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PREVALENCE OF RENAL CALCULI;
TYPE, AGE AND GENDER SPECIFIC IN SOUTHERN PUNJAB, PAKISTAN

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ABSTRACT… Renal calculus is a hard mass. It is formed from the crystals that aggregate on the inner surfaces of the kidney. Small crystals flow to the urinary tract and pass out of the body spontaneously along with urine without being noticed. **Objectives**: The purpose of the present study is to find the type; age and gender related prevalence of the renal calculus disease in Southern Punjab Pakistan. **Study design:** The study design is retrospective. **Period:** Two year from June 2009 to June 2011. **Materials and Methods**: In this work, 1176 samples of renal calculi from both male and female patients of the southern Punjab, Pakistan, were collected. Semiquantitative analysis of the renal calculi was carried out using Merckogonost Reagent Kit. **Results**: Highest prevalence of the renal calculus disease was in the age group 40-49 in males and in the age group 30-39 in females. The disease was more common in males than females. Calcium oxalate was the predominant renal stone.

Key words: Renal calculi, type, age and gender specific prevalence, southern Punjab, Pakistan.

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INTRODUCTION

Renal calculus is a hard mass. It is formed from the crystals that aggregate on the inner surfaces of the kidney. Small crystals flow to the urinary tract and pass out of the body spontaneously along with urine without being noticed.[1]

Renal stone disease has been bothering humans for millions of years. The Babylonian Talmud refers to bladder-stone disease and includes the suggestion that patients urinate on the doorstep in order to see the stone. In Greece, Hippocrates recognized both renal and bladder stone and recommended diuretics and large quantities of water. The Assyrian Book of Medicine (c. 300 B.C.) includes much of Hippocrates's teaching. Among numerous prescriptions are two for flushing out or dissolving renal stones; In Alexandria around 100 B.C. Ammonios developed an instrument for crushing stones within the bladder. In the first century A.D., Rufus gave detailed instructions for removing bladder stones through a transverse perineal incision. Galen described lateral perineal lithotomy and noted the frequent occurrence of bladder stone in young boys. He also administered stone solvents (lithotryptics).

In Arabic medicine, Rhazes at about the turn of the tenth century described both renal and bladder stones and implicated salt intake and hot weather as factors in renal stone formation.

Around a century later, Avicenna thought that bladder stones formed when the urine contained excess matter.[2]

Renal calculus disease is the third most common problem of the urinary tract after urinary tract infections and pathologic conditions of the prostate. It is affecting about 10% of the global population.[3] The lifetime risk for nephrolithiasis exceeds 6% to 12% in the general population, and it is also projected that the prevalence of kidney stones will escalate.[4] Urinary stone disease (USD) is an important healthcare problem in the US affecting both adults and children, and costs $10 billion to the nation. Prevalence of USD has nearly doubled during the last 15 years in parallel to the obesity and type 2 diabetes epidemics.[5]

Pakistan lies in the geographical region known as the "stone belt" stretching from Egypt and Sudan through the Middle East, India, Pakistan, Burma, Thailand, Indonesia and Philippines reporting consistently high incidence of Urolithiasis.[6]

The population of southern Punjab is 29.32 millions. Although the incidence and prevalence of stone disease are not known in Pakistan due to lack of centralized epidemiological data, it roughly constitutes 40-50% of the urological workload in major hospitals.[7]

The process of renal stone formation and chemical composition of prevalent type of stone depends on age and gender.[8] Adult patients form more stones. On the other hand, it has been found in clinical observations that this pattern is now changing. In the 3rd to 6th decade of life, the renal stones having the symptoms of calcium stones are more common. However, differences are seen with differences in age and type of stone.[9] Maximum age for the development of stone disease is from third to fifth decade and during this period, the recurrence is widespread.[10] The risk of developing renal stone, incidence and prevalence in men are 2-4 times more in men as compared to women.[11] However, it has been reported that a change in this pattern is taking place in the USA during the last decade.[12]

The importance of the analysis of urinary stones cannot be overempsized. It is imperative to know the composition of urinary stone as it is a recurrent disease in many people.[13] Preventive measures, medical therapy and decision about proper procedures for treatment, require the knowledge of stone composition.[14]

The information regarding the chemical composition of renal stones may be of importance as it (1) guides for the clinical management. (2) The knowledge of chemical composition helps in understanding the fundamental physicochemical principles of the formation of calculi. This knowledge will help in advising and suggesting the people and patients to carry out preventive measures in reducing the risk of the prevalence and recurrence of urolithiasis in this region respectively.

The present study was therefore undertaken to determine the age and gender prevalence of renal calculi in the area of southern Punjab, Pakistan. Chemical composition of the renal calculi was also determined.

PATIENTS AND METHODS

The study design was retrospective. An epidemiological descriptive regional study of prevalence of renal calculus disease from the Southern Punjab, Pakistan was undertaken. Data on the epidemiology of the disease including chemical composition of the renal calculi were collected.

Male and female residents of the Southern Punjab, Pakistan, were included in the study. Samples of both sexes of ages ranging from 1 year to 75 years were collected. A total of 1176 samples were collected. The diagnosis of renal calculus disease was established in all the patients in radiologic image or ultrasound or spontaneous passage in the urine or symptomatic and clinical examination.

All the required basic information regarding the history of the disease of the patient was obtained using the questionnaire. The data were collected during the period of two years.

The kidney stones of the patients those included in the study were collected from the places of their visits mostly wards and clinical laboratories. The stones were kept in the plastic bottles and they were assigned identification number.

All the stones were washed with deionized water to remove any contamination such as blood, cellular debris etc. Then the stones were dried. Smaller stones were mixed and ground while larger calculi were broken mechanically.

Chemical analysis of the renal calculi was done using the Merckognost Reagent Kit (Merck, Germany). Analysis was performed at Bahauddin

Age group (years)	Total	Percentage	Males	Females	M:F ratio	Chi-square/p- value
1-9	19	1.60	12	7	1.7:1	
10-19	39	3.30	27	12	2.25:1	
20-29	144	12.20	93	51	1.8:1	
30-39	348	29.60	256	92	2.8:1	
40-49	371	31.50	285	86	3.3:1	**23.56** / ***0.001**
50-59	120	10.20	82	38	2.1:1	
60-69	100	8.50	83	17	4.9:1	
70-79	35	3.00	33	12	16.5:1	
TOTAL	1176	100	871	305	2.8:1	

Table-I. Age and gender specific prevalence of renal calculi in patients from Southern Punjab

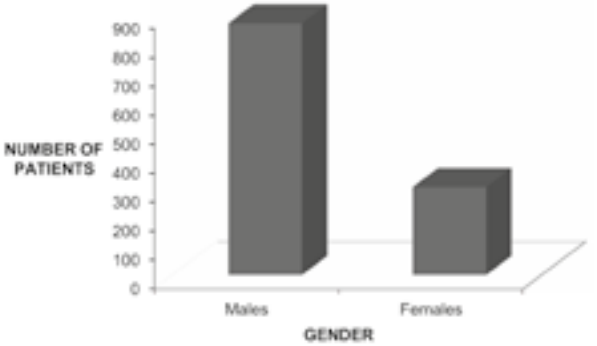

Figure-1. Overall prevalence of renal stones in males and females

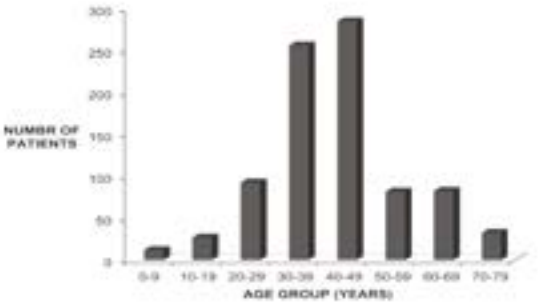

Figure 2: Prevalence of renal stones in males in different age groups

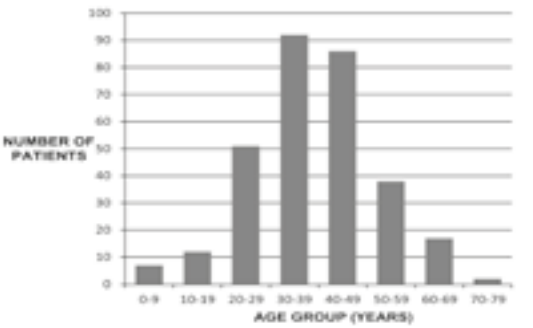

Figure 3: prevalence of renal calculi in females in different age groups

Zakariya University, Multan and Clinical laboratory, Jinnah Medical Centre, Nishtar Road, Multan, Pakistan.

The sample of the renal calculus to be analyzed was dissolved as homogeneous as possible. From this solution, various components of the calculus were determined semiquantitatively. Titrimetric method was used for calcium and colorimetric method (i.e., visual color comparison) was used for oxalate, phosphate, magnesium, ammonium, uric acid and cystine. The composition of the urinary calculus was obtained from the results of these determinations with the help of the enclosed calculation aid.

RESULTS

Table-I. Shows that peak age group of the high prevalence of renal calculus disease observed was 40-49 (31.5%), followed by 30-39 (29.6%) and then 20-29 (12.2%).

The patient of maximum age encountered in the study was of 75 years and minimum of 1 year. The highest number of cases were 371 (31.5%) in the age group of 40-49 years. Subsequently the age group with high prevalence was 30-39 having cases 348 (29.6%) (Table-I). The mean age plus standard deviation of the patients was 41.45± 14.11 years for men and 39.20±12.21 for women. Male predominance was in the age group 40-49 whereas female preponderance was found in the

age group 30-39 years (Figure-2, Figure-3).

The least number of stone formers was present beyond 70 s, and under 20 s The lowest prevalence in males was in children i.e., in the age group 0-9 years having 12 renal calculi formers and the lowest prevalence in females was in the age group 70-79 years. This group had only two renal stone formers.

Chi-square test was performed to study the relationship between the patients' age and gender. The data was arranged in a contingency able. The chi-square test ($p=0.001$) indicates strong (significant) association between patients' age and gender in terms of their suffering from renal stones.

Results show that 765(65%) were pure stones whereas 411(35%) mixed in nature.

Of all the stones analyzed, 377 (32%) were calcium oxalate (Ca Ox), 247 (21%) were uric acid. The percentage of calcium phosphate (CaP) among the stones analyzed was seven. Two percent of all the stones were magnesium ammonium phosphate (MAP). The Ammonium Urate content in total stones was 2%.

Among the mixed stones, combinations were CaOx and CaP, CaOx and Uric acid, CaOx, CaP and Uric acid and finally Uric acid and CaP. From the results it appears that tendency of pure stone

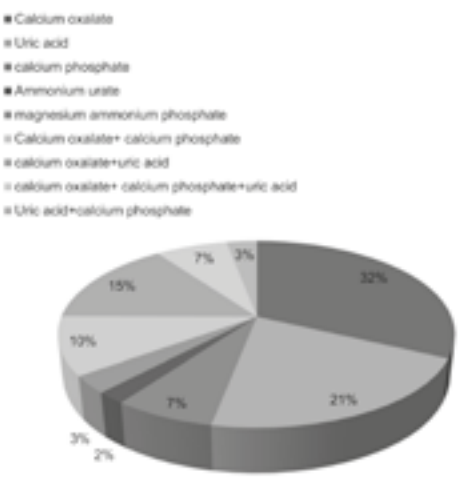

Figure-4. General natures of renal calculi from the Southern Punjab.

formation was higher 765 (65%) than mixed stone 411 (35%). (Figure-4, 5)

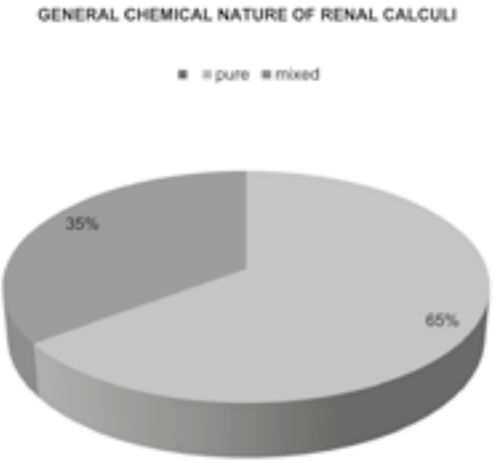

Figure-5. Prevalence of renal stones according to type

DISCUSSION

Renal calculus disease in its most multiform reality is the third most common affliction of the urinary tract. It is the commonest urological ailment in Pakistan.[15] In the present study, prevalence with respect to age and gender from the population of the Southern Punjab, Pakistan was studied. The chemical composition of all the collected renal calculi was also determined.

Regarding age specific prevalence, this finding is close to that of Tasadaque et al[16] who reported that a kidney stone is more prevalent in the age group 13-50 years among the reported operated cases of kidney stone in Multan, Pakistan. According to Ahmad[17] maximum incidence of renal calculi in the age group 30-50 years. The maximum number of patients was between 3rd and 5th decade, the most productive period of life.[18]

In the present work, the higher preponderance of the renal calculus disease was found in males than females. Male to female ratio in this study was 2.8:1. This result is in agreement to that of Rasool et al who reported it to be 3:1 in urinary stone patients at Bahawalpur.[19] Rafique et al[20] carried out chemical composition of upper urinary tract calculi in Multan, pakistan and reported the

male to female ratio 3:1 which is also close to this research.

The high prevalence of renal calculi in males in this study can be described by the effect of sex hormones on some lithogenic risk factors. Androgens appear to increase the oxalate excretion and deposition of calcium oxalate crystals in the kidney; both are the main risk factors to form kidney stones while estrogen decreases the urinary oxalate excretion. Therefore, there is more prevalence of this problem in males as compared to females.[21]

This may also be due to the reason that males have a greater muscle mass compared to females. Consequently, the metabolic waste is increased due to daily breakdown of the tissue and hence tendency to form a renal calculi increased. The other noteworthy cause may be more complicated male urinary tract than female one.[22]

Calcium Oxalate was the predominant stone in the study undertaken. Of the total 1176 kidney stones, 765 (65%) contained calcium oxalate. Among these, 377 (32%) were pure calcium oxalate. Zafar et al[23] from Multan, Pakistan, reported that out of 505 stones analyzed, 117 (23.17%) contained calcium oxalate. Another work from Multan, Pakistan, reported that in their series of 700 calculi, the percentage of calcium oxalate stones was 26.1.[24] Renal calculi containing calcium oxalate were the most frequent type found in the study at Rawalpindi (more than 90%), out of which pure calcium oxalate (CaOx) calculi were 34% whereas mixed calcium calculi were 58%.[25] In a study conducted in east region of Algeria Calcium oxalate prevailed in 68.5% of stones.[26] The most common stones in Oman was Calcium Oxalates 45%.[27]

Next predominant renal calculus in the series was Uric acid. There were 540 uric acid containing renal calculi altogether. Pure Uric acid containing calculi were 247 (21%). In the studies reported by Zafar et al[23] Khalil et al[28] and Safdar and Sial[29] 43.3 %, 40.8 % and 60% of their calculi respectively contained uric acid. In another study reported from Karachi by Shah Jahan and Rehman, 52.8% of the renal calculi contained uric acid.

Chemical composition of urinary tract stones carried out at the University Hospital of West Indies, Uric acid was present in 37% stones. There were 5.5 % pure uric acid stones, a figure much lower than the present work. Gout is a state in which approximately 10-20 percent patients generate extra uric acid. This condition is linked with a diet rich in purine. Such a type of diet is a risk for uric acid stone formation. pH of the urine below 5.5 is also a possible risk factor for the uric acid stone formation. In patients with normal excretion of uric acid, the basic defect seems to be excretion of ammonia in urine. Such stones are normally radiolucent but they may be opaque if calcium is present in them.[30]

Renal calculi next in abundance were calcium phosphate. Total renal calculi containing calcium phosphates were 282 in number in which only 82 (7%) were of pure calcium phosphate composition. Rafique et al[20] from Multan, Pakistan, reported that calculi containing calcium oxalate plus calcium phosphate constituted 10.4% and those containing calcium oxalate, calcium phosphate and uric acid accounted for 7.1% of the calculi. Pure calcium phosphate calculi in their series were only 0.7%, which is, much less than the present study. Kang E C[30] reported 15.1 % calcium phosphate in their work, which is higher than the present study.

Among the mixed calculi, calcium oxalate and uric acid was most frequent which is in agreement with that of Khalil et al[26,28] who analyzed 137 upper urinary calculi from Quetta, Pakistan and reported that most frequent mixed calculi were those containing calcium oxalate and uric acid.

Safdar and Sial[29] found calcium oxalate plus uric acid 20%, which is close to our results. In a study from Karachi, Pakistan, by Rizvi[31] 75 renal calculi were analyzed. The commonest were calcium oxalate calculi followed in frequency by calculi containing calcium oxalate plus the uric

acid. There is global diversity in the prevalence of uric acid (UA) nephrolithiasis. UA nephrolithiasis comprises 8-10 % of all kidney stones in the United States.[32] Excessive dietary acid intake, increased endogenous acid production and/or defective NH4+ excretion play an important role, among other factors for uric acid stone formation.[33]

The presence of mixed type of stones suggests the multifactorial etiology of renal calculi formation. For calcium calculi, risk factors may vary by population. The risk factors may be hypercalciuria, hyperthyroidism, hypocitraturia, renal tubular acidosis. Hyperoxaluria may be primarily caused by excess ingestion of oxalate containing foods.[34]

CONCLUSIONS

It is concluded that the highest prevalence of the renal calculus disease is in the age group 40-49 in males and in the age group 30-39 in females. The disease is more common in males than females. The decrease in prevalence of the stone disease in the older age groups may be due to deaths at the earliest age. This may be possible as in the stone disease, number of medical co-morbidities like renal failure, obesity, diabetes mellitus, hypertension have been associated.

The predominant renal calculi in the region are of a pure chemical composition. The most prevalent is calcium oxalate

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"I don't Mind being hated.
But I hate being misunderstood"

Unknown

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