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Assessment of Risk Factors for Chronic Kidney Disease in Saudi Arabia

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Abstract: ***Background:*** ***A number of risk factors are associated with increasing prevalence of chronic kidney disease (CKD) with disease progression in many patients. Therefore, this study aimed at providing epidemiological data on the prevalence of risk factors for CKD in Hail, Kingdom of Saudi Arabia (KSA).*** ***Methodology:*** ***Data were collected during cross sectional survey included 5000 Saudi selected from 30 primary health care centers (PHCs) in Hail Region.*** ***Results:*** ***The overall prevalence of risk factors for CKD in Hail was 75%. The prevalence rates of cardiovascular diseases (CVD), continuous use of non-steroidal anti-inflammatory drugs (NSAIDs), herbal preparations and cigarette smoking were 5.3%, 10.7% and 13.5%, and31%, respectively. The correlation of high creatinine levels (>1.4mg/dl) have shown statistically significant differences with hypertension (p=0.0000, diabetes (p=0.000), obesity (P= 0.013), CVD (P< 0.05) and smoking (P=0.02).*** ***Conclusion:*** ***There are many risk factors significantly contributing to the development of CKD in Hail Region. Application of future prevention and control measures are highly recommended to reduce the burden of CKD.***

Keywords: CKD, Risk factors, Hail, Saudi Arabia

1. Introduction

Chronic kidney disease (CKD) is continuously growing to be to be a global health problem [1]. Cardiovascular disease (CVD)[2], hypertension [3], diabetes[4], and obesity[5], are increasing in frequency throughout the world and are commonly associated with an increase in the prevalence of CKD. CKD is correlated with an increased risk of CVD proceedings. Recently, high neutrophil gelatinase-associated lipocalin (NGAL) levels have been detected in patients with heart failure, coronary heart disease, or stroke [6,7]. Evidence for the relationship between renal function impairment and many CVD events was first detected in the dialysis patients in whom the incidence of CVD death is very high. Approximately 50% of individuals with end stage renal disease (ESRD) die from a CVD cause [8, 9].

Diabetes is the leading cause of CKD, demonstrated for 33% of the adult cases with CKD [10]. Nevertheless, 20% to 40% of diabetics will develop diabetic nephropathy during the end stage of their disease [11]; therefore, with the increase of cases of diabetic patients, the incidence of CKD is expected to rise. The initial presentation of diabetic kidney disease is microalbuminuria followed by increasing severity of proteinuria as the glomerular filtration membrane is damaged [12].

Hypertension represents a powerful risk factor for CKD and is almost fixedly found in patients with renal failure. Sodium retention and activation of the renin-angiotensin system have been regarded as the most effective mechanisms implicated in the rising of blood pressure in patients with CKD [13].

Obesity has been realized as a risk factor for the development of CKD, independently of hypertension, diabetes, and pre-existing renal disease [14]. Obesity often coexists with hypertension, which may cause nephropathy [15]. Obesity is associated with the early onset of glomerulomegaly, hemodynamic changes of a hyperfiltering kidney, and increased albuminuria, which are reversible with weight loss [16].

NSAIDs have been associated both with acute kidney injury in the general population and with disease progression in those with CKD [17]. Smoking is risk factor for several diseases including renal diseases. Cigarette smoking is proven as a major risk factor for the development and progression of CKD in community [18, 19].

The development of CKD and later proportion of decline in renal function are diversely variable among individuals with the same implied cause of renal disease. This Individual variability reflects the multi factorial nature of the biologic mechanisms that are involved in the underlying disease process. Therefore, the aim of this study was to assess the association between CKD and the common risk factors for the development of CKD in Hail area, KSA.

2. Materials and Methods

Data regarding risk factors for CKD were collected as a part of a comprehensive survey included 5000 Saudi civilians living in Hail region Northern Saudi Arabia. The purpose of the survey was to estimate the prevalence of for chronic kidney disease and its associated risk factors in the area. During the survey participants were interviewed at PHC or home and invited to a mobile examination center to undergo various examinations and laboratory measurements. Data were collected by the doctors of the team utilizing a standard questionnaire, which included demographic information including; family history of CKD, renal stone, recurrent urinary tract infection, stroke, heart attack, congestive heart failure, lower limb deep vein incompetence, non-steroidal anti-inflammatory drugs abuse, herbal abuse, smoking, and others.

Venous blood sample was collected from each participant for the measurement of creatinine level.

3. Results

The mean age and of the study population was 43.5 ± 18.7 years with 44.6±20.2 for male and 42.3±16.9 for female. Male female ratio was 1.00: 1.01. The overall prevalence of exposure to CKD risk factors other than diabetes and hypertension was 75%. The prevalence rates of family history of CKD, recurrent urinary tract infection and renal stones were 1.6%, 13% and 3.6% respectively. The prevalence rates of CVD including; stroke, heart attack (HA), congestive heart failure (CHF), and lower limb deep venous incompetence (LDVI), was 5.3%. The prevalence rates of continuous use of NSAIDs and herbal preparations and cigarette smoking were 10.7% and 13.5%, and in this order, 31% as indicated in fig 1.

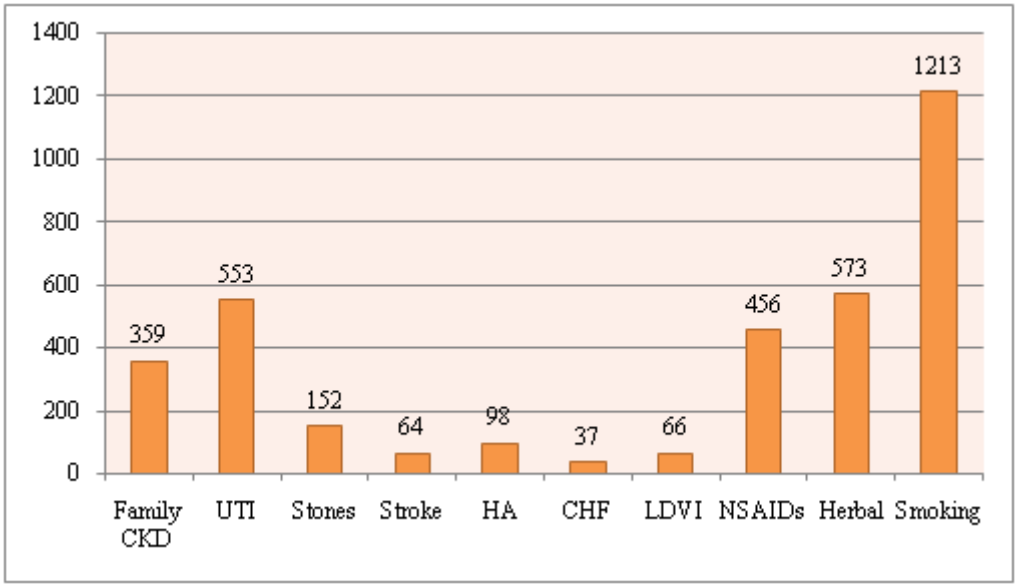

Figure 1: Description of the study population by CKD risk factors

In regard to the relation between risk factors for CKD and gender, smoking, HA and stroke were found to be statistically associated with male ($P < 0.00001$), since, LDVI, NSAIDs, UTI, and herbal preparations use were strongly linked to female, and these was found to be statistically significant ($P < 0.0001$, 0.001, 0.001, 0.001 for LDVI, NSAIDs, UTI and herbal, in this order), as indicated in Fig.2.

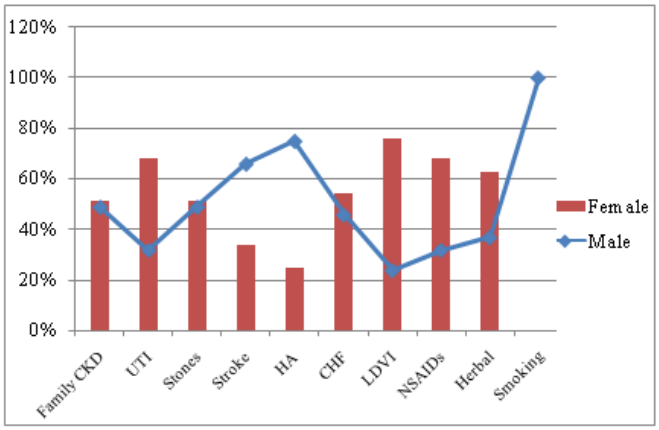

Figure 2: Description of risk factors for CKD by gender

Table 1: Distribution of risk factors by creatinine levels

Risk factors	Creatinine mg/dl		Total	P value
	< 1.4	>1.4		
Hypertension	573	136	709	0.000
Diabetes	673	127	800	0.000
Obese	1456	145	1601	0.013
Stroke	29	10	39	0.001
HA	30	16	46	0.000
CHF	17	8	25	0.001
LDVI	50	5	55	0.5
Stone	197	11	108	0.5
NSAIDs	329	38	367	0.08
Herbal	366	35	401	0.4
Smoking	1100	113	1213	0.02

Table 1, summarizes the correlation between risk factors and creatinine level. The correlation of high creatinine levels have shown statistically significant differences with hypertension (p=0.0000), diabetes (p=0.000), obesity (P =0.013), stroke (P = 0.001), HA (P=0.000), CHF (P= 0.001) and smoking (P=0.02). However, NSAIDs have relatively elevated insignificant value (P=0.08).

Table 2: Distribution of the study population by risk factors for CKD and age

Age	Stroke	HA	CHF	LDVI	UTI	Stones	NSAIDs	Herbal
<25 years	0	0	0	1	34	17	53	85
26-40	3	4	6	19	227	31	111	164
41-55	16	22	14	24	164	47	131	176
56-70	30	41	7	15	95	40	110	115
71+	15	31	10	7	33	17	51	33
Total	64	98	37	66	553	152	456	573

Table 2, summarizes the relationship between risk factors and age. However, the peaks for most risk factors were at middle age 41-55 years, followed by age range 26-40 years.

4. Discussion

The development of CKD prevention and control strategies is a key factor for reducing the burden of the disease. Identifying individual's risk factors and at-risk populations are potential targets for a suitable intervention in different populations. This should include active expansion of the existing perception of health care, social, and economic risk factors at both the individual and the community level. In the present study the exposure to different risk factors of CKD is collectively very high, which requires more attention.

However, there is close relationship between CVD and smoking, as smoking is a major risk factor for occurrence of CVD. In turn this expresses why CKD is growing worldwide problem. Since the prevalence of smokers is high among those with high creatinine levels (31%) and also relatively those with CVD (5.3%) in the current study, this is increasingly showing that CKD is linked to CVD and smoking. The relevance between CKD and CVD is well known that, CKD and its epiphenomena magnify the risk for CVD [20]; moreover, CVD is the main cause for the majority of morbidity and mortality in patients with CKD [21]. The prevalence of CKD is expected to increase particularly in developing countries, where smoking and other cardiovascular risk factors are increasing substantially [22], such as in case of Saudi Arabia. According to the WHO statistics in 2008, the majority of killer diseases in the KSA are non-communicable, chronic diseases. Of these is CVD which is responsible of 35% of cases of death [23]. Another study from eastern province of Saudi Arabia has found that 2.7% has a history of CVD [24], which is much lower than our findings in this study.

The consequences of smoking for patients with CKD mostly serious, it has influence on both the progression of CKD and CVD [25]. However, Smokers had a significantly higher creatinine clearance than nonsmokers, expressing the fact that smoking-induced hyperfiltration [26]. However, some studies from KSA have shown relatively similar prevalence rates to the findings in the current study. In an article reviewed the literature on the epidemiology of tobacco smoking in KSA. The prevalence of current smoking in KSA ranges from 2.4-52.3%. Among school students, the prevalence of current smoking ranges from 12-29.8% (median = 16.5%), among university students from 2.4-37%, and among adults from 11.6-52.3%. In elderly people, the prevalence of current smoking is 25%. The prevalence of smoking in males ranges from 13-38%, while in females it ranges from 1-16% [27]. Notably, no female has confessed smoking habit in this study, since it is consider as social stigma. Another study included 1382 Saudi students from 9 colleges; the prevalence of current smoking was 28.1% [28].

Hypertension is well known to be a risk factor for CKD worldwide [29] and CKD is accepted as one of the independent risk factors for CVD, which in turn can be a risk for hypertension. In the present study, 19% of hypertensive patients were found with high creatinine level and the correlation between high creatinine level and hypertension was found to be statistically significant (P = 0.000). In hypertension, glomerular infiltration rate (GFR) has been reported to decline faster compared to those without hypertension [30]. Furthermore, some studies have found a close relation between the rate of decline of GFR and the development of new onset CKD after a while in patients with hypertension [31].

Although, obesity represents only 9% of those with high creatinine level, but obesity is a known risk factor for CKD and its progression. Adipose tissue and have been able to produce hormone-like peptides named adipokines or adipocytokines. Among these adipocytokines, which represent a link between obesity, hypertension, and chronic nephropathy, leptins and adiponectin appear to play an important role. Leptin not only is a prohypertension element (renal progression factor) through the activation sympathetic nervous, but also is able to induce prosclerotic effects directly on the kidney [32].

There is a global increase in the prevalence of diabetes-associated CKD with an expected doubling of the number of people with diabetes in many countries within the next 20 years [33]. In the present study 16% of the diabetic patients were found with increased creatinine level (>1.4 mg/dl). Patients with type 2 diabetes mellitus have a 25–40% lifetime risk of developing CKD [34]. However, there is no available data on the prevalence rates of risk factors (including diabetes) for CKD in the general population of the KSA.

NSAIDs are commonly used and its safety is still questionable for the development of CKD. In the present study 10.4% of individuals with high creatinine levels confessed that they in continuous use of these drugs. It is well known that NSAIDs can cause analgesic nephropathy or chronic interstitial nephritis; accordingly, it might be another risk factor for the development of CKD. Several previous researches suggest that regular use of large compounds of NSAIDs may increase the risk of CKD [35]. Adverse renal effects of NSAIDs include acute renal failure; nephrotic syndrome with interstitial nephritis; and chronic renal failure with or without glomerulopathy, interstitial nephritis, and papillary necrosis [36]. Thus, the status of NSAIDs usage is important, because it is widely used medications in the elderly because of osteoarthritis [37].

Furthermore, 8.7% of the individuals with creatinine were found to use herbal preparations of a wide spectrum as medications for different diseases. The components of most herbal preparations practiced in Hail area are not scientifically known; and therefore, their risk is still obscure. Some herbal products contain undisclosed amounts of potassium, which can cause hyperkalemia. Some may contain heavy metals that are toxic to the kidneys, or ephedralike vasoconstrictive compounds that can cause hypertension [38-40].

Future Scope: This study of identified multiple risk factors associated with the development and progression of CKD. These findings underline the importance of early detection

and management of those exposed to these factors in an attempt to delay CKD progression. In this study we identified several clinical risk factors associated with renal progression in our study population, including hypertension, Diabetes, obesity and others, which require further assessment. These may represent potential targets for improved management of patients with CKD that have the effect to influence the rates of CKD progression.

In conclusion: There is an increase prevalence rate of risk factors of CKD in Hail, which requires health authorities to implement preventive strategies. Smoking emerges as a chief modifiable renal risk factor particularly among patients with diabetes, hypertension and patients with CVD. Awareness programs should be implemented at community-based to reduce the overall burden of risk factors which in turn will reduce the incidence of CKD in Hail.

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