To beat acute kidney injury, you need to keep your eye on the goal

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In this issue of the *Journal*, Magruder and colleagues¹ present the results of a goal-directed perfusion initiative designed to reduce acute kidney injury (AKI) associated with cardiac surgery in adults. Goal-directed therapies have been described since the 1980s.² The concept gained attention in 2001 with the publication of results demonstrating improved outcome in severe sepsis and septic shock when early goal-directed therapy was initiated.³ Ironically, recent attempts to replicate the success of this early goal-directed therapy protocol in severe sepsis have failed to demonstrate improved outcomes compared with conventional therapy.⁴ Proponents of goal-directed therapy would argue, in this case, that conventional therapy has evolved to include the original, important goal-directed interventions, and thus the 2 have converged. In the case of severe sepsis, this is early aggressive fluid administration. Successful goal-directed therapy ultimately should become conventional therapy.

For goal-directed therapy to be effective, tangible bias must be avoided.^{5,6} "Favoring less important but immediately measurable variables, such as mean arterial blood pressure (MAP), over more important but less measurable variables, such as tissue oxygen delivery (DO₂), is the result of 'tangible bias,' our tendency to favor what we can see and understand over what we cannot."⁶ Furthermore, there must a solid, evidence-based physiologic link between the goal-directed therapies and the desired outcome. Factors implicated in the genesis of AKI-associated cardiac surgery have been extensively reviewed by Thiele and colleagues.⁷

For the most part, Magruder and colleagues¹ have done an admirable job of assembling an evidence-based, goal-directed perfusion protocol. Minimizing cardiopulmonary bypass (CPB) circuit volume should be common practice given that both anemia (dilutional or otherwise) and transfusion to treat anemia during CPB consistently have been identified as a risk factors for AKI.⁸⁻¹⁰ The evidence presented to support threshold oxygen delivery values during CPB to reduce AKI is solid.¹¹⁻¹³ Evidence cited to justify the use of zero balanced ultrafiltration (ZBUF) to

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Central Message

AKI after cardiac surgery is associated with significant morbidity and mortality. A pilot, goal-directed perfusion initiative to reduce AKI is discussed.

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reduce the risk of AKI is less convincing. Although patients with impaired renal function (estimated glomerular filtration rate <60 mL/min adjusted for 1.73 m² of body surface area) randomized to ZBUF or no ZBUF during CPB demonstrated lower estimated glomerular filtration values, urinary neutrophil gelatinase-associated lipocalin/urinary creatinine ratio, creatinine values, and urea values on admission to the intensive care unit in the ZBUF group, none of these improvements were sustained at 24 hours or more.¹⁴ It is plausible that avoidance of overzealous continuous ultrafiltration is more important than the use of ZBUF.¹⁵ It makes intuitive sense to limit the rapidity of rewarming; however, the evidence presented is inferential, referring to the relationship of rewarming rate to neuronal damage. Avoidance of phenylephrine to support mean arterial pressure on CPB makes sense given that increases in CPB flow rate will increase oxygen delivery and that animal data suggest phenylephrine reduces renal blood flow.⁷ Finally, mannitol use to reduce AKI is of unproven value and was avoided.

Where does this leave us? This study is an excellent first step in what hopefully will be the evolution of a well-devised, goal-directed protocol into conventional care.

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