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Demographic Information and Biochemical Variables Helping to Predict the Frequent Kidney and Urinary Tract Stone Factors

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Key words:

This study is approved by the Ethics committee of the jahrom University of medical sciences, jahrom, Iran

Abstract

Urinary stones are formed by pathologic bio-mineralization processes in the urinary system, affected by many factors such as age, gender, race, and geographical location as well as biochemical factors. This descriptive cross-sectional study was conducted to predict the effective factors in the recurrence of kidney and urinary tract stone in patients visiting Peymanieh Hospital of Jahrom on 116 kidney stone patients. After receiving the patients' demographic data, two urine samples of 24-hour were taken at two different time intervals after at least one month of the treatment of kidney stone disease. The data analysis was done based on the obtained regression coefficients. The result of Poisson Regression showed that no biochemical parameters (pH, 24-hour urine volume, urinary phosphorus/ creatinine /calcium/ oxalate/sodium/ uric acid/ urea/ magnesium/ chlorine/ citrate or urinary potassium), age, gender and BMI can significantly predict the frequent occurrence of kidney and urinary tract stones in patients.

Introduction:

Urinary stones are formed by pathologic biomineralization processes in the urinary system (Giannossi *et al.*, 2012). Indeed, stones are formed in the kidney and leave the body through urine. Small stones may be passed without signs, but stones more than 5 mm tend to cause more obstruction and cause severe pain. Some stones do not enter the ureter, instead, they can grow and take the kidney's pelvis, and if they are not treated timely, they can cause kidney damage. Bladder stones have other causes that are usually associated with prolonged urinary retention in the bladder with obstruction resulting from prostate hyperplasia. Bladder stones are much more common in men, and these stones may originate from the bladder itself, but small stones may also form in the kidney and then enter the bladder (Tiselius, 2003; Morgan & Pearle, 2016). The incidence of kidney stones is varied from 68 to 720 per 1,000,000 people, depending on the country or region where the studies were conducted (Basiri *et al.*, 2009). In fact, the prevalence of kidney stones has been reported as a common disease with the possibility of 15% throughout life. It is influenced by many factors such as age, gender, race, and geographical location (Soucie *et al.*, 1996; Basiri *et al.*, 2010). Dietary risk factors also left a different impact on the development of urinary stones based on age and gender. Calcium phytate

and the use of adequate liquids reduce the risk of urinary stones in young women while animal proteins and sucrose increase this risk. In older adults, calcium intake does not affect stones, however, magnesium, potassium, and liquids reduce the risk of urinary stones, while, vitamin C increases the risk of symptomatic stones (Trinchieri, 2008). Currently, the patients are taking interest to know the cause of kidney stones, but unfortunately, their interests are not always offered in long-term continuity with medical advice or treatment, thus, before starting a broad metabolic work, it must be taken into account how to motivate the patient to perform analytical and therapeutic steps (Pearle *et al.*, 2014). Therefore, the mechanisms for the metabolism of stones that are repeatedly developed in patients should be evaluated to determine the risk factors for kidney stones (Nicoletta & Lande, 2006). Up to 15% of people suffer from kidney stones in their life. A simple metabolism assessment, including a 24-hour urine collection, can be sufficient to analyze all the risk factors for developing kidney stones for medical evaluation (Pak *et al.*, 2001). By keeping in mind the above facts and figures, this study was conducted to predict the effective factors in the recurrence of kidney and urinary tract stones based on demographic and biochemical characteristics.

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Methodology cum Results:

Total of 116 patients with kidney and urinary tract stones were enrolled for this study among which 62.1% were male and 37.9% were female. Their average age was 14.68 ± 44.66 and 47.2% of patients were of less than 40 years old. Body Mass Index (BMI) of 62.1% of the participants was normal and 28.4% of them was overweight. Table-1 & 2 show descriptive indices of demographic variables in patients.

Table-1: Demographic analysis of the patients

Variables	Count	%
Sex	male	72
	female	44
Age	<30	24
	30-40	31
	40-50	23
	50-60	20
	>60	18
BMI	Underweight	3
	Normal	72
	Overweight	33
	Obese	8

Table-2: Demographic data of the patients (n=?)

Parameters	Mean	SD	Minimum	Maximum
Age	44.46	14.68	18.00	88.00
Weight	68.75	13.23	31.00	125.00
Height	167.23	6.48	150.00	192.00
BMI	24.53	4.25	13.78	42.25

Table-3: Parameters studied among patients for predicting frequent kidney and urinary tract stones

Parameters	Mean	SD	Minimum	Maximum
First 24 hours	vol :24h	1655.72	569.47	200.00
	Cr :24h	1241.89	390.95	272.00
	Ca :24h	215.59	136.49	50.00
	Mg :24h	67.41	30.01	1.40
	U.acid :24h	394.47	157.39	5.30
	ox :24h	6.67	7.48	0.14
	citrate :24h	547.89	358.25	153.00
	p :24h	543.43	213.47	168.00
	Na :24h	182.60	78.14	38.60
	K :24h	68.07	32.83	25.00
	Cl :24h	125.09	61.48	30.00
	urea :24.1	19.48	5.49	10.50
Second 24 hours	vol :24h-1	1677.16	545.83	500.00
	Cr :24h	1252.68	477.82	19.60
	Ca :24h	219.75	143.98	18.00
	Mg :24h	66.03	33.41	0.01
	U.acid :24h	434.41	180.01	86.00
	ox :24h	15.23	70.27	0.10
	citrate :24h	533.36	346.30	3.70
	p :24h	550.23	235.87	180.00
	Na :24h	194.78	116.83	12.00
	K :24h	68.99	42.39	23.00
	Cl :24h	114.75	70.18	17.50
	urea :24.2	19.01	4.87	10.50

Stone analysis showed that 48 (41.4%) samples were Ca-ox and 22 (19%) samples were U.acid and 46 (39.7%) samples were Ca-ox + U.acid. The average stone size was 10.93 ± 16.07 mm and the minimum size was 5 mm whereas the maximum was of 55 mm.

Table-3 shows the mean of the variables (pH, 24-hour urine volume, urinary phosphorus, urine creatinine, urinary calcium, urinary oxalate, urinary sodium, urinary uric acid, urinary urea, urinary magnesium, urinary chlorine, urinary citrate, and urinary potassium) among frequent kidney and urinary tract stone patients.

Table-3: Parameters studied among patients for predicting frequent kidney and urinary tract stones

Parameter	B	Sig.	OR	Lower	Upper
(Intercept)	3.059	.000	21.313	11.978	37.924
sex=male	.110	.100	1.117	.979	1.274
sex=Female					
age=>30	-.430	.000	.651	.541	.783
age=30-40	-.383	.000	.682	.569	.817
age=40-50	-.386	.000	.680	.574	.806
age=50-60	-.230	.013	.794	.662	.954
age=>60					
BMI=>18.5	-.972	.000	.378	.223	.643
BMI=18.5-25	-.161	.145	.851	.685	1.057
BMI=25-30	-.306	.014	.736	.577	.939
BMI=>30					
vol :24h=Normal	-.017	.837	.983	.837	1.155
Cr :24h=Normal	.313	.010	1.368	1.078	1.736
Ca :24h=Normal	-.309	.000	.734	.642	.839
P :24h=Normal	.391	.005	1.478	1.125	1.942
Ox :24h=Normal					
Na :24h=Normal	-.164	.029	.849	.732	.983
U.acid :24h=Normal	-.012	.891	.988	.838	1.166
Mg :24h=Normal	-.210	.165	.810	.602	1.090
Citrate :24h=Normal	-.011	.875	.989	.862	1.134
Cl :24h=Normal	-.183	.195	.833	.631	1.099
K :24h=Normal	.388	.005	1.473	1.121	1.936
Urea :24h=Normal	.052	.399	1.053	.934	1.187

Table-4 shows the results of Poisson Regression of biochemical factors (pH, : 24-hour urine volume, urinary phosphorus, urine creatinine, urinary calcium, urinary oxalate, urinary sodium, urinary uric acid, urinary urea, urinary magnesium, urinary chlorine, urinary citrate, and urinary potassium), age, gender and BMI in predicting frequent kidney and urinary tract stones among patients. The results of Poisson Regression showed that none of these factors can significantly predict the frequent occurrence of kidney and urinary tract stones in patients.

Clinically, the possibility of frequent kidney and urinary tract stones in patients ranging from 30-40 and 40-50 are respectively 1.36 and 1.22 times higher. In addition, this possibility in patients with abnormal magnesium is 1.25 times higher.

Discussion:

Kidney stone disease is a multifactorial illness and many

factors such as genetic, biochemical and epidemiologic factors are involved in the development of this disease. Internal factors (genetics, age, and gender) and external factors (geographical environment, climate, water consumption, diet and occupation) are effective factors in the formation of stone (Fouladi *et al.*, 2012; Zayid Al-Risi *et al.*, 2014). Therefore, this study was conducted to predict the effective factors in the recurrence of kidney and urinary tract stones based on demographic information and biochemical factors. Our results advocated that 52.8% of patients suffering from kidney stone were over 40 years old and the remaining was less than 40 years old. The majority of patients suffering from kidney stone and ureter stone in the United States were 50 and 46 years old respectively (Kim *et al.*, 2001). The data analysis and the result of Poisson Regression showed that none of the demographic factors such as age, gender, and BMI can predict the frequent occurrence of kidney and urinary tract stones in patients. Fouladi *et al.* (2012) established the relationship between Types of Urinary Stones and their Risk Factors in Patients Visiting Health Centers, the BMI of all patients was reported 3.83 ± 25.80 and no significant difference was found between the BMIs of patients suffering from different kinds of urinary stones. As per Siener *et al.* (2004), BMI and 24-hour urine parameters showed that the concentration of uric acid and serum creatinine is directly related to the increase in BMI. BMI was also associated with a direct increase in the formation of kidney stones. Sarica *et al.* (2008) stated that obesity increases the ingredients of stones. Although the incidence of kidney stone has been reported more frequent in male compared to female patients, the result of regression analysis of the present study did not confirm this statement. Noshad *et al.* (2014) reported that 65 out of 200 patients suffering from kidney stone were male whereas Healy *et al.* (2013) done the assessment of the stone metabolism through 24-hour urine collection and reported that 52% of the patients were male. In a study by Moghaddas *et al.* (2015) the effect of the type and amount of liquid consumption on kidney stones increased BMI and male gender was referred to as the risk factors for Urinary Stones. Walker *et al.* (2013) investigated the effect of age and gender on the stone formation factors. In their study, male to female ratio was 2.43 to 1 and the mean age was 49 thus the risk factors for men and women were different and varied with aging. Based on the clinical results of the present study, the possibility of frequent kidney and urinary tract stones in patients ranging from 30-40 and 40-50 were respectively 1.36 and 1.22 times higher. Thus, the possibility of frequent stone formation increases at ages 30-40. The result of Poisson Regression showed that no biochemical parameters (pH, 24-hour urine volume, urinary phosphorus, urine creatinine, urinary calcium, urinary oxalate, urinary sodium, urinary uric acid, urinary urea, urinary magnesium, urinary chlorine, urinary citrate,

and urinary potassium) can significantly predict the frequent occurrence of kidney and urinary tract stones in patients. In addition, this possibility in patients with abnormal magnesium is 1.25 times higher.

Magnesium has been reported to play a preventive role in the formation of kidney stones (Tiselius, 2005). Urine magnesium decreases calcium oxalate urinary saturation by increasing urinary pH and citrate (Khan & Hackett, 1993). Higher levels of magnesium in the male group as compared to the control group were also evidenced (Curhan *et al.*, 2001; Curhan & Taylor, 2008). Therefore, the protective role of magnesium in preventing frequent kidney stones is well established.

Conclusively, on the basis of regression analysis, it could be stated that none of these factors (to demographic information (demographic and/or biochemical factors) can predict the formation of frequent kidney stones. Thus, such studies can be done at longer intervals as prospective studies to achieve better results.

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