Epidemiology of Chronic Kidney Diseases in Ethiopian Police Hospital: Institutional based cross sectional study

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Abstract

Background

Diabetes mellitus remains the leading cause of end stage renal disease in most countries in the world. In Ethiopia, renal complications of diabetes may remain unrecognized due to limited diagnostic resources. As a result, the studies that shows the prevalence of chronic kidney disease (CKD) and its risk factors among adult diabetics in Ethiopia are flimsy. Hence, this study was aimed at assessing the prevalence of chronic kidney disease and associated factors among diabetic patients who attended federal police hospital diabetic clinic in Addis Ababa.

Methods

Hospital based cross sectional study was conducted among 362 Diabetes Mellitus patients using systematic sampling method. Chronic kidney disease stage was categorized according to the classification system established by the National Kidney Foundation Kidney Disease out comes Quality Initiative and defined by Estimated Glomerular Filtration Rate (eGFR) <60ml/min/1.73m2. Analysis was performed using SPSS. The prevalence estimates for the reduced GFR and overall chronic kidney disease were obtained. Binary logistic regression was used to see associated factors with chronic kidney disease.

Results

The prevalence of chronic kidney disease diagnosed by Cockroft-Gault equation and Modification of Diet in Renal Disease equation was 14.6% and 7.7% respectively. Age 50-59 years (AOR= 4.0; 95% CI:1.2, 13) by Cockroft-Gault equation (CG), age 60-69 years (AOR=5.8 95%CI:1.5,21.0) by Modification of Diet in Renal Disease (MDRD) and (AOR;22.9 95%CI:7.1,74.2) by CG, age 70 years and above (AOR=4.7; 95 CI: 1.1, 19.7) by MDRD and (AOR= 22.9; 95%CI:7.1,74.2) by CG, BMI (AOR=2.2; 95% CI:1.6, 4.2) by CG, and previous kidney disease (AOR=6.2 95%CI:2.0,8.4) by MDRD and (AOR;4.6 95%CI:1.9,10.8) C-G equation were found to have a significant association with chronic kidney disease after an adjustment done using multivariate analysis.

Conclusion

The prevalence of chronic kidney disease among Diabetic patients in this study was high. Age, BMI
and previous recurrent kidney disease were associated with Chronic Kidney Disease. Preventive measures like giving health education and screening of patients with risk factors should get more attention.

Introduction

Chronic kidney Disorder (CKD), a progressive disease, abnormalities of kidney structure and function for greater than 3 months with an estimated glomerular filtration rate (eGFR) less than 60 mL/min/1.73 m² and/or evidence of kidney damage, including persistent albuminuria-defined as greater than 30 mg of urine albumin per gram of urine creatinine (1). It has five stages which are determined by glomerular filtration rate, the process by which the kidney filter the blood, removing excess wastes and fluids (2). Even though there are many causes CKD, its two most common causes which are responsible for two-thirds of all cases are diabetes (44%) and high blood pressure/hypertension (29%) (3). Studies revealed that Diabetic nephropathy affects approximately 20–40 % of individuals who has diabetes, making it one of the most common complications related to diabetes (4, 5).

The prevalence of CKD is increasing rapidly worldwide with its prevalence estimated to be between 8% and 16% and is now recognized as a global public health problem. Despite various measures, the burden of renal disease is likely to escalate since both population age and prevalence of diabetes are projected to increase dramatically(6, 7). Furthermore, the rapid increase in the prevalence of risk factors, such as hypertension, and obesity, has increased the burden of CKD, making CKD an important socioeconomic and public health problem. Moreover, study revealed factors like gender, occupation, level of education, marital status, hypertension, hyperuricemia, history of kidney stones, and the use of nephrotoxic medications are contributing factors for the development of chronic kidney disease (8). Ethiopia, like the rest of the world, is experiencing prevalence of non-communicable diseases mainly as a result of urbanization, sedentary life styles, obesity, population growth and aging. Even though there were studies for the better prevention and control of this disease, the studies from developing countries including Ethiopia are very scanty. There have been only a few studies that examined CKD prevalence among diabetic patients in Ethiopia (9, 10). On the other hand,
in Ethiopia, renal complications of diabetes may go unrecognized due to limited diagnostic resources. Since there is no renal registry that is established to document the epidemiology of renal disease, the prevalence of CKD among adult diabetics in Ethiopia has not been well described. However, since chronic illnesses are increasing in Ethiopia as the rest of the world, continuous assessment and updated data is helpful to increase the effectiveness and efficiency of effort on prevention of further expansion of the disease. Therefore, this study was designed to assess the epidemiology of CKD among diabetic adults attending the Federal Police Commission Referral Hospital Diabetes Clinic in the capital city of Ethiopia, and to identify the associated risk factors based on estimated glomerular filtration rate derived from the Modification of Diet in Renal Disease.

Methods
Hospital based cross-sectional study design was conducted in federal police hospital, Addis Ababa, from October to December 2017. Federal police hospital is one of the government hospitals in Addis Ababa, Ethiopia, which was established in 1962, under Ethiopian Federal Ministry of Health, which is located around Lideta kifle ketema (administrative classification of the city). It provides various health services to the police officers and their families. One of the services provided by the hospital is care for chronic disease at a chronic disease clinic. During the study, there were about 1800 diabetic patients enrolled for follow up care and the patients visited the clinic for follow-up care every 3 months. All diabetic patients taking their follow-up visit at the outpatient diabetic clinic of the hospital were the source population and systematically selected diabetic patients attending the hospitals outpatient diabetic clinic for follow up during the data collection period were the study population. Diabetes patients greater than 18 years old who were attending the clinic and registered at chronic care were eligible for the study. However, pregnant women were excluded from the study to avoid the effect of gestational diabetes.

Sample size was calculated using single population proportion formula by considering the following parameters: 10.4% proportion of chronic Kidney Diseases from previous study (10), 95% confidence interval and 5% margin of error. Since the total number of patients on follow up care was less than 10,000, sample size was adjusted by using finite population correction formula. Then, by considering
non-response rate 10%, the total sample size calculated was 363. Systematic sampling technique was used to select the study subjects. From a total number of 1800 diabetic patients, every 4\textsuperscript{th} diabetic patient was selected as a study unit the study subjects reached at the level of the total sample size. The first subject was determined by simple random sampling method from the first 4 patients.

Data collection and measurement

STROBE checklist was used to analyze and report data (11). Data were collected by two trained personnel using structured questionnaire. A questionnaire was adopted and prepared from related literature with modification to local context (4, 12, 14, 15, 16, 17, 18, 19). First, the English version questionnaire was developed and then it was translated to Amharic (the local language). The Amharic version was back translated to English to check for its consistency. Before the actual data collection, the questionnaire was pretested on a small sample of respondents (5\%) in Zewditu Memorial Hospital in Addis Ababa. Based on the pretest, necessary modification was done on the questions. Finally, the Amharic version interviewer administered structured questionnaire were used.

To assure the quality of data, data collectors and supervisors were trained. The questionnaire containing socio-demographic status, personal and family health history and lifestyle behavior were collected from each subject. History of taking medications with nephrotoxic potential was recorded, Weight and height were measured, and BMI was calculated by the data collectors. Similarly, laboratory results of blood tests, which were done every 3 months, were filled from records in the Hospital.

Measurement

For this research CKD was defined as eGFR less than 60ml/min/1.73m\textsuperscript{2} by both equations (MDRD and C-G). High blood glucose level and Serum cholesterol level were defined as those who has FBS>150mg/dl and cholesterol level>200mg/dl during the study period respectively. Physical exercise was defined as having physical activities greater than 150 min per week. Alcohol consumption was also measured in this study as patients who consumed greater than two alcoholic beverages per day. Former alcohol consumer was defined as who consumes greater than two
alcoholic beverages but has not consumed for the last 12 months before the study and current smoker was defined as those who has smoked greater than 100 cigarettes in their life time and has smoked in the last 28 days before the study. Ex-smoker was defined as those who has smoked greater than 100 cigarettes in their life time but has not smoked in the last 28 days before the study. Knowledge of CKD was defined as respondent’s understanding of kidney disease symptom, treatment, management and risk factors and those who answered more than 50% of the question were considered as knowledgeable.

Analysis

The collected Data were coded and entered to EpiData manager and cleaned, then exported to SPSS version 21 for analysis. Continuous variables were presented in terms of measure of central tendency and measure of dispersion whereas categorical variables were presented as frequency and percentage. Bivariate logistic regression analysis was done to select candidate variables for multivariate logistic regression analysis. Variables with p-value less than 0.25 in the bivariate analysis were considered as candidate to be entered in multivariate logistic regression models. Multivariable Logistic regression analysis was performed to control for possible confounding effect. Odds ratio (OR) with 95% confidence interval (CI) were calculated to analyze the associations of categorical variables. P-value < 0.05 was considered statistically significant.

Results

Description of the Study Subjects

Total of 362 diabetic patients participated in our study making the overall response rate 99.7%. The mean (SD) of age of study participants were 55.4 (±13.63) years. Fifty eight percent of the study participants were in the age group of less than 60 years and about 69% were male. More than three fourth (81.2%) of study participants were married. Two hundred ninety six (81.8%) of participants were from Addis Ababa. Majority (42.5%) of the study had primary education and more than three fourth (85.4%) had more than 500 Ethiopian birr monthly income (Table 1).

Prevalence of Chronic Kidney Disease
among diabetic patients

The prevalence of CKD diagnosed by C-G equation was 14.6% (n = 53) and the prevalence diagnosed by MDRD equation was 7.7% (n = 28). Using the MDRD equation the stages of CKD were diagnosed as; stage 3 were 6.9% (n = 25), stage 4 were three individuals and none on stage 5. 0.8% (n = 3) and no one diagnosed on stage 5. Whereas, as per CG equation, among the 53 individuals, 13.5% (n = 49) were on stage 3, four individuals were on stage 4 and none on stage 5. This indicates the prevalence of CKD is higher at stage 3 and none at stage 5.

Factors associated with chronic kidney disease

At bivariate analysis age, sex, income, BMI, DM duration, types of medication, history of hypertension, duration of hypertension, cardiovascular disease, previous history of kidney disease, cigarette smoking, alcohol intake and knowledge were found to be candidates for multivariable logistic regression analysis.

At multivariable logistic regression analysis; age, BMI and previous kidney disease were found to be independently associated with chronic kidney disease (Table 2). Attendants whose age was between 50–59 years were 4 times more likely (AOR = 4.0; 95% CI (1.2,13) to develop chronic kidney disease compared to patients whose age was under 60 years by CG equation. Similarly, attendants whose age was between 60–69 years by MDRD (AOR = 5.8; 95% CI:1.5, 21.0) and by CG (AOR = 8.1; 95% CI (2.6, 25.0) were about 6 and 8 times more likely to develop chronic kidney disease respectively when compared to patients whose age was under 60 years. Respondents whose age was 70 years and beyond by MDRD (AOR = 4.7; 95% CI: (1.1,19.7) and by CG (AOR = 22.9; 95% CI (7.1,74.2) were about 5 and 23 times more likely to develop chronic kidney disease respectively when compared to patients whose age was under 60 years. Patients with high BMI were significantly associated with chronic kidney disease when using C-G equation. Obese patients were about two times more likely to develop chronic kidney disease than those who were not obese (AOR = 2.2; 95% CI:1.6, 4.2). Previous recurrent kidney disease was another factor which was significantly associated with chronic kidney
disease. Those who has been recurrently diagnosed to have any form of kidney disease were 6 and 5 times more likely to develop chronic kidney disease when using MDRD (AOR;6.2 95% CI:2.0,8.4) and C-G equation (AOR;4.6 95%:1.9,10.8) respectively.

Discussion
This study found the prevalence of CKD to be 7.7% and 14.6% by using MDRD and C-G equations respectively. Age, BMI and previous recurrent kidney disease were associated with chronic kidney disease. Previous studies conducted in Addis Ababa and southern Ethiopia has shown that CKD prevalence is between 10.4% by MDRD and 19.1% by C-G equation and 18.2% by MDRD and 23.8% by C-G equation respectively. The estimated prevalence of CKD using both equations in the current study is lower than previously conducted studies in Ethiopia (9, 10). On the contrary, a study done in Bangladesh and Mediterranean area using MDRD equation, 13.1% and 13.4% respectively, were higher than the estimated prevalence of CKD obtained from this study using the same equation (14, 15).

The estimated prevalence of CKD using C-K equation was higher than the estimated prevalence of CKD reported in sub-Saharan Africa 12.4% and lower than estimated prevalence of CKD in Tanzania 24.7% (13, 17). The possible reason for the discrepancy is the estimated prevalence of CKD might be due to unavailability of the patients during the data collecting period. Patients with end stage renal disease (stage 5 CKD) referred to other hospitals for possible dialysis were unavailable at the time of the survey. On the other hand, the difference might be due to difference in population, as this study was in police Hospital, somehow different from general population.

In this study, advanced age groups were found to have a significant association with chronic kidney disease using both MDRD and C-G equation. The finding is consistent with other studies conducted in China and southern Ethiopia (9, 16). In various studies conducted worldwide, older age was found to be the strongest predictor of lower estimated GFR and it has been significantly associated with increased incidence of CKD among diabetic patients. Although the prevalence of CKD in older diabetic patients was high, only very few of these individuals with CKD were aware that they had this disease. Our study was conducted on a diabetic clinic, where most of the patients with CKD are either
asymptomatic or have few clinical symptoms, which may help to explain the low disease awareness. Since age increases the risk, long-term reduction of CKD morbidity and mortality requires more attention to early detection and prevention of CKD using various screening tools among the older diabetic population.

In this study, being obese was inversely associated with the disease using the C-G equation. This is in contrary to the study done in India (20). The difference might be due to difference in population and study setting, as this study was in police Hospital, somehow different from the report from India which was community base study. Previous recurrent attack of kidney disease was also significantly associated with CKD irrespective of the equation were used. Those who had been diagnosed with kind of kidney disease previously were found to be more likely to develop current chronic kidney disease compared to those who had never been diagnosed to have kidney disease using both equations. A study done in Tanzania showed an association when analysis done using bivariate but was not associated when enters in to multivariate logistic regression (17).

However, this study had several limitations. Even though this study has strength like using both standard equations to calculate the glomerular filtration rate, it has also the following limitations; it was conducted in only one hospital which may affect the generalization of the finding and since the study was cross sectional study the possibility of recall bias may result in under reporting and misreporting of results.

**Conclusion**

This study identified prevalence of chronic kidney disease in diabetic patients using both equations is high. Age of the patients, having history of previous kidney disease and BMI were associated with chronic kidney disease. Therefore, alleviating modifiable and preventable factors that leads to kidney disease is recommended. Further, provision of persistent health education and training for those who are diagnosed to have diabetes mellitus reduces the magnitude of the problem.

**Acronyms/abbreviations**

C-G, Cockroft-Gault equation; CKD, Chronic Kidney Disease; CVD, Cardio Vascular Disease; DM,
Diabetes Mellitus; ESRD, End Stage Renal Disease; eGFR, estimated Glomerular Filtration Rate; FBS, Fasting Blood Sugar; GFR, Glomerular Filtration Rate; HTN, Hypertension; KDIGO, Kidney Disease Improving Global Outcomes; MDRD, Modification of Diet in Renal Disease

Declaration

Ethics approval and consent to participate

Ethical clearance was obtained from ethical review board of institute of health, Jimma university, from Addis Ababa Health Bureau ethical committee and from the Ethical Committee at Federal Police Commission Referral Hospital. Each participant was informed about the objectives and benefits of the research and its findings, preceding the data collection. Verbal consent was obtained from each participant prior to enrollment. Names were not used in collecting the data from the medical files, and confidentiality were maintained by keeping the data collection forms locked in a secure cabinet.

Consent for publication

Not applicable

Availability of data and materials

Data will be available upon request from the corresponding author.

Competing interests

The authors declare that they have no competing interests. All authors have reviewed and approved the submission of the manuscript.

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Authors’ contributions

MA involved in conception, designing methods, analysis, interpretation and drafting of the manuscript. LD, HM and BA Participated in designing, data analysis, interpretation of the findings and
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Tables

Table 1: Socio demographic characteristics of study participants in federal police hospital, Addis Ababa, 2017

| Variables                  | Frequency | Percentage (%) |
|----------------------------|-----------|----------------|
| Age (year)                 |           |                |
| 18-49                      | 119       | 32.9           |
| 50-59                      | 91        | 25.1           |
| 60-69                      | 96        | 26.5           |
| ≥70                        | 56        | 15.5           |
| Sex                        |           |                |
| Male                       | 251       | 69.3           |
| Female                     | 111       | 30.7           |
| Educational status         |           |                |
| Illiterate/primary         | 89        | 24.6           |
| Secondary                  | 154       | 42.5           |
| Higher                     | 119       | 32.9           |
| Marital status             |           |                |
| Unmarried                  | 15        | 4.1            |
| Married                    | 294       | 81.2           |
| Divorced/Widowed           | 53        | 14.6           |
| Residence                  |           |                |
| Urban                      | 296       | 81.8           |
| Rural                      | 66        | 18.2           |
| Monthly income (Ethiopian Birr) |       |                |
| ≤ 500                      | 53        | 14.6           |
| >500                       | 309       | 85.4           |

Table 2: Bivariate and Multivariate analysis of factors associated with CKD among participants in Federal police hospital Addis Ababa, 2017

Due to technical limitations, Table 2 is only available as a download in the supplemental files section.

Supplementary Files

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Table 2.jpg