Identifying Acute Kidney Injury in the Outpatient Setting: The First Step

Stuart L. Goldstein

The association between AKI in hospitalized patients and poor outcomes including intensive care unit and hospital length of stay, development of CKD and progression to ESKD, worsening cardiovascular disease, and in-hospital mortality has been documented repeatedly over the past two decades (1). The association between “community acquired AKI” (i.e., AKI that is evident upon evaluation in an emergency department) and poor outcomes is also well recognized (2). Adoption of standardized multidimensional AKI diagnosis and staging criteria (3), coupled with mandated implementation of electronic health record systems provide the promise of feasible and effective AKI detection in near real-time, with the potential ability to alert health care providers of AKI presence and in some cases of AKI risk.

The performance of these alerting systems is mixed in the published literature and is related mostly to the primary objectives of the study. Although studies that aim to improve a process measure, such as time to AKI detection, time to discontinuation of nephrotoxic medications, or appropriate dose changes of renally excreted medications, have largely been successful (4,5), those that aim to improve an outcome measure such as AKI severity or duration have not (6). Clinical decision support systems that identify risk for AKI based on nephrotoxic medication burden or kidney stress by urine biomarkers, which then activate clinical pathways to mitigate AKI severity or decese AKI rates, have been successful (7,8). Given the fact that electronic health records tend to be organized by the beginning and end of a patient encounter (hospital admission, surgical procedure, outpatient visit), it is understandable that AKI clinical decision support alerting systems have targeted the inpatient environment because serum creatinine changes can be extracted from the electronic health record (EHR) in the same encounter, an individual can be assigned to check the changes in serum creatinine for patients on a particular unit, and/or the EHR can be programmed to send a message or populate a database with the identifiers for patients who develop serum creatinine based AKI. To date, similar processes had not been evaluated in the outpatient setting.

In this issue of Kidney360, Tolan and colleagues develop a prospective three-stage clinical decision support system to identify patients who have elevated serum creatinine over baseline in the outpatient setting. The reader may notice that I did not write “who have developed AKI” in the outpatient setting—that is a distinction that I will discuss later but does not detract from the importance of this work. Until then, I will use the term AKI. The authors had both process and outcome measures as targets for improvement—AKI diagnosis entered into the medical record and clinical actions based on the AKI diagnosis. The outcomes measures were AKI recovery within 7 days, prolonged AKI lasting from 8 to 89 days (also known as acute kidney disease, or progression to CKD. The first stage of the study involved generation of baseline data, the second involved an automated EHR generated alert for the rise in creatinine, and the third stage employed an email directly to the provider regarding the presence of AKI.

The investigators observed improvement in both of their process measures—the rates of AKI documentation and the clinical actions increased with the alert and email phase, although no difference in the rates between the two intervention phases, and the time to follow-up creatinine was reduced by 21 days (50%). Nephrotoxic medication burden reduction was the sole clinical action that increased in the intervention phases. None of the clinical outcomes improved over the course of the study. The authors also note that the third phase was short as a result of the time burden required to review the list of identified patients and sending emails to the providers—this was a manual process at the time of the study.

Despite the seeming lack of improved clinical outcome (and it is difficult to estimate a sample size to power a study such as this adequately), the authors should be commended for the work to improve the processes of identifying patients with increased serum creatinine over baseline in the outpatient setting. The study design was strong, the methods for validation of chart review between two independent reviewers were robust, and the authors were appropriately tempered in their discussion of their results. In fact, this study sets a standard which can be calibrated for future similar studies to be built upon. As I noted above, it is important that patients who were flagged...
for increasing serum creatinine over baseline cannot be classified as having AKI, as that definition has a time-based component (<48 hours or presumed to have occurred in the previous 7 days) (3). Nonetheless, the observation of improved process outcomes and improvement in clinical outcomes (although none reached statistical significance) provide the initial basis for development of definition standards for “AKI” or “risk of AKI” in the outpatient setting. The potential impact of these results cannot be overstated.

The information provided by this project followed optimal informatics clinical decision support guidelines (utilizing the “The Five Rights of CDS”) (9) by sharing and integrating the (1) right information, with (2) the right caregivers, (3) at the right time, via the (4) right media channel and (5) right format. In effect, this project has taken the first steps toward a more ideal and effective AKI informatics intervention in the outpatient setting. The impressive results of this project also provide the opportunity to employ an AKI risk screening algorithm, similar to what we have published in the Nephrotic Injury Negated by Just in time Action (NINJA) programs (7,10). NINJA identifies children with a high nephrotoxic burden (receiving three or more nephrotoxic medications on the same day or intravenous vancomycin or an intravenous aminoglycoside for 3 or more days). We have observed sustained reductions in nephrotoxic medication exposure and associated AKI rates in both single- and multicenter study. The main NINJA intervention is to ensure a serum creatinine is provided the initial basis for development of definition standards for “AKI” or “risk of AKI” in the outpatient setting. The potential impact of these results cannot be overstated.

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Author Contributions
S.L. Goldstein wrote the original draft.

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