Monthly Clinical Pearl: Neonatal Acute Kidney Injury: Mixed Reviews

Joseph R. Hageman, MD, Vidya Mahavadi, MD, and Shireen Hashmat, MD

I have had the privilege of working with Dr. Shireen Hashmat, who is one of our very bright pediatric nephrologists on a NICQ Quality Improvement project for the year and a half. Shireen's idea is to increase the awareness of neonatal clinicians of the existence of acute kidney injury (AKI) in neonates. (1,2) As you probably already know, the criteria for neonatal AKI are derived from criteria originally characterized in the adult intensive care unit, then modified for the pediatric intensive care unit and now applied to infants in the NICU. The criteria we are using in our QI initiative are the Kidney Disease Improving Global Outcomes (KDIGO) criteria, and we are using the criteria, which involves a 100% rise in creatinine within 48 hours of the baseline creatinine (Table 1). Changes in urine output can also be utilized as seen in the table, but we are just using increases in serum creatinine.

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Our basic purpose is to educate the nurses, NNPS, residents, fellows and attending neonatologists about the existence of neonatal AKI, which translates into putting the diagnosis of AKI into the problem list and arranging a follow-up appointment with the pediatric nephrologist. When we presented this project to our clinical neonatologists, their skepticism about the clinical significance of this entity was evident. I have to admit; I had just written a review of neonatal acute renal failure with Drs. Chris Clardy, our other pediatric nephrologist, and Owais Khan, who was one of our neonatal fellows at the time about two years ago. (3) Dr. Hashmat educated all of us about the long term sequelae of neonatal AKI based on data published by Jetton and colleagues .(1,3) Neonates with AKI are at increased risk for hypertension, proteinuria and chronic kidney disease. (1-5) All Shireen wanted the group to do was to document AKI in the problem list and schedule an appointment for follow up with her in the clinic post discharge.

Dr. Vidya Mahavadi, one of our second-year pediatric residents, who has an interest in nephrology, collected the current practice data at the time the initiative started. In this retrospective analysis from 2014-2016, 3levated serum creatinine was noted in 18% of 1414 neonates. AKI was classified in 7% of 1414 infants due to limited information in the rest of the patients' records. A total of 60% had Stage 1 AKI, 25% had stage 2 AKI, and 15% had Stage 3 AKI. A discharge diagnosis of AKI was recorded in 14% of neonates' records, and only 3/105 were referred to the pediatric nephrologist.

We proposed a quality improvement project involving neonatologists, pediatric residents and nephrologists working together to redesign the current workflow. It will include:

1. Quarterly brief educational sessions for residents starting their NICU rotation
2. The KDIGO criteria for neonatal AKI were posted at the computers where the residents wrote their progress notes in the electronic medical record (EMR- EPIC)
3. We presented the background about neonatal AKI in an education session for the nurses, residents, fellows and attending neonatologists
4. Shireen has been collecting the AKI problem list documentation and follow-up data subsequently which she has presented to the group.

Since the initiative began in 2016, we have presented our data at Vermont Oxford Network, Illinois Perinatal Quality Collaborative and Shireen will be presenting at the Pediatric Academic Society Meeting in April 2019 in Baltimore. Our follow up data through a number of Plan-Do-Study-Act (PDSA) cycles has demonstrated that the documentation of neonatal AKI in the problem list has improved. However, follow up appointments in the pediatric nephrology clinic has not improved. When Shireen queried the clinical neonatal providers, they continue not to be convinced about the true clinical significance of AKI, and replied that, although it may be a problem, they are reluctant to discuss AKI with the families because of the potentially possible long term problems…maybe almost theoretical risk. The parents have too many other major issues to worry about with their infants such as bronchopulmonary dysplasia or intraventricular hemorrhage.

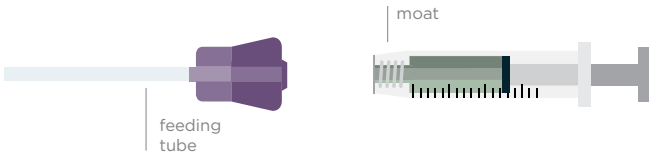
What is also interesting is I have had the privilege of presenting our poster for a time at Vermont Oxford, Illinois Perinatal Quality Collaborative (ILPQC), and just more recently at the Illinois Chapter of the American Academy of Pediatrics poster session and I have

Table 1
Neonatal KDIGO (Kidney Diseases: Improving Global Outcomes) acute kidney injury definition.

Stage	Serum creatinine (SCr)	Urine output over 24 h
0	No change in serum creatinine or rise <0.3 mg/dL	>1 mL/kg/h
1	SCr rise ≥0.3 mg/dL within 48 h or SCr rise ≥1.5 to 1.9 × reference SCr[a] within 7 days	>0.5 and ≤ 1 mL/kg/h
2	SCr rise ≥2 to 2.9 × reference SCr[a]	>0.3 and ≤ 0.5 mL/kg/h
3	SCr rise ≥3 × reference SCr[a] or SCr ≥2.5 mg/dL[a] or Receipt of dialysis	≤0.3 mL/kg/h

[a] Reference SCr is the lowest prior SCr measurement.

A new tubing design meant to eliminate tubing misconnections has introduced new challenges for the NICU population. Pediatric providers must deliver medication in small volumes to tiny patients with high levels of accuracy. The new tubing design, known as ENFit®, could present dosing accuracy and workflow challenges.



DOSING ACCURACY

- The moat, or area around the syringe barrel, is difficult to clear. Medication can hide there, inadvertently increasing the delivered dose when the syringe and feeding tube are connected; patients may receive extra medication.

INFECTION RISK

- The moat design can increase risk for infection if residual breast milk or formula remains in the moat and transfers to the feeding tube.

WORKFLOW ISSUES

- Increased nursing workflow is seen with additional steps for clearing syringe moats, cleaning tube hubs, and using multiple connectors.

Improved standards are important to protect patients from the dangers of tubing misconnections. But we must avoid mitigating existing risks by creating new ones.

Individual hospitals should consider all factors impacting their NICU patients before adopting a new tubing design.

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encountered the same level of skepticism from neonatologists and pediatricians.

There are more long term follow up data that are due to be published soon by David Askenazi and colleagues and when I discussed this feedback with him after the VON meeting in October 2018, he offered to come to the next VON meeting to talk about neonatal AKI.

Stay tuned as we progress with our QI initiative and we all get the opportunity to review more long-term follow-up data. Then we can establish the importance of close long term follow up of infants who have AKI in the NICU.

References:

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Summarize the pearl for emphasis.

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