



## Relationship between parathyroid hormone and anemia in uremic patients

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An inversely relationship between serum intact parathormone (iPTH) and serum hemoglobin level among end-stage renal disease (ESRD) patients undergoing maintenance hemodialysis, is an issue of much importance. According to the various studies, an increase in serum level of iPTH leads to a decrease in serum level of hemoglobin among hemodialysis patients (1-3).

While, several studies have also suggested a significant relationship between secondary hyperparathyroidism (SHPTH) and anemia in ESRD patients (2-7), however, the evaluation of other common cause of anemia among ESRD patients undergoing maintenance hemodialysis including iron deficiency anemia, inflammation, aluminum toxicity and etc., is also needed for better evaluation.

For example, in a cross-sectional study, Chutia and Ruram (3), evaluated the role of secondary hyperparathyroidism as a cause of anemia and correlation of intact parathyroid hormone and hemoglobin level among 63 individuals admitted in hemodialysis (HD) unit of North East Indira Gandhi Institute of Health and Medical Science. The result of this study showed a reverse correlation between intact parathyroid hormone and hemoglobin level. There was no correlation between intact parathyroid hormone and serum ferritin level in the Chutia and Ruram, study which indicate that the anemia is not due to depleted iron stores.

In another study, Baradaran and Nasri (4), evaluated the role of SHPTH in the severity of anemia in 36 ESRD patients undergoing maintenance hemodialysis. The result of this study also showed, a reverse correlation between iPTH and hemoglobin level as well as between alkaline phosphatase and hemoglobin level. In addition, they also showed a correlation between severity of hyperparathyroidism and intensity of anemia. They concluded that SHPTH, *per se* can intensify anemia among these patients.

The results of other cross-sectional study carried out by Trovato *et al.* (6), is also consistent with the results of studies by Baradaran and Nasri (4), Chutia and Ruram (3), and Sliem *et al.* (5) study. In Trovato *et al.* (6), study on 45 hemodialysis patients, a reverse correlation between the degree of anemia and hyperparathyroidism was detected. In addition, Trovato *et al.* (6), showed that hemodialysis patients with elevated intact parathyroid hormone level need to higher dose of recombinant human erythropoietin (r-HuEpo) for correction of anemia.

In addition to above studies, there are several articles that

### ■ Implication for health policy/practice/research/medical education

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evaluate the possible beneficial effect of parathyroidectomy on anemia in ESRD patients (8-12).

Zingraff *et al.* (8), study is the first report, more than 3 decades ago, on the positive effects of parathyroidectomy on correction of anemia among uremic patients. They observed an increase in hemoglobin level 6 to 9 months after parathyroidectomy in 18 patients. They also showed a correlation between the amount of marrow fibrosis and the improvement of anemia after surgery.

Approximately two decades later, the positive effects of parathyroidectomy on correction of anemia among uremic patients was also reported by Goicoechea *et al.* (9), who evaluated seven uremic patients 6 months after parathyroid surgical removal. They detected an increase in hemoglobin level, along with reduced erythropoietin needs from 136 to 94 units/kg per week.

More recently, Chow *et al.* (10), in a retrospective cohort study, compared the preoperative and six months postoperative hematological and biochemical variables after parathyroidectomy in 23 Chinese ESRD patients undergoing long-term dialysis in a 3-year period. The result of the study showed that, the mean hemoglobin level but not the mean platelet level is significantly increased six months post parathyroidectomy with an exceedingly low complication rate. Although the hemoglobin level is significantly elevated six months postoperatively in the study, however the study is limited because of retrospective design and short duration of study.

Additionally, Trunzo *et al.* (11), have evaluated the effect of parathyroidectomy on anemia and erythropoietin dosing in 37 ESRD patients. The result of the study showed that the recombinant human erythropoietin dosing requirement for

correction of anemia is decreased and hemoglobin level is increased significantly after parathyroidectomy suggesting, either increased endogenous erythropoietin production or improved response after operation. Trunzo *et al.* (11), proposed refractory anemia as a secondary indication for parathyroidectomy resection among ESRD patients.

It is suggested that, the possible causes of anemia due to secondary hyperparathyroidism is severe bone marrow fibrosis with a concomitant reduction of space for erythropoiesis, which may lead to decreased erythropoietin production and increased resistance to erythropoietin (13-15).

This hypothesis is firstly suggested by Brickmann *et al.* (13), approximately four decades ago and two decades later, it was confirmed by Rao *et al.* (14), who evaluated the response to erythropoietin therapy in 18 uremic patients and showed that the mean serum PTH levels and the degree of bone marrow fibrosis are significantly greater in the uremic patients with poor-response to erythropoietin therapy.

In addition there is also evidence that the parathyroid hormone is probably a major factor influencing red blood cell (RBC) osmotic fragility in ESRD patients. RBC osmotic fragility is the resistance of RBC hemolysis to osmotic changes. One of cause of short erythrocyte life span in uremic patients is increase in erythrocyte osmotic fragility due to high concentration of the parathyroid hormone (7). Another possible cause of anemia among patients with secondary hyperparathyroidism is calcitriol deficiency, which may impair erythropoiesis among these patients (15,16).

#### Author's contribution

SSBM is the single author of the manuscript.

#### Conflict of interests

The author declared no competing interests.

#### Ethical considerations

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