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Higher Hemoglobin Level is Relevant to Subtle Declines in Renal Function and Metabolic Syndrome in Early CKD Stages

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Purpose: Anemia is common in advanced renal stages and is caused by a relative deficiency of erythropoietin. However, little is known about the renal response to early declines in estimated glomerular filtration rate (eGFR) before the onset of anemia. In addition, it was reported that cardiovascular risk factors such as diabetes and stroke are related to elevated hemoglobin, few studies have analyzed the relationship between hemoglobin and metabolic syndrome which was associated with the development of atherosclerosis. So we investigated hemoglobin concentration across subtle declines in renal function according to the components of metabolic syndrome in subjects with eGFR above 50 mL/min/1.73m^2.

Methods: We recruited 145,586 subjects, aged 18 years or older based on the data from a voluntary routine heath check-up in tertiary university hospitals.

Results: Hemoglobin levels among eGFR group 2-6 (50≤eGFR<100 mL/min/1.73m^2) were significantly higher compared to eGFR group ≥100 mL/min/1.73m^2 (p<0.001) using ANCOVA adjusted by age, systolic blood pressure, total cholesterol, diabetes and smoking history in both genders. The highest level of mean hemoglobin was seen at eGFR 50-59 mL/min/1.73m^2. And we divided subjects into four groups (MS 0, 1, 2, and 3, respectively) according to the number of metabolic syndrome components (0, 1, 2, ≥3), and hemoglobin level of MS group 2-3 were higher than that of MS group 0 among eGFR groups 2-6 (p≤0.003) in both genders. Also, in MS groups 0, 2, and 3, hemoglobin value of eGFR groups 4-6 was higher compared to eGFR group 1 (p≤0.001).

Conclusion: Hemoglobin level was higher across subtle decreases in renal function and the presence of metabolic syndrome in early CKD stages.

Key Words: Glomerular filtration rate, Hemoglobins, Metabolic syndrome

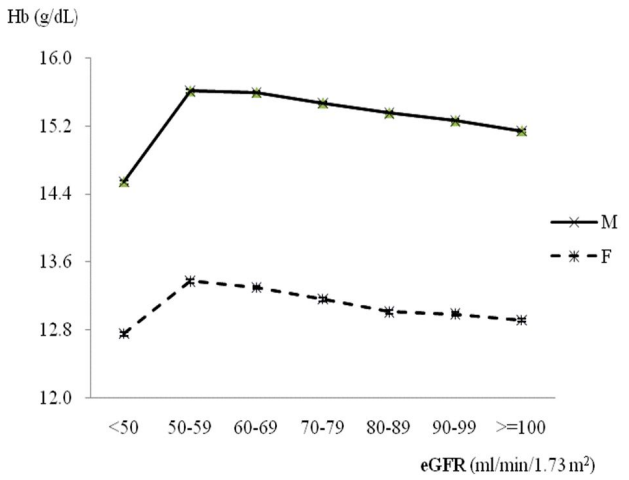

Fig. 1. The distribution of hemoglobin level among eGFR groups in each gender.
The hemoglobin value is adjusted by age, systolic blood pressure, serum total cholesterol, diabetes, and smoking history using co- variance (ANCOVA) analysis. Error bars show the standard error of the mean. eGFR; calculated glomerular filtration rate by modified MDRD equation (mL/min/1.73 m^2).

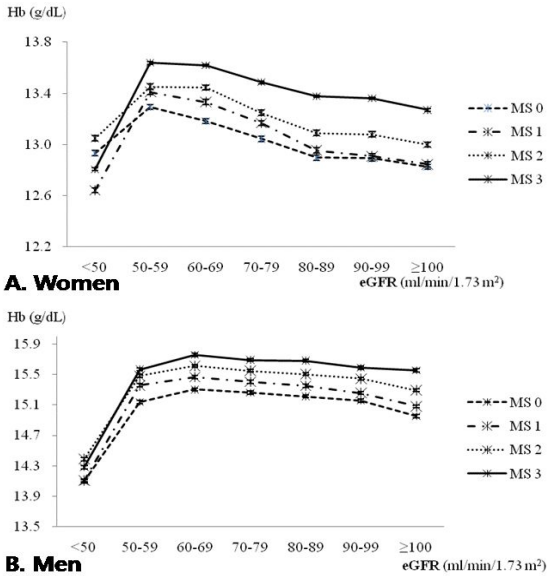

Fig. 2. The hemoglobin levels among eGFR groups according to the number of metabolic syndrome components.