

Nephrotoxic Effects of Chemotherapeutic Agents

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Nephrotoxicity can be a severe complication of oncology treatment. The most common presentations of chemotherapy-related renal disorders include acute kidney injury, electrolyte abnormalities, acid base disturbances, hemolytic anemia, and hypertension. Oncology nurses should be aware of the potential renal complications of oncology therapeutics and advocate for appropriate monitoring and treatment of patients. This article reviews the most common chemotherapeutic agents that may cause nephrotoxicity.

AT A GLANCE

- The kidneys play an important role in eliminating chemotherapeutic agents and their metabolites, which may be nephrotoxic, putting patients at risk for numerous renal complications.
- Chemotherapeutic agents may affect any portion of the nephron and renal microvascular cells and can cause acute kidney injury, electrolyte disturbances, and acid base imbalances.
- Common renal complications related to cancer chemotherapeutic agents include acute tubular necrosis; acute interstitial nephritis; thrombotic microangiopathy; and electrolyte imbalances, such as hyponatremia and Fanconi syndrome.

KEYWORDS

nephrotoxicity; chemotherapy; acute kidney injury; chronic kidney disease

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Despite improvements in oncology therapies, nephrotoxicity related to chemotherapy treatment is associated with significant morbidity and mortality (Perazella, 2012). Because the kidneys play an important role in eliminating chemotherapeutic agents that can cause numerous renal complications, patients are at risk for nephrotoxicity. The risk for nephrotoxicity is dependent on patient factors, including increased age, volume depletion, prior kidney dysfunction, and the pharmacology of certain chemotherapies (Perazella, 2012).

The kidneys are responsible for handling electrolytes, regulating volume status, managing acid base balance, maintaining blood pressure and homeostasis, and playing a role in erythropoiesis (Gilbert et al., 2018). The numerous functions of the kidneys are carried out through the nephron, which is the functional unit of the kidney. The nephron is composed of five segments: the glomerulus, proximal tubule, loop of Henle, distal tubule, and collecting duct (see Figure 1). Each segment is responsible for numerous physiologic mechanisms that ultimately maintain homeostasis of key bodily functions (Goyal et al., 2021).

Renal function is measured through serum chemistry, calculation of glomerular filtration rate, and creatinine clearance (Horie et al., 2018). Urinalysis is performed to evaluate specific gravity, hematuria, pyuria, and proteinuria. Urine microscopy completed by a nephrologist is used to evaluate the presence and morphology of red blood cells and white blood cells and to detect casts (Gilbert et al., 2018).

Nurses at the front line of oncology treatment should be aware of specific chemotherapeutic agents that cause renal dysfunction. This article provides an overview of the nephrotoxic effects of chemotherapeutic agents and nursing implications.

Nephrotoxic Effects of Chemotherapy

Chemotherapy may affect any portion of the nephron and renal microvascular cells. Common nephrotoxic effects from chemotherapeutic agents include acute tubular necrosis, acute interstitial nephritis, thrombotic microangiopathy, electrolyte imbalances, syndrome of inappropriate antidiuretic hormone, and Fanconi syndrome (Santos et al., 2020) (see Table 1). Acute tubular necrosis is a renal disease that causes renal tubular damage and cell death, resulting in acute kidney injury (Hanif et al., 2021). Many chemotherapies can cause acute interstitial nephritis, a drug-mediated hypersensitivity reaction that causes an immune-mediated injury to the kidney (Naik & Annamaraju, 2021). Thrombotic microangiopathy is a renal microvascular disease characterized by hemolytic anemia,