

**The cardio renal anemia syndrome in adult patients with congenital heart disease**

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Background and aims: Increasing numbers of reports have documented recently the close linkage between congestive heart failure (CHF) and chronic kidney disease (CKD). Both conditions can cause and worsen each other. Since these patients are often anemic, some investigators have called this vicious circle "cardio renal anemia syndrome". This study aimed to elucidate the linkage between CKD and anemia in adult patients with congenital heart disease (ACHD), and to investigate whether these factors can predict cardiovascular events.

Methods and results: A total of 268 ACHD patients were enrolled (mean age  $30\pm 11$  years, 45% female). During a follow-up of  $33\pm 13$  months, 69 patients (26%) experienced a cardiovascular event (cardiac death, symptomatic arrhythmia, hospitalization because of worsening heart failure, and/or thromboembolism). The mean eGFR in these 268 patients was  $83\pm 25$  ml/min/1.73 sq m and the mean hemoglobin level was  $15.3\pm 5.4$  g/dl. The overall prevalence of CKD (eGFR $<60$ ml/min/1.73 sq m) was 12%, and the prevalence of anemia (hemoglobin $<12$ g/dl) was 7% in this cohort. The prevalence of CKD and anemia were higher in patients with a New York Heart Association functional classification of class I or greater ( $p<0.05$ ). ACHD patients with CKD had lower hemoglobin levels and higher BNP levels compared with those of patients without CKD ( $p<0.01$ ). eGFR was related to the hemoglobin level ( $R=0.39$ ,  $p<0.05$ ), and inversely related to the serum BNP level ( $R=0.54$ ,  $p<0.01$ ). Application of Kaplan-Meier analysis to the overall patient group indicated that eGFR was a significant predictor of cardiovascular events, while the hemoglobin level was not. In patients without cyanosis, both the eGFR and the hemoglobin level were strong predictors of cardiovascular events.

Conclusion: The eGFR and hemoglobin levels were closely related to each other, and both levels declined with worsening CHF. Although the hemoglobin level had a predictive value only in patients without cyanosis, eGFR was a significant predictor of cardiovascular events in the ACHD study group overall.