Harsukh Educational Charitable Society
International Journal of Community Health and Medical Research
Journal home page:www.ijchmr.com doi: 10.21276/ijchmr

ISSN E: 2457-0117 **ISSN P:** 2581-5040 **Index Copernicus** ICV 2018=62.61

ORIGINAL RESEARCH

Assessment of the timing of onset of CKD related metabolic complications

Rakesh Chander[1], Jithesh G[2], Tarsem Pal[3], Anil Batta[4], Raman Sharma[5], Ajay Chhabra[6], Surinder Pal [7], Kamalpreet Singh[8]

[1,7]Assistant Professor, [2]Junior Resident, [3,5]Professor, [6]Associate Professor, [8]Senior, Resident, Department of Medicine
[4]Professor and Head, Department of Biochemistry, Govt. Medical College, Amritsar, Punjab

ABSTRACT:
Background: Chronic kidney disease is a precursor to end-stage kidney disease and is associated with an increased risk of death. The present study was conducted to assess the timing of onset of CKD related metabolic complications (anemia/hyperkalemia/ hyperphosphatemia/ hypocalcemia/metabolic acidosis) at different stages of CKD. **Materials & Methods:** The present study was conducted on 150 patients of CKD of both genders. Blood sample was collected in a dry disposable syringe under aseptic condition by vein puncture and arterial sample was collected by arterial puncture under aseptic condition. Biochemical assay was done in all patients. **Results:** Out of 150 patients, fatigue was seen in 69 patients (46%), muscle pain in 58 (38.7%), numbness in 52 (34.6%), bone pain in 48 (32%) and vomiting in 47 (31.2%). Maximum number of CKD patients was seen in CKD 5 which constitute 46% followed by CKD 4 which constitutes 20.6%. As the stage of CKD advances there is a significant occurrence of anemia, hyperkalemia, hyperphosphatemia, hyperuricemia, hypocalcemia and metabolic acidosis. The anemia hyper phosphatemia, hyperuricemia occurrence become significant from stage 3B onwards and the occurrence of hypocalcemia hyperkalemia and metabolic acidosis become significant from stage 4. **Conclusion:** Monitoring for anemia hyper phosphatemia, hyperuricemia are mandatory from stage 3 B and for hypercalcemia hyperkalemia and metabolic acidosis stage 4, so as to treat the patients effectively and retard the progression of CKD to some extent. Early diagnosis and management of these conditions may prevent or delay the progress to end stage renal disease.
Key words: Bicarbonate, Chronic kidney disease, Serum phosphate.

Corresponding author: Dr. Jithesh G, Junior Resident, Department of Medicine, Govt. Medical College, Amritsar, Punjab

This article may be cited as: Chander R, Jithesh G, Pal T, Batta A, Sharma R, Chhabra A, Pal S, Singh K Assessment of the timing of onset of CKD related metabolic complications. HECS Int J Comm Health Med Res 2020; 6(1):21-24.

INTRODUCTION

Chronic kidney disease (CKD) is a precursor to end-stage kidney disease and is associated with an increased risk of death. End-stage kidney disease has a poor prognosis and requires major intervention, in the form of dialysis or transplant. Early identification of subjects with CKD should, therefore, be encouraged for the purpose of targeting potential interventions, e.g. low-protein diet, control of blood pressure, etc.[1] Chronic kidney disease encompasses a spectrum of different pathophysiological processes associated with abnormal kidney function and a progressive decline in glomerular filtration rate. Chronic Kidney Disease is a major public health problem and major cause of morbidity and mortality worldwide.[2] Metabolic complications associated with CKD are anemia, hyponatremia, hypokalemia, metabolic acidosis, hyperuricemia, hypocalcemia and hyperphosphatemia. The World Health Organization defines anemia as a hemoglobin level less than 13 g/dL in men and post-menopausal women and less than 12 g/dL in pre-menopausal women. The pathogenesis of the hypocalcemia includes (a) phosphate retention, (b) skeletal resistance to the calcemic action of PTH, and (c) altered vitamin D metabolism.[3]

In the early stages of CKD, phosphorus retention stimulates FGF-23 and PTH secretion, which in turn suppress renal phosphate reabsorption and augment renal phosphate excretion. FGF-23 also suppresses 1, 25-dihydroxyvitamin D (1,25D) production, which limits intestinal phosphate absorption but allows increases in PTH levels.[4] The present study was conducted to assess the timing of onset of CKD related metabolic complications (anemia/hyperkalemia/ hyperphosphatemia/ hypocalcemia/metabolic acidosis) at different stages of CKD.

MATERIALS & METHODS

The present study was conducted in Medicine Department in collaboration with biochemistry department Guru Nanak Dev Hospital, Amritsar attached to Government Medical College. This is a cross sectional study in which CKD patients presenting to outpatient and inpatient department of Guru Nanak Dev Hospital, Amritsar over a period of 12 months were enrolled and screened using a predetermined proforma. A minimum of 150 patients (males- 91, females-59) were included in the study. The patients were explained in their vernacular language about the procedures to be adopted in the study and their informed written consent was

taken. The study was conducted after approval from institutional thesis and ethical committee.

Blood sample was collected in a dry disposable syringe under aseptic condition by vein puncture and arterial sample was collected by arterial puncture under aseptic condition. Venous sample was stored in EDTA and plain tube arterial sample was stored in heparinized tube. The blood sample was centrifuged at 3000 rpm for 10 minutes for the separation of serum and plasma respectively for the estimation of biochemical assay. Biochemical assay was done in all patients. The data collected was analyzed according to the standard statistical methods to reach a conclusion. P value less than 0.05 was considered significant.

RESULTS

Table I Clinical features in patients

Clinical features	Frequency	Percentage
Fatigue	69	46%
Muscle pain	58	38.7%
Numbness	52	34.6%
Bone pain	48	32%
Vomiting	47	31.3%

Table I shows that out of 150 patients, fatigue was seen in 69 patients (46%), muscle pain in 58 (38.7%), numbness in 52 (34.6%), bone pain in 48 (32%) and vomiting in 47 (31.2%).

Table II Distribution of patients based on CKD stage

Stages of CKD	Frequency	Percentage	P value
CKD 1	6	4	0.001
CKD 2	9	6	
CKD 3A	13	8.6	
CKD 3B	22	14.6	
CKD 4	31	20.6	
CKD 5	69	46	

Table II shows out of total 150 patients, maximum number of CKD patients was seen in CKD 5 which constitute 46% followed by CKD 4 which constitute 20.6%. The difference found to be significant (P< 0.05).

Table III Comparison of hypocalcemia of CKD 1 with different CKD stages

Stage of CKD	Number of patients	Stage of CKD	Number of patients	P value	Significance
1	0	2	0	0	Not significant
1	0	3A	3	0.3	Not significant
1	0	3B	7	0.1	Not significant
1	0	4	16	0.01	Significant
1	0	5	48	0.001	Significant

Table III shows that as the stage of CKD advances, there is a considerable increase in number of patients of hypocalcemia with each stage. P value becomes significant from stage 4 onwards.

Table IV Comparison of hyperkalemic patients of CKD 1 with different CKD grading

Stage of CKD	Number of patients with hyperkalemia	Stage of CKD	Number of patients with hyperkalemia	P value	Significant
1	0	2	0	0	Not Significant
1	0	3A	1	0.4	Not Significant
1	0	3B	5	0.19	Not Significant
1	0	4	14	0.04	Significant
1	0	5	28	0.04	Significant

Table IV shows that as the stage of CKD advances, there is a considerable increase in number of patients of hyperkalaemia with each stage. P value becomes significant from stage 4 onwards.

Table V Comparison of hyperuricemia of CKD stage 1 with different CKD stages

Stage of CKD	Number of patients with hyperuricemia	Stage of CKD	Number of patients with hyperuricemia	P value	Significant
1	0	2	2	0.21	Not significant
1	0	3A	5	0.07	Not significant
1	0	3B	14	0.006	Significant
1	0	4	21	0.002	Significant
1	0	5	53	0.000	Significant

Table V shows that as the stage of CKD advances, there is a considerable increase in number of patients of hyperuricemia with each stage. P value becomes significant from stage 3B onwards.

Table VI Comparison of Metabolic acidosis of CKD 1 with different CKD grading

Stage of CKD	Number of patients with Metabolic Acidosis	Stage of CKD	Number of patient with Metabolic Acidosis	P value	Significant
1	0	2	2	0.21	Not Significant ant
1	0	3A	3	0.20	Not significant
1	0	3B	5	0.19	Not significant
1	0	4	15	0.03	Significant
1	0	5	42	0.005	Significant

Table VI shows that as the stage of CKD advances, there is a considerable increase in number of patients of metabolic acidosis with each stage. P value becomes significant from stage 4 onwards.

Table VII Comparison of hyperphosphatemia of CKD 1 with different CKD stages

Stage of CKD	Number of patients	Stage of CKD	Number of patients	P value	Significant
1	0	2	1	0.39	Not significant
1	0	3A	5	0.07	Not significant
1	0	3B	12	0.01	Significant
1	0	4	19	0.006	Significant
1	0	5	56	0.00	Significant

Table VII shows that as the stage of CKD advances, there is a considerable increase in number of patients of hyperphosphatemia with each stage. P value becomes significant from stage 3B onwards. Table VIII shows that as the stage of CKD advances, there is a considerable increase in number of patients of anemia with each stage. P value becomes significant from stage 3B onwards.

Table VIII Comparison of anemia of CKD 1 with different CKD stages

Stage	Number of anemic patients	Stage of CKD	Number of patients without anemia	P value	Significant
CKD 1	0	2	3	0.3	Not significant
CKD 1	0	3A	6	0.07	Not significant
CKD 1	0	3B	13	0.01	Significant
CKD 1	0	4	25	0.000	Significant
CKD 1	0	5	56	0.000	Significant

DISCUSSION

Early detection of CKD and its metabolic complications is now a priority for delaying disease progression and for primary prevention of many CKD-associated chronic diseases, including cardiovascular, mineral, and bone diseases. The present study analyzed the spectrum of Chronic Kidney Disease related metabolic complications (hyperkalemia/ hyperphosphatemia/ hypocalcemia/ metabolic acidosis/anemia) with regards to different stages of Chronic Kidney Disease among 150 patients presented to General Medicine Department.

In present study of the total 150 patients, 91 (60%) were males and 59 (40%) were females. Male to Female ratio was 3:2. Predominance of male was in tally with Zhang et al[5] where Male to Female ratio was 2.33:1. The mean age of males was 53.8 years and females were 52.8 years. This is consistent with the study done by Zhang et al[5] also confirmed increasing prevalence of CKD with increase in age. Nakhaul et al[6] found that the mean age of the study population was 72 ± 11.9 years with 55% being females and 13% which is higher than our study. We found that out of 150 patients, fatigue was seen in 69 patients (46%), muscle pain was seen in 58 patients (38.7%) patients, numbness was seen in 52 patients (34.6%) patients, bone pain was

seen in 48 patients (32%) patients, vomiting was seen in 47 patients (31.3%) patients. Aslam et al[7] found that Gastrointestinal manifestations stand out among the clinical presentations with anorexia (76%), nausea (60%) vomiting (40%) and abdominal pain (26%). In this study, there were 74 patients out of 150, (prevalence of 49.3 %) who were having hypocalcemia. The hypocalcemia become significant from stage 4 onwards. There is increase in hypocalcemia patients as the stage of CKD advances. Luo et al[8] found hypocalcemia in 38.2% of patients which was lower than our study. Hyperkalemia was present in 48 (32%). Maximum number of number of hyperkalemic patients were with CKD 5 (28) followed by CKD 4 (14).the hyperkalemia used to be significant from stage 4. Sarafidis et al[9] found out that the prevalence of hyperkalemia to be 43 %. So it is recommended to avoid high potassium diet and drugs which increase the potassium level from stage 4 and use them with caution from stage 3B which is similar to our study. We found that while taking hyperuricemia into account, it was found out that 63.3 % (n=95) of patients in this study group had hyperuricemia. Hyperuricemia become significant from stage 3B. A study conducted by Doualla et al[10] showed prevalence of hyperuricemia was 67% which is similar to our study. We observed that out of the 150 patients, 67 (44.7%) were having some degree of metabolic acidosis. Metabolic acidosis become significant from stage 4 .Moranne et al[11]and Agarwal[12] found that metabolic acidosis is a common complication from stage 4 with prevalence of more than 30 -50%. We found that hyperphosphatemia was present in 93 (62%). Oh et al[13] found out that prevalence of hyperphosphatemia was 53% which is similar compared to this study. In this study anemia was present in out of 150 patients 103 had anemia (68.7%).hyperphosphatemia become significant from 3B. Moranne et al[11] found out that as GFR decreases, chance of anemia increases and prevalence increased from 8 to 40% which is lower than our study.

We observed that occurrence of anemia increase as the stage of CKD advances. The anemia become significant from stage 3 B onwards**.** Moranne et al[11] found out that as GFR decreases, chance of anemia increases and prevalence increased from 8 to 40% which is lower than our study This is only a cross sectional study and with small sample size.

CONCLUSION

We found that risk for anemia, hyperphosphatemia, hyperuricemia occurrence become significant from stage 3B. Hence screening for anemia, hyperphosphatemia hyperuricemia is better started from stage 3A. and for hypocalcemia hyperkalemia and metabolic acidosis become significant from stage 4. So screening should be started from stage 3B onwards. This means that regular monitoring of these parameters are essential in addition to regular monitoring of blood urea, serum creatinine, and blood sugars as is the practice usually followed. We also recommend the treating physician should be alert and anticipate for coronary artery disease and stroke. Early diagnosis and management of these conditions may prevent or delay the progress to end stage renal disease.

REFERENCES

1. Bailey JL: Metabolic acidosis: An unrecognized cause of morbidity in the patient with chronic kidney disease. Kidney Int Suppl. 2005; 15–23.

2. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY: Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004;351:1296–1305.

3. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med. 2004;351(13):1296-305.

4. Longitudinal follow-up and outcomes among a population with chronic kidney disease in a large managed care organization. Arch Intern Med. 2004;164(6):659-63.

5. Raphael, K.L., Zhang, Y., Ying, J., and Greene, T. Prevalence of and risk factors for reduced serum bicarbonate in chronic kidney disease. Nephrology. 2014;19:648–54.

6. Nakhoul GN, Huang H, Arrigain S et al. Serum potassium, end-stage renal disease and mortality in chronic kidney disease. Am J Nephrol 2015; 41:456–463.

7. Aslam F, Haque A, Haque J, Joseph J. Clinical spectrum of chronic kidney disease: A study of 50 patients at Lumhs. ISRA Medical Journal 2015; 4(5): 1-6.

8. Luo J, Brunelli SM, Jensen DE, Yang A. Association between serum potassium and outcomes in patients with reduced kidney function. Clinical Journal of the American Society of Nephrology. 2016 Jan 7;11(1):90-100.

9. Sarafidis PA, Georgianos PI, Bakris GL. Advances in treatment of hyperkalemia in chronic kidney disease. Expert Opin Pharmacother. 2015;16(14):2205–15.

10. Doualla M, Halle MP, Moutchia J, Tegang S, Ashuntantang G. Determinants of hyperuricemia in non-dialysed chronic kidney disease patients in three hospitals in Cameroon. BMC nephrology. 2018 Dec;19(1):169.

11. Moranne O, Marc Froissart, Jerome Rossert, Cedric Gauci, Jean-Jacques Boffa, Jean Philippe Haymann, Mona Ben M'rad. Timing of Onset of CKD-Related Metabolic Complications. J Am Soc Nephrol 2009; 20: 164–171.

12. Aggarwal H, Alam F, Naqvi S A J. Experience of Hemodialysis at Kidney Center. J Pak Med Assoc. 1992; 42(10):234-36.

13. Oh TR, Choi HS, Kim CS, Bae EH, Ma SK, Sung SA, Kim YS, Oh KH, Ahn C, Kim SW. Hyperuricemia has increased the risk of progression of chronic kidney disease: propensity score matching analysis from the KNOW-CKD study. Scientific reports. 2019 Apr 30;9(1):6681.