4)].

Numerous risk factors responsible for or contributing to stone formation have been identified including environmental, metabolic, dietary, racial, sex, obstructive uropathy and infection of urinary tract. The last is an important risk factor and at least in females, urinary tract infection (UTI) is one of the most common causes of urolithiasis [(5)]. In fact the destructive effect upon the kidney by renal calculi may be complicated by a superadded infection, most commonly associated with a gram negative organism [(6,7)].

Patients and methods:

The study included 53 patients with clinically and radiographically diagnosed urolithiasis consulted the urology department at Al- Yermouk Teaching Hospital, in the period between January 2009 & January 2011, for management of renal calculi. Of the 53 patients, 35 were males and 18 were females. Their ages ranged (13 – 69 years), the mean age was 36.5 years.

Some of the stones were obtained by spontaneous passage; others were collected using extra corporeal shock-wave lithotripsy (ESWL) or open surgery. All calculi were analyzed using the chemical method. Pre-operative mid stream urine (MSU) samples of all patients were collected aseptically and processed for bacteriological culture.

Results:

Fifty- three patients complaining of urolithiasis were enrolled in the study. The affected side of treated stones was more frequently the right (58.5%) than the left (41.5%). The median size of treated stone on both sides was (7 mm). The patient's demographic and treated stone characteristics are provided in [table -1].

Table 1: Patient's demographic & treated stone characteristics

Age, yr, (range)	(13-69)
Gender	
Male No. (%)	35 (66)
Female No. (%)	18 (34)
Total No. (%)	53 (100)
Treated stone	
Rt side No. (%)	31 (58.5)
Lt side No. (%)	22 (41.5)
Size, mm, median (range)	7 (4-20)

The calculi were obtained by different means; spontaneous passage, ESWL and open surgery [Table -2].Then they were submitted to analysis using the chemical method [Table -3]

Table 2: Methods of stone removal according to the patient's sex

Sex	Spontaneous passage	ESWL	Surgical intervention	Total
Male	5 (14.3%)	14 (40%)	16 (45.7%)	35(66.1%)
Female	2 (11.1%)	7 (38.9%)	9 (50%)	18(33.9%)
Total	7 (13.2%)	21(39.6%)	25(47.2%)	53(100%)

Table -3: Chemical analysis of 53 renal calculi

Stone type	Male		Female		Total	
	No.	%	No.	%	No.	%
Calcium oxalate	22	75.86	7	24.14	29	54.7
Calcium oxalate urate	4	80	1	20	5	9.5
Uric acid	5	83.34	1	16.66	6	11.3
Calcium phosphate urate	1	33.34	2	66.66	3	5.6
Calcium phosphate	2	50	2	50	4	7.6
Magnesium ammonium phosphate (struvite) also called "triple phosphate"	1	16.67	5	83.33	6	11.3

It had been found that calcium oxalate was the most common and frequently occurring constituent of the examined calculi accounting for (64.2%) of all renal calculi (54.7% pure & 9.5% mixed), while triple phosphate stones were only (11.3%).

Out of 53 patients, 20 (37.7%) had UTI, many of these patients showed chronic pyelonephritic changes of the kidney from which the calculus was removed. E–coli (40%) was the most common micro-organism encountered in urine culture examination followed by Proteus (30%) [Table-4].

Table -4: Shows frequency distribution of bacterial species in pre-operative urine culture

Micro-organism	No.	%
E .coli	8	40
Proteus mirabilis	6	30
Klebsiella aerobactor	2	10
pseudomonas pyocyanea	1	5
staphylococcus pyogenes	2	10
Streptococcus faecalis	1	5
Total	20	100

The incidence of sterile urine in stones composed of calcium oxalate (72.41%) was more in comparison to infected urine (27.59%) in stones of the same composition. By contrast the incidence of infected urine was more in stones composed of triple phosphate (83.33%) [Table -5].

Table-5: shows correlation between chemical composition of stones and their urine culture

Type of stone	Total no. of stones	Sterile urine		Infected urine	
		No.	%	No.	%
Calcium oxalate	29	21	72.41	8	27.59
Calcium oxalate urate	5	4	80	1	20
Uric acid	6	5	83.33	1	16.67
Calcium phosphate urate	3	1	33.33	2	66.67
Calcium phosphate	4	1	25	3	75
Magnesium ammonium phosphate (struvite) [triple phosphate]	6	1	16.67	5	83.33
Total	53	33	62.27	20	37.73

E –Coli was isolated in maximum number from stones composed of calcium oxalate (50%) while isolate rate of Proteus was (83.33%) in cases of triple phosphate stones and (16.67%) in calcium phosphate stones [Table -6]

Table -6: Shows correlation between microbial isolate types with chemical nature of infection stones

Micro-organism			Calcium oxalate	Calcium oxalate urate	uric acid	Calcium phosphate urate	Calcium phosphate	Triple phosphate
	No.	%	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
E –coli	8	40	4 (50)	2 (25)	2 (25)			
Proteus mirabilis	6	30					1 (16.67)	5 (83.33)
Klebsiella	2	10				1 (50)		1 (50)
Pseudomonas	1	5		1 (100)				
Staph. pyogenes	2	10				1 (50)		1 (50)
Strept. faecalis	1	5	1 (100)					

Discussion:

The study was conducted on 53 patients of urolithiasis to identify the causative micro-organism from pre-operative urine samples and demonstrate its relation to chemical analysis of stones.

In the 53 patients studied, 20 (37.73%) were found to have infected urine. This figure is lower than that noted by Thompson and Stamey [8] , but in the 6 patients with struvite calculi, a positive bacterial culture was obtained in 5 (83.33%) which is closer to the figures observed by Dincel et al [9], Ohkawa et al [10] and Holmgren et al [11]. This high figure is not surprising as the development of these calculi is closely linked to bacterial growth. In addition we had found in our study that although urolithiasis is predominant in males but the infection stones were recovered more in females, this being related to higher incidence of UTI in women giving rise to the type of calculus which forms in alkaline medium typically the triple phosphate (struvite) stones. Similar findings were reported by Miano et al [12], Parmar [13] and Stoller [14].

The relative incidence of calcium oxalate (56.6%) in our study was on the higher side as compared to other types of stones and this is in conformity with the observation made by Abdel-Halim [15], Djelloul et al [16] and Daudon et al [17]. Some of the reasons for this high incidence of calcium oxalate might be due to non vegetarian diets (animal protein) which lowers citrate excretion and increases calcium and uric acid excretion [18], diet with high oxalate content and high carbohydrate intake (especially rice), which provides acidic medium to urine favoring calcium oxalate stone formation [19,20]. The occurrence of pure triple phosphate stone was only (11.3%) similar to the study made by Sharma et al [21]. The observed variation in chemical composition may be due to geographical variation and dietary habits which have some contributing influence in the incidence of urinary tract calculi and type of calculi which occur within a given area [22].

The present study showed that the lowest frequency of associated infection was in calcium oxalate and uric acid stones (27.59%, 16.67% respectively) and the highest in triple phosphate stones (83.33%) and this finding is consist with the finding of Holmgren et al [11].

In the group of patients with struvite calculi, the commonest organism found in urine was Proteus mirabilis which is a urease –producing bacteria and thus considered to be a stone producing micro-organism. While E-coli were the predominant micro-organism recovered in the urine of patients with calcium oxalate calculi. The present finding is consistent with the study of Dajani & Shahbi and Bratell et al [23, 24].

Conclusion:

Kidney stones come in different types; the most common are calcium oxalate stones.

UTI caused by urea- splitting organisms (e.g. Proteus species) carries high risk of promoting formation and growth of struvite stones.

Contrary to overall increased incidence of renal stones in males, females are more prone to struvite stones than males due to increased incidence of recurrent UTI in them.

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