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HIV: Current Research

Opinion Article

Renal Complications in HIV Infection Treatment and its Causes

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DESCRIPTION

Human Immunodeficiency Virus (HIV) infection, a major global health challenge, affects multiple organ systems, including the kidneys. Renal manifestations of HIV infection are diverse, encompassing a spectrum of disorders ranging from Acute Kidney Injury (AKI) to Chronic Kidney Disease (CKD), with distinct pathological mechanisms linked to the virus itself, opportunistic infections, and Anti-Retroviral Therapy (ART) [1]. Understanding these renal complications is critical for optimizing the management of individuals living with HIV and mitigating associated morbidity and mortality. The direct impact of HIV on the kidneys is exemplified by HIV-Associated Nephropathy (HIVAN), a condition primarily affecting individuals of African descent due to genetic predispositions such as APOL1 risk alleles. HIVAN is characterized by collapsing Focal Segmental Glomerulo Sclerosis (FSGS), microcystic tubular dilatation, and interstitial inflammation. Clinically, patients often present with proteinuria, nephrotic syndrome, and rapidly progressive renal dysfunction [2]. The pathogenesis of HIVAN involves direct infection of renal epithelial cells by HIV, resulting in dysregulated cellular proliferation, apoptosis, and podocyte injury. Effective ART has significantly reduced the incidence of HIVAN; however, it remains an important cause of CKD in untreated or late-diagnosed patients [3].

HIV infection is also associated with immune complex-mediated kidney diseases, collectively termed HIV-associated immune complex kidney disease. These conditions include membrano Proliferative Glomerulo Nephritis (MPGN), membranous nephropathy, IgA nephropathy, and lupus-like glomerulonephritis. HIVICK results from chronic immune activation and the formation of circulating immune complexes that deposit in the glomeruli, leading to inflammation and glomerular damage [4,5]. The clinical presentation varies depending on the specific type of glomerulopathy, ranging from asymptomatic proteinuria to nephrotic syndrome and CKD. Diagnosis requires renal biopsy and immunofluorescence studies, which typically reveal immunoglobulin and complement deposition. Management involves ART to control viremia and additional immuno-suppressive therapies for severe cases [6-8].

Acute kidney injury is a frequent complication of HIV infection, particularly in hospitalized patients. The etiology of AKI in this population is multifactorial, including volume depletion, sepsis, nephrotoxic medications, and opportunistic infections such as cryptococcosis and tuberculosis [9]. Additionally, HIV-related Thrombotic Micro Angiopathy (TMA) can cause AKI due to endothelial injury and microvascular occlusion. ART has altered the epidemiology of AKI in HIV, with a shift from opportunistic infections as predominant causes to drug-related nephrotoxicity in the era of modern therapy. Nephrotoxicity related to antiretroviral therapy represents a significant concern in HIV management [10]. Tenofovir Disoproxil Fumarate (TDF), a commonly used nucleotide reverse transcriptase inhibitor, is associated with proximal tubular toxicity, leading to Fanconi syndrome and progressive CKD. The risk is higher in individuals with pre-existing renal dysfunction or concomitant use of other nephrotoxic agents. Switching to Tenofovir Ala Fenamide (TAF), a newer formulation with reduced renal toxicity, has improved renal safety profiles in HIV treatment. Protease inhibitors such as indinavir and atazanavir can also contribute to nephrolithiasis and obstructive uropathy. Close monitoring of renal function and early intervention are essential to prevent irreversible damage.

Chronic kidney disease in HIV-infected individuals is a growing public health issue, driven by aging populations, prolonged survival due to ART, and comorbidities such as hypertension, diabetes, and hepatitis C co-infection. HIV-associated CKD is often multifactorial, with contributions from direct viral effects, immune activation, ART toxicity, and traditional risk factors. CKD significantly impacts the quality of life and increases the risk of cardiovascular events and mortality in this population. Early identification through routine screening for proteinuria and estimated Glomerular Filtration Rate (eGFR) is important for timely intervention. Opportunistic infections and malignancies associated with HIV can involve the kidneys, either directly or indirectly. Kaposi sarcoma and non-Hodgkin lymphoma may cause renal impairment due to tumor infiltration or obstructive uropathy. Additionally, opportunistic pathogens such as cytomegalovirus, toxoplasmosis, and can lead to interstitial nephritis or obstructive complications. ART has

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reduced the prevalence of these complications, but they remain relevant in individuals with advanced immuno- suppression.

HIV-related kidney diseases have significant implications for clinical management. ART initiation and maintenance are pivotal in preventing and mitigating renal complications. Integrase Strand Transfer Inhibitors (INSTIs) and non-nucleoside reverse transcriptase inhibitors (NNRTIs) are generally considered safer for renal function. Dose adjustments of renally excreted medications are necessary in patients with impaired renal function to avoid toxicity. The use of Angiotensin-Converting Enzyme Inhibitors (ACEIs) or Angiotensin Receptor Blockers (ARBs) is recommended for proteinuria reduction and renal protection, particularly in individuals with HIVAN or diabetic nephropathy. Multidisciplinary care involving nephrologists and infectious disease specialists is essential for comprehensive management.

Kidney transplantation has emerged as a viable option for End-Stage Renal Disease (ESRD) in HIV-infected individuals. Advances in ART and immunosuppressive regimens have improved outcomes, with graft and patient survival rates comparable to those of non-HIV-infected recipients. However, challenges such as opportunistic infections, rejection, and drug-drug interactions require meticulous monitoring and individualized care. Living donor transplantation and expanded donor criteria have increased access to transplantation for this population. The intersection of HIV and renal disease underscores the need for ongoing research and innovation. Biomarkers for early detection of renal dysfunction, strategies to minimize ART nephrotoxicity, and interventions to address health disparities are critical areas of focus. Community-based initiatives and public health programs should prioritize kidney health in HIV care to reduce the burden of renal complications.

CONCLUSION

The renal manifestations of HIV infection are multifaceted, influenced by viral factors, host genetics, opportunistic infections, and antiretroviral therapy. Advances in ART have transformed the landscape of HIV-related kidney diseases, yet challenges persist in addressing CKD, drug-related nephrotoxicity, and access to specialized care. A proactive, multidisciplinary approach encompassing prevention, early detection, and individualized management is essential to optimize outcomes and improve the quality of life for individuals living with HIV.

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