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Haemodialysis and Its Dual Impact on Red Blood Cells and Immune Activation

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Objectives : Haemodialysis in chronic kidney disease (CKD) induces mechanical stress and oxidative damage, leading to red blood cell (RBC) deformities that exacerbate anaemia. Additionally, mast cell activation, traditionally associated with allergic responses and tissue repair, contributes to chronic inflammation in CKD patients, further aggravating anaemia. This study evaluates RBC morphology and mast cell activation to better understand their roles in CKD-associated anaemia, with the goal of informing targeted interventions to improve patient outcomes.
Methods : A cross-sectional study of 90 haemodialysis patients from Pusat Hemodialisis MAIWP-PICOMS was conducted to examine the cellular and immunological mechanisms of anaemia in CKD. Peripheral blood smears from EDTA-anticoagulated samples were stained with Leishman stain and analyzed under light microscopy to identify RBC abnormalities, including echinocytes, acanthocytes, and spherocytes. Mast cell activation was assessed using triplicate slide analysis for accuracy. This study aims to clarify the roles of RBC deformities and mast cell activation in CKD-related anaemia, providing insights for improved management strategies.
Results : RBC analysis revealed significant morphological changes, with echinocytes (49%) and acanthocytes being the most prevalent deformities. Age-related patterns were observed, with echinocytes predominant in patients aged 51–60 and acanthocytes in those aged 61–70. Male patients exhibited higher levels of RBC abnormalities compared to females. Mast cell activation was identified in 47.8% of the patients, highlighting its potential role in chronic inflammation. Elevated eosinophil and basophil counts were also observed, suggesting underlying allergic or inflammatory responses contributing to anaemia.
Conclusions : This study highlights the dual impact of RBC damage and mast cell activation in CKD-related anaemia. Haemodialysis-induced mechanical stress and mast cell-driven inflammation worsen anaemia, emphasizing the need for targeted interventions. Addressing these factors may improve anaemia management and patient outcomes in CKD.