



Exploring Renal Effects of Hematopoietic Stem Cell Transplantation: Risks, Complications, and Management

Silje Johansen *

Department of Medicine, University of Bergen, Bergen, Norway

DESCRIPTION

Hematopoietic Stem Cell Transplantation (HSCT) is a potentially life-saving treatment for various hematologic disorders, including leukemia, lymphoma, and aplastic anemia. While HSCT facilitates patients facing these challenging conditions, it can also have significant effects on kidney function.

Mechanisms of kidney injury

The effects of hematopoietic stem cell transplantation on kidney function are multifactorial and can occur through several mechanisms. Pre-transplant conditioning regimens, which often involve high-dose chemotherapy and/or total body irradiation, can lead to direct kidney toxicity, resulting in Acute Kidney Injury (AKI) or Chronic Kidney Disease (CKD). Additionally, the use of nephrotoxic medications, such as calcineurin inhibitors (e.g., tacrolimus, cyclosporine) for Graft-Versus-Host Disease (GVHD) prophylaxis, can further exacerbate renal injury by impairing renal blood flow and promoting nephrotoxicity.

Acute kidney injury

Acute kidney injury is a common complication following hematopoietic stem cell transplantation and is associated with significant morbidity and mortality. Risk factors for AKI include older age, underlying renal impairment, use of nephrotoxic medications, and the development of systemic complications such as sepsis or thrombotic microangiopathy. The pathophysiology of AKI in the context of HSCT is complex and may involve ischemic injury, tubular toxicity, and immune-mediated processes. Early recognition and management of AKI are essential to prevent progression to more severe forms of renal injury and improve transplant outcomes.

Chronic kidney disease

Chronic kidney disease is a recognized long-term complication of hematopoietic stem cell transplantation and can develop months

to years after the procedure. The cumulative effects of pre-transplant conditioning regimens, nephrotoxic medications, and the underlying disease process can contribute to the development and progression of CKD. Additionally, factors such as hypertension, diabetes mellitus, and dyslipidemia, which are common in transplant recipients, further increase the risk of CKD. Longitudinal monitoring of renal function, including serial measurements of serum creatinine and assessment of proteinuria, is essential for early detection of CKD and implementation of appropriate interventions to slow disease progression.

Graft-versus-host disease

Graft-versus-host disease is a common complication of allogeneic hematopoietic stem cell transplantation and can have significant effects on kidney function. Acute GVHD may lead to immune-mediated renal injury, resulting in AKI or glomerular dysfunction. Chronic GVHD, particularly in the form of sclerotic or eliminate lesions involving the renal vasculature, can manifest as proteinuria, hypertension, and progressive CKD. Management of GVHD-related renal complications often involves immunosuppressive therapy, including corticosteroids, calcineurin inhibitors, and other agents targeting aberrant immune activation.

Strategies for mitigating renal injury

Several strategies have been proposed to control renal injury in patients undergoing hematopoietic stem cell transplantation. Optimization of pre-transplant conditioning regimens, including the use of reduced-intensity or non-myeloablative conditioning protocols, may reduce the risk of kidney toxicity while maintaining effective disease control. Close monitoring of renal function and early intervention for AKI, including fluid optimization, avoidance of nephrotoxic medications, and renal replacement therapy when indicated, can help prevent progression to more severe forms of kidney injury. Additionally,

Correspondence to: Silje Johansen, Department of Medicine, University of Bergen, Bergen, Norway, E-mail: Johansen@edu.no

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efforts to minimize the cumulative dose of nephrotoxic medications, such as dose adjustments based on renal function and therapeutic drug monitoring, are essential for preserving kidney health in transplant recipients.

Hematopoietic stem cell transplantation is a fundamental treatment for various hematologic disorders but can have significant effects on kidney function. Acute and chronic kidney injury are common complications following HSCT and can result from a combination of pre-transplant conditioning

regimens, nephrotoxic medications, and the development of graft-versus-host disease. Early recognition and management of renal complications are essential for optimizing transplant outcomes and preserving long-term kidney function. By understanding the mechanisms underlying kidney injury in the context of HSCT and implementing strategies for mitigating renal toxicity, clinicians can improve outcomes for transplant recipients and minimize the burden of kidney-related complications.