Prevalence of Chronic Kidney Disease and Its Risk Factors in Gonabad, Iran

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Introduction. Chronic kidney disease (CKD) is an important health problem in Iran, with an increasing prevalence rate. Knowledge about the prevalence and risk factors of this disease in different health jurisdictions can help in planning to control this condition.
Materials and Methods. In this cross-sectional study, 1285 individuals aged between 20 and 60 years old were recruited. Participants were selected from the general population residing in Gonabad, Iran, via simple random sampling in 2012. Demographic data were collected. Urine and blood test were performed, and the glomerular filtration rate was estimated based on the simplified Modification of Diet in Renal Disease equation.
Results. Sixty-five participants (5.1%) had CKD (5.1% men and 5% women; $P = .90$). The mean age was significantly higher in the CKD group ($P = .001$). Hypertension and diabetes mellitus were significantly more prevalent among the participants with CKD than those without CKD ($P < .001$ for both). Proteinuria was significantly associated with CKD, whereas a history of urinary tract infection, a history of nephrolithiasis, smoking, serum uric acid level, lipid profile, and blood glucose level were not.
Conclusions. Chronic kidney disease has a high prevalence rate in this part of Iran. We suggest further studies in other parts of our country for the better estimation of the prevalence of CKD in Iran and for better planning to prevent and treat this condition.

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INTRODUCTION

Chronic Kidney Disease (CKD) is one of the most important diseases with increasing prevalence worldwide and in Iran.[1-6] It is a major risk factor for cardiovascular diseases, and also it is a reason for mortality with increasing prevalence in almost all populations all over the world.[7,8] Many patients with CKD reach a state that is called end-stage renal

disease, in which the surviving is impossible unless with renal replacement therapy.[5,8] The definition and guidelines for classification of CKD were introduced by the National Kidney Foundation's Kidney Disease Outcomes Quality Initiative in 2002, and were subsequently adopted with minor modifications by the international guideline group Kidney Disease Improving Global Outcomes in 2004.[9-11] These CKD guidelines shifted the concept of kidney disease from that of an uncommon life-threatening condition requiring care by nephrologists to that of a common condition with a range of severity meriting attention by general internists, and demanding strategies for prevention, early detection, and management.

The guidelines had a major effect on clinical practice, research, and public health, but also generated substantial controversy. Patients with end-stage renal disease use a disproportionate share of health care resources.(11, 102) The total cost of the end-stage renal disease program in the United States was approximately US $ 39.46 billion in 2008. Medicare costs per person per year were nearly US $ 66 000 overall, ranging from US $ 26 668 for transplant patients to US $ 77 506 for those receiving hemodialysis therapy.[12] In Iran, the cost of kidney transplantation without the costs of rehospitalization, which sometimes is equal to or exceeds surgery costs itself, is near US $ 10 000.[13] Costs associated with each session of hemodialysis, excluding surgical setup, were estimated at US $ 80 (US $ 12 500 annually) in Iran. On the other hand, recognition of CKD in its early stages can improve the patients' condition and save the cost of CKD care.[14]

Some evidence suggests that CKD is not well recognized. Based upon findings from the National Health and Nutrition Examination Survey, for example, awareness of kidney disease in the United States population is low, particularly among certain patient subsets.[15] It was reported that self-awareness about the disease is about 40.5%, 29.3%, 22%, and 44.5% in stages 1, 2, 3 and 4, respectively. Non-Hispanic blacks, men, and those with hypertension were less likely to know that they had some degrees of kidney disease. A similar lack of awareness was noted in a second study based on the National Health and Nutrition Examination Survey data. In this study, women were much less likely to be aware about their decreased kidney function. This was thought to be due to the misinterpretation of clinicians of a "normal" serum creatinine concentration.[16]

Patients who are at risk of developing CKD should be screened with both urine and blood tests for proteinuria and creatinine, respectively, to estimate glomerular filtration rate (GFR). Patients who are at risk of glomerulonephritis should be screened for hematuria by urinalysis.[17] Because of the relatively low prevalence of CKD in the United States, massive screening in the general population is not recommended.[18-20] Such screening, however, would almost certainly detect individuals who have no identified risk factors but are at risk for progression to end-stage renal disease.[21,22]

In Iran, there are studies about the prevalence and other epidemiologic aspects of CKD, but none of them were conducted in the northeast of Iran.[23-28] We designed a study to determine the prevalence of CKD and its related risk factors in individuals aged 20 to 60 years old in Gonabad, northeast of Iran, in 2012.

MATERIALS AND METHODS

This cross-sectional study was conducted in Gonabad, a city located in the northeast of Iran, in Razavi Khorasan Province. According to the last population census in 2011, its population is 80 783. Three centers in this city provide healthcare services to all residents.[29] Each health center was considered as a separate stratum. By using stratified simple random sampling, individuals from the communities served by each center were selected proportioned to each stratum. After phone calls and describing the study, a total number of 1285 individuals enrolled in this survey. Inclusion criterion was an age between 20 years 60 years. The presence of acute kidney injury was considered as an exclusion criterion. This study complied with the Declaration of Helsinki and was approved by the local Ethics Committee. Written Informed consent was obtained from all participants.

The participants referred to their assigned center. Demographic information including age, sex, and educational status were collected. Laboratory tests were performed, including urinalysis, blood urea nitrogen, serum creatinine (by the Jaffe method), serum uric acid, fasting blood glucose, and serum levels of total cholesterol, high-density lipoprotein cholesterol, low-density lipoprotein cholesterol,

and triglyceride. Height, body weight, and blood pressure were also measured. Glomerular filtration rate was estimated using the simplified Modification of Diet in Renal Disease (MDRD) equation, as below[30]:

186 × (serum creatinine [mg/dL])$^{-1.154}$ × (age [years])$^{-0.203}$ × 1.212 (if African-American) × 0.742 (if female)

A GFR less than 60 mL/min/1.73 m^2 was considered CKD.

The SPSS software (Statistical Package for the Social Sciences, version 11.5, SPSS Inc, Chicago, Ill, USA) was used for all statistical analyses. Normality of distributions was assessed with the Kolmogorov-Smirnov test. The *t* test and the Mann-Whitney test were applied to comparisons of normally distributed and skewed data, respectively. To examine the association between categorical data, the chi-square and the Fisher exact tests were used, where appropriate.

RESULTS

A total of 1285 individuals participated in this study. Among those, 760 (59%) were women and 525 (41%) were men. The mean age of the participants was 41.9 ± 11.6 years, and on average, the women were 2 years older than the men (P = .001).

Among all of the participants, 65 (5.1%) had CKD. While the age ranges were comparable between the CKD and non-CKD groups (21 to 60 years versus 20 to 60 years, respectively), the mean age was significantly higher in the CKD group (P = .001; Table 1).

Hypertension was significantly more frequent among the participants with CKD than those without CKD (P < .001); both systolic and diastolic blood pressure measurements were higher on average in this group. The systolic blood pressure ranged from 100 mm Hg to 180 mm Hg in the CKD group 80 mm Hg to 180 mmHg in the non-CKD group. The diastolic blood pressure ranged from 70 mm Hg to 100 mm Hg versus 50 mm Hg to 100 mm Hg in the CKD and non-CKD groups, respectively. Chronic kidney disease was present in 15% of hypertensive patients, whereas it was present 2.7% of the participants with normal blood pressure.

Diabetes mellitus was also more prevalent among those with CKD (Table 1). Chronic kidney disease was present in 8.8% of diabetic patients, while it was present in 4.2% of the nondiabetic participants.

Eight percent of the participants with a history of urinary tract infection had CKD, but 4.5% of those without a history of urinary tract infection were screened positive for CKD. Among individuals with a history of nephrolithiasis, 3 (6.3%) had CKD and 45 (93.7%) did not, while among those without a history of nephrolithiasis, 40 (4.8%) had CKD and 796 (95.2%) did not (P = .50; Table 1).

Serum creatinine level ranged from 1.1 mg/dL to 10.0 mg/dL in the CKD group. Other than serum creatinine and blood urea nitrogen levels, none of the blood tests showed a significantly different level in the CKD group as compared with the non-CKD group (Table 2). Among 1194 persons whose dipstick tests were negative for proteinuria, 45 (3.8%) had CKD, whereas this was 22% in those with proteinuria (Table 2).

Table 1. Demographic and Clinical Characteristics of Participants*

Characteristics	Participants Groups		*P*
	CKD (n = 65)	Non-CKD (n = 1220)	
Sex			
Male	27 (42)	498 (41)	
Female	38 (58)	722 (59)	.90
Mean age, y	48.1 ± 9.2	46.1 ± 11.7	< .001
Diabetes mellitus	9 (14)	93 (7)	.04
Hypertension	22 (34)	125 (10)	< .001
Mean systolic blood pressure, mm Hg	131.8 ± 20	118.7 ± 14.3	< .001
Mean diastolic blood pressure, mm Hg	82.12 ± 7.5	74.4 ± 9.7	< .001
History of urinary tract infection	7 (10)	81 (6)	.18
History of nephrolithiasis	3 (4)	45 (3)	.50
Smoking	4 (6)	38 (3)	.13

*values are mean ± standard deviation for age and blood pressure and frequency (percentage) for all other variables.

Table 2. Laboratory Findings of Participants*

Laboratory Tests	Participants Groups		*P*
	CKD	Non-CKD	
Fasting blood glucose, mg/dL	110.5 ± 50.3	100.4 ± 35.1	.12
Blood urea nitrogen, mg/dL	20.2 ± 8.9	14.1 ± 4.4	< .001
Serum creatinine, mg/dL	9.0 ± 2.0	1.9 ± 1.7	< .001
Serum uric acid, mg/dL	4.8 ± 2.1	4.6 ± 1.5	.54
Serum Lipid profile			
Serum triglyceride, mg/dL	165.8 ± 73.1	146.9 ± 96.7	.12
Serum total cholesterol, mg/dL	193.9 ± 52.9	190.9 ± 41.5	.65
High-density lipoprotein, mg/dL	40.2 ± 22.5	38.7 ± 18.5	.52
Low-density lipoprotein, mg/dL	121.7 ± 53.2	123.6 ± 34.2	.66
Positive dyslipidemia	53 (81.5)	869 (71.2)	.07
Positive proteinuria	20 (22.0)	71 (5.8)	< .001

*values are mean ± standard deviation for all except for positive dyslipidemia and proteinuria, which are frequency (percentage).

DISCUSSION

Prevalence of CKD has been reported to vary in between studies. In our study, as mentioned above, the prevalence of CKD was 5.1%. In different studies in Iran, this prevalence was between 4.6% and 37.9%. Najafi and colleagues in Golestan Province and Barahimi and colleagues in Isfahan Province detected the prevalence of 4.6% and 4.7%, respectively.[23,28] On the other hand, Ghaffari and coworkers reported a prevalence of 37.9% in Urmia in West Azerbaijan in Iran.[24] The prevalence of CKD in Fars province was reported to be 11.6% in year.[31]. One of the probable causes of differences in these results is the difference in the method of measuring the serum creatinine level. For example in our study, the Jaffe method was used for measuring it.

The other probable cause might be due to difference in the way of determining GFR. In some studies, inulin clearance or diethylene triamine pentaacetic acid clearance are the measuring methods for GFR estimation, while in some studies measuring of serum creatinine alone is used. The Cockroft-Gault equation is used for estimating GFR in some studies and the MDRD methods are applied in other ones.[24-29] As mentioned above, in the current study, we used the MDRD method for calculating GFR. In Ghaffari and colleagues' study, elevated serum creatinine was the only criteria for determining CKD and GFR was not estimated at all; therefore, comparison of their reported prevalence of 37.9% in that part of Iran with the other figures is not possible.[24] Reports from Golestan and Isfahan provinces used the MDRD method and their results were relatively similar.[23,28]

Variations in the populations' characteristics would be the other reason for differences between our result and what Ghaffari and colleagues reported. They studied the high-risk groups (such as diabetic and hypertensive patients), while our sample came from the general population. The prevalence of CKD in a study by Mahdavi-Mazdeh and colleagues[26] was 6.5%, whereas both studies used the MDRD method. It would be because of the differences in populations too; The latter was on male taxi drivers in Tehran.[24,26] In our study, there were no significant differences between men and women, while in most of the abovementioned studies, the prevalence of CKD was higher in women.[23,26,28]

CONCLUSIONS

Overall, it seems that CKD is a common health problem in Iran, but further studies in other parts of this country is recommended for the better estimation of CKD prevalence. This study shows the importance of screening for CKD. Greater attention to risk factors and underlying diseases should be placed high on the agenda.

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CONFLICT OF INTEREST

None declared.

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