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Screening for Chronic Kidney Disease in a Small Developing Country using the National Kidney Foundation Guidelines

Case Report

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Abstract

Objective: The purpose of this study is to screen high risk patients greater than 45 years attending primary care facilities who have undiagnosed CKD and identify this group for further intervention.
Design and Methods: A cross-sectional study design was used. The populations consisted of all adults 45 years and older in a primary care setting. A validated questionnaire was administered to all eligible participants.
Results: A total of 227 participants were entered into the study. No participant refused to participate resulting in a 100% response rate. One hundred and five participants 105 46.3% were classified as normal and one hundred and twenty two 122 53.7% were classified as having Stages 1-3 CKD. Further, 22 (18.0%) participants were found to be in Stage 3 of CKD.
Conclusion: We provide evidence that screening can detect as much as 18.0% of asymptomatic individuals with Stage 3 CKD.

Keywords: Chronic Kidney Disease (CKD); Estimated Glomerular Filtration Rate (eGFR); Stage 3 CKD; End Stage Renal Disease (ESRD).

Introduction

Over the past two decades (1990-2010), deaths from chronic kidney disease (CKD) rose to almost 82% worldwide, the third largest increase among the top 25 causes of death after HIV/AIDS and diabetes. In England £1.45 billion was spent on caring for people with CKD in 2009-10 [1]. The Caribbean has the highest prevalence of chronic non communicable diseases (CNCD) in the region of the Americas, of which CKD is an important contributor [2]. PAHO in its 2008 report stated that deaths due to CNCD were 673 per 100,000 in Trinidad and Tobago [3]. In 2011, the Ministry of Health (MoH) reported 699 patients on dialysis treatment at public and private health facilities throughout Trinidad and Tobago [4, 5]. In 2010, the MoH signed a contract with the British-based company Fresenius Medical Care and Biomedical Technologies for operation of haemodialysis units which were estimated to cost the state $108,675,375.00 (TT) annually [6]. The state is also continuing to subsidised dialysis treatment by paying a monthly grant of $5,000 (TT) to recipients needing dialysis, thus further emphasising the urgent need to reduce the incidence of CKD and its progression to end-stage renal disease (ESRD) [7]. Several studies have demonstrated a positive correlation between CKD and type 2 diabetes mellitus (T2DM) and hypertension, both of which are the major contributors in our setting [8-11]. Soyibo et al., in 2006 reported that more than 50% of all cases of Stage 5 CKD in Trinidad was associated with DM (28.9%) or hypertension (25.3%) [8]. This is against a background in which the adverse outcomes of CKD including kidney failure and premature death are preventable [12], through screening of at risk, asymptomatic individuals [12-15].

A critical web exists between awareness of risk, the presence of disease, and steps taken by the patient and clinician to change the natural history of disease. Chronic illnesses such as diabetes mellitus, dyslipidaemia, anaemia and a multitude of endocrinological and rheumatological diseases are relatively silent and rely on the clinical laboratory for diagnosis, particularly in their early stages. Probably no such illness permits such a large loss of organ function before symptoms become present than

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CKD [16]. Thus, the considerable dependence on the laboratory to establish the diagnosis of CKD is an issue for low-income and middle-income countries (LMIC), where access to *in-vitro* diagnostics on a screening basis might not be universally available. Even in high-income countries where routine laboratory tests are performed, CKD seems to lag considerably behind diabetes mellitus, hypertension, and cardiovascular disease in terms of patient and clinician awareness [17]. This difference is partly due to the two-dimensional nature of CKD defined as a reduction in estimated glomerular filtration rate (eGFR) and the presence of markers of chronic kidney damage (albuminuria or imaging evidence) over 3 months time. Thus, to have the eGFR and albumin/creatinine ratio at the same time clearly inform the patient of the potential presence of CKD is complex. With these challenges as the backdrop, the aim of this study is to screen patients greater than 5 years attending primary care facilities for undiagnosed CKD in order to provide the evidence to support this intervention.

We used a cross-sectional study design. The population consisted of all patients attending primary health care facilities (PHCF) in the Eastern Regional Health Authority (ERHA) which has an estimated population of 120,000 persons. In this region, primary health care is delivered through fifteen (15) PHCF (clusters) of which seven were randomly selected to meet our calculated sample of 227. All adult patients greater than 5 years with T2DM, hypertension or both were eligible for entry into the study. Pregnant patients, patients with obstructivenephropathy, polycystic kidney disease, lupus nephritis and existing stages 4 and 5 CKD were excluded from the study.

Demographic data and clinical data such as blood pressure, current treatment, duration of comorbidities, waist circumference, weight (kg), height (m) and BMI were collected. Also included were laboratory results for urinalysis, blood glucose, HbA1c and serum creatinine. The serum creatinine was used to calculate the estimated Glomerular Filtration Rate (eGFRCr) using the epidemiological formula: eGFRCr = 141 x $\min(Scr/\kappa,1)^{\alpha}$ x $\max(Scr/\kappa,1)^{-1.209}$ x 0.993^{Age} x 1.018 [if female] x 1.159 [if black], where Scr is serum creatinine (mg/dL), κ is 0.7 for females and 0.9 for males, α is –0.329 for females and –0.411 for males, "min" indicates the minimum of Scr/κ or 1, and "max" indicates the maximum of Scr/κ or 1 [18].

Blood pressure was measured using a mercury sphygmomanometer using standard techniques, two measurements were made in both the right and left arms and the average recorded [19]. Hypertension was defined as a BP>140/90 (JNC8) [20] and T2DM was defined as a physician diagnosis with or without the use of an oral hyperglycaemic agent, insulin or a fasting blood sugar >126mg/dL, a random blood sugar of >200mg/dL or a HbA1c >7% [21]. Ethical approval for this study was obtained from the University of the West Indies' Ethics Committee. All data was stored, retrieved and analysed using SPSS vs 22.0.

Results

All 227 participants who met the entry criteria for the study were available for analysis. The mean age was 63.07 years (SD± 9.7) with an interquartile range of 56-70 years. The majority of participants 83 (36.6%) were in the age group 55-64 years. There were more females than males with a female:male ratio of 1.8:1.The sample consisted of more persons of South Asian origin 130, (57.3%) than of African origin 71 (31.3%), although both represent 35% of the population [22]. Of the 227 patients entered into the study, 105 patients had a normal eGFRCr (≥ 90ml/min/1.732m^2) and no clinical evidence of proteinuria. Thus, 122 participants were found to have stages 1-3 CKD. Therefore, 122 (53.7%) patients had confirmed CKD of which the majority 81 (66.4%) were in Stage 2 (eGFRCr of 60-89ml/min/1.732m^2). However, the major finding of the study was 18.0% (95% CI-13%-23%) of participants had Stage 3 CKD. Since the study was conducted in an outpatient clinic, it is unlikely that patients with Stage 4 or 5 CKD would be attending the clinic.

Further analysis revealed that there was a significant temporal relationship with the occurrence of CKD. CKD (Stage 1-3) was significantly higher (p=.004) in participants with T2DM and hypertension for greater than 5 years 59 (85.5%) than those with T2DM and hypertension for greater than 5 years 10 (14.5%). Among all 227 participants, hypertension was more common 184 (81.1%) than T2DM 128 (56.4%), and 92 (40.5%) patients had both hypertension and T2DM. Approximately one quarter of the patients already had established coronary heart disease 21 (9.3%) and dyslipidaemia 52 (22.9%). Overall only 4 patients (1.7%) had no evidence of any underlying comorbidity. The majority of participants 111 (48.9%) were either retired or unemployed and therefore not earning an income. 198 (87.2%) patients had a family history of either T2DM or hypertension and 27 (11.9%) had a family history of CKD. Using logistic regression analysis there was a significantly higher odds ratio for CKD by age and ethnicity. Of concern was only 87(38.3%) participants had an HbA1c, mainly among patients with T2DM (34) of which 22 (64.7%) was greater than 7%.

Discussion

The major finding of the study was screening identified 22 (18.0%), (95% CI: 13-23) previously undiagnosedcases of Stage 3 CKD. Stage 3 CKD occurred predominantlyin the age group 65-84 years and among patients with obesity (68.2%), T2DM (63.6%), and hypertension (86.4%). In the Third National Health and Nutrition Examination Survey [23], a nationally representative sample of the U.S. population, 13% of adults with T2DM had a GFR less than 60 ml/min/1.73 m^2, consistent with stage 3 CKD. Several large studies have reported a proportion of Stage 3 CKD ranging from 4.3-15.6% [23, 24]. It is apparent that Trinidad has a high prevalence of Stage 3 CKD, emphasising the need for screening programs to detect CKD. Screening programs are generally aimed at conditions with a substantial public health impact for which there is benefit from early interventions. CKD certainly fits this criterion. CKD Stage 3 is associated with an increased incidence of both renal failure and death compared to the general population, particularly for those younger than 70 years [25]. Studies of Stage 3 CKD have also shown that over a 10 year period, 34.6% will progress to Stage 4 CKD and 26.2% will progress Stage 5 CKD requiring renal replacement therapy [25]. Notwithstanding, cardiovascular disease far outweighs the risk of renal failure [26]. The majority of patients 21 (95.45%) with stage 3 CKD had both T2DM and hypertension for greater than 5 years, both factors are significant predictors of Stage 3 CKD (OR 8.25, 95%CI: 1.02-8.18, p = 0.042). In addition 198 (87.2%)

patients had a family history of CKD which was also identified as a significant risk factor (OR 2.01, p=0.03) for the development of CKD, consistent with the literature [27].

Overall, 122 (53.7%) participants had stages 1-3 CKD. The occurrence of CKD was significantly ($p < 0.05$) more common in women 73 (59.8%) than men 49 (40.2%) and occurred most common 46 (37.7%) in the age group 65-74 years. Several studies have reported a similar pattern [24, 28-31].

As Stages 1-3 CKD, occurred in older age groups, it was not unusual to find that most of these patients were unemployed 103 (84.4%) or receiving government assistance and therefore not financially equipped to suitably manage their disease. Therefore impacting adversely on quality of life as well as adding an additional burden to the state.

The major limitation of the study was the unavailability of laboratory support to determine the albumin/creatinine ratio which is a key marker of chronic kidney disease, emphasising not only gaps in the clinical care of patients but the challenges confronted in the developing world. Hence, the study was restricted to eGFR estimations. A single eGFR may also contribute to misclassification bias.

In conclusion our data seem to present a three-part challenge: (1) to screen and detect CKD, (2) to become aware of the condition, and (3) to understand and act on the knowledge that controlling modifiable risk factors like blood pressure and glucose can attenuate progression of CKD. In the end it all starts with screening and detection of a silent disease, which give years of opportunity for discovery and modification of its natural history.

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