

# The Role of the Neurointensive Care Nursery for Neonatal Encephalopathy



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## KEYWORDS

- Neurocritical care • Infant • Critical care • Therapeutic hypothermia
- Neonatal seizures • Cerebral palsy • Neonatal encephalopathy
- Hypoxic-ischemic encephalopathy

## KEY POINTS

- In neonatal neurocritical “brain-focused” care units, all bedside providers maintain constant awareness of the neurologic complications of critical illnesses, and the impact of management on the developing brain.
- Neonatal encephalopathy is the commonest condition treated by a neonatal neurocritical care service.
- A neurocritical care approach may mitigate adverse outcomes among neonates with HIE by preventing secondary brain injury, rapid recognition and treatment of neurologic complications, consistent management using guidelines and protocols, and use of optimized teams at dedicated referral centers.

## INTRODUCTION

Neonatal encephalopathy due to intrapartum events is estimated to occur in 1 to 2 per 1000 live births in high-income countries.<sup>1</sup> Outcomes following neonatal encephalopathy due to birth asphyxia include death and neurologic disabilities, such as cerebral palsy, epilepsy, and cognitive impairment.

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Neonatal neurocritical care has emerged over the past decade as a subspecialty that involves a culture change toward a “brain-focused” approach with all bedside providers (physicians, nurses, respiratory technologists, and trainees) maintaining constant awareness of the potential neurologic complications of critical illnesses, as well as the impact of management on the developing or injured brain. Several important advances have prompted this culture change, including increased survival from critical illness, as well as the advent of digital neurophysiology monitoring and safe, high-resolution MRI. Conditions cared for in a neurocritical care unit include neonatal encephalopathy (and hypoxic-ischemic encephalopathy [HIE]), seizures, intracranial hemorrhage, ischemic stroke, and intracranial infection, among others. A neurocritical care approach to monitoring, diagnosis, and treatment of neurologic conditions has been shown to improve outcomes among adults.<sup>2,3</sup> In neonates, a neurocritical care approach may mitigate adverse outcomes among neonates with HIE by preventing secondary brain injury; rapid recognition and treatment of neurologic complications, like seizures; early identification of HIE mimics, like neonatal-onset epileptic encephalopathies; consistent management using guidelines and protocols; and use of optimized teams at dedicated referral centers, although long-term outcome studies are needed to show the benefits of this management.

Neonatal encephalopathy is the commonest condition treated by a neurocritical care service.<sup>4,5</sup> Neonates with HIE require rapid implementation of neuroprotection with hypothermia, have high rates of multiorgan failure, and neurologic signs and symptoms, such as encephalopathy, seizures, and brain injury. Therefore, this condition lends itself to the neurocritical care approach. In principle, a neurointensive care nursery (NICN) can lessen adverse outcomes as a result of prevention of secondary brain injury through attention to basic physiology, earlier recognition and treatment of neurologic complications, such as seizures, consistent management using guidelines and protocols, and use of optimized teams at dedicated referral centers, as discussed later in this article.<sup>6</sup> Moreover, the NICN can also serve as an ideal platform for research. Early diagnosis will allow interventions during critical neuroplasticity windows,<sup>7–9</sup> high-intensity therapies,<sup>10</sup> and patient stratification for novel interventions. For example, recent early phase safety studies have evaluated hypothermia combined with administration of potential biological (eg, erythropoietin<sup>11,12</sup>), inhaled (eg, Xenon<sup>13</sup>) and cell-based (eg, cord blood stem cells<sup>14</sup>) therapeutics.

### ***Establishing a Neurointensive Care Nursery***

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The neurocritical care approach involves a culture shift for the entire neonatal intensive care unit (NICU) toward brain-focused care, such that providers at every level are continually aware of the potential neurologic complications of critical illnesses and the impact of their management strategies on the developing brain. From the time of birth through patient discharge, the neonatal neurocritical care team serves to prevent secondary injury, implement neuroprotective strategies, including therapeutic hypothermia, manage neurologic complications, optimize developmental care, and establish outpatient developmental services and high-risk follow-up.

To establish an NICN, a leadership team (with representatives from neonatology, neurology, and nursing) must work together to establish a program for the following core functions of the unit:

- Training and education for all providers, including physicians, nurses, nurse practitioners, and respiratory therapists

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