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Original Article

Study of renal stones complications in 200 patients in Tabriz, Iran

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Abstract

Introduction: Urinary stones are the third most common disease of the urinary. Renal stones may lead to some preventable complications. This study was designed to investigation and prediction of these complications.

Methods: In this cross-sectional study, 200 patients with kidney stones were enrolled. Kidney stone was confirmed and proven in all patients referred to Sina and Shaikh Al-Rais clinics. Their demographic characteristics like gender, age, stone number, stone type, renal failure and bio-chemistry data were evaluated.

Results: Of 200 patients, 130 cases (65.0%) were male and 70 cases (35.0%) were female. The mean age of patients was 41.30 ± 16.06 years. Type of stone was (when evaluation was possible) was mixed (11.5%). However, the type of stone was not analyzed in 112 cases (56.0%). Among complications, recurrent infection was seen (16.0%), and staghorn stones were seen in 2.5% of patients. Dialysis was positive in 3 patients (1.5%). History of surgery was positive in 3 patients (1.5%). Extracorporeal shock wave lithotripsy (ESWL) history was positive in 8%. In evaluated patients, the mean level of calcium was 8.83 ± 0.27, phosphorus was 4.60 ± 0.33, parathyroid hormone (PTH) was 35.20 ± 14.22, uric acid was 4.98 ± 1.57, creatinine was 1.38 ± 1.02 and blood urea nitrogen level was 16.69 ± 11.54 mg/dl. Staghorn stones are significantly associated with progression to renal failure and subsequent complications such as hemodialysis (P = 0.001), surgery (P = 0.001). Recurrent infection was more frequent in calcium-containing stones (P = 0.001) and ESWL undergoing patients (P = 0.030). Stone numbers were more than 3 in hemodialyzed (HD) patients (P = 0.001). Uric acid stones were more seen in HD patients (P = 0.170).

Conclusion: According to results hemodialysis and recurrent infections are seen in patients with renal stones, and they may be detected in earlier with close periodic follow-up.

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Introduction

Kidney stones and chronic kidney disease (CKD) were reported in 5% and 13% of the adult population.[1,2] CKD is a complication of kidney stones as a result of rare hereditary disorders.[3-5] Kidney stones may be associated with complications such as infection, acute renal failure (due to obstructive uropathy), and chronic kidney damage. The prevalence of the end-stage renal disease (ESRD) due to kidney stones among patients who start maintenance hemodialysis was approximately 3.2%.[6] Infection stones are the most frequent cause of urolithiasis associated ESRD especially in bilateral developing of stag horn stones configuration.[7,8] Extensive stone development has been observed with uric acid, calcium-oxalate or cystine stones.[9] The exact mechanism of progressive renal failure has not yet completely recognized, even with well-known obstructive and infections mechanisms of kidney injury crystal deposition in the tubules

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and interstitium of both kidneys. The potential risk of degradation of renal function justifies the etiological investigation of all lithiasis associated pathologies. Thus, calculus analysis of the crystalline phases and morphological characteristics is an important factor in the etiological diagnosis of the disease. Hence, the aim of this study was to investigate renal stones complications in Tabriz, Iran.

Methods

In this cross-sectional study, 200 patients referred to Sina Teaching Hospital or Shaikh Al-Rais clinics with kidney stones that had renal colic were examined during 2 years (June 2011-July 2013). Kidney stone was confirmed and proven in all patients, and there were no other known cause of renal failure, such as diabetes or lupus glomerulonephritis.

Demographic data including age, gender, type of stone, calcium, phosphorus, parathyroid hormone (PTH), urine analysis in terms of calcium, oxalate, uric acid, sodium nitrate, uric acid and also the sonographic details, including stone size, number and location of the stones and finally the patients symptoms, including renal colic, urinary tract infection and hematuria were evaluated and recorded (Table 1).

In some patients, nephrolithiasis was diagnosed accidentally during an ultrasound or X-ray examination. All patients were informed on research purposes, and written consent was obtained from all of them. All patient records data is kept completely confidential. Blood biochemical examinations were performed based on the type (Table 2) and the number of stones (Table 3).

Obtained data are expressed as mean ± standard deviation, frequency and percentage. Data were analyzed with the help of SPSS for Windows (version 17, SPSS Inc., Chicago, IL, USA). Quantitative variables were compared by using Student's t-test, and qualitative variables have been compared by using the chi-square test. In all investigated cases, the results have been known statistically significant in the case of $P \leq 0.05$. Univariate logistic analysis was done for risk prediction for some variables.

Table 1. Demographic characteristics of studied patients (according to gender)

Variables	Gender		All	P
	Female (n = 70) (%)	Male (n = 130) (%)		
Age	41.07 ± 16.46	41.42 ± 15.92	41.30 ± 16.06	0.730
Calcium	8.83 ± 0.27	8.83 ± 0.27	8.83 ± 0.27	0.770
Phosphorus	4.60 ± 0.33	4.61 ± 0.33	4.60 ± 0.33	0.990
PTH	36.42 ± 13.63	34.54 ± 14.53	35.20 ± 14.22	0.330
Uric acid	4.94 ± 1.69	5 ± 1.50	4.98 ± 1.57	0.900
Recurrent infections	1 (7.7)	12 (92.3)	13 (100)	0.020*
Staghorn stone	0 (0)	5 (100)	5 (100)	0.110
Creatinine	1.21 ± 0.45	1.46 ± 1.21	1.38 ± 1.02	0.010*
BUN	14.57 ± 7.89	17.83 ± 12.98	16.69 ± 11.54	0.010*
Hemodialysis	0 (0)	3 (100)	3 (100)	0.270
Surgery	0 (0)	3 (100)	3 (100)	0.270
ESWL	2 (12.5)	14 (87.5)	16 (100)	0.030*

Data are presented as mean ± standard deviation

PTH: Parathyroid hormone; ESWL: Extracorporeal shock wave lithotripsy; BUN: Blood urea nitrogen

Table 2. Comparison of the measured blood markers in patients based on the type of stone

Type of stone	Calcium	Phosphorus	PTH	Uric acid	Creatinine	BUN
Calcium oxalate	8.87 ± 0.22	4.59 ± 0.32	33.30 ± 16.31	4.71 ± 1.08	1.68 ± 0.29	19.71 ± 16.78
Calcium phosphate	8.84 ± 0.29	4.60 ± 0.35	35.70 ± 10.86	4.64 ± 0.99	1.26 ± 0.39	15.94 ± 6.96
Uric acid	8.89 ± 0.20	4.68 ± 0.31	36.50 ± 15.92	9.28 ± 1.32	1.95 ± 0.63	21.85 ± 6.22
Struvite	8.75 ± 0.35	4.65 ± 0.49	28 ± 12.72	5.5 ± 0.70	1.50 ± 0.70	18.00 ± 8.48
Mixed	8.79 ± 0.29	4.61 ± 0.33	37.04 ± 12.70	4.3 ± 1.02	1.27 ± 0.51	15.17 ± 8.26
Not analyzed	8.81 ± 0.28	4.60 ± 0.33	35.2 ± 14.32	4.68 ± 0.99	1.26 ± 0.50	15.58 ± 8.22

Data are presented as mean ± standard deviation

PTH: Parathyroid hormone; BUN: Blood urea nitrogen; ESWL: Extracorporeal shock wave lithotripsy

Table 3. Comparison of the measured levels of blood markers in patients based on the number of stone

Stone count	Calcium	Phosphorus	PTH	Uric acid	Creatinine	BUN
1	8.82 ± 0.27	4.60 ± 0.32	35.25 ± 14.40	4.97 ± 1.56	1.26 ± 0.48	15.63 ± 8.11
2	8.85 ± 0.27	4.70 ± 0.29	34.20 ± 10.96	5.40 ± 2.01	1.15 ± 0.14	13.80 ± 3.11
3	8.80 ± 0.26	4.36 ± 0.32	33.60 ± 20.98	4.33 ± 0.57	1.10 ± 0.10	12.60 ± 1.15
> 3	9.01 ± 0.03	4.51 ± 0.41	36.10 ± 12.26	4.85 ± 1.46	4.81 ± 3.63	49.50 ± 33.56

Data are presented as mean ± standard deviation; PTH: Parathyroid hormone; BUN: Blood urea nitrogen

Results

Of 200 patients, 130 (65%) cases were male and 70 cases (35%) were female. Demographic characteristics are shown in table 1.

Comparison of the measured blood markers in patients based on the type of stones as shown in table 2. Type of stone was (when evaluation was possible) was mixed (11.5%). However, type of stone was not analyzed in 112 cases (56.0%). Among complications, recurrent infection was seen (16.0%) and staghorn stones were seen in 2.5% of patients. In table 2 comparison of blood markers based on the kind of Kidney stone is demonstrated.

Dialysis was positive in 3 patients (1.5%). History of surgery was positive in 3 patients (1.5%). ESWL history was positive in 8.0%. In evaluated patients, the mean level of calcium was 8.83 ± 0.27, phosphorus was 4.60 ± 0.33, PTH was 35.20 ± 14.22, uric acid was 4.98 ± 1.57, creatinine was 1.38 ± 1.02 and blood urea nitrogen level was 16.69 ± 11.54. In table 3 comparison of measured blood markers regarding to the number of stones are seen.

Stag horn stones are significantly associated with progression to renal failure and subsequent complications like hemodialysis (P = 0.001), surgery (P = 0.001). Recurrent infection was more frequent in calcium containing stones (P = 0.001) and ESWL undergoing patients (P = 0.130). Stone numbers were more than 3 in HD patients (P = 0.001). Uric acid stones were more seen in HD patients (P = 0.170).

HD was seen more frequently in males than females and OR = 0.84, 95% CI (0.44-0.95), P = 0.030. History of ESWL was a positive predictor for future renal failure and loges tic regression result was: OR = 6.48, 95% CI (1.74-24.14), P = 0.002.

Discussion

This study was performed to investigate the prevalence and risk factors of renal failure following nephrolithiasis in Tabriz, Iran.

Prevalence of urinary stones is estimated to be about 3-2%. The probability that a white person until age 70 experience at least one renal stone is 1 in 8.[10] Repeated renal stone possibility without proper treatment was 10% during the 1st year and35% during the first 5 years. Urolithiasis is a major health problem in at least 20% of peoples that cause different levels of renal insufficiency. Urinary stones are found in men more than females (ratio of 3-1).[10] Our study also confirms these results and also staghorn form of renal stone was seen more frequently in males, but the difference was not statistically remarkable (P = 0.110). In our study of 200 patients, 130 cases (65%) were male, and 70 cases (35%) were female and there was a significant difference (P = 0.001) like some other studies.[11]

Hemodialysis in men was needed more than females and logistic regression result was: odds ratio = 0.84, 95% confidence interval (0.44-0.95), P = 0.030. Relative studies reported that the mean common age for the incidence of nephrolithiasis was in the 20-50 of age range,[11] although it may occur at any age. In a study on 183 patients by Oussama et al. in Morocco in evaluation of correlation between nephrolithiasis and renal failure, mean age of patients was 60 years with a significant prevalence in males[12] as it was seen in our results. Coe et al. also reported similar results.[13]

In our study, the mean age of patients was 41.3 ± 16.06 years, range of 18-70 years. Mean

age in females and males was 41.07 ± 16.46 and 41.42 ± 15.91 respectively (P = 0.730). The focus of the patients in our study was in the range of 20-50 years, so that of 200 patients, 130 cases were in this age range. The mean age in our study was much lower than Oussama et al. [12] and Coe et al.[13] studies. However, in confirmation of two above studies, the male gender was the dominant sex with 65.0%. In Oussama et al. of 183 patients, 15.3% had struvite renal stones,[12] that in our study was seen only in 1.0% of cases. It is reported that the calcium oxalate stones were the most common type of urinary stones in men and women,[13,14] we showed that incidence of this kind of stones is (68.7%).

Based on United States renal data system information, among 228332 patients that were candidates for renal transplantation between the years 1993 and 1997, 1.5% of patients candidate due to nephrolithiasis, obstruction and gout, therefore, the estimated incidence was 2.9 cases/year.[14] In our study incidence of hemodialysis was 0.015 which is really lesser than their results. It may be due to small sample size. Similar studies with larger sample sizes are recommended for comparing the results.

Jungers et al. also reported that the overall contribution of nephrolithiasis lead to ESRD was 3.2%.[6] In a retrospective epidemiological study of nephrology and dialysis departments of Ile de France (including a population of about 10.7 million people), of 1060 dialysis patients, nephrolithiasis was responsible for ESRD in 1.8%.[15] In a cohort study involving 171 patients with severe idiopathic calcium stones, 18% of patients had mild renal failure, but no patients had reached ESRD during the follow-up of 3.5 years.[16]

In Gupta et al. study on 2000 patients with nephrolithiasis (which were collected sequentially and non-selective), only 33 patients (1.7%) had mild to moderate renal failure.[17] In our study only 0.08% of the patients had impaired renal function (serum creatinine level more than 1.5 mg/dl). Jungers et al. reported that the prevalence of nephrolithiasis lead to ESRD was significantly reduced over time (decrease from 4.7% during the 1989-91-2.2% during the 1998-200).[6]

Potential degeneration of renal function, the importance of exact analysis and metabolic evaluation of stone in the early diagnosis and treatment highlights the possible situations leads to ESRD. In our study, few patients had a history of surgery or ESWL. So it seems that immediate intervention is necessary in patients with nephrolithiasis that showed symptoms of renal failure.

In Ounissi et al., calcium stones were responsible for ESRD in 26.7% of patients while the prevalence of calcium stones is very high.[18] The ratio was 26.7% in Jungers et al.[6] while this value was significantly high in Oussama et al. (58.5%).[12] In our study, calcium stones are responsible for renal failure in 24.0% of cases (49 patients out of 200 patients) which was lower than Ounissi et al.[18] Among the 12 cases reported with calcium stones in Jugers et al., severe hypercalciuria in 33.0% of cases, primary hyperparathyroidism in 16.7% and medullary sponge kidney was reported in 41.7% of cases.[6] In our patients who needed hemodialysis we could not find similar problems.

The prevalence of uric acid stones in various studies has been reported in 7.2-15.3% of cases.[14,15] This value in Oussama et al.[12] and Jungers et al.[6] was 17.8 and 18.0% respectively. The prevalence of uric acid stones in our study was 7.0% which was in the reported range, but was lower than Oussama et al.[12] and Jungers et al.[6] It appears that the prevalence of this type of stone in North Africa was more than European or American countries. This reflects the impact of nutritional factors in the incidence of this type of stones.

In Worcester et al. study on 3266 patients with nephrolithiasis, non-progressive ESRD and non-significant reduction in creatinine clearance between the two cut points were reported.[8] In our study, the mean creatinine level was 1.38 ± 1.02 that showed a wide range (range 0.9-10). In Ounissi et al., patients reached ESRD at an average period of 12

months.[18] Furthermore, in Singh et al. study, 14 of the 20 patients with nephrolithiasis have reached to the ESRD in less than a year.[19]

Ounissi et al.[18] and Singh et al.[19] reported that age, gender and geographic origin had no effect on progression to ESRD but we found that in north earth of Iran the incidence of ESRD is lower. They also mentioned that disease progress towards CRF may be prevented with rapid diagnosis of renal stones etiology and appropriate therapy. In all of our HD patients' diagnosis was done so late because they were not closely under observation. In our study, 180 patients had only one renal stone, thus low stone count in patients should not prevent the regular evaluation in order to progress toward renal failure.

Conclusion

Nephrolithiasis despite recent advances in diagnosis, treatment and prevention of stone formation in patients, remains as a preventable cause of ESRD in many patients but the incidence is lower in our region but due to severity and importance of this complication all of the physicians and also patients must be aware about it and all of the patients followed up regularly specially when the patient is involved with staghorn stones and history of surgery.

Conflict of Interests

Authors have no conflict of interest.

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