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A Prospective Study on Renal Biomarkers and their Correlation with Comorbidities in Chronic Kidney Disease Patients

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ABSTRACT

Introduction: Impact of renal biomarkers and their correlation with co-morbidities in chronic kidney disease (CKD) patients is importantly evaluated with use of standardized tool to estimate the serum creatinine, blood urea nitrogen (BUN) and glomerular filtration rate (GFR) from national kidney foundation (NKF) practice guidelines. **Aim:** The aim of the study is to assess the importance of renal biomarkers in association with co-morbidities in CKD patients. **Methods:** A prospective observational study was conducted at a tertiary care hospital in Vadodara from September 2018 to February 2019. All adult CKD patients less than 60 ml/min of GFR and undergoing dialysis were included. Renal function was estimated from serum creatinine using Cockcroft-Gault formula and dose appropriateness was determined. **Results:** Overall prevalence of CKD varied widely and increased with the age, which was highest in middle aged adults. Male gender and substantial decline in GFR was significant factors whereas addiction demonstrates a borderline significance. Increased prevalence of CKD can be partly explained by the high prevalence of diabetes, hypertension and both in the screened population (5.71%, 40.00% and 22.86% respectively). **Conclusion:** CKD, with its high prevalence, morbidity and mortality, is a crucial public health problem but the prognostic significance of its co-morbidities is not well understood. In current scenario where health illnesses like diabetes and hypertension are gaining more awareness, CKD is silently progressing and yet remains unrecognized. Early intervention, planning for preventive health policies, allocation of more resources for treatment and awareness are imperative for disease prevention.

INTRODUCTION

Chronic kidney disease is a progressive pathological condition marked by deteriorating renal function over a period of time. It is characterized by destruction of renal parenchyma and loss of functional nephrons which leads to chronic renal failure. CKD is emerging to be an important global health burden. The lack of community-based screening programs has led to patients being detected with CKD at an advanced stage. CKD encompasses a spectrum of different pathophysiologic processes associated with abnormal kidney function and a progressive decline in GFR. The detection of kidney damage in an early stage needs robust biomarkers.

Cells use a large number of clearly defined signalling pathways to regulate their activity. On the onset of cellular impairment, there is dysregulation in signalling molecules which are either up-regulated or down-regulated and act as an indicator or biomarker of diseased stage. Biomarkers allow monitoring the disease progression at initial stages of disease. CKD typically evolves over many years, with a long latent period when the disease is clinically silent and therefore diagnosis, evaluation and treatment is based mainly on biomarkers that assess kidney function[1].

In 2015 Global Burden of kidney disease was the 12th most common cause of death, accounting for 1.1 million deaths worldwide[2]. One reason being rapid increase in the incidence of diabetes and hypertension. In India, approximately >1 billion, the rising incidence of CKD is likely to pose major problems for both healthcare and economy in future years[3]. Serun urea and creatinine are nitrogenous end products of metabolism. Creatinine is a breakdown product of creatinine phosphate in muscles, and is usually produced at a fairly constant rate by the body depending on muscle mass. The National Kidney Disease Education Program recommends calculating GFR from serum creatinine concentration[4]. The focus of the current study is to assess the importance of renal biomarkers in association with co-morbidities in CKD patients with renal impairment and to assess the dose appropriateness.

METHODS

Study design and Participants

A prospective observational study was conducted from September 2018 to February 2019 at a tertiary care teaching hospital in Vadodara, Gujarat. The Institutional Ethics Committee has

approved the study protocol. Informed consent was taken from all patients who had participated in our study and also described the study protocol.

Study Population

A total of 70 patients were enrolled for the study. Both outpatients and inpatients in the dialysis department diagnosed with CKD, other associated co-morbidities and patients less than 60 ml/min of GFR were included in the study. The exclusion criteria referred to patients <18 years of old and who are not diagnosed with renal diseases.

Data collection

The data was collected from the patients who met the inclusion and exclusion criteria using specially designed data collection form. The data contains the following details such as demographic data (age, gender), risk factors, biochemical parameters like GFR, serum creatinine and urea. Also, associated with co-morbid conditions identified for developing CKD were noted from the medical records. Patients or their care takers are interviewed for source of treatment given previously. The details of the data collected were transferred and analyzed using statistical tools.

RESULTS AND DISCUSSION

During the study period, a total of 70 patients were reviewed in nephrology department in a tertiary care hospital. Out of 70 patients, 49 (70%) were male, 21(30%) were female patients. Age was one of the factors contributed to CKD. Older people are at higher risk, so patients with CKD were distributed according to age (Figure 1) and according to the GFR range (Figure 2). Several co morbidities were observed in CKD patients and the list is shown in (Figure 3).

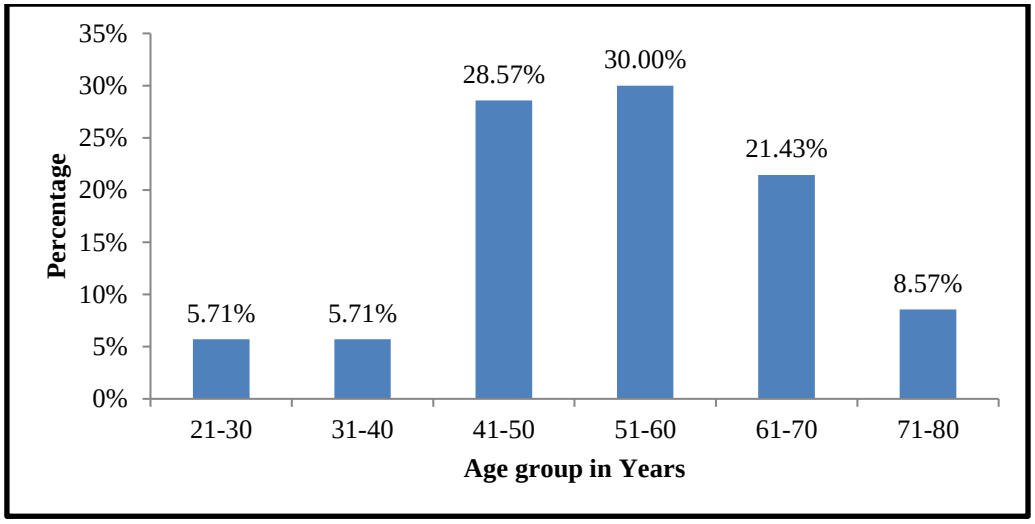

Figure 1: Age-specific Prevalence of CKD

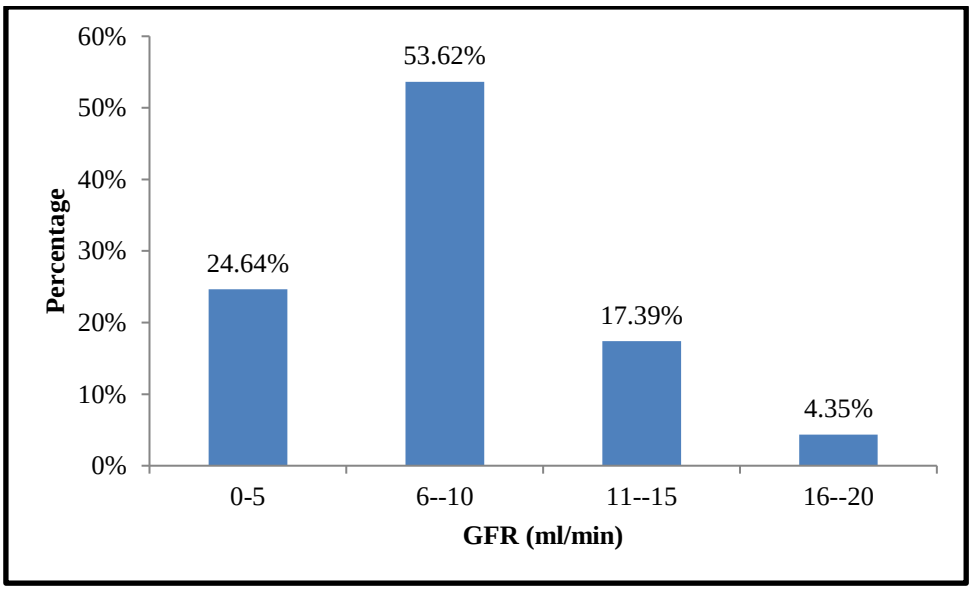

Figure 2: Categorization according to GFR range

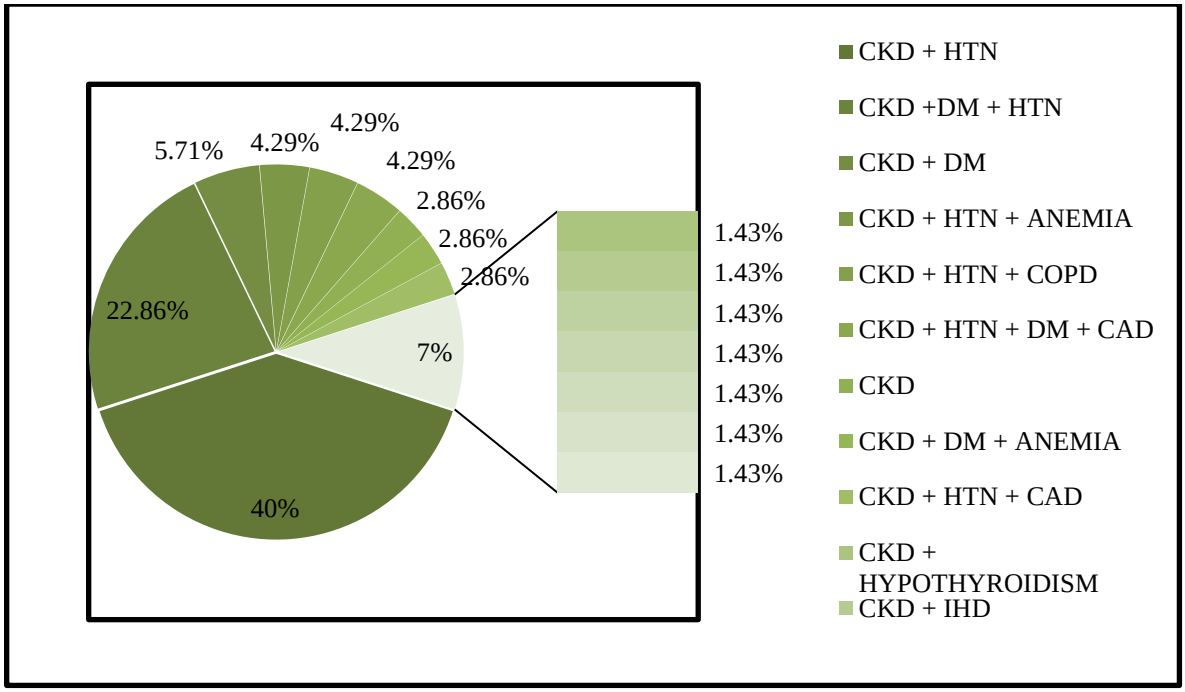

Figure 3: List of Co-morbidities in CKD patients

HTN = Hypertension, DM = Diabetes Mellitus, CAD = Coronary Artery Disease, COPD = Chronic Obstructive Pulmonary Disease

Age represents one of the most crucial factors that affect kidney function. Generally, kidney function is stable after infancy until late adulthood[12]. GFR declines by 1 ml/ min/1.73 m^2 per year after the age of 30 years in healthy individuals[13]. The decrease in kidney function might be due to the changes in the kidney structure associated with aging[14]. In this study, the elderly had a markedly higher prevalence of CKD and the prevalence increased with age in all populations, particularly amongst middle-aged adults [41-60 years]. This steep increase in elderly patients might be due to co-morbidities such as cardiovascular diseases or diabetes mellitus. Maximum reported cases shown GFR (53.6%) between the range of 6-10 ml/min which depicts lack of awareness regarding the disease and late diagnosis. We also observed that amongst 70 patients, 3-5 cases presented with a GFR < 3 ml/min which may have been due to their late approach to the hospital. GFR provides an excellent measure of filtering capacity of kidneys. Monitoring changes in GFR can delineate progression of kidney disease. The level of GFR was a strong predictor of the time to onset of kidney failure as well as the risk of complications of CKD[11].

Maximum cases of CKD with concomitant HTM or DM or both were reported under this study. Both of this co-morbid conditions lead to disease progression and may precipitate complications like diabetic neuropathy, anemia, nephropathy, stroke etc. Few cases of SLE, CAD and hypothyroidism were also reported.

Most patients with CKD have other diseases that cause CKD or contribute to the risk of cardiovascular events or death. Managing these co-morbidities is a challenge. Diabetes, HTN, CVDs, and anemia are more common in CKD patients than in individuals who do not have CKD, and the prevalence of these co-morbidities increases as CKD progresses. Patients with CKD have interrelated co-morbidities with shared risk factors, including hypertension, atherosclerosis, glucose intolerance or diabetes, and lipid disorders, at can worsen renal and cardiovascular outcomes. Strategies that target these co-morbidities are common features of primary prevention programs in general medical practice[6].

Importance of renal biomarkers in correlation to co-morbidities in CKD patients

In consistent with relevant clinical guidelines, our study demonstrates the strong association between the progression of CKD and increase in various renal biomarkers. Our analysis revealed the association between the co-morbidities such as hypertension, diabetes with CKD. These co-morbidities contribute to a large percentage of morbidities (97.14%) and mortalities (4.2%) in study population. The exact burden of CKD in India still remains undefined [10]. Using Cockcroft-gault equation for estimation of GFR and data analysis, we were able to produce important prognostic information about the impact of renal biomarkers in relation to co-morbidities, personal characteristics and social addiction in the CKD patients.

CONCLUSION

In conclusion, despite the disparities of GFR estimation, accurate detection of CKD remains inadequate. Besides putting more efforts to estimate GFR accurately in the general population, further studies should validate the means of GFR estimation in elderly persons, females and different ethnical groups.

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CONFLICT OF INTEREST STATEMENT: NO

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