Chronic Kidney Disease and Adverse Outcomes in the Perioperative Period

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KEYWORDS

• Chronic kidney disease • Preoperative evaluation
• Estimated glomerular filtration rate • Perioperative outcomes • Medication dosing
• Acute kidney injury

HOSPITAL MEDICINE CLINICS CHECKLIST

1. All 3 risk assessment tools recommended for use in the 2014 American College of Cardiology/American Heart Association guidelines on perioperative cardiovascular evaluation take into account renal function.
2. Current clinical practice guidelines recommend assessing for chronic kidney disease (CKD) using estimated glomerular filtration rate (eGFR) rather than simply using serum creatinine values, given the risk that a normal serum creatinine can be falsely reassuring, particularly in the elderly.
3. The Kidney Disease Improving Global Outcomes scheme is used to classify CKD severity.
4. The Cockcroft-Gault formula, the Modification of Diet in Renal Disease formula, and the Chronic Kidney Disease Epidemiology Collaboration formula are 3 commonly used tools for calculating eGFR.
5. Studies examining the relationship between eGFR and cardiovascular outcomes generally have found that decrements in eGFR are associated with an increased risk of cardiovascular (and all-cause) mortality in the perioperative setting (and generally).
6. The magnitude of the increased risk of postoperative death associated with CKD is comparable to other commonly used risk factors for adverse postoperative outcomes, such as diabetes mellitus.

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7. CKD appears to be an independent risk factor for adverse events in the perioperative setting. CKD is a significant predictor of postoperative mortality in multivariate models, and, as the severity of CKD worsens, so do postoperative outcomes.
8. Higher rates of bleeding, an increased infection risk, and incorrect dosing of medications are 3 possible mechanisms by which CKD could result in adverse perioperative outcomes.
9. Among patients with CKD, medication dosing in the perioperative setting can be a challenge, and medications requiring adjustment for impaired renal function are often dosed incorrectly. Collaboration with a clinical pharmacist to help ensure correct dosing of medications is useful.
10. Hospitalists need to appreciate that CKD is an important perioperative risk factor and assess a patient's renal function as part of a preoperative evaluation.
11. Patients with perioperative acute kidney injury (AKI) superimposed on CKD have particularly poor outcomes. Specific actions hospitalists should take to avoid perioperative AKI in the CKD population are to avoid those causes of AKI known to occur in this setting: hemodynamic stress/hypotension, administration of intravenous contrast material, and administration of nephrotoxic medications.

BACKGROUND

The importance of kidney disease to perioperative outcomes is demonstrated by its inclusion in the commonly used tools for assessing perioperative cardiovascular risk. All 3 risk assessment tools recommended for use in the 2014 American College of Cardiology/American Heart Association guidelines on perioperative cardiovascular evaluation take into account renal function.[1] The older revised cardiac risk index, designed to predict major perioperative cardiac complications, has a preoperative serum creatinine level greater than 2.0 mg/dL as 1 of its 6 risk factors.[2] Using a serum creatinine threshold of 1.5 mg/dL, the American College of Surgeons (ACS) National Surgical Quality Improvement Program (NSQIP) cardiac risk calculator counts renal function among the 5 factors that it considers in predicting the risk of perioperative myocardial infarction (MI) or cardiac arrest.[3] Finally, the ACS NSQIP Surgical Risk Calculator—another of the newer risk prediction instruments that predicts multiple domains of perioperative risk, including the risk of cardiac complications—considers both whether the patient has acute renal failure and whether the patient is on dialysis.[4] Current clinical practice guidelines recommend assessing for chronic kidney disease (CKD) using estimated glomerular filtration rate (eGFR) rather than simply using serum creatinine values, given the risk that a normal serum creatinine level can be falsely reassuring, particularly in the elderly.[5]

Recent studies assessing the association between CKD and clinical outcomes, including perioperative outcomes, use the Kidney Disease Improving Global Outcomes (KDIGO) scheme to classify CKD severity. Therefore, understanding the KDIGO nomenclature is necessary in order to examine the association between CKD and perioperative cardiac risk. The KDIGO scheme has 6 categories, based on eGFR, as shown in **Table 1**.[5,6]