Prevalence of Chronic Kidney Disease among Hypertensive non-Diabetic Patients Attending Primary Healthcare Centers in Cairo, Egypt

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ABSTRACT

Background: Although chronic kidney disease (CKD) is considered the major cause of morbidity and mortality in hypertension, the recognition and prevention of CKD remain deficient. CKD is one of the major health challenges in Egypt. CKD affects approximately 13% of the adult population, resulting in significant morbidity, mortality and health care costs. Patients with more progressive stage 3 or stage 4 CKD experience a high rate of cardiovascular events and death compared to earlier stages of CKD. **Aim:** This study was performed to determine the prevalence of chronic kidney disease among hypertensive non-diabetics patients attending Primary health care (PHC) Centers in Cairo. **Methodology:** The study type is a cross sectional study, Study setting: Two Primary Health Care centers (PHCs): Saraya El-kobba and El-Sharabya. Sampling method: Recruitment of participants was done in one day weekly. Any known essential hypertensive patients aged 18 or more registered in the two PHC Centers in Cairo. **Results:** The prevalence of CKD was 33% among the hypertensive non-diabetic patients. Among CKD participants, the prevalence is more common in females (59.7%) than males (40.3%), in those who completed primary education and the illiterates and low socioeconomic class. Surprisingly, it is more common in patients with positive family history of CKD and patients with ischemic heart disease and the antihypertensive drugs used. **Conclusion:** CKD has a high prevalence among hypertensive non-diabetic patients, and it has a significant morbidity and mortality among those patients.

Keywords: *Prevalence, Chronic Kidney Disease, Hypertension, Primary health care centers.*

INTRODUCTION

Chronic Kidney Disease (CKD) is one of the major health challenges in Egypt. Chronic kidney disease (CKD) affects approximately 13% of the adult population, resulting in significant morbidity, mortality and health care costs. Patients with more progressive stage 3 or stage 4 CKD experience a high rate of cardiovascular events and death compared to earlier stages of CKD (Yamany et al., 2017).

Hypertension is both a presentation and a cause of CKD because the kidney plays a significant role in the control of blood pressure and may predict underlying kidney disease. Poorly controlled hypertension also leads to rapid deterioration in renal function culminating in end-stage kidney disease (ESKD). Hypertension was, however, found to be the third most common causes of CKD in a single-center study in Ghana (Tannor et al., 2019).

KDIGO 2012 defined CKD as abnormalities of kidney structure or function, present for >3 months, with implications for health, and the classification system has been revised to encompass cause and severity. Identifying cause is emphasized because of it is very important in predicting outcome and guiding choice of cause-specific treatments. Severity is expressed by level of GFR and albuminuria. Severity is linked to risks for adverse outcomes, including death and kidney outcomes (Stevens et al., 2013).

The stages of CKD are classified as follows: Stage 1: Kidney damage with normal or increased GFR (>90 mL/min/1.73 m2) Stage 2: Mild reduction in GFR (60-89 mL/min/ 1.73 m2) Stage 3a: Moderate reduction in GFR (45-59 mL/min/1.73 m2) Stage 3b: Moderate reduction in GFR (30-44 mL/min/1.73 m2) Stage 4: Severe reduction in GFR (15-29 mL/min/1.73 m2) and Stage 5: Kidney failure (GFR < 15 mL/min/1.73 m2 or dialysis) (KDIGO, 2012).

In China, the incidence of CKD coexisting with hypertension is 6%–18%, and the prevalence of hypertension in CKD is estimated at 60%–80% (Bao et al., 2020). In the United States, the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) reports that one in 10 American adults has some level of chronic kidney disease (CKD). Kidney disease is the ninth leading cause of death in the United States (CDC, 2017).

In Egypt a cross-sectional study was conducted on the relatives of patients with CKD from a community-based screening programme to detect the prevalence and risk factors for MA. The prevalence of MA was more than 10% in the population screened and higher in the subjects with diabetes, hypertension, obesity or CVD (Gouda et al., 2011).

Unfortunately, the number of patients developing ESRD as a complication of hypertension is increasing in Egypt. However, the diagnosis of hypertensive ESRD is one of exclusion and no pathologic data corroborate this classification. These patients suffer from a diversity of diseases, including accelerated hypertension and atherosclerotic disease of the large arteries and undiagnosed chronic renal disease. It is also identified that mild-to moderate hypertension can lead to ESRD. Therefore, additional studies are essential to determine the frequency with which essential hypertension leads to ESRD in Egypt (Soliman et al., 2012).

Multiple guidelines recommend that patients with diabetes or hypertension be screened annually for CKD. Furthermore, patients with other risk factors, including cardiovascular disease, older age(>than 60), racial or ethnic minorities, history of low birth weight, obesity, , exposure to known nephrotoxins, low income or education level, autoimmune diseases, systemic infections, urinary tract infections, nephrolithiasis, neoplasia, recovery from acute renal failure, reduction in kidney mass and a family history of CKD, warrant consideration for screening. The American College of Physicians and the American Academy of Family Physicians recommend against screening for CKD in asymptomatic adults without risk factors (Gaitonde et al., 2017).

However, more than 90% of individuals who have CKD remain unidentified. High blood pressure and diabetes are the main risk factors of CKD. Therefore, early screening and avoidance of progression of CKD having a very high cardiovascular risk are extremely essentials challenges and goals for primary care physicians (Alemán-Vega et al., 2017).

METHODOLOGY

PARTICIPANTS

The study participants comprised 200 hypertensive non- diabetic patients of both sexes registered for 2 primary health care centers in Cairo: Saraya El-kobba and El-Sharabya PHC centers. They were recruited, from the internal medicine clinics of both PHCs, in one day weekly. All the hypertensive patients were enrolled in the study till completion of the sample size.

Participants with the following criteria were excluded:

1. Any cases suffering from Diabetes Mellitus.
2. Pregnant females.
3. Any cases suffering from Secondary hypertension
4. Any cases suffering from chronic kidney disease due to: Polycystic kidney disease, obstructive uropathy or autoimmune diseases like systemic lupus erythematosus and rheumatoid arthritis.
5. Individuals with a history of drug addiction / NSAIDs abuse.

An agreement to an informed consent was obtained from all subjects, fulfilling the study criteria, before taking part in the study. The protocol of this study was approved by the Institutional Review Board (IRB) of Ain shams University graduate school of medicine.

STUDY TOOLS _

All study participants were subjected to:

1- An interview questionnaire: The questionnaire was divided into four parts:

First part inquired about the socio-demographic data about the age, sex ,level of education, occupation, smoking habit, having exercise regularly, gravidity, parity and past history of preeclampsia (in females).

Second part inquired about information about hypertension duration, control, medication compliance and drugs taken.

Third part inquired about past history of cardiovascular diseases, Ischemic heart diseases, cerebrovascular strokes, surgical operations done and contrast dye exposure

Fourth part inquired about family history of hypertension, diabetes mellitus, and chronic kidney disease.

2- Clinical Examination including:

a) Arterial blood pressure was measured twice using sphygmomanometer.
b) Anthropometric Measurements:

i) Weight was measured by a digital scale. The participant stands with minimal movement with hands by their side. Shoes and excess clothing were removed. Weight was approximated to the nearest .5 kilogram (kg).

ii) Standing height was measured using stadiometer.

iii) Body mass index (weight/height "m2") was calculated.

iv)Waist and Hip circumference are measured using non-stretch flexible fiberglass tapes.

v) The waist hip ratio is calculated as waist measurement divided by hip measurement (W ÷ H).

3. Laboratory investigations:

1) A 2.5mLof blood sample was drawn from the participants and was sent to the Central Laboratories of El-Demerdash Hospital, Ain Shams University to determine the serum creatinine level.
2) A spot urine sample was collected in a transparent plastic container and was sent to the Central Laboratories of El-Demerdash Hospital, Ain Shams University to measure the Protein Creatinine Ratio (PCR).

Then GFR was calculated using the Modification Diet in Renal Disease formula (MDRD) Equation. This calculator uses the 4-variable equation from Levey 2006 (sex, age, race and serum creatinine). The CKD stages were estimated using the National Kidney Foundation Kidney Disease Outcomes Quality Initiative guidelines.

The following criteria were applied in order to classify stages of CKD:

Stage 1: GFR ≥90 mL/min/1.73 m2

Stage 2: GFR between 60 and 89 mL/min/1.73 m2

Stage 3A: GFR between 45 and 59 mL/min/1.73 m2

Stage 3B: GFR between 30 and 44 mL/min/1.73 m2

Stage 4:GFR between 15 and 29 mL/min/1.73 m2

Stage 5: GFR < 15 mL/min/1.73 m2.

Individuals with a GFR <60 mL/min/1.73 m2 (i.e., stages 3A, 3B, 4 and 5) were considered to be affected by CKD.

Statistical analysis and package:

First, the following descriptive analysis was done: frequency, percentages, mean and standard deviation (SD). Thereafter, a comparison was done using Student t-test for quantitative variables and Fisher exact test for qualitative variables. Level of significance was set at p value equals to or less than 0.05. Data entry and statistical analysis was done using Statistical Package for Social Science (SPSS) version 23.0.

RESULTS

The study shows that the prevalence of CKD (i.e. GFR<60 mL/min/1.73 m2) among hypertensive non-diabetics patients (i.e. Stages 3a, 3b, 4 and 5) was found to be 33%.

Table 1 shows distribution of individuals according to the classification stages of GFR following recommendation of KDIGO 2013. The majority of patients lie is stage 2.

Table 2 compares sociodemographic data of CKD and non CKD patients; age and less physical exercise were important risk factors for CKD.

Table 3 compares CKD and non CKD patients regarding information about hypertension; long duration of hypertension and non-adherence to treatment were a predictive risk factor for CKD.

Table 4 compares CKD and non CKD patients regarding antihypertensive drugs; angiotensin converting enzyme inhibitors with thiazides were found to protect against CKD.

Table 5 shows that past medical histories of ischemic heart disease and dye exposure, together with family history of CKD are risk factors for CKD.

Table 6 shows that high BMI and waist/hip ratio are important risk factors for CKD.

DISCUSSION

Chronic Kidney Disease (CKD) is one of the major health challenges in Egypt. Chronic kidney disease (CKD) affects approximately 13% of the adult population, resulting in significant morbidity, mortality and health care costs. Patients with more progressive stage 3 or stage 4 CKD experience a high rate of cardiovascular events and death compared to earlier stages of CKD.

Hypertension is both a presentation and a cause of CKD because the kidney plays a significant role in the control of blood pressure and may predict underlying kidney disease. Poorly controlled hypertension also leads to rapid deterioration in renal function culminating in end-stage kidney disease (ESKD). Hypertension was, however, found to be the third most common causes of CKD in a single-center study in Ghana.

The findings of the present study demonstrate an alarming prevalence of CKD among the hypertensive non-diabetic patients attending the primary heath care centers in El-Sharabya and Saraya El-kobba centers assessed: 33% (95% CI: 33.0e44.2). Longitudinal studies in the 1980's, such as Hypertension, Detection and Follow-up Program and Intervention Study of Multiple Risk Factors, demonstrate a significant prevalence and incidence of CKD among systolic arterial hypertension (SAH) patients, which has continued up to the present day.

An observational study of SAH patients in Spain reported that 40% of those assessed exhibited reduced GFR which is similar to the results of the present study. It is notable that this was the greatest prevalence found in all published studies. A cross sectional study was done by Da Silva et al ., 2016 in Brazil and revealed that the hidden prevalence of CKD among SAH patients attending primary health care centers in the town of Porto Firme in Minas Gerais at Brazil is 38.3%.

Mohanty and collaborators (2020) stated that there is a paucity of data in the national registry on the incidence and prevalence of CKD. Hence, the accurate burden of CKD in India is lacking. The approximate prevalence is around 800 per million population and the incidence of end-stage renal failure cases is about 200 per million population [20]. In our study total, 14.3% were diagnosed CKD and the prevalence of CKD without diabetes or hypertension was 10.8% (Mohanty et al., 2020).

Tonner and collaborators (2019) stated the prevalence of CKD among patients with hypertension was 26.3% which is less than that reported in an earlier single−center study in Ghana showing a prevalence of CKD of 46.9% among hypertensive patients.

The worldwide prevalence of CKD is 11%–13% with age-standardized prevalence among the 20 years and above population occurring in 10.4% of males and 11.8% of females (Mills et al., 2010).

The prevalence of various stages of CKD in our study was stages I (29.5%), II (37%) IIIa (14.5%), IIIb (12%), and IV (6.5%), V (6.5%).

Our current study revealed that CKD prevalence is more common in females (59.7%) than in males (40.3%) which is not similar to that done in India by Mohanty and collaborators (2020) that stated that In developing countries, the prevalence is 10.6%

female and 12.5% male. However, in developed nations 8.6% of males and 9.6% of females are living with CKD.

With regards to education, in our study the prevalence of CKD is higher among those who completed their primary school (26.9%), illiterate (20.9%), those who completed their preparatory school (22.4%), secondary school (20.9%) than those who completed their university(7.5%) which is much similar to the Cross-Sectional study conducted by Ravi Kumar assessing the Prevalence of Chronic Kidney Disease and Its Determinants in Rural Pondicherry, India showing that prevalence of CKD is higher among the illiterate people (27.2%) than the literate ones (20.6%).

With regards to occupation, the prevalence of CKD is more among the retired patients (28.4%) and the housewives (20.9%), elementary occupations (13.4%) and plant with machine operators (10.4%) than the professionals, associate professionals and the clerks (7.6%) which is similar to the study done by Mohanty and collaborators (2020) which reported that the CKD of unknown origin was found more among members of the lower socioeconomic group (70%), and among farmer and agricultural labor (48%).

Da Silva and collaborators (2016) as well reported that when the prevalence ratio was assessed, it was negatively associated with CKD, without statistical significance. Studies have shown that a low socio-economic level is a risk factor for non-communicable diseases (NCD) and an association between this indicator and the incidence of CKD has been reported. Possible explanations for the association with CKD include the difficulty of access to known that CKD is more in low socioeconomic class, health care systems and the inadequate control of illnesses such as SAH and diabetes, which affect the understanding of the disease and the adhesion to its treatment. In a study conducted in the state of Rio Grande do Sul using CKD patients in dialysis, patients in hemodialysis exhibited significantly lower levels of education, lower family income and lower active employment levels than the general population of the region.

As regards the duration of hypertension, it is known that CKD prevalence rate in higher in long standing uncontrolled hypertension, in our study CKD prevalence varies as following: 30.3% in those whose duration is less than five years, 24.2% for 5-10 years, and 45.5% for more than 10 years. This corresponds with the results conducted by Da Silva and collaborators (2016) that reported CKD prevalence among SAH patients > 10 years are 55% while that among SAH patients < 10 years are 45%.

As regards the control and compliance of the patients towards regular checkup of their hypertension and regular intake of the antihypertensive drugs, it is obvious that 65% of CKD were not controlled on their treatment while 35% of them were compliant on their treatment and this huge proportion revealed that those patients were not taking the correct anti-proteinuric antihypertensive agents (e.g. ACEI & ARBS).

From the list of antihypertensive agents, we can conclude that 41.79% of CKD take BB, 17.91% take CCC, 19.4% take ACEI and thiazides, 7.46% take ARB and thiazides, 5.97% take BB and Lasix, 4.48% take BB and Aldactone and 3% take CCC and Thiazides which means that The CKD prevalence are more common in those who use Beta Blockers drugs. There is statistically significant difference between those CKD patients and non CKD regarding the antihypertensive drug used. However, Tannor and collaborators (2019) stated that the use of ACEI and ARBs was not significantly protective of CKD which is not similar to our study results. Also, Komaroff and collaborators (2018) conducted their first study to the authors' knowledge that estimated changes in relationships between use of antihypertensive medications and stages of CKD for American hypertensive adults with CKD. They stated that their results are consistent with the population-based ecological study in the United Kingdom and suggest that significant increase in advanced stages of CKD can be potentially attributable to the treatment with ARB polytherapy, perhaps, damaging the kidney and increasing albuminuria.

As regards the clinical examination there is a statistically significant relationship between CKD patients and non CKD patients regarding the age, Body Mass Index and Waist hip circumference.

These results were similar to the studies conducted by Da Silva and collaborators (2016) clarifying that the expressive prevalence of CKD in individuals over 60 years of age corroborates the findings of several studies which stated that advancing age is an established risk factor for this disease. The prevalence of CKD among individuals aged between 61 and 70 years was 3.01 times greater than that of adults aged between 25 and 50 years. Similarly, the prevalence of CKD was 5.36 times greater among individuals aged 71 years or more.

Regarding the physical activity, those involved in less physical activity (98.5%) were also at increased risk of developing CKD. Decreased physical activity leads to obesity. Obesity is associated with diseases such as hypertension and DM. Increased BMI has been shown to lead to CKD through DM and hypertension and through other pathophysiology such as hyperfiltration leading to focal segmental glomerulosclerosis which presents with heavy proteinuria (22.5%).

Tonner and collaborators (2019) reported that obesity shares an intimate relation with and the development and the progression of CKD. It is a risk factor for hypertension and diabetes, both also established risk factors for CKD. The prevalence of overweight/ obesity in our study was high, much higher than rates reported in the general population. Of this, 65.2% had CKD. Other studies also reported high prevalence of obesity in CKD cohorts. Waist circumference rather than BMI is said to be a better measure of obesity and correlates more accurately with CKD risk and CVD outcomes.

As regards the toxemia of pregnancy, the Prevalence of CKD among those who had past history of toxemia of pregnancy was 20% while among those who did't have was 13.9% and there is no statistically significant between them.

In this study, the prevalence of proteinuria accounts for 22.5% of all CKD patients which is somewhat similar to the results conducted by Da Silva and collaborators (2016) that revealed the prevalence of microalbuminuria is 22.5%. The prevalence of CKD according to eGFR using MDRD Formula 34%.While prevalence of CKD according to Protein/Creatinine Ratio 22.5%.

In total, 39 individuals were diagnosed with CKD by estimating the GFR through the CKD-MDRD formula and did not exhibit high proteinuria. In addition, 27 individuals with proteinuria were not classified as CKD patients using the CKD-MDRD formula, which may suggest that these individuals were in the early stages of the disease.

Most of the studies assess the CKD using albuminuria while this study assesses CKD using proteinuria which is a barrier for comparison between different studies.

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