

■ NOVEL BIOMARKERS

BUN and creatinine are functional biomarkers of glomerular filtration rather than tissue injury biomarkers and, therefore, may be suboptimal for the diagnosis of actual parenchymal kidney damage. BUN and creatinine are also relatively slow to rise after kidney injury. Several urine and blood biomarkers have been investigated and show promise for earlier and accurate diagnosis of AKI and for predicting AKI prognosis. In cases of oliguric AKI, the urinary flow rate in response to bolus intravenous furosemide 1.0–1.5 mg/kg can be used as a prognostic test: urine output <200 mL over 2 h after intravenous furosemide may identify patients at higher risk of progression to more severe AKI, and the need for renal replacement therapy. The severity or risk of progressive AKI may also be reflected in findings on urine microscopy. In one study involving review of fresh urine sediments by board-certified nephrologists, a greater number of renal tubular epithelial cells and/or granular casts in the urine sediment was associated with both the severity and worsening of AKI. Protein biomarkers of kidney injury have also been identified in animal models of AKI and have been used in humans and found to be particularly useful in toxicity identification. *Kidney injury molecule-1* (KIM-1) is a type 1 transmembrane protein that is abundantly expressed in proximal tubular cells injured by ischemia or multiple, distinct nephrotoxins, such as cisplatin. KIM-1 is not expressed in appreciable quantities in the absence of tubular injury or in extrarenal tissues. KIM-1 can be detected after ischemic or nephrotoxic injury in the urine and plasma. *Neutrophil gelatinase associated lipocalin* (NGAL, also known as lipocalin-2 or siderocalin) is another biomarker of AKI. NGAL was first discovered as a protein in granules of human neutrophils. NGAL can bind to iron siderophore complexes and may have tissue-protective effects in the proximal tubule. NGAL is highly upregulated after inflammation and kidney injury and can be detected in the plasma and urine within 2 h of cardiopulmonary bypass–associated AKI. Soluble urokinase plasminogen activator receptor (suPAR) is a signaling glycoprotein expressed in multiple cell types and thought to be involved in the pathogenesis of certain kidney diseases; suPAR has been measured in the plasma and found to predict the subsequent development of