

## ORIGINAL ARTICLE

# ROLE OF SERUM ALKALINE PHOSPHATE LEVEL IN HEMODIALYSIS PATIENTS- A CLINICAL STUDY

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### ABSTRACT:

**Background:** Alkaline phosphatase (ALP) consists of enzymes that catalyze the hydrolysis of phosphate esters in an alkaline environment. This study was conducted to assess the role of ALP level in hemodialysis patients. **Materials & Methods:** The present retrospective study was conducted on patients on hemodialysis therapy. It comprised of 205 patients (male- 110, female- 95). In all patients, venous blood was obtained before starting dialysis session. Analysis of serum albumin, AST, urea nitrogen, ALT, ALP, Ca, C- reactive protein was done as normal laboratory process. Serum PTH was also assessed. **Results:** Out of 205 patients, 110 were males and 95 were females. The difference was non significant ( $P = 0.2$ ). In patients with  $ALP < 236 \text{ IU/l}$ , diabetes was seen in 46%, CVS in 15% and cerebrovascular disease in 12% cases. In patients with  $ALP > 236 \text{ IU/l}$ , diabetes was seen in 38%, CVS in 8% and cerebrovascular disease in 7% cases. The difference was non- significant ( $P > 0.05$ ). Peripheral vascular disease was seen in 3% cases and 7% in patients with  $ALP < 236 \text{ IU/l}$  and  $ALP > 236 \text{ IU/l}$  respectively. Mean hemoglobin level was 11.4 gm% and 10.6 gm% in both groups respectively. Serum albumin level was 3.8 g/dL and 3.6 g/dL respectively. The difference was non- significant ( $P > 0.05$ ). 15 patients and 16 patients were HCV +ve in both groups respectively. Mean C- reactive protein was 0.4mg/dl and 0.8mg/dl in both groups respectively. Mean arterial blood pressure was 105.24 mm Hg and 102.4 mmHg respectively. The difference was non- significant ( $P > 0.05$ ). Serum calcium was 9.5mg.dL and 9.3mg/dL in both groups. Serum phosphorus was 5.6 and 5.1 mg/dL, serum parathyroid hormone was 156 pg/ml and 245 pg/dL. Serum phosphorus more than 5.5 mg/dL was seen in 65 and 42 patients, serum calcium phosphorus product (mg/dL) was seen in 57 and 52, serum calcium phosphorus product  $> 55 \text{ mg/dL}^2$  was seen in 54 and 31 respectively. **Conclusion:** High baseline serum ALP levels were more associated with increased mortality of chronic HD patients ALP may play important role as target for the treatment of HD patients.

**Key words:** Alkaline phosphatase, Serum phosphorus, Hemodialysis

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## INTRODUCTION

Alkaline phosphatase (ALP) consists of enzymes that catalyze the hydrolysis of phosphate esters in an alkaline environment, produces an organic radical and inorganic phosphate. This enzyme has multiple isoenzymes. It is produced mainly by liver, bones, intestines, placenta, kidneys, and leukocytes. The alteration in its level is indicating of some disease process.<sup>1</sup>

Serum ALP levels are elevated in patients with metastatic colorectal cancer (CRC), infiltrative liver disease, extrahepatic bile obstruction, intrahepatic cholestasis and hepatitis. To provide definite diagnosis, the level of ALP should be three times the normal level. The increase in serum ALP levels is considered to be a biomarker of high bone turnover.<sup>2</sup>

In primary biliary cirrhosis, primary sclerosing cholangitis, hepatic lymphoma, and sarcoidosis, the level

is markedly elevated. It elevated level also indicative of metastatic liver disease. However, its level is lowered in following conditions such as hypophosphatasia, postmenopausal women receiving estrogen therapy, children with achondroplasia and cretinism, men with recent heart surgery, malnutrition and severe anemia etc.<sup>3</sup> The level of alkaline phosphatase in the blood is checked through the ALP test, which is often part of routine blood tests. The levels of this enzyme in the blood depend on factors such as age, gender, blood type and whether an individual is pregnant or not.<sup>4</sup> Researchers are doing study that how it affects the inflammatory responses in patients with chronic kidney disease and is directly associated with Erythropoiesis stimulating agent resistant anemia. There is increase of tumor necrosis factor- $\alpha$  and its direct effect on the expression of alkaline phosphatase in vascular smooth

muscle cells.<sup>5</sup> This study was conducted to assess the role of ALP level in hemodialysis patients.

## MATERIALS & METHODS

The present retrospective study was conducted on patients on hemodialysis therapy. It comprised of 205 patients (male- 110, female- 95). Ethical clearance was obtained before starting the study. Patients consent was taken in their own language. After enrolling the patients in the study, they were followed for next 4 years. They were routinely underwent dialysis and bicarbonate dialysate.

In all patients, venous blood was obtained before starting dialysis session. Analysis of serum albumin, AST, urea nitrogen, ALT, Ca, C- reactive protein was done as normal laboratory process. For measurement of ALP level, ELISA method was used. Normal level of  $203 \pm 4.6$  IU/L was considered. Serum PTH was also assessed ( $10-65$  pg/mL). Blood pressure was measured by sphygmomanometer using auscultatory method. Both systolic and diastolic blood pressure was measured in supine position.

Results were tabulated and subjected to statistical analysis. P value less than 0.05 was considered significant.

## RESULTS

**Table I** Distribution of patients

Total - 205		
Male	Female	P value
110	95	0.2

**Graph II** Patient characteristics based on ALP level

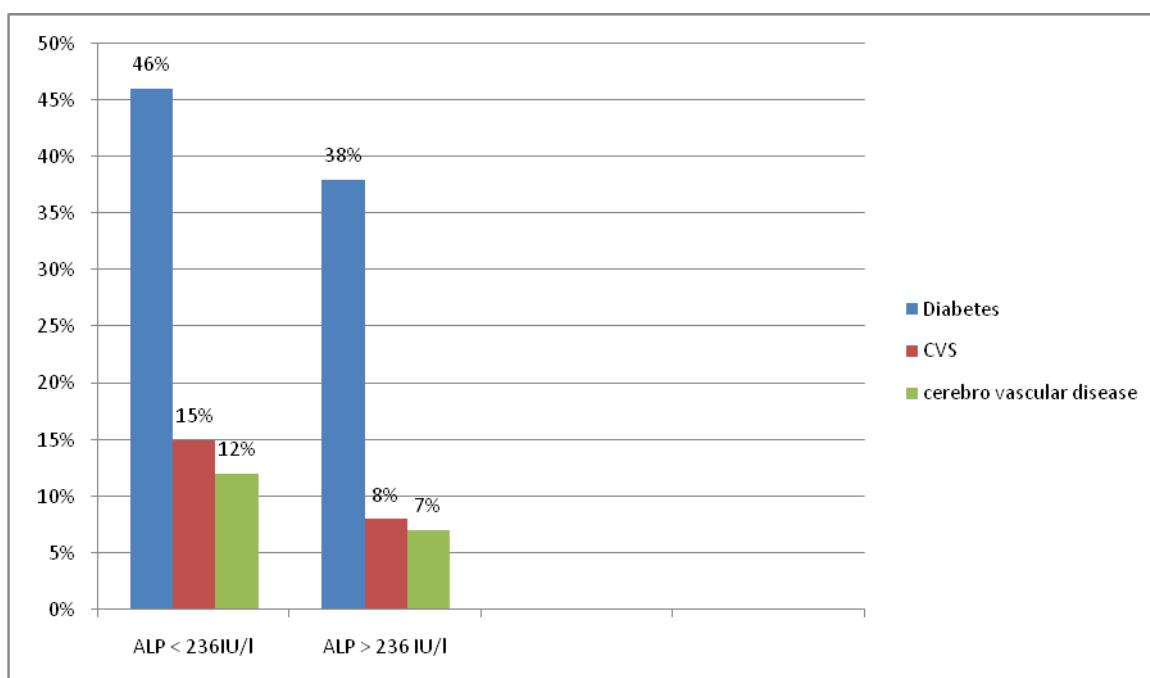
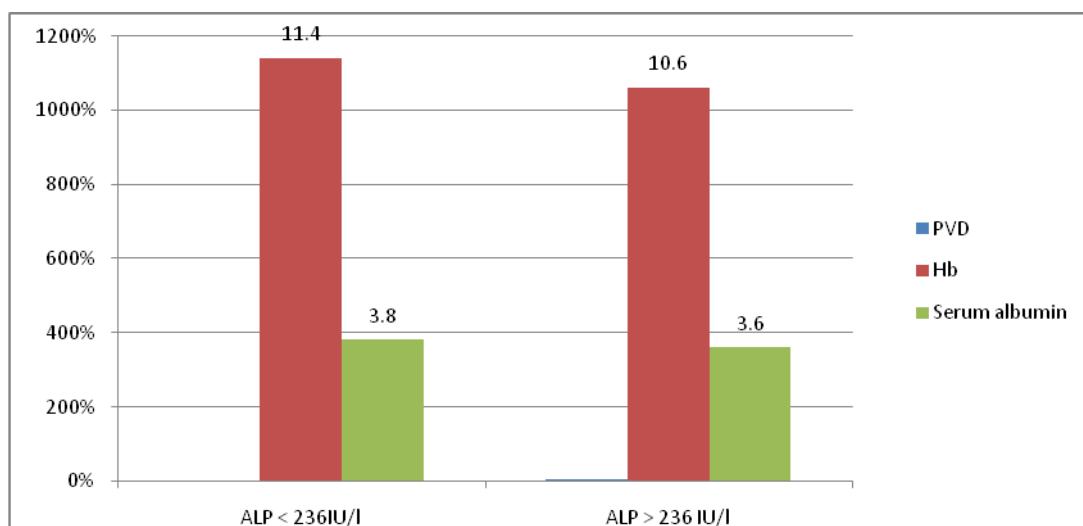
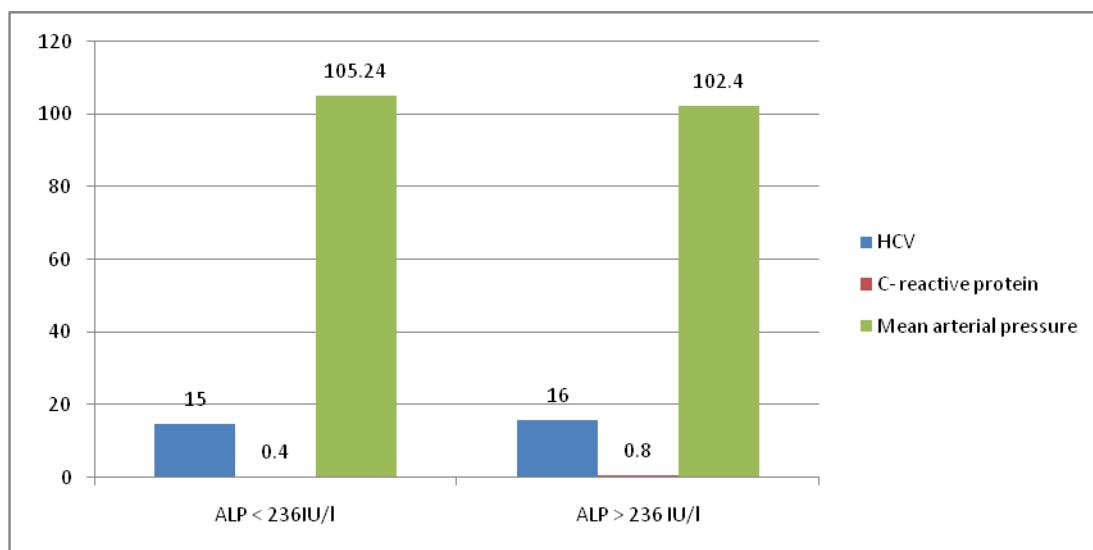


Table I shows that out of 205 patients, 110 were males and 95 were females. The difference was non significant (P- 0.2). Graph I shows that in patients with  $\text{ALP} < 236$  IU/l, diabetes was seen in 46%, CVS in 15% and cerebrovascular disease in 12% cases. In patients with  $\text{ALP} > 236$  IU/l, diabetes was seen in 38%, CVS in 8% and cerebrovascular disease in 7% cases. The difference was non- significant (P > 0.05). Graph II shows that peripheral vascular disease was seen in 3% cases and 7% in patients with  $\text{ALP} < 236$  IU/l and  $\text{ALP} > 236$  IU/l respectively. Mean hemoglobin level was 11.4 gm% and 10.6 gm% in both groups respectively. Serum albumin level was 3.8 g/dL and 3.6 g/dL respectively. The difference was non- significant (P > 0.05). Graph III shows that 15 patients and 16 patients were HCV +ve in both groups respectively. Mean C- reactive protein was 0.4mg/dl and 0.8mg/dl in both groups respectively. Mean arterial blood pressure was 105.24 mm Hg and 102.4 mmHg respectively. The difference was non- significant (P > 0.05). Graph IV shows that serum calcium was 9.5mg.dl and 9.3mg/dl in both groups. Serum phosphorus was 5.6 and 5.1 mg/dl, serum parathyroid hormone was 156 pg/ml and 245 pg/dl. Serum phosphorus more than 5.5 mg/dl was seen in 65 and 42 patients, serum calcium phosphorus product (mg/dl) was seen in 57 and 52, serum calcium phosphorus product  $> 55$  mg/dl<sup>2</sup> was seen in 54 and 31 respectively.

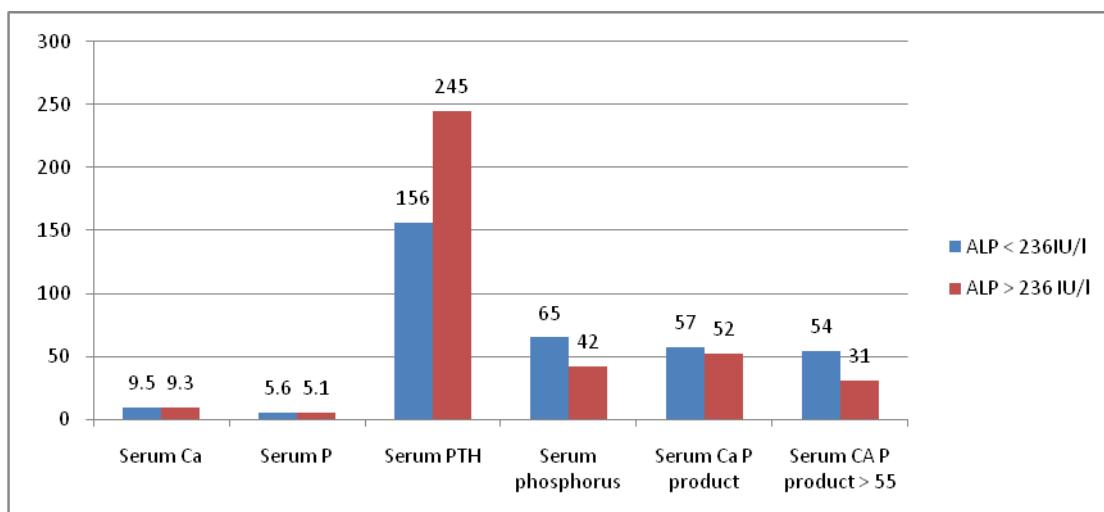
**Graph II** PVD, Hb and serum albumin level



**Graph III** HCV, C-reactive protein and mean arterial pressure



**Graph IV** Mineral metabolism



## DISCUSSION

Alkaline phosphatase is a homodimeric protein enzyme of 86 kilodaltons, containing two zinc atoms crucial to its catalytic function per monomer, and is optimally active at alkaline pH environments. Abnormal levels of Alkaline phosphatase in the blood could indicate issues relating to the liver, gall bladder or bones. Kidney tumors, infections as well as malnutrition has also shown abnormal level of alkaline phosphatase in blood. This study was conducted to assess the role of ALP level in hemodialysis patients. It comprised of 205 patients (male- 110, female- 95). We divided the patients on the basis of ALP level such as those with  $\text{ALP} < 236 \text{ IU/l}$  and patients with  $\text{ALP} > 236 \text{ IU/l}$ . Similar study was conducted by Flecher et al in year 1997.<sup>6</sup> We found that in patients with  $\text{ALP} < 236 \text{ IU/l}$ , mortality rate was slow as compared to those with  $\text{ALP} > 236 \text{ IU/l}$ . As diabetes was seen in 46%, CVS in 15% and cerebrovascular disease in 12% cases whereas in patients with  $\text{ALP} > 236 \text{ IU/l}$ , diabetes was seen in 38%, CVS in 8% and cerebrovascular disease in 7% cases. This is in agreement to Schoppet.<sup>7</sup>

Similarly that peripheral vascular disease, mean hemoglobin level and serum albumin level was low in patients with  $\text{ALP} < 236 \text{ IU/l}$ . This is similar to finding of Blaney et al.<sup>8</sup> Mean C-reactive protein level was low and mean arterial blood pressure was higher in first group as compared to second. This is in accordance to Regidor et al.<sup>9</sup> Our study showed that serum calcium, serum phosphorus was higher and serum parathyroid hormone was lower in first group. This is in agreement to Kerner et al.<sup>10</sup> Elevated serum ALP levels were shown to be associated with progressive arterial calcification in a longitudinal study of 134 patients with Stage 4 or Stage 5 CKD, even after statistical adjustment for serum Ca, P, PTH and CRP levels. High serum ALP levels were also found to be associated with increased mortality of HD patients.<sup>11</sup>

ALP is a biomarker and that it may play a pathogenic role in uremia leading to increased all-cause mortality. ALP may therefore serve as target for the treatment of HD patients, and novel ALP inhibitors that suppress vascular smooth muscle cell calcification.

## CONCLUSION

High baseline serum ALP levels were more associated with increased mortality of chronic HD patients ALP may play important role as target for the treatment of HD patients.

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