IMPACT OF HEMODIALYSIS ON FOLATE METABOLISM, HYPERHOMOCYSTEINEMIA, AND ANEMIA SEVERITY IN PATIENTS WITH END-STAGE CHRONIC KIDNEY DISEASE

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Chronic kidney disease (CKD) is a major global health problem associated with high morbidity and mortality. In its terminal stage (stage 5 CKD), patients require renal replacement therapy, most commonly maintenance hemodialysis. Anemia is one of the most prevalent complications in end-stage renal disease (ESRD) and is traditionally attributed to erythropoietin deficiency. However, growing evidence suggests that disturbances in micronutrient metabolism, particularly folate and other B vitamins, play an important contributory role. Folate is essential for DNA synthesis, erythropoiesis, and homocysteine remethylation. In Chronic kidney disease patients, reduced renal clearance, chronic inflammation, oxidative stress, and dialysis-related nutrient losses may alter folate homeostasis. Hyperhomocysteinemia, frequently observed in ESRD, is strongly associated with endothelial dysfunction and increased cardiovascular risk. Therefore, investigating folate metabolism in patients undergoing long-term hemodialysis is of significant clinical importance. To assess the impact of maintenance hemodialysis on serum folate levels and to evaluate their association with hyperhomocysteinemia and anemia severity in patients with end-stage Chronic kidney disease.

Materials and Methods. A cross-sectional study was conducted among patients diagnosed with stage 5 Chronic kidney disease undergoing regular hemodialysis (three sessions per week). The following laboratory parameters were evaluated: Serum folate concentration, Plasma homocysteine levels, Hemoglobin, mean corpuscular volume (MCV), and erythrocyte indices, Serum creatinine and estimated glomerular filtration rate (eGFR), C-reactive protein (CRP) as a marker of inflammation,

Duration of dialysis therapy. Patients were stratified according to dialysis duration (<3 years and ≥3 years). Correlation and regression analyses were performed to determine associations between biochemical parameters and anemia severity.

Results. Patients receiving long-term hemodialysis demonstrated significantly reduced serum folate levels compared to standard reference values.

A statistically significant negative correlation was found between serum folate and plasma homocysteine levels. Lower folate concentrations were associated with decreased hemoglobin levels and higher inflammatory markers. Furthermore, patients undergoing dialysis for more than three years showed a higher prevalence of folate deficiency and relative resistance to erythropoiesis-stimulating agents. Elevated homocysteine levels were linked with markers of cardiovascular risk, supporting the hypothesis that impaired folate metabolism contributes not only to anemia but also to vascular complications in ESRD patients.

Conclusion. Maintenance hemodialysis in patients with end-stage CKD is associated with alterations in folate metabolism, contributing to hyperhomocysteinemia and worsening anemia severity. Regular monitoring of folate status and individualized supplementation strategies may enhance the effectiveness of anemia management and potentially reduce cardiovascular risk in this vulnerable population.

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