KSN 2019
Seoul, Korea · May 23 - 26

**Abstract Type : Oral**
**Abstract Submission No. : OR-1195**

# Low bone mass is significantly associated with an Increased Risk of Anemia in Patients with Non-dialysis Chronic Kidney Disease

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**Objectives:** Hypoxia has been considered to be a risk factor for osteoporosis. Several studies have reported on the close associations between the anemia and an increased risk of bone loss. However, the relationship between hemoglobin(Hb) levels and bone mineral density(BMD) has not been established in chronic kidney disease (CKD) patients. Therefore, the aim of this study is to investigate the relationship between BMD and anemia in a non-dialysis CKD cohort.

**Methods:** Among 2,242 patients with non-dialysis CKD enrolled in the KoreaN cohort study for Outcome in patients With Chronic Kidney Disease (KNOW-CKD), 2,117 patients who measured Hb and BMD were included in the analysis. We defined anemia as Hb levels of < 13.0 g/dL and 12.0 g/dL for males and females, respectively. In addition, we further classified the patients into 4 groups according to anemia severity.

**Results:** The mean age was 53.6 ± 12.2 years and 1,293(61.0%) patients were males. At baseline, there were 525(24.8%) patients with osteopenia and 208(9.8%) patients with osteoporosis in this cohort. In the multivariate logistic regression model, the prevalence of osteoporosis and osteopenia was significantly higher in the anemia group than that in the normal Hb group (odds ratio [OR], 1.94; 95% confidence interval [CI], 1.26-2.98, P=0.003). Moreover, the prevalence of osteoporosis and osteopenia showed the incremental tendency according to the degree of anemia (OR, 1.62; 95% CI, 1.03-2.55; P 0.035, OR, 1.89; 95% CI, 1.04-3.42; P 0.036, OR, 4.32; 95% CI, 1.99-9.39, P 0.000). This association was consistently observed between the Hb levels and bone mineral density (OR, 0.74; 95% CI, 0.65-0.85; P 0.000).

**Conclusions:** This study showed that anemia and low hemoglobin levels are independently related with low BMD in patients with non-dialysis CKD. Our findings suggest that correction of anemia may be important to preserve bone mass in patients with CKD.