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Renal Stones among Adult Population in Arar City, Northern Saudi Arabia

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ABSTRACT

Background: Renal stone is a major health problem with adverse medico-economic consequences. It cost the healthcare services a great deal of money without reaching any desired destiny. **Objective:** To describe the current prevalence, risk factors, manifestations, methods of diagnosis and treatment of renal stones in Arar city, Northern Saudi Arabia **Method:** Cross-sectional community based on survey applied to the adult of the general population of Arar city during the period fromJune to October 2017. The statistical significance level is made at less than 0.05. **Results:** Among 470 participants, 57.7% male and 42.3% females, 23% had renal gravel, 13% had renal stones. Only 15% complained from recurrent renal colic and 28% had family history of renal stones or gravels. Among the found cases of renal stones, 39.7% had family history of renal stones (P<0.05), 30% had other chronic diseases, 67% have renal gravels (P<0.05) and more than half (55.2%) of them had recurrent renal colic (P<0.05) and 39.9% were obese (P<0.05). The most common symptom is renal colic as it appear in 55% of cases and 82% of affected people are diagnosed by complete urine analysis and ultrasound examination. The most common type is oxalate stone 55.2%, uric acid stones 27.6% and mixed stones 17.2%. More than half (55.2%) of renal stones are small in size and 46% found in the kidney. Most (84%) of the cases get herbal treatment, 89% medical treatment and only 8.6% got surgical treatment but 46% had recurrent stones. **Conclusion:** The prevalence of renal calculi and associated renal colic in Arar city, Northern is considerable. Suggestions for health education about risk factors in addition to future researches are mandatory.

Keywords: Renal Stones; Oxalate stone; Uric acid stones; Adult Population; Arar City; Northern Saudi Arabia

INTRODUCTION

The nephrolithiasis, or as such publically known the renal stone is an ongoing major health problem worldwide with an every-changing incidence and prevalence over time. According to the available data, the prevalence and incidence of renal stone kept on changing from time to time and varying from place to another [1]. This variability was apparent among different sociodemographic and geographic features, such as gender [2], nationality [3], age[2], and seasons [4,5] or could be attributed to availability of highly sensitive modality, like Computed Tomography scan (CT scan) [6] After all, there has been a uniformed result which could constitute a net conclusive variety of epidemiological trends at any time anywhere in the world. The most striking example of this conceded conclusive trends is that the renal stone is more predominant among men [7].

In the Kingdom of Saudi Arabia, a number of studies were conducted on the epidemiology of renal stone [5] However, those studies were retrospective in the most part and there still is thirst for more epidemiological reports extending to several regions.

Renal stone is usually associated with several lethal complications ranging from acute obstruction of urinary tract to chronic kidney diseases [8] Furthermore, it is leading cause of the consumption of strong addictive pain medication. To cap it all, those pain medication which is not addictive are to the detrimental to the patients' renal function. To illustrate, a previous study stated that NSAIDs are associated with a decline of the kidney function [9]**.** As consequence, it would be better to focus attention on how to prevent and completely resolute the renal stones rather than employing the conservative management.

The knowledge of epidemiology, etiology, risk factors and pathogenesis can assist in putting a limit to the increasing incidence of the renal stones [10] . To clarify, a previous study had confirmed the cost-efficacy of the prevention of renal stone [11] .

In Saudi Arabia **Khan *et al*.** studied the epidemiological risk factors and composition of urinary stones in the middle region of Saudi Arabia.

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In that analysis, the authors found a high male: female predominance of 5:1, and clear association with the hot weather where calcium oxalate stones were found to be the most common followed by uric acid and phosphate stones [3].

Contrary to our knowledge, there is an obvious dearth of epidemiological and analytic data about renal stone in the northern region of KSA.

Accordingly, the objective of this study is to estimate the self-reported prevalence of renal stone and determine possible risk factors among general adult population residing in Arar City to pave the way for a major epidemiological study in future.

Objectives:

To describe the current prevalence, risk factors, manifestations, methods of diagnosis and treatment of renal stones in Arar city, Northern Saudi Arabia.

METHODOLOGY

This is a cross-sectional, community-based survey being directed to the Saudi adult population living in Arar city during the period fromJune to October 2017.

Arar is rural city situated on the northern province of Saudi Arabia includes no more than 300,000 citizens including Saudi and expatriates. The vast majority of its original residents are belonging to Arabic white ethnicity a descended of tribes. Arare is a country's border region so it shelters a military members and their families. So as to attain the desired confidence level and margin of errors (95% and 5%, respectively) Roasoft online sample size calculator is being exploited here. To be on the safe side, we presumed a figurative number that no questions is larger than the reality and it was 2000000. Therefore, a sample size of 470 subjects should be sampled to get a confidence level of 95% and a margin of errors of 5%.

The sampling method was multistage random systematic dividing the city into equally populated regions including all the diversity of socioeconomic levels. Each region then was divided into blocks. Within each block a 9th numbered house-holding was included and in turn, one participant was picked and surveyed.

The study instrumentation is a self-administered questionnaire developed based on the literature review and the previously formed versions of National Health and Nutrition Examination Survey (NHNES [12,13]. The surveyors was trained on using the questionnaire. Then a pilot study was conducted on a convenience sample of subjects.

The final form of the questionnaire consisted of:

1) Sociodemographic features, 2) Environment and lifestyle, 3) Primary screening questions of renal stones, 4) Diagnostic questions of renal calculi, 5) The clinical, pathological, therapeutic details of the positive condition, 6) Past family, medical, and surgical history and comorbidities. 7) The weight and height for Body Mass Index.

Ethical considerations

Study approval obtained from research ethical committee of Northern borders general directorate of health affairs and from administration of selected health facilities. The participants assured that their data was dealt with confidentiality. Informed consent obtained from each participant before starting interview.

Statistical analysis

Collected data was coded and analysis was done using Statistical Package for Social Sciences (SPSS, version 16). Both descriptive and inferential statistics was extracted via using the most suitable statistical tests. P value was set at the level of 5%.

RESULTS

table (1) shows the socio-demographic characteristics, hereditary diseases, other chronic diseases obesity and muscular exercises among the studied population. 57.7% male and 42.3% females and 59% of them in the age range from 21-40 years. Married people were 72.3% and 92% has no family history of the disease. 86.6% hadn't chronic disease, 29% complain from obesity and 40% perform muscular exercises.

table (2) illustrates renal gravels, renal stones, recurrent renal colic and family history of renal stones and/or gravels among the studied population. 23% had renal gravel, 13% had renal stones. Only 15% complained from recurrent renal colic and 28% had family history of renal stones or gravels.

Table (3) shows the relationship between the presence of renal stones and socio-demographic characteristics, hereditary diseases, other chronic diseases obesity and muscular exercises among the studied population. 57% of the population were male and 65.5% of them have renal stones. Most affected cases in the age range from 21-40 years as they represented 72% of the cases. We found that 75% of cases were married and 57% reached university

education. 39.7% had family history of renal stones (P<0.05), 30% had other chronic diseases, 67% have renal gravels (P<0.05) and more than half (55.2%) had recurrent renal colic (P<0.05) and 39.9% were obese (P<0.05).

Table (4) show clinical manifestations, diagosis, stones (type, size, site) and treatment of cases. The most common symptom is renal colic as it appear in 55% of the cases and 82% of the affected people are diagnosed by complete urine analysis and ultrasound examination. The most common type is oxalate stone 55.2%, uric acid stones 27.6% and mixed stones 17.2%. 66% of cases urinate 3-7 times daily and 58% of them consume less than 3 liter of fluid daily and 58% get water from drinking water stations. More than half (55.2%) of the renal stones are small in size and 46% were found in the kidney. Most (84%) of the cases get herbal treatment but 31% of them were not improved, 89% turn to medical treatment and half of them had good response. Only 8.6% got surgical treatment. About half (46%) of the cases had recurrent stones.

Table (1): socio-demographic characteristics, hereditary diseases, other chronic diseases obesity and muscular exercises among the studied population, Arar, 2017 (N=470)

Sex	**No.**	**%**
Female	199	42.3
Male	271	57.7
Age group (in years)		
< 18	14	3.0
18-21	38	8.1
21-40	279	59.4
40-60	127	27.0
> 60	12	2.6
Marital status		
Single	130	27.7
Married	340	72.3
Educational status		
Illiterate	4	.9
Primary	24	5.1
Secondary	116	24.7
University +	326	69.4
Working status		
In private sector	67	14.3
In governmental sector	230	48.9
Not working	173	36.8
Hereditary diseases		
No	434	92.3
Yes	36	7.7
Chronic diseases		
No	407	86.6
Yes	63	13.4
Obesity		
No	338	71.9
Yes	132	28.1
Muscular exercises		
No	279	59.4
Yes	191	40.6

Table (2): Renal gravels, renal stones, recurrent renal colic and family history of renal stones and/or gravels among the studied population, Arar, 2017 (N=470)

Variables	No.	%
Renal gravels		
No	362	77.0
Yes	108	23.0
Renal stones		
No	412	87.7
Yes	58	12.3
Recurrent renal colic		
No	398	84.7
Yes	72	15.3
Family history of renal stones and/or gravels		
No	339	72.1
Yes	131	27.9

Table (3): The relationship between the presence of renal stones and socio-demographic characteristics, hereditary diseases, other chronic diseases obesity and muscular exercises among the studied population, Arar, 2017

Variables	Presence of renal stones		Total (N=470)	P value
Sex	Yes (N=58)	No (N=412)		
Female	20	179	199	0.124
	34.5%	43.4%	42.3%	
Male	38	233	271	
	65.5%	56.6%	57.7%	
Age group (in years)				
< 18	2	12	14	0.75
	3.4%	2.9%	3.0%	
18-21	0	38	38	
	.0%	9.2%	8.1%	
21-40	42	237	279	
	72.4%	57.5%	59.4%	
40-60	12	115	127	
	20.7%	27.9%	27.0%	
> 60	2	10	12	
	3.4%	2.4%	2.6%	
Marital status				
Single	14	116	130	0.319
	24.1%	28.2%	27.7%	
Married	44	296	340	
	75.9%	71.8%	72.3%	
Educational level				
Primary	7	17	24	0.004*
	12.1%	4.1%	5.1%	
Secondary	16	100	116	
	27.6%	24.3%	24.7%	
University	33	293	326	
	56.9%	71.1%	69.4%	
Illiterate	2	2	4	

Variables	Presence of renal stones		Total (N=470)	P value
Sex	Yes (N=58)	No (N=412)		
	3.4%	.5%	.9%	
Working status				
In private sector	11	56	67	0.439
	19.0%	13.6%	14.3%	
In governmental sector	29	201	230	
	50.0%	48.8%	48.9%	
Not working	18	155	173	
	31.0%	37.6%	36.8%	
Hereditary diseases				
No	47	387	434	0.002*
	81.0%	93.9%	92.3%	
Yes	11	25	36	
	19.0%	6.1%	7.7%	
Other chronic diseases				
No	41	366	407	0.001*
	70.7%	88.8%	86.6%	
Yes	17	46	63	
	29.3%	11.2%	13.4%	
Obesity				
No	36	302	338	0.05*
	62.1%	73.3%	71.9%	
Yes	22	110	132	
	37.9%	26.7%	28.1%	
Muscular exercise				
No	37	242	279	0.279
	63.8%	58.7%	59.4%	
Yes	21	170	191	
	36.2%	41.3%	40.6%	
Renal Gravels				
No	19	343	362	0.001*
	32.8%	83.3%	77.0%	
Yes	39	69	108	
	67.2%	16.7%	23.0%	
Family history of renal stones				
No	35	304	339	0.026*
	60.3%	73.8%	72.1%	
Yes	23	108	131	
	39.7%	26.2%	27.9%	
Recurrent renal colic				
No	26	372	398	0.001*
	44.8%	90.3%	84.7%	
Yes	32	40	72	
	55.2%	9.7%	15.3%	

* Significant

Table (4): Clinical manifestations, diagnosis, stones (type, size, site) and treatment of cases, Arar, 2017 (N=58)

Variables	No.	%
Symptoms		
Dysuria	20	34.5
Urinary dribbling	21	36.2
Renal colic	32	55.2
Repeated fever	12	20.7
Diagnosis		
Complete urine analysis and ultrasound examination	48	82.8
Chemical type of stones		
Oxalate stone	32	55.2
Urate stone	16	27.6
Mixed calcium oxalate/phosphate/uric acid stone	10	17.2
Frequency of urination/day		
< 3 times	12	20.7
3-7 times	38	66
> 7 times	8	13.8
Fluids consumption/day (in Liter)		
< 3	34	58.6
3-7	22	37.9
7-12	1	1.7
> 12	1	1.7
What type of water is used in drinking:		
Water from drinking water stations	34	58.6
Mineral water	24	41.4
Stone size		
Large stone	6	10.3
Small stone	32	55.2
Gravels	14	24.1
Unknown	6	10.3
Site of the stone		
Ureter	17	29.3
Kidney	27	46.6
Urinary bladder	4	6.9
Kidney pelvise	4	6.9
Urethra	2	3.4
Unknown	4	6.9
Treatment trials		
Herbal treatment	**49**	**84.0**
Improvement on herbal treatment	17	29.3
Mild improvement	14	24.1
No improvement	18	31.0
Medical treatment		
Response to medical treatment	**52**	**89.2**
Excellent response	11	19.0
Good response	29	50.0
No response	12	20.7

Variables	No.	%
Appearance of side effect	11	19.0
Surgical treatment	**8**	
Open surgery	5	8.6
Laparoscopic surgery	3	5.2
Breaking up stones (by radiation)	10	17.2
Outcome of treatment		
Complete cure	19	32.8
History of recurrent stone	27	46.6
Having good information about the disease	19	32.8

DISCUSSION

Renal stones, one of the most painful of the urologic disorders, are not a product of modern life. Unfortunately, renal stones are one of the most common disorders of the urinary tract. A large number of people are suffering from urinary stone problem all over the globe [8]. Renal stones, which are solid crystals that are formed from dissolved minerals in urine, can be caused by both environmental and metabolic problems. Calcium oxalate and/or phosphate stones account for almost 70% of all renal stones observed in economically developed countries [8]. This is a cross sectional study conducted on 470 participants, 57.7% males and 42.3% females, in Arar, city, Northern Saudi Arabia. The aim of the study was to describe the current prevalence and risk factors of renal stones in Arar city, northern Saudi Arabia; and to identify the manifestations, methods of diagnosis and treatment of the disease. This study reported 12.3% of the participants had renal stones, 65.5% were male and 34.5% were female. According to data from the National Health and Nutrition Examination Survey (NHANES), the self-reported prevalence of kidney stones in the United States has increased nearly three folds, from 3.2% in the period 1976–1980 to 8.8% in 2007–2010[12]. The prevalence of kidney stones in the United Kingdom increased by 63% (7.14–11.62%) between 2000 and 2010 [16]. Another study reported, the prevalence of kidney stones was 8.8%, among men the prevalence of stones was 10.6%, compared with 7.1% among women [2]. In Italy another study was conducted among 1,543 subjects, male to female ratio 0.79, The overall prevalence of stone disease (either current or previous) was 7.5 %,the prevalence of the disease in males was higher than in females (8.5 vs. 6.6 %, respectively) [14].Another study was conducted among 666 renal stone patients, 430 were males (64.56%) and 236 were females (35.44%) [13].In Greece another study among 422 subjects, the prevalence of renal stone was 15%, the rate was slightly higher in men than in women [15]. Historically stones have been 2–3-times more common in men than in women, recent data indicated that this disparity is diminishing [17]. The male to female ratio of incident kidney stones also declined in Rochester, Minnesota, USA, from 3.1 to 1.3, between 1970 and 2000 [1]. In Florida (USA), analysis of resource use related to procedures for stones revealed that the increase in rates in women was greater than that in men between 1998 and 2004 [18]. Comparison of NHANES II (1988–1994) with NHANES III (2007–2010) data has shown that the rise in kidney stone prevalence among Hispanics and African Americans was nearly double that of their white counterparts [13].

In our study, the most common type is oxalate stone 55.2%, uric acid stones 27.6% and mixed stones 17.2%. In Eastern Saudi Arabia, it was reported that, pure calcium oxalate stones were the predominant form accounting for 74.2% of all stones followed by uric acid stones (12.8%) [5].

Regarding risk factors of renal stones, our study reported, 65.5% of cases were males. Age of cases ranged from 21-40 years with mean age 35.4. Family history of renal stones was found in 39.7% ($P<0.05$), 30% had other chronic diseases, 67% have renal gravels ($P<0.05$) and more than half (55.2%) of them had recurrent renal colic ($P<0.05$) and 39.9% were obese ($P<0.05$).

Numerous systemic diseases and factors have been associated with an increased risk of kidney stones. Weight, weight gain, body mass index [21] and diabetes [20] have been shown in large prospective cohort studies to correlate with the risk of incident kidney stones, with a greater effect in women than in men in some cohorts. Another study found a significant relationship between dehydration and kidney stone, also it found a significant relationship between high intake of animal protein, sodium, sugar, coffee and tea [13]. The higher

prevalence of renal stones in Saudi Arabia than in the USA and Europe has been ascribed to a high intake of animal protein, which was 10% and 50% higher than in the USA and Europe, respectively [21]. In Saudi Arabia, there was a male predominance with a male: female ratio of 3.9:1. The average age was 48.5 years. Weight abnormality was predominant [5] .

Obesity and metabolic syndrome has been implicated as a risk factor for the formation of both calcium oxalate and uric acid kidney stones [23].

CONCLUSION AND RECOMMENDATIONS

The prevalence of renal calculi and associated renal colic in Arar city, Northern is considerable. Suggestions for health education about risk factors in addition to future researches are mandatory.

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