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Blood transfusion is a major determinant of all-cause mortality in ESKD patients : Machine learning analysis of National Health Insurance Claims data

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Objectives : Anemia, a prevalent complication of chronic kidney disease (CKD), significantly increases the risk of cardiovascular disease (CVD) in End-Stage Kidney Disease (ESKD) patients. While blood transfusion effectively alleviates anemia symptoms, it introduces potential health risks, including iron overload, immune reactions, infection, and volume overload. This study employs extensive machine-learning analysis of National Health Insurance Claims data to identify predictors of blood transfusion, all-cause mortality, and CVD in ESKD patients.
Methods : The dataset comprises 14,394 new ESKD patients initiating dialysis between 2009 and 2010 in South Korea. Exploring 41 independent variables against dependent variables such as all-cause mortality and cardiovascular diseases, Random Forest variable importance (GINI) is utilized to identify pivotal factors, with a specific focus on blood transfusion.
Results : Analysis reveals that blood transfusion within the initial three months post-dialysis was associated with prior anemia, advanced age, low socioeconomic status, diabetes, and liver disease, etc. The patients who died during the first three years post-dialysis received significantly more transfusions than those who survived. In random forest analysis for correcting potential confounders, the top ten predictors of all-cause mortality were old age, transfusion within the initial three months, prior CVD, diabetes, dementia, socioeconomic status, COPD, malignancy, secondary hospital care, and liver disease, highlighting transfusion during the early dialysis period as an independent and robust risk factor. Important predictors for new-onset CVD during dialysis also included age, transfusion, secondary hospital care, diabetes, hemiplegia, dementia, iron levels, and socioeconomic status. Notably, blood transfusion emerged as the independent factor increasing poor outcomes compared to other anemia treatments including iron, erythropoiesis-stimulating agents.
Conclusions : Comorbidities and blood transfusion are major determinants of all-cause mortality in ESKD patients, as revealed by machine-learning analysis. Addressing anemia in dialysis patients requires a multifaceted strategies, but the decision to administer transfusions requires careful evaluation, considering the associated potential risks.