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Original Research Article

Predictors of Progression in Chronic Kidney Disease

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Abstract:

Background: Millions of people worldwide are impacted by this significant socioeconomic burden and global public health issue. According to estimates from the WHO, CKD affects roughly 10% of the world's population, making it a major cause of disease burden.

Objectives: The study sought to ascertain the independent risk variables linked to declining renal function in patients undergoing treatment at a tertiary care facility, as well as the clinical and laboratory predictors of CKD progression.

Materials and Methods: It was a retrospective, observational study. The study was carried out at a tertiary care centre. The study data that was retrieved was for one year. Data from 218 participants were retrieved for the study. Patients with CKD who were 18 years of age or older, attended the tertiary care facility during the study period, and had complete medical records, including baseline laboratory results and follow-up information to gauge the progression of CKD were considered as a part of the study.

Results: The average age of patients with CKD advancement was 58.9 ± 11.2 years, while the average age of patients without progression was 55.3 ± 12.8 years. This difference was statistically significant, with a p-value of 0.041. A p-value of less than 0.001 indicated a strong correlation between proteinuria and the advancement of CKD.

Conclusion: The study found that the following factors were independent predictors of the advancement of chronic kidney disease: proteinuria, lower baseline eGFR, hyperphosphatemia, diabetes mellitus, and hypertension.

Recommendations: The advancement of the condition can be slowed by early treatment of blood pressure, proteinuria, and hyperphosphatemia as well as dietary and lifestyle changes.

Keywords: Disease Progression, Chronic Kidney Disease, Predictors, CKD, eGFR.

Introduction

Renal replacement therapy (RRT), such as dialysis or kidney transplantation, is required for chronic kidney disease (CKD), a progressive and incapacitating disorder marked by the progressive loss of kidney function over time [1]. Early detection and monitoring are essential for preventing further deterioration and associated problems since chronic kidney disease (CKD) progresses insidiously, with patients exhibiting few to no symptoms in the early stages [2, 3].

Millions of people worldwide are impacted by this significant socioeconomic burden and global public health issue. According to estimates from the World Health Organization (WHO), CKD affects roughly 10% of the world's population, making it a major cause of disease burden [4].

In order to postpone the onset of end-stage renal disease (ESRD) and lower the related morbidity and mortality, it is crucial to monitor and control the course of CKD. Monitoring risk factors such diabetes, hypertension, and proteinuria, as well as regularly evaluating kidney function by blood and urine tests, are essential for following the course of the disease and directing treatment choices [5, 6].

According to research mainly from the Alberta Kidney Disease Network (AKDN), progression in CKD is characterized by either with decline in eGFR of at least 25% from the baseline and a worsening in the glomerular filtration rate category, or with reduction in eGFR of more than 5 mL/min/1.73 m2 annually showing progression rapidly. KDIGO advocates intensive therapy and specialized management approaches for individuals with progressing CKD mainly to prevent failure of renal in this at-risk population [7, 8].

KDIGO also recommends identifying patients at high risk for renal failure using established risk prediction methods to help plan for kidney replacement therapy. The most popular risk prediction model for this unfavorable result at the moment is the Kidney Failure Risk Equation (KFRE). Among the techniques for hazards that are proportional, one of them was Cox techniques, which included some of basic demographics like age, gender, laboratory parameters like eGFR and UACR. This model was initiated mainly for dataset of Canada for the people having CKD at its advanced stage, i.e., from 3a stage to stage 5. Failure of renal is being depicted for 2 to 5 years based on progression probability with excellent discrimination using demographic characteristics and spot laboratory test results with AUC of 0.84 [9].

The study sought to ascertain the independent risk variables linked to declining renal function in patients undergoing treatment at a tertiary care facility, as well as the clinical and laboratory predictors of CKD progression.

Methodology

Study Design: It was a retrospective, observational study.

Study Settings: The study was carried out at a tertiary care centre. The study data that was retrieved was for one year.

Study Population: Data of 218 participants were retrieved for the study. Patients with CKD who were 18 years of age or older, attended the tertiary care facility during the study period, and had complete medical records, including baseline laboratory results and follow-up information to gauge the progression of CKD were included in the study. The study excluded patients who had acute kidney injury, were currently receiving dialysis or had previously received a kidney transplant, had incomplete or missing medical data, or had serious systemic diseases that affected kidney function, such as advanced liver disease or cancer.

Data Collection: Demographics, comorbidities, CKD stage, and laboratory markers such serum creatinine, eGFR, electrolytes, hemoglobin, albumin, and proteinuria were all gathered retrospectively from medical records of CKD patients over a one-year period. A reduction in eGFR of ≥25% from baseline or more than 5 mL/min/1.73 m² annually was considered CKD progression.

Study Procedure: A standardized data collection form was utilized to obtain pertinent laboratory, clinical, and demographic data. Patients were divided into groups according to their baseline lab results, comorbidities, and stages of chronic kidney disease. A decrease in eGFR of more than 5 mL/min/1.73 m² annually or a decrease of at least 25% from baseline was considered CKD progression. The accuracy and completeness of all extracted data were checked. Statistical analysis, including univariate and multivariate analyses to find independent predictors, was then conducted to discover factors linked to the course of chronic kidney disease.

Statistical Analysis: SPSS version 26.0 was used for statistical analysis. Data were initially entered in Microsoft Excel. The data have been presented as either the number of participants (n) with percentages (%), or mean±SD.

The independent t-test was used for statistical analysis. Statistical significance was defined as a p-value of less than 0.05. Other than this, univariate and multivariate logistic regression analysis model were used for further analysis.

Results

The majority of patients (43.1%) were in stage 3 CKD, with stage 4 (32.1%) and stage 5 (24.8%) following closely behind. Hypertension (75.2%) and diabetes mellitus (56.0%) were the most prevalent comorbidities, while cardiovascular disease was linked to 31.2% of cases. Of the patients, 54.1% had proteinuria, 67.0% had anemia, and 33.0% had hyperphosphatemia. The study participants' baseline demographics are shown in Table 1.

Table 1: Baseline Demographics of Study Participants

Parameters	Values
Age (in years)	56.8 ± 12.4
Male Participants	132 (60.6%)
Female Participants	86 (39.4%)
Stages of CKD	
Stage 3	94 (43.1%)
Stage 4	70 (32.1%)
Stage 5	54 (24.8%)
Hypertension	164 (75.2%)
Diabetes mellitus	122 (56.0%)
Cardiovascular disease	68 (31.2%)
Mean baseline eGFR (mL/min/1.73 m²)	38.6 ± 12.7

Proteinuria present	118 (54.1%)
Anemia (Hb < 11 g/dL)	146 (67.0%)
Hyperphosphatemia	72 (33.0%)

The 50–59 age group was the most represented, with 62 athletes. The age groups of 60–69 years old (58 individuals) and 40–49 years old (38 participants) came next. While there were only 12 participants in the 20–29 age category, there were 24 in the 30-39 and over 70 age groups, respectively. Figure 1 shows the age-group distribution of research participants.

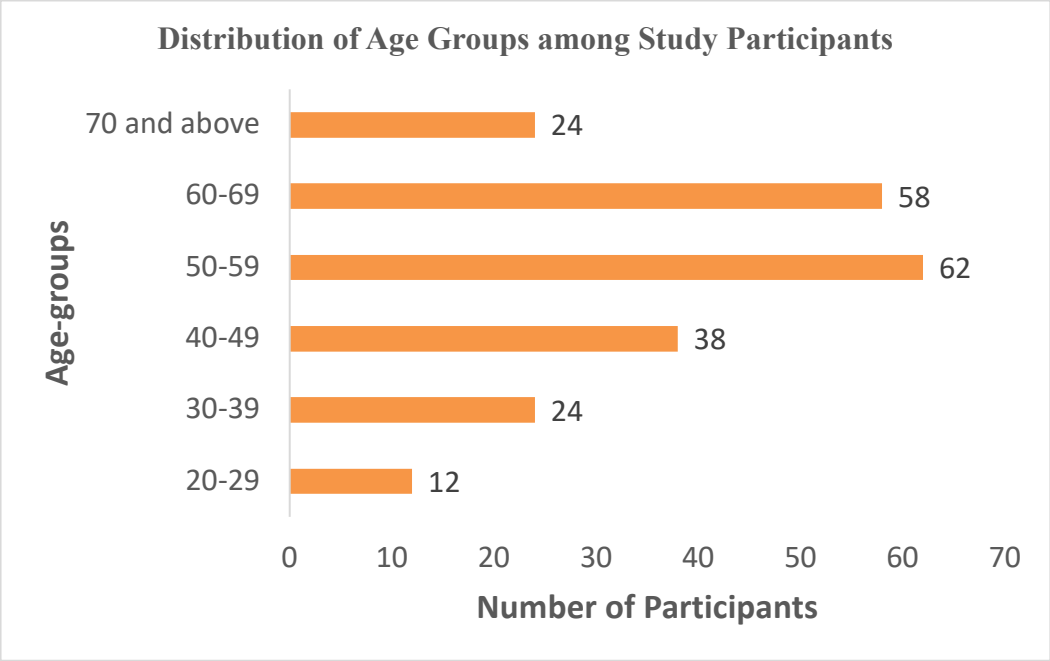

Figure 1: Distribution of Age- Group among Study Participants

Figure 2 shows the gender distribution among study participants. Among all participants, 132 participants were male, 86 participants were female.

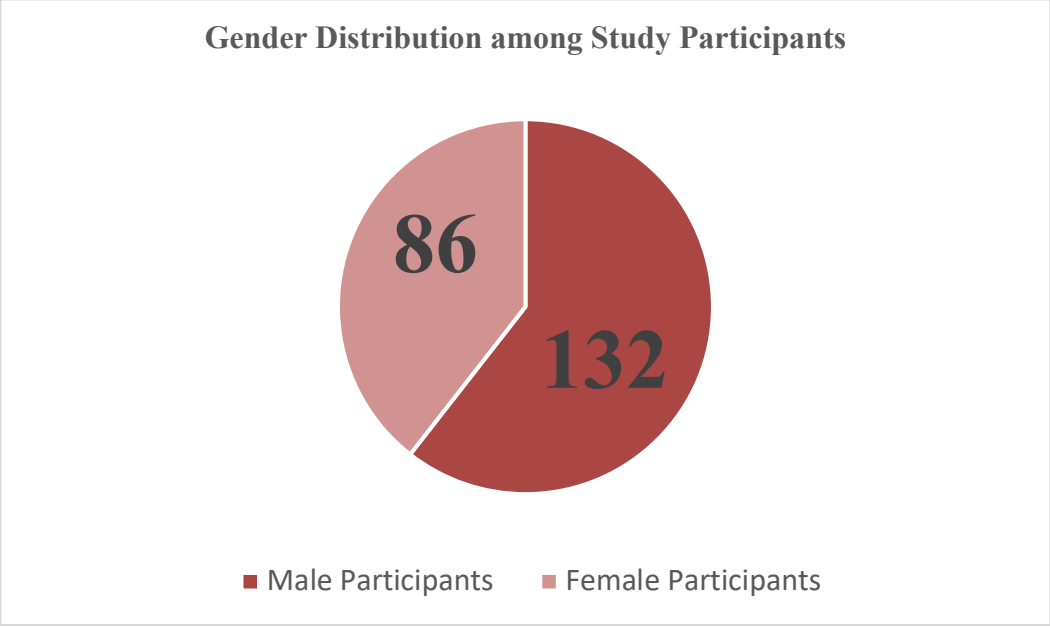

Figure 2: Distribution of Gender among Study Participants

While eGFR was significantly lower in the progression group (29.2 ± 10.8 mL/min/1.73 m²) and lower in the non-progression group (44.6 ± 11.3 mL/min/1.73 m²), the mean serum creatinine was

significantly higher in the progression group (3.6 ± 1.5 mg/dL) and 2.3 ± 1.0 mg/dL in the non-progression group (p-value less than 0.001). Laboratory results for renal parameters among research participants are shown in Table 2.

Table 2: Laboratory Values of Renal Parameters among Study Participants

Parameter	Progression (n = 82)	No progression (n = 136)	p-value
Serum creatinine (mg/dL)	3.6 ± 1.5	2.3 ± 1.0	**<0.001**
eGFR (mL/min/1.73 m²)	29.2 ± 10.8	44.6 ± 11.3	**<0.001**
Blood urea nitrogen (mg/dL)	56.2 ± 18.4	43.9 ± 15.8	**<0.001**
Serum sodium (mmol/L)	136.5 ± 4.5	137.7 ± 3.8	0.082
Serum potassium (mmol/L)	4.9 ± 0.9	4.5 ± 0.7	**0.012**
Serum calcium (mg/dL)	8.4 ± 0.6	8.8 ± 0.7	**0.004**
Serum phosphate (mg/dL)	5.6 ± 1.3	4.8 ± 1.1	**<0.001**
Hemoglobin (g/dL)	9.9 ± 1.3	10.9 ± 1.4	**<0.001**
Albumin (g/dL)	3.3 ± 0.4	3.6 ± 0.5	**0.002**
Proteinuria >1 g/day, n (%)	64 (78.0%)	54 (39.7%)	**<0.001**

The average age of patients with CKD advancement was 58.9 ± 11.2 years, while the average age of patients without progression was 55.3 ± 12.8 years. The difference was depicted to be significant with 0.041 as p-value. A p-value of less than 0.001 indicated a strong correlation between proteinuria and the advancement of CKD. The univariate analysis of CKD progression factors is explained in detail in Table 3.

Table 3: Univariate Analysis of Predictors of CKD Progression

Parameters	CKD Progression (n=82)	No progression (n=136)	p-value
Age (in years)	58.9 ± 11.2	55.3 ± 12.8	0.041
Male Participants	53 (64.6%)	79 (58.1%)	0.352
Diabetes mellitus	56 (68.3%)	66 (48.5%)	0.004
Hypertension	70 (85.4%)	94 (69.1%)	0.008
Proteinuria	64 (78.0%)	54 (39.7%)	<0.001
Baseline eGFR <45	66 (80.5%)	74 (54.4%)	<0.001
Anemia	62 (75.6%)	84 (61.8%)	0.048
Hyperphosphatemia	40 (48.8%)	32 (23.5%)	<0.001

The multivariate analysis of logistic regression in the course of CKD is shown in Table 4. Analysis revealed that the progression of CKD was independently predicted by proteinuria, decreased baseline eGFR, hyperphosphatemia, diabetes, and hypertension. The strongest correlation was found among those with proteinuria >1 g/day.

Table 4. Multivariate Analysis of Logistic Regression in CKD Progression

Parameters	Adjusted OR	95% CI	p-value
Diabetes mellitus	1.92	1.05 – 3.48	0.033
Hypertension	2.11	1.06 – 4.19	0.032
Proteinuria > 1 g/day	3.46	1.90 – 6.30	<0.001
Baseline eGFR <45	2.74	1.44 – 5.21	0.002
Hyperphosphatemia	2.38	1.24 – 4.56	0.009

Discussion

The study was conducted to assess the prognostic predictors among study participants. Among these, proteinuria >1 g/day demonstrated the strongest association, highlighting its critical role in renal deterioration.

The finding that proteinuria is a strong predictor aligns with prior studies emphasizing its role in CKD progression. Persistent proteinuria induces glomerular injury, tubulointerstitial inflammation, and fibrosis, accelerating renal function decline [9, 10]. Interventions aimed at reducing proteinuria, including renin-angiotensin-aldosterone system (RAAS) inhibitors, are known to slow CKD progression [7].

Reduced baseline eGFR was also independently associated with progression, consistent with previous research showing that lower initial kidney function predicts faster decline toward end-stage renal disease (ESRD) [10, 11]. Patients with eGFR <45 mL/min/1.73 m² were at significantly higher

risk, emphasizing the need for close monitoring and early nephrology referral in this population.

Hyperphosphatemia emerged as another significant predictor. Elevated phosphate levels contribute to vascular calcification, secondary hyperparathyroidism, and CKD-mineral bone disorder, all of which have been linked to accelerated renal decline [10, 11]. Timely dietary phosphate restriction and use of phosphate binders may help mitigate this risk.

The study also confirmed that diabetes mellitus and hypertension are independent risk factors, consistent with established evidence. Both conditions contribute to glomerular hypertension, endothelial dysfunction, and oxidative stress, leading to progressive nephron loss [12]. Effective glycemic and blood pressure control remains central to CKD management.

Age and anemia showed significant associations in univariate analysis but were not independent predictors in multivariate analysis. This suggests that while they contribute to overall risk, their effects may be mediated through other factors like proteinuria and baseline eGFR.

The findings underscore the importance of early identification and aggressive management of modifiable risk factors, including proteinuria, hypertension, hyperphosphatemia, and glycemic control, to slow CKD progression and prevent complications. Risk stratification using clinical and laboratory parameters can guide targeted interventions and timely referral to nephrology services.

Conclusion

The study found that the following factors were independent predictors of the advancement of chronic kidney disease: proteinuria, lower baseline eGFR, hyperphosphatemia, diabetes mellitus, and hypertension. The strongest correlation was found among those with proteinuria >1 g/day. In order to decrease the progression of CKD, avoid complications, and enhance long-term renal outcomes, it is imperative that these risk factors be identified and managed early.

Limitations

Since this study was conducted in a single urban tertiary care facility, it may not be feasible to extrapolate the findings to the broader population. Additionally, the study's sample size was too small to draw conclusions and extrapolate findings.

Recommendations

The advancement of the condition can be slowed by early treatment of blood pressure, proteinuria, and hyperphosphatemia as well as dietary and lifestyle changes. Larger investigations are required to confirm the conclusion that high-risk patients should be sent to nephrology as soon as possible.

List of Abbreviations

CKD- chronic kidney disease.

AKDN- Alberta Kidney Disease Network.

ESRD- End-stage renal disease.

WHO- World Health Organization.

RRT- Renal Replacement Therapy.

KFRE- Kidney Failure Risk Equation.

eGFR- Estimated Glomerular Filtration Rate.

UACR- Urine Albumin Creatinine Ratio.

References

1. Vaidya SR, Aeddula NR. Chronic kidney disease. InStatPearls [Internet] 2024 Jul 31. StatPearls Publishing.
2. Chouhan AS, Kaple M, Hingway S, Kaple MN. A brief review of diagnostic techniques and clinical management in chronic kidney disease. Cureus. 2023 Nov 18;15(11).
3. Whaley-Connell A, Nistala R, Chaudhary K. The importance of early identification of chronic kidney disease. Missouri medicine. 2011 Jan;108(1):25.
4. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. Kidney international supplements. 2022 Apr 1;12(1):7-11.
5. Christofides EA, Desai N. Optimal early diagnosis and monitoring of diabetic kidney disease in type 2 diabetes mellitus: addressing the barriers to albuminuria testing. Journal of primary care & community health. 2021 Mar; 12:21501327211003683.
6. Chen TK, Knicely DH, Grams ME. Chronic kidney disease diagnosis and management: a review. Jama. 2019 Oct 1;322(13):1294-304.
7. Levin A, Stevens PE, Bilous RW, Coresh J, De Francisco AL, De Jong PE, Griffith KE, Hemmelgarn BR, Iseki K, Lamb EJ, Levey AS. Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney international supplements. 2013 Jan 1;3(1):1-50.
8. Hemmelgarn BR, Clement F, Manns BJ, Klarenbach S, James MT, Ravani P, Pannu N, Ahmed SB, MacRae J, Scott-Douglas N, Jindal K. Overview of the Alberta kidney disease network. BMC nephrology. 2009 Oct 19;10(1):30.
9. Tangri N, Stevens LA, Griffith J, Tighiouart H, Djurdjev O, Naimark D, Levin A, Levey AS. A predictive model for progression of chronic

kidney disease to kidney failure. Jama. 2011 Apr 20;305(15):1553-9.
10. Chen TK, Knicely DH, Grams ME. Chronic kidney disease diagnosis and management: a review. Jama. 2019 Oct 1;322(13):1294-304.
11. Kovesdy CP. Epidemiology of chronic kidney disease: an update 2022. Kidney international supplements. 2022 Apr 1;12(1):7-11.
12. Christofides EA, Desai N. Optimal early diagnosis and monitoring of diabetic kidney disease in type 2 diabetes mellitus: addressing the barriers to albuminuria testing. Journal of primary care & community health. 2021 Mar;12:21501327211003683.