PREVALENCE OF CARDIOVASCULAR RISK FACTORS AMONG CHRONIC KIDNEY DISEASE PATIENTS UNDERGOING HEMODIALYSIS IN A TERTIARY CARE CENTER, KATHMANDU, NEPAL

Pokhrel A,[1] Gyawali P,[2] Pokhrel BR,[3] Khanal MP,[1] Manandhar DN,[4] Bwititi P,[5] Nwose EU[5]

[1]Department of Biochemistry, Nepal Medical College & Teaching Hospital, Kathmandu, Nepal, [2]Priority Research Centre for Stroke and Brain Injury, School of Biomedical Sciences and Pharmacy, University of Newcastle, New South Wales, Australia, [3]Department of Biochemistry, Universal College of Medical Sciences, Bhairahawa, Nepal, [4]Hemodialysis unit, Department of Medicine, Nepal Medical College and Teaching Hospital, Kathmandu, Nepal, [5]Faculty of Sciences, Charles Sturt University, NSW Australia

ABSTRACT

The risk of cardiovascular disease is higher in chronic kidney disease patients compared to the general population and its impact is higher in developing countries compared to the developed countries. With this background in mind, we aimed to evaluate the prevalence of different cardiovascular risk factors in patients on maintenance hemodialysis in a tertiary care center. Chronic kidney disease patients aged 18 years and above who were under maintenance hemodialysis in the hemodialysis unit of Nepal Medical College were included in the study. Pre-dialysis venous blood samples from the participants were collected and analyzed for serum calcium, phosphorus, total protein, albumin and hemoglobin. Calcium phosphate product was calculated. Out of 100 study participants, 52% were male and 48% were female. Age-wise distribution showed 38% of the participants were below 40 years. The mean age of the participants was 45.86 ± 14.4 years. Ninety-three percent had hypertension and 29% had diabetes mellitus. Hypocalcemia was present in 80%, hyperphosphatemia was seen among 81% and high calcium phosphate product was present in 33% of the participants. Low hemoglobin (< 10gm/dL) was found in 86%. The cardiovascular risk trend in the Nepalese chronic kidney disease population is fairly different compared to the western population. Participants were younger. Prevalence of hypertension and diabetes was high. The high prevalence of anemia might be due to unaffordability of the participants for regular erythropoietin therapy. Inadequately managed hyperphosphatemia despite the widespread use of phosphorus binders, is still a major clinical challenge in patients on hemodialysis.

KEYWORDS

Cardiovascular risk, chronic kidney disease, hemodialysis, anemia, calcium phosphate product

CORRESPONDING AUTHOR

Dr. Asmita Pokhrel
Lecturer, Department of Biochemistry,
Nepal Medical College Teaching Hospital,
Kathmandu, Nepal
Email: dr.asmita321@gmail.com
ORCID ID: 0000-0002-5739-6056
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INTRODUCTION

Chronic kidney disease (CKD) is a global epidemic with more than a million people on dialysis or with a functioning graft worldwide.[1] Global prevalence of CKD in the general population is 13.4%,[2] while it is reported as 10.6% in Nepal.[3]

The rationale of dialysis is removing toxic nitrogenous waste products and excess fluid from the body and correcting acid-base disorders. Apart from urea, creatinine, albumin, total protein, sodium, potassium; abnormal levels of hemoglobin (Hb), calcium (Ca) and phosphorus (P) in blood have been identified as predictors of survival in patients undergoing maintenance hemodialysis.[4] Moreover, age, hypertension, diabetes and physical inactivity are considered as the major contributors of cardiovascular disease (CVD) in hemodialysis patients.[5]

Anemia, a common complication seen in hemodialysis patients is associated with increased risk for cardiovascular morbidity and mortality. Possible explanations include reduction in tissue oxygenation, increase in cardiac output, reduction in the capacity for exercise and left ventricular hypertrophy. Moreover, anemia reduces patients' quality of life and contributes to shortened life span.[6,7]

Hyperphosphatemia has long been suggested as an independent risk factor for all-cause and cardiovascular mortality in CKD patients and lowering serum P levels were found to improve clinical outcomes.[8] Similarly, elevated calcium phosphate product (Ca x P) has been linked with CVD complications in later stages of CKD in many studies. Possible mechanisms include vascular calcification, endothelial dysfunction, myocardial hypertrophy and cardiac malfunctions.[9] However, in many cross-sectional and longitudinal studies, vascular calcification did not correlate with Ca x P or serum Ca or P.[10,11]

CKD is associated with huge economic burden and the impact of this burden is disproportionately high in low-income countries like Nepal where the most important risk factors for CKD, hypertension and diabetes mellitus, are rising.[12] Diabetic nephropathy is the commonest cause of end-stage renal disease (ESRD) in the USA followed by hypertensive nephropathy.[13] A systemic review has shown the pooled prevalence of CKD is 10.1% in the general population, 24.7% in hypertensive, and 16.6% among diabetes mellitus patients in Africa.[14]

Due to poverty and poor education, the burden posed by complications of CKD is more in developing countries.[15] Hence, the clinical scenario of dialysis patients in economically constrained countries like Nepal may be different from the developed countries with strong economies sufficient enough to meet the challenges posed by CKD. With this background in mind, we aimed to evaluate the prevalence of different cardiovascular risk factors in CKD patients on hemodialysis in a tertiary care center.

MATERIALS AND METHODS

Ethical approval was obtained from the Institutional Review Committee of Nepal Medical College Teaching Hospital (NMCTH), Kathmandu, Nepal. A hospital-based descriptive cross-sectional study was conducted from September to December 2017 among 100 patients. CKD patients aged 18 years and above, who were under maintenance hemodialysis in the hemodialysis unit of NMCTH, were included in the study. Patients were explained about the study and verbal consent was taken. Convenient sampling technique was used. Pre-dialysis venous blood samples were collected from the participants following standard aseptic protocol and serum were analyzed for Ca, P, total protein and albumin by dry chemistry using Vitros 250. Ca x P was calculated. Hb was estimated in coulter counter, Sysmex XS-500i. Serum Ca level <9mg/dL was considered low and between 9-11mg/dL was considered normal. Similarly, serum P >4.5mg/dL was considered high. Ca x P >55 mg^2/dL^2 was considered high. Hb level <10gm/dL was considered low, serum total protein <6gm/dL and albumin <3.5gm/dL were considered low.[16] Other demographic and medical details were noted from the patients' medical records on the day of sample collection. Data were analyzed using Epi Info 7. Descriptive statistical tools were employed. The mean and standard deviation of numerical data were calculated, both overall and gender-wise. Prevalence of CVD risk factors was expressed as percentages.

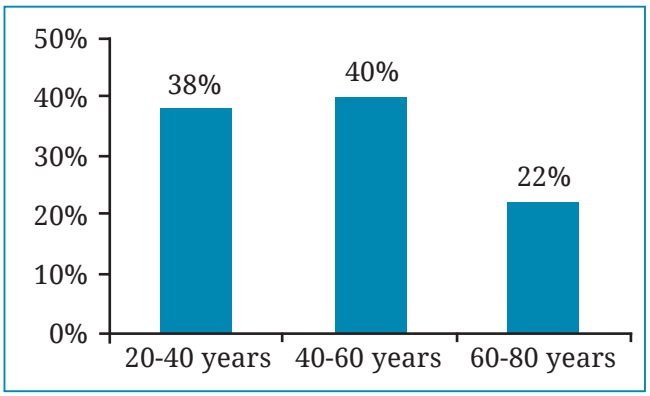

Fig. 1: Age wise distribution of the study participants

Table 1: Demographic and clinical data of the study participants			
Mean ± SD	**Overall (n = 100)**	**Male (n = 52)**	**Female (n = 48)**
Age (years)	45.8 ± 14.4	45.6 ± 15.5	46.1 ± 13.3
Ca (mg/dL)	7.9 ± 1.1	7.9 ± 1.1	8.0 ± 1.1
P (mg/dL)	6.1 ± 1.8	6.2 ± 1.6	5.9 ± 1.9
Ca X P (mg^2/dl^2)	48.7 ± 15.3	49.6 ± 14.8	47.7 ± 15.8
Total Protein (gm/dL)	5.9 ± 0.6	5.9 ± 0.6	5.8 ± 0.7
Albumin (gm/dL)	3.6 ± 0.4	3.6 ± 0.4	3.6 ± 0.4
Hb (gm/dL)	8.8 ± 1.8	9.0 ± 1.9	8.6 ± 1.8
Hematocrit (%)	26.8 ± 5.5	27.1 ± 5.7	26.4 ± 5.3
Duration of dialysis (months)	24.1 ± 17.8	24.4 ± 19.4	23.8 ± 16.0

Table 2: Comorbidity and habits of the study participants	
Prevalence of cardiovascular risk factors	**%**
Hypertension	93
Diabetes	29
Past smoking	40
Past alcohol users	49

Table 3: Biochemical profile of the study participants			
	All (n=100) %	Male (n=52) %	Female (n=48) %
Hypocalcemia	80	43	37
Hyperphosphatemia	81	45	36
High Ca x P	33	19	14
Low Hb	86	43	43
Low Total Protein	56	28	28
Low albumin	38	17	21

RESULTS

Among a total of 100 study participants, 52% were male and 48% were female. Age-wise distribution showed 38% of participants were below 40 years. Details are presented in Figure 1.The mean age of the participants was 45.86 ± 14.4 years. The baseline characteristics of the study participants are presented in Table 1.

In terms of participants' clinical history, 40% were past smokers, 49% were past alcohol users while 29% had both habits in the past. Ninety-three percent had hypertension, 29% had diabetes mellitus (Table 2).

Hypocalcemia was present in 80%, hyperphosphatemia was seen among 81% and high Ca x P was seen in 33% of the participants. Hb, total protein and albumin were low in 86%, 56% and 38% respectively (Table 3).

DISCUSSION

The present study on cardiovascular risk profiling in hemodialysis patients has highlighted some important cardiovascular issues in the Nepalese CKD population. The findings hint towards different demographics and cardiovascular risk trend in our population when compared to the developed countries.

To start with, 38.0% of our participants were under the age of 60. The mean age of the hemodialysis patients in the present study is 45.86 ± 14.4 years. Other studies from Nepal have also revealed mean age of 42.33 ± 15 years,[17] and 50.92 ± 17.98 years,[18] in contrast to 65 years or above, as reported in several larger international studies.[19,20] A study in India also revealed the median age of 43 years among the ESRD patients.[21] The consistent lower age trend for hemodialysis in our country might be attributed to the lack of health promotion and no good access to better health care in terms of early screening, preventing, detecting and managing CKD risk factors such as hypertension or diabetes.

The prevalence of hypertension among adults 20 years and above was 34.0%,[22] and that of diabetes among general population of 15 years and above was 8.4% in Nepal.[23] In the present study, 93.0% of the patients under maintenance hemodialysis had hypertension and 29.0% had diabetes. Other similar studies from Nepal have also reported a high prevalence of hypertension and diabetes in CKD patients,[17,18,24,25] compared to international studies.[26-28] Other than limited access to contemporary health care practices, factors such as urbanization, poor dietary habits and sedentary lifestyle, maybe responsible for the increasing prevalence of hypertension and diabetes in the context of Nepal which in turn leads to CKD progressing to ESRD.[29]

Anemia which is a common complication in dialysis patients is mainly due to reduction in erythropoietin (EPO) concentration. In the present study, 86.0% participants had low Hb (<10gm/dL). The average Hb was 8.8 ± 1.8 gm/dL while the recommended target Hb was 11-13 gm/dL.[30] Though common, such a high prevalence is unexpected especially when they are under maintenance hemodialysis. However, most of the patients in our setting were unable to afford the cost of regular EPO therapy and they preferred blood transfusion for anemia correction. Along with this, inadequate and improper nutrients may also contribute to low Hb. Similar results were obtained in the study conducted at NMCTH back in 2008.[17] Nepal Government has offered free dialysis twice a week to the needy CKD patients from 2016 onwards. However, this service does not cover medication cost.[31] Hence, newer health policies which offer coverage for basic medications as well as sufficient dialysis packages for the patients will be much helpful in improvement and management of this critically ill group of patients.

Most of the participants in our study were physically inactive. Physical activity has been recommended by Kidney Disease Outcomes Quality Initiative clinical practice guidelines as part of the management of CVD state in all dialysis patients.[32] Various preliminary studies have also attested the positive outcomes of physical activity on CVD mortality in hemodialysis patients.[33] This is intricately linked to the anemic state of most of the patients, as physical inactivity in the anemic state may precipitate dyspnea. Such inter-relationships of CVD risk factors should be properly analyzed and addressed to improve hemodialysis patient status and overall quality of life. Probably, this might be an area of scope for us to work upon to lower the CVD risk burden in this medically compromised group of dialysis patients in our context.

In the present study, 80.0% had hypocalcemia and 81.0% had hyperphosphatemia inspite of therapy with calcium-containing phosphate binders. This finding gave us enough ground to say that hypocalcemia and/or hyperphosphatemia could have been probable in all of the patients if they were not under medication. The high prevalence of hyperphosphatemia in the present study indicates an area that needs serious attention. However, these findings need validation from large scale studies.

Though considered as an independent predictor of cardiovascular risk, a high Ca x P was found among 33.0% of the participants in the present study. This can be explained by the almost equal prevalence of hypocalcemia (80.0%) and hyperphosphatemia (81.0%) among the patients which resulted into normal Ca x P. Moreover, the clinical utility of Ca x P for cardiovascular risk assessment is still questionable as it lacks a scientific basis. Many studies claim that Ca × P is a grossly oversimplified and scientifically flawed approach to the problem of ectopic calcification.[34,35]

The cardiovascular risk trend in the Nepalese CKD population is fairly different when compared to western population. Patients are younger and have high prevalence of diabetes, hypertension and anemia. The high prevalence of anemia might be due to insufficient use of EPO, because of poverty. Inadequately managed hyperphosphatemia despite the widespread use of phosphorus binders, is still a major clinical challenge in patients on dialysis.

The observations from this study showed that Ca x P may not be applicable for screening cardiovascular risk in hemodialysis patients, especially given the hypocalcemia/hyperphosphatemia status that requires calcium supplement and phosphate binders.

Health policies that offer sufficient dialysis and basic regular medications for the dialysis patients will help in effective management of complications of CKD. Incorporation of exercise into the dialysis session may help to lower the CVD risk factors to some extent. Longitudinal and larger-scale studies are recommended.

LIMITATIONS: The cross-sectional design of the study, small sample size and lack of comparison group were the limitations of this study.

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