Should urinary biomarkers be a standard component of evaluation after cardiac surgery?

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After cardiac surgery, acute kidney injury (AKI) develops in 15% to 30% of patients.¹ The development of AKI after cardiac surgery is associated with significant morbidity and mortality,^{2,3} prolonged intensive care unit and in-hospital stays,⁴ increased treatment costs, and decreased long-term survival and quality of life. Standard risk-assessment tools have been ineffective in reducing this incidence.

In this important study by Albert and colleagues,⁵ a variety of kidney injury biomarkers including neutrophil gelatinase-associated lipocalin (NGAL), interleukin-6, midkine, and total protein were measured and correlated with survival after cardiac surgery in 200 patients at a single center. Patients with chronic renal impairment were excluded. Biomarkers were obtained preoperatively and at 6 and 24 hours after cardiopulmonary bypass. Kidney function was assessed at 90 days and 5 years after discharge. AKI was defined according to the R-risk, I-injury, or F-failure (RIFLE) criteria using serum creatinine and urinary output, both assessed during the first 7 postoperative days.⁶

The majority of patients (67%) had no AKI (RIFLE –). RIFLE + patients were older and had longer, more complicated procedures and more blood transfusions. The most interesting finding, however, was that, independent of RIFLE status, urinary biomarker-positive patients had worse outcomes. NGAL +/RIFLE – patients had a 10-fold increased in-hospital mortality compared with NGAL –/RIFLE – patients. Similar, although less profound, findings were noted for the other biomarkers, midkine, and interleukin-6.

Subclinical AKI or kidney stress is a relatively new concept.⁷ It is characterized by a positive biomarker without subsequent creatinine or urine output–based criteria for AKI. Whereas stress may not lead to damage, particularly if the stress is eliminated promptly,^{8,9} subclinical AKI implies damage below the clinical detection threshold but

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Central Message

Biomarkers may be indicated early after cardiac surgery to identify patients with subclinical AKI. This would allow coordinated efforts to prevent short- and long-term morbidity and mortality.

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revealed as decreased survival when biomarkers are positive. By using different urinary biomarkers, clinicians have successfully reduced the incidence of postcardiac surgery AKI by 30% with directed implementation of care bundles based on the Kidney Disease Improving Global Outcomes AKI guideline in biomarker-positive patients. These bundles include hemodynamic monitoring and titration, avoidance of nephrotoxic agents, higher transfusion thresholds, discontinuation of angiotensin-converting enzymes and angiotensin receptor blockers, and nephrology consultation.^{9,10} In the future, standard postoperative care will certainly include the use of these early indicators (within several hours after cardiac surgery) to deploy a multidisciplinary rapid response effort^{11,12} to eliminate kidney stress and prevent subclinical and clinical AKI.

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