Commentary

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Is Neonatal Delirium Ready for Prime Time Quality Improvement?

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In adult and pediatric critical care patient populations, delirium is a life-threatening condition characterized as acute decline in cerebral function.[1] Adult and pediatric critical care patients with delirium may present with altered arousal ranging from near-coma levels of reduced responsiveness to hypervigilance and severe agitation.[1] Delirium is formally diagnosed using the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria (Table 1)[2] and has been associated with increased risk of death, longer hospital stays, and long-term cognitive impairment such as dementia.[3] Disease pathophysiology is characterized by altered brain energy metabolism, inflammation, and derangements in neuroanatomical substrates, resulting in impairment in neuronal network connectivity.[4] In adult critical care patients, 4 decades of clinical science in delirium have been conducted, including multicenter randomized control trials[5] and the prospective validation of delirium screening tools.[6] The implementation of large-scale quality improvement (QI) methods in adult critical care patients only began in earnest after the widespread dissemination and appraisal of rigorous delirium research.

Given the poor outcomes observed in adult critical care patients with delirium, there is growing interest in diagnosing and treating delirium in pediatric critical care patients. Observational studies suggests that delirium rates range from 15% to 21% in pediatric intensive care unit patients with delirium rates approaching 50% in critically ill children treated with mechanical ventilation.[7,8] Similar to adults, pediatric delirium is associated with an increased risk of mortality.[8] An important challenge in screening for and diagnosing delirium in critically ill pediatric patients is the unique neurodevelopmental aspects of patients who span ages from 0 to 18 years. Owing to age-appropriate neurodevelopment or constitutional developmental delay occurring secondary to medical comorbidities, many pediatric patients cannot be formally evaluated for delirium using the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition criteria. Consequently, a number of pediatric-oriented delirium screening tools have been developed that address the inherent challenges in screening for pediatric delirium. These tools provide developmentally appropriate assessments, emphasize the importance of serial assessments, and incorporate caregiver perceptions into their child's behavior.[9] The Cornell Assessment of Pediatric Delirium (CAPD) is an example of a commonly used pediatric delirium screening tool. The CAPD has a number of notable strengths including the ability to perform the screen in children <18 months of age, the use of developmental anchor points for assessment in younger patients, and assessment of hypoactive delirium states.[10] The CAPD has undergone prospective validation in pediatric critical care patients ranging in age from 0 to 18, including 25% of whom suffered from predelirium developmental delay.[11] The long-standing interest in and rigorous study of pediatric delirium has resulted in evidence-based clinical practice guidelines published by the Society of Critical Care Medicine.[12]

For critically ill neonates admitted to neonatal intensive care units (NICUs), there is an emerging interest in screening for delirium using tools such as the CAPD. In this issue of *Pediatric Quality and Safety*, Moyer et al report findings from a single-center QI initiative entitled, "Implementing Screening for Neonatal Delirium in the Neonatal Intensive Care Unit: A Quality Improvement Initiative." This well-designed, rigorously implemented initiative was carried out at a large level IV NICU from

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Table 1. Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition Delirium Criteria

Criterion	Description
A	Disturbance in attention and awareness
B	Disturbance occurs over a short period of time and represents an acute change from baseline attention and awareness
C	An additional disturbance in cognition (eg, memory deficit, disorientation, language, visuospatial ability, or perception)
D	The disturbances in criteria A and C are not better explained by a preexisting neurocognitive disorder and do not occur in the context of a severely reduced level of arousal such as a coma
E	There is evidence from the history, physical examination, or laboratory findings that the disturbance is a direct physiological consequence of another medical condition

October 2020 to December 2021. During the intervention period, delirium screening was implemented using a combination of the CAPD and the Richmond Agitation and Sedation Scale. The Richmond Agitation and Sedation Scale is a screening tool that measures the level of consciousness in a patient and permits the observer to determine whether CAPD scoring should be performed based on the patient's level of arousability. Initially, screening was performed in infants greater than 38 weeks' postmenstrual age (PMA), treated with mechanical ventilation >7 days, and prescribed opiate or benzodiazepine medications. These patients were considered to be at the highest risk of neonatal delirium. Subsequently, the authors expanded screening to all infants greater than or equal to 38 weeks' PMA. In the first 6 months of the QI project, compliance with screening increased from 0% to 76% with improvement to 88% compliance after incorporation of CAPD scoring into electronic health record flowsheets and implementation of an electronic order set. Though screening compliance did decrease after eligibility criteria were modified to include all patients older than 38 weeks' PMA, screening compliance increased to 77% after integration of delirium screening checklists into the EMR, resulting in 82% of eligible patients undergoing delirium screening prior to discharge.

Moyer et al deserve praise for the well-designed and rigorous QI methods used in the report. Screening for neonatal delirium, the focus of the QI initiative, remains a poorly studied area in neonatal populations. As others have previously stated, delirium is likely present in NICUs given the patient acuity, environmental risk factors for delirium, and wide use of neurosedative medications known to increase the risk of delirium.[13] Nonetheless, unlike adult and pediatric critical care patients, neonates lack an extensive corpus of delirium-centered research. As such, evidence-based clinical practice guidelines that can be used to identify and treat neonates at the highest risk of experiencing the life-threatening sequelae of delirium are lacking. A major barrier toward developing evidence-based screening and treatment of neonatal delirium is a lack of validation of delirium screening tools in critically ill neonates, most notably those born preterm. although the CAPD is commonly used to screen for delirium in the NICU, as was the case in this study, to our knowledge, this tool has not been rigorously studied as a valid and reproducible screening tool in critically ill neonates.

Given the lack of clinical research in either screening or treatment of neonatal delirium, we think QI teams should exercise care in implementing QI initiatives focused on identifying and treating neonatal delirium. Given the relative immaturity of the central nervous system at birth, it remains unclear how critically ill infants may experience delirium. Furthermore, many common NICU disease states such as bronchopulmonary dysplasia, hypoxic ischemic encephalopathy, congenital heart defects, and neonatal surgical conditions present with symptoms that mimic screening questions on delirium screening tools such as the CAPD. As has been done in both adult and pediatric intensive care medicine, neonatology as a field should focus our efforts first on validating tools for the screening and diagnosis of delirium in critically ill neonates. Once we have done this, we should focus on testing interventions aimed at neonatal delirium while rigorously evaluating the long-term outcomes of neonatal delirium and its treatment. Until we do this, we risk adding more off-label and untested medication use to an already pervasive problem in NICUs.

Good QI often identifies where we have gaps in the current knowledge-base or where we need more research. In the case of neonatal delirium, we advocate for research on screening and treatment to catch up to that done in adult and pediatric medicine. Only then should neonatal practitioners begin to unleash the immense power of QI to implement that research into everyday clinical practice.

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