Acute Kidney Injury in Children: Being AWARE

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Acute kidney injury (AKI) in either adults or children is associated with both short- and long-term consequences, such as increased mortality, hospitalizations, and higher risk of evolution to chronic kidney disease (CKD).[1,2] Studies of AKI in either children or adults were limited in the past by lack of standardized criteria and absence of large-scale data. With the harmonization of other definitions into one globally accepted definition through the Kidney Disease Improving Global Outcomes (KDIGO) 2012 AKI criteria,[3] more recent studies are now more comparable, but we still have challenges in collecting enough large-scale data for children. The Acute Kidney Injury, Renal Angina, and Epidemiology (AWARE) study was the largest to-date compilation of well-annotated data on AKI in the pediatric intensive care setting.[4] In several other studies, researchers have used existing large data repositories to assess AKI in hospitalized but not critically ill children.[5,6] However, large national administrative databases cannot be used to assess AKI incidence and follow-up within a community population.[7]

In this issue of *Pediatrics*, Parikh et al[8] have now interrogated the large Kaiser Permanente integrated health care delivery network to assess both the incidence of AKI in a large pediatric community and the degree of follow-up. Their study revealed that two-thirds of the AKI episodes were not associated with an ICU stay and that more than half of the more severe cases did not have an outpatient serum creatinine test within 30 days after discharge.

Integrated health care delivery networks that have uniform electronic health records and mature data sets offer a unique opportunity to study diseases, such as AKI, that have aspects of both inpatient and outpatient follow-up. The challenges of using such community data sets include the absence of high-quality, reliable urine output data during hospitalizations; thus, Parikh et al[8] used only the serum creatinine component of the KDIGO criteria. The AWARE study revealed that 18% of severe AKI can be missed without the urine output criteria, so the incidence data from Parikh et al[8] may well be underestimates. Another challenge in such data sets is that a child may never have had the serum creatinine level measured previously or may have had none measured just before the AKI episode. Previous pediatric data have revealed that the sensitivity and specificity of an AKI diagnosis are significantly affected by the definition of surrogate baseline creatinine used.[9] In this study, the authors performed several validated techniques to establish a baseline, such as using the last value 7 to 365 days before admission or an imputed value of 120 mL/min per 1.73 m^2.

One of the most important findings from their study was the low rate of follow-up, even in cases in which the need for follow-up would seem obvious. By day 365, only 28.5% with unresolved AKI had a follow-up serum creatinine measurement, a value that did not increase beyond 71% for confirmed, unresolved stage 3 AKI. In section 2.3.4, the 2012 KDIGO guideline

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for AKI states that patients should be monitored at 3 months after AKI for resolution, new onset, or worsening of preexisting CKD.[3] This AKI-to-CKD time point is termed acute kidney disease by the Acute Disease Quality Initiative Workgroup.[10] The National Institute for Health and Care Excellence clinical guidelines from the United Kingdom made the following recommendations in 2013,[11] reiterated without alteration in 2019[12]:

Section 1.5.16

Monitor serum creatinine after an episode of acute kidney injury. Consider referral to a nephrologist or pediatric nephrologist when eGFR [estimated glomerular filtration rate] is 30 mL/min/1.73 m^2 or less in adults, children and young people who have recovered from an acute kidney injury.

Section 1.5.17

Consider referral to a pediatric nephrologist for children and young people who have recovered from an episode of acute kidney injury but have hypertension, impaired renal function or 1+ or greater proteinuria on dipstick testing of an early morning urine sample.

A low rate of follow-up after AKI is not unusual,[13] although some centers have started post-AKI follow-up clinics with specific recommendations for adults and children.[14] If complete recovery has occurred, the recommended follow-up is at 3 months. To support this point, Menon et al[15] found high rates of de novo CKD in children who developed AKI from a high nephrotoxic medication burden. If recovery is incomplete, then follow-up should be at 3 weeks or earlier. For the purpose of determining follow-up, Vanmassenhove et al[16] consider complete recovery as an eGFR back to within 90% of the baseline eGFR at hospital discharge, although patients might not yet be at a steady state. This group also provided a recommended algorithm for both follow-up and a restart schedule of previous medications.

Taken together, the cumulative results by Parikh et al[8] reveal a need for greater awareness of an AKI diagnosis in hospitalized children plus increased attention to the need for follow-up, at least in stage 2 and stage 3 AKI cases.

ABBREVIATIONS

AKI: acute kidney injury
CKD: chronic kidney disease
eGFR: estimated glomerular filtration rate
KDIGO: Kidney Disease Improving Global Outcomes

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