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An Assessment of the Parameter of Bone Mineral Disease between Non-Dialytic CKD Stage V & CKD Stage II-III

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Abstract **Original Research Article**

This was a cross sectional study which has been done with a view to compare the clinical and biochemical profile of end stage renal disease (ESRD) population or CKD stage V who are not on any renal replacement therapy with the patients of chronic kidney disease (CKD) stage II and III. This study was carried out on all CKD patients who attended the outpatient department and was admitted, transferred or referred to nephrology department of Sir Salimullah Medical College and Mitford Hospital, Dhaka during the study period. All patients were included in the period from July 2008 to December 2009. Data were collected by using an interviewed questionnaire, examination and investigations. Eighty (80) CKD stage V patients were taken in a group I against 40 cases of CKD stage II and III in group II. Anemia was found in both the group but more severe in the group I. Mean serum hemoglobin level of the group I was 8.327 gm/dl and 10.933 gm/dl in the group II. Edema was present in 46% of patients of group I and in 15% in group II. CKD stage V patients had a mean systolic blood pressure (BP) of 145.6 mm Hg whereas it was 143.6 mm Hg in CKD stage II-III patients. Mean diastolic pressure in group I was 87.81 mmHg which was 82.77 mmHg in group II. Diastolic pressure was more significantly raised in group I patients than the group II. Serum albumin level showed hypoalbuminemia in patients with CKD stage V. It was 2.816 gm/dl in the group I whereas 5.20 gm/dl in group II. From this study we could observe that the clinical and biochemical profiles related to kidney failure were present in more severe form in the patients with non-dialytic CKD stage V patients then the earlier stages (stage II and III) of CKD patients.

Keyword: *Biochemical, Chronic Kidney Disease (CKD), Nephrology, Hypoalbuminemia, Serum, Albumin*.

INTRODUCTION

Chronic kidney disease (CKD) is emerging in the 21st century as a global public health issue. Chronic kidney disease is defined as either kidney damage or glomerular filtration rate (GFR) <60 ml/min/1.73m^2 ≥ 3 months. Kidney damage is defined as pathologic abnormalities or markers of damage, including abnormalities in blood or urine or imaging studies [1]. Stages of kidney disease are as follows:

stage	Description	GFR (ml/min/1.73m^2)
1	Kidney damage with normal or ↑ GFR	≥90
2	Kidney damage with mild ↓ GFR	60-89
3	Moderate ↓ GFR	30-59
4	Severe ↓ GFR	15-29
5	Kidney failure	<15 (or dialysis)

The concept of CKD was developed to prevent kidney failure and end-stage renal disease (ESRD) and other related medical complications. Kidney failure is defined as either a level of GFR or <15 ml/min/1.73 m^2. It is accompanied in most cases by signs and symptoms of uremia, or a need for initiations of renal replacement therapy in the form of dialysis or renal transplantations for treatment of complications of kidney failure, which would otherwise increase the risk of mortality and morbidity. Even some patients may need dialysis or transplantation before the level of GFR to 15ml/min/1.73 m^2 because of symptoms of uremia. When the irritation of renal replacement therapy (RRT) is necessary for the occurrence of signs and symptoms of kidney failure, the term end-stage renal disease (ESRD) is used. ESRD includes patients need to be treated by dialysis or transplantation, irrespective of the level of GFR [1]. Chronic kidney disease (CKD) is an

insidious disease that gradually impairs kidney functions. CKD staging terminology is proposed by the national kidney foundation's kidney disease outcomes quality initiative (NKF-K/DOQI) and uses the term chronic kidney disease to encompass the entire spectrum of kidney disease, from its earliest stages through ESRD [2]. In a study 2007 Horl revealed that iron deficiency can easily be corrected by intravenous iron administration, which is more effective than oral iron supplementation, at least in adult patient's chronic kidney disease (CKD). The integration of recombinant human erythropoietin and intravenous (i.v.) iron therapy into standard anemia management protocols dramatically increases measures of hematocrit and hemoglobin and reduced the need for red blood cell transfusions. I/V iron has been proven to improve patient's response to EPO therapy replacing patients ongoing iron losses [3]. The third National Health and Nutrition Examination Survey (NHANES III) in USA estimated that eight million people had an estimated glomerular filtration rate (eGFR) less than 60 ml/min/1.73 m^2. The prevalence of CKD, particularly of stage 3-5, has grown 40% since 1988-1994, with the disease now affecting 13.8-15.8 percent of the general population of USA [4]. Patients with the end stage renal disease (ESRD) are likely to represent the tip of the iceberg of the entire burden of CKD; it has been estimated that the number of patient with the earlier stage of CKD (stage I to IV) are likely to exceed by as much as 50-fold that of those reaching ESRD (stage V). Currently more than 1 million with end-stage renal disease (ESRD) are on renal replacement therapy worldwide, with as many as 2 million predicted to require therapy by 2010. The majority of these patients come from developed nations that can afford the cost of RRT, whereas a large number of those requiring treatment in developing countries do not have access to RRT [5]. In a study done by Kraut and Kurtz in 2005 it becomes obvious that metabolic acidosis occurrence in the majority of patients with CKD when glomerular filtration red (GFR) decreases to less than 20% to 25% of normal, although as many as 20% of individuals can have acid-base parameters close to or within the normal range [6]. Incidence rate of ESRD in Bangladesh is not exactly known. But data from different hospitals suggest an annual incidence of ESRD of about 100-110 patients per million populations [7]. The combination of metabolic acidemia and elevated serum levels of parathyroid hormone such as is found in patients with CRF, leads to a far greater efflux of calcium compared with either metabolic acidemia or hyperparathyroidism. Correction of metabolic acidemia improves bone minimization and histology in CKD patients [8]. Common clinical and biochemical profiles of renal failure namely anemia, edema, systolic and diastolic hypertension, malnutrition by serum albumin, electrolyte imbalance i.e. hyponatremia, hyperkalemia, metabolic acidosis by serum bicarbonate, hypocalcemia and hyperphosphatemia were observed in both groups.

OBJECTIVES

General objective

To assess the parameter of bone mineral disease between non-dialytic CKD stage V & CKD stage II-III

Specific objectives

To see the common clinical and biochemical profiles in the non-dialytic CKD stage V patients (group- I).

METHODOLOGY AND MATERIALS

This study was carried out on patients with chronic kidney disease (CKD) stage II, III and V who attended the out-patient department and was admitted, transferred or referred to nephrology department of Sir Salimullah Medical College and Mitford Hospital, Dhaka during the study period. All non-dialytic patients of CKD stage V attending the out-patient and in-patient department of Sir Salimullah Medical College hospital having the inclusion criteria was included in the same group I and CKD stage II and III patients in group II. After considering the drop out cases 80 patients with non-dialytic CKD stage V were taken as group I and 40 patients with CKD stage II and III as group II.

- **Inclusion Criteria**

1. Any CKD patients having eGFR<15m1/min
2. Not receiving any form of renal replacement therapy
3. Age 18-65 years

- **Exclusion Criteria**

1. Patients who have history of any systemic illness other than CKD before diagnosed with CKD.

RESULTS

In this study a total number of ESRD patients as group I and 40 patients CKD stage II and stage III as group II were included. Blood hemoglobin (Hb) edema systolic and diastolic blood pressure, serum albumin, serum sodium, serum potassium, serum bicarbonate, serum calcium and serum phosphate were estimated in the both groups. (Table I) Regarding anemia mean hemoglobin level if the group I was 8.327 gm/dl and it was 10.933 gm/dl in the group II. Though both the groups rebuild anemia, group I had the lesser hemoglobin level than the group II. (Table II) Edema was observed in 46.3% of the group I patients. Group II showed only 15% edema. (Table III) Systolic blood pressure was not significantly raised in the group I. The cross table number II showed that patients with CKD stage V, group I had a mean systolic pressure 145.625 mmHg. Were as a group II patients had mean systolic blood pressure 143.625 mmHg. The two groups did differ a little. (Table IV) Mean diastolic pressure of the group I was found 87.81 mmHg and that it was 82.7 mmHg in the group II. Statistical analysis by Pearson Chi-square test diastolic pressure was significantly higher in the patients with ESRD than CKD stage I and

II patients were p value was found 0.013. (Table V) Albumin was seen in the two groups. It reveled hypoalbuminemia ESRD but normal serum albumin in the CKS stage I and II. Mean serum albumin was 2.816 gm/dl in the group I. CKD stage II and III showed a mean serum albumin level of 5.2 gm/dl. Serum albumin was decreased highly significantly in the group I.

Table-1: Cross table showing hemoglobin level in the group I and II patients.

	Group	N	Mean	P value
Hb (gm/dl)	I	80	8.3275	0.002 [S]
	II	40	10.9338	

Table-2: Cross table showing the percentage of edema within group I and II.

		Edema		Total	P value
		Present	Absent		
Group	II	15.0%	85.0%	100.0%	0.001[S]
	I	46.3%	53.8%	100.0%	

Person Chi-square test revealed a highly significant (as p value was 0.001) increase of percentage of edema in the patients with ESRD who were not dialysis.

Table-3: Mean systolic blood pressure in group I and group II.

	Group	No of cases	Mean	P value
Systolic blood pressure	I	80	145.6250 mmHg	0.6 [NS]
	II	40	143.6250 mmHg	

The two groups did differ a little. P value of the statistical analysis was 0.6.

Table-4: table showing the diastolic pressure in the group I and II patients.

Diastolic Blood pressure(mmHg)	Group	N	Mean	P value
	I	80	87.8125	0.013 [S]
	II	40	82.7750	

Stage I and II patients were p value was found 0.013.

Table-5: Cross table showing level of serum albumin in group I and II.

	Group	N	Mean	P value
Serum Albumin(Gm/dl)	I	80	2.8162	0.001[S]
	II	40	5.2050	

Here p value was found 0.001

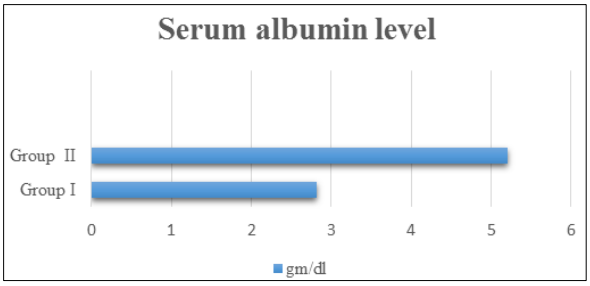

Fig-1: Chart showing serum albumin level in group I and group II.

DISCUSSION

This study was carried out to determine the severity of clinical and biochemical profiles occurring in CKD stage V patients without dialysis and compare those with patients of CKD stage II and III. Commonly occurring uremic profiles were seen in this study. These were anemia determined by Hb in gm/dl, edema determine by presence or absence of edema in clinical examination, malnutrition by serum albumin level in gm/dl, systolic and diastolic hypertension by clinical examination, electrolyte imbalances by estimating serum bi-carbonate level in mmol/l and alteration of serum calcium in mg/dl and serum phosphate level in mg/dl by estimating blood level of serum calcium and phosphate respectively. Edema was observed in the group I who were non-dialytic patients with CKD stage V and in the group II who were the patient with CKD stage II and III. A study in 1999 done by Obrador *et al*.[9] revealed a mean serum albumin level of 3.3 g/dl in the pre-dialysis patient where 60% were in a hypoalbuminic state. This study showed that Amon the patients of group I, 46.3% had edema and 53.8% were edema free. On the other hand, the group II showed edema in 15% cases. In comparison to group II, the group I reveled a higher percentage of presence of edema. Regarding anemia mean hemoglobin level if the group I was 8.327 gm/dl and it was 10.933 gm/dl in the group II. Edema was observed in 46.3% of the group I patients. Group II showed only 15% edema. Systolic blood pressure was not significantly raised in the group I. The cross table number II showed that patients with

CKD stage V, group I had a mean systolic pressure 145.625 mmHg. Were as a group II patients had mean systolic blood pressure 143.625 mmHg. The two groups did differ a little. Mean diastolic pressure of the group I was found 87.81 mmHg and that it was 82.7 mmHg in the group II. Statistical analysis by Pearson Chi-square test diastolic pressure was significantly higher in the patients with ESRD than CKD stage I and II patients. Albumin was seen in the two groups. It reveled hypoalbuminemia ESRD but normal serum albumin in the CKS stage I and II. Mean serum albumin was 2.816gm/dl in the group I. CKD stage II and III showed a mean serum albumin level of 5.2gm/dl. Serum albumin was decreased highly significantly in the group I. Serum calcium levels were estimated in mg/dl in both the groups. Narula el al in their review article described the high turnover disease as the pre dominant bone lesion were hypocalcemia and hyperphosphatemia are a common finding, starting early in CKD and progress with deterioration of the disease [10] the mean serum calcium level in this study was 8.57 mg/dl in the group I, patients with ESRD. It was 10.35 mg/dl u=in the group II. Though the mean calcium level was in the lower range of the normal value, it was significantly decreased in the group I in comparison with the group II. Statistical analysis with chi-square test this decreased level of serum bicarbonate in the group I reveled a highly significant result where P value was 0.0001.

LIMITATIONS OF THE STUDY

Patients were receiving management for the complications, which were seen in the study. No definite protocol for the management was followed and it was not similar in all patients.

CONCLUSION

This was a cross sectional medical college and Mitford hospital on 80 patients diagnosed with ESRD without any renal replacement therapy as group I, 40 patients diagnosed with CKD stage II and III as group II. Common clinical and biochemical profiles of renal failure namely anemia, edema, systolic and diastolic hypertension, malnutrition by serum albumin, electrolyte imbalance i.e. hyponatremia, hyperkalemia, metabolic acidosis by serum bicarbonate, hypocalcemia and hyperphosphatemia were observed in both groups. Anemia was more severe in the group I, though both the groups were anemic. Edema was present in a comparatively higher percentage in the patients of group I than group II. Mean systolic blood pressure was increased in both the groups than the KDOQI recommendations. Mean diastolic blood pressure was about 5 mmHg higher in the group I than group II. Hypoalbuminemia was found in the group I and was about half of that in the group II. Mean serum sodium was decreased in the group I in comparison with the group II. Serum potassium level was normal in both the groups, but in a higher range in group I. Metabolic acidosis indicated by serum by carbonate level was found in group I were it was normal in the group II. Regarding mean serum calcium level, group I revealed a lower normal range where group II had about 2 mg/dl higher value. Hyperphosphatemia was present in group II but was normal in the group II. From this study we could observe that the clinical and biochemical profiles related to kidney failure were present in more severe form in the patients with non-dialytic CKD stage V patients then the earlier stages (stage II and III) of CKD patients.

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