Introduction

Anemia is a severe complication of chronic kidney disease (CKD) that is seen in more than 80 % of patients with impaired renal function ***(Melnikova ; 2006).*** Although there are many mechanisms involved in the pathogenesis of renal anemia, the primary cause is inadequate production of erythropoietin by the damaged kidneys.

Erythropoietin is produced in the peritubular cells of the kidney and is the major hormone involved in the synthesis of red blood cells (Erythropoiesis). When erythropoietin levels are low, an inadequate number of oxygen-carrying red blood cells are produced. Anemia decreases oxygen supply all over the body and causes decreased exercise capacity, cognitive impairment, and diminished quality of life ***(Melnikova ; 2006).***

Anemia has also been implicated in the development of congestive heart failure and left ventricular hypertrophy ***(Rao and Pereira ; 2006)***. If left untreated, anemia may cause death ***(Melnikova ; 2006).***

By 1990 , recombinant human erythropoietin (epoetin) was licensed in the United States and Europe for the treatment of anemia associated with chronic renal failure, including patients on dialysis ***(Macdougall ; 2006) .***

Epoetin is administered by subcutaneous or intravenous injection 1 to 3 times weekly. Darbepoetin alfa, a second-generation erythropoiesis stimulating agent, can be administered once weekly or once every other week ***(Macdougall and Eckardt ; 2006)***.

Despite the successes of epoetin alfa and darbepoetin alfa, the management of anemia of CKD is poised for further clinical research. Several new anemia therapies are in various stages of development. The agent closest to the market is the third-generation erythropoiesis-stimulating agent continuous erythropoiesis receptor activator (CERA)

administered every 3 to 4 weeks is safe and effective for the treatment of anemia associated with CKD, also in the development stages for the treatment of anemia of CKD are the erythropoietin-mimetic peptides. One agent in this class, Hematide , is in phase 2 of clinical development in vivo studies have shown that Hematide is well-tolerated and can stimulate erythropoiesis in multiple species to produce a sustained increase in hemoglobin levels. The first oral therapy for the treatment of anemia in CKD is also in phase 2 of clinical development ***(Macdougall ; 2006) .***

This oral agent is a hypoxia-inducible factor (HIF) stabilizer. It is a possibility that the HIF stabilizer may surpass the effectiveness of recombinant erythropoietin because of its ability to stimulate iron absorption and suppress the negative effects of pro inflammatory cytokines on red blood cell production ***(Rastogi and Nissenson ; 2006).***

Osada et al (1999) reported on the results of gene therapy with the human erythropoietin gene as a method of treating anemia of renal origin. They studied mice with polycystic kidney disease, transfected cells with an adenovirus vector and the human EPO gene, and inserted these cells intraperitoneally .There was a significant increase in serum EPO levels and reticulocyte response. Similar results have been reported with human EPO gene therapy in primates. This mode of therapy is very promising but has some potential drawbacks including irreversibility of the mode of treatment, possible over expression and oncogenic potential.