

# Relation between Serum Intact Parathyroid Hormone Level and Hematocrit in Chronic Kidney Disease Patients.

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## Citation

Adhikary LP, Pokhrel A, Yadava SK, Khadka D, Thakur R. Relation between Serum Intact Parathyroid Hormone Level and Hematocrit in Chronic Kidney Disease Patients. *Kathmandu Univ Med J* 2015;51(3):220-3.

## ABSTRACT

### Background

Anemia is a common complication of chronic kidney disease. There are various causes of anemia in chronic kidney disease patients on hemodialysis. Secondary hyperparathyroidism is one of the less recognized causes of anemia in chronic kidney disease patients.

### Objectives

The main objective of the study is to find the correlation between intact parathyroid hormone and hematocrit level in chronic kidney disease (CKD) patients undergoing hemodialysis.

### Method

Verbal consent was taken from all the participants. Eighty participants between the age of 29 and 70 years with chronic kidney disease having indication of hemodialysis were included in this study. Hematocrit was measured by bioelectrical impedance method and serum intact parathyroid hormone was by using Chemi Luminescence Immuno Assay (CLIA) method.

### Result

A weak reverse correlation was found between serum intact parathyroid level and hematocrit ( $r = -0.33$ ).

### Conclusion

In chronic kidney disease patient, there is reverse correlation between level of serum intact parathyroid and hematocrit level. This association may have clinical relevance in assessing the cause of unexplained low hemoglobin level in CKD patients.

## KEY WORDS

*Anemia, chronic kidney disease, hematocrit, intact parathyroid hormone, secondary hyperparathyroidism.*

## INTRODUCTION

Relative deficiency of erythropoietin (EPO), diminished red blood cell survival, bleeding diathesis, iron deficiency, folate or vitamin B12 deficiency, hemoglobinopathy and hyperparathyroidism are the causes of anemia in chronic kidney disease (CKD) patient.<sup>1,2</sup> Among these, EPO deficiency is considered as the most important cause.<sup>3</sup> While managing a case of anemia in CKD patient, we miss secondary hyperparathyroidism (SHPT) as a culprit.

Hyperparathyroidism secondary to CKD is an overproduction of parathyroid hormone (PTH) caused by several changes that occur in bone and mineral metabolism as a result of decreased kidney function.<sup>4</sup> In past experimental studies, it was observed that synthesis of endogenous erythropoietin, formation of erythroid progenitors, and survival of red cells were reduced by a high PTH.<sup>5-7</sup> Similarly, negative effects of very high serum levels of PTH on serum hemoglobin were observed in patients on dialysis.<sup>8</sup> In fact, improved serum concentration of hemoglobin, need for lower doses of erythropoietin stimulating agents and reduced fibrosis of bone marrow were attained after either better control of secondary hyperparathyroidism or parathyroidectomy.<sup>9-17</sup> The introduction of recombinant human erythropoietin (rhEPO) therapy for treatment of anemia of patients undergoing hemodialysis (HD) has led to a significant reduction in anemia.<sup>3</sup> Moreover, around 5-10% of the patients show a marked resistance to rhEPO therapy.<sup>18-22</sup> There are many causes of this variability of resistance to rhEPO therapy, one of the possible reasons may be SHPT.

In this study, we have assessed correlation of intact parathyroid hormone (iPTH) and Hematocrit level if there is any, in HD patients. Confirmation of this association may have clinical relevance in assessing the cause of unexplained low hemoglobin level in CKD patients.

## METHODS

This is a hospital-based cross sectional study carried out at Division of Nephrology, Department of Internal Medicine, Kathmandu Medical College Teaching Hospital, Kathmandu, Nepal. A total of 80 CKD patients attending Kathmandu Medical college teaching hospital, the division of Nephrology between June 2013 to May 2014 for dialysis were enrolled in this cross sectional study after ethical clearance was obtained from the Research and Ethical committee, Kathmandu Medical Collage. Participants having a history of parathyroidectomy or thyroidectomy were excluded. Weight in kilogram, height in centimeter, Body Mass Index in kg/m<sup>2</sup>, and Body Surface Area in square meter were recorded. Hematocrit was measured by bioelectrical impedance method in percentage. Serum intact parathyroid hormone (iPTH) in picogram per milliliter was measured using CLIA.

SPSS version 20 was used for data entry. Range, mean and standard deviation were computed to describe the characteristics of data. Pearson correlation was used to measure relationship between hematocrit and level of serum iPTH. Verbal consent from the study group was taken.

## RESULTS

In our study, comprising 80 patients, 52(65%) of the subjects were male and 28(35%) were female. The minimum and maximum age of the study group was 29 and 70 years respectively. The mean age was 59.72 ± 10.56 years (males: 54.96 ± 10.65, females: 56.82 ± 10.25).

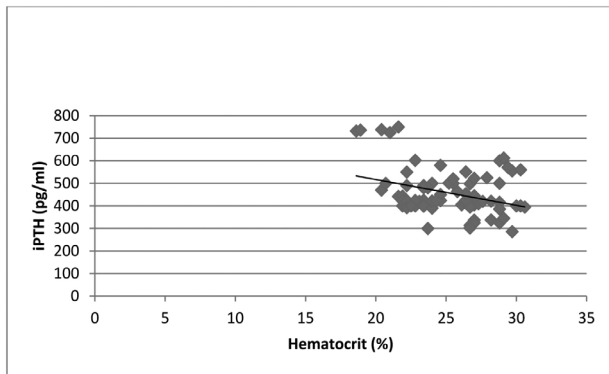
**Table 1. Baseline characteristics of patients**

Variables	Both sex Mean ± SD (range)	Male Mean ± SD (range)	Female Mean ± SD (range)	P value
Age (years)	59.72±10.56 (29-70)	54.96±10.65 (29-70)	56.82±10.25 (29-70)	0.448652
Blood Urea (mg/dl)	274.92±69.15 (100 - 512)	270.69±67.85 (100 - 412)	277.14±75.18 (198 - 512)	0.706643
Serum Creatinine (mg/dl)	14.71±3.34 (10.2 - 30)	15.10±3.90 (10.2 - 30)	14.14±1.73 (10.9 - 18)	0.132842
Hematocrit (%)	25.15±2.98 (18.6 - 30.6)	25.05±0.60 (18.9 - 30.6)	25.33±2.92 (18.6 - 30)	0.654253
Intact Parathyroid hormone (Pg/ml)	458.12±101.27 (286 - 750)	447.46±98.83 (300 - 750)	475.14±103.99 (286 - 732)	0.253165

A weak negative correlation was found between serum intact parathyroid level and hematocrit ( $r = -0.33$ ) which indicates that the variables iPTH and hematocrit level are inversely proportional to each other as shown in figure 1. Table 2 shows that iPTH has significant positive correlation with age, blood urea. There is no difference between male and female groups in respect to age, blood urea, serum creatinine, iPTH and hematocrit in CKD patients in our study.

**Table 2. Correlation between serum iPTH level and various parameters.**

Variables	Intact parathyroid level Pearson correlation coefficient (r)
Age (years)	0.052
Blood Urea (mg/dl)	0.004
Serum creatinine (mg/dl)	-0.136
Hematocrit (%)	-0.334



**Figure 1.** Scatter diagram showing reverse correlation between iPTH and hematocrit level ( $r = -0.33$ ) in CKD patients

## DISCUSSION

According to Kidney Disease Outcomes Quality Initiatives (KDOQI) and Kidney Disease Improving Global Outcomes (KDIGO) guidelines 2013 CKD is defined by the presence of kidney damage or decreased kidney function for three or more months, irrespective of the cause. SHPT is an insidious disease that develops early in the course of CKD and increases in severity as the glomerular filtration rate deteriorates. The normal level of iPTH in healthy population is about 32 pg/ml. KDOQI has recommended Serum iPTH levels of 35–70 pg/ml for stage 3 CKD, 70–110 pg/ml for stage 4 and 150–300 pg/ml for stage 5 and dialysis. SHPT as well as anemia is a common complication of CKD.

In our study, there is reverse correlation of hematocrit and serum iPTH level ( $r = -0.33$ ), which is consistent with Chutia H et al, Baradaran A et al, Sliem H et al, and Trovato et al.<sup>4,23-25</sup> In comparison, our study has weak negative correlation

between serum iPTH level and hematocrit level. This may be because our study population would have been on vitamin D, calcium, and EPO supplementation that altered the level of hematocrit and iPTH level. In Chutia H et al. study the value of Pearson correlation coefficient was 0.54 ( $r = -0.54$ ) and Sliem H et al. was  $-0.60$  ( $r = -0.60$ ).<sup>4,24</sup>

Possible causes of low hematocrit or anemia due to SHPT may be because of increased bone marrow fibrosis, which may lead to decreased erythropoietin and increased resistance to EPO.<sup>26</sup> Erythropoietin cells express calcitriol receptors, which induces proliferation and maturation of erythroid progenitor cells.<sup>4</sup> Therefore, deficiency of calcitriol, a cause of hyperparathyroidism may impair erythropoiesis.

Since SHPT developed in the early course of the CKD but it is often not recognized and left untreated in patients with early stage of CKD when therapy would have greater benefits.

### Limitation

Severity of Anemia and level of iPTH are influenced by EPO stimulating agent, vitamin D and calcium supplementation. It is not mentioned in our study whether patients were on EPO treatment or not.

## CONCLUSION

The level of iPTH is negatively correlated with hematocrit level. This association may have clinical relevance in assessing the cause of unexplained low hemoglobin level in CKD patients and treatment of some rhEPO resistance anemia by correcting iPTH level.

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