

PERINATAL ASPHYXIA IN NEWBORNS: PROGNOSTIC INDICATORS AND RESUSCITATION APPROACHES

Sharipov Behruz Rashidovich

Pulatova Shahnoza Haydarovna,

pulatova.shaxnoza@bsmi.uz

Bukhara Institute of Medical Sciences

named after Abu Ali Ibn Sino

Abstract: Perinatal asphyxia is one of the leading causes of neonatal morbidity and mortality worldwide. This article examines the major prognostic indicators that determine the severity and outcomes of perinatal asphyxia, including APGAR scoring, biochemical markers, neurological assessments, and neuroimaging findings. Evidence-based resuscitation approaches recommended by the Neonatal Resuscitation Program (NRP) and the World Health Organization (WHO) are critically discussed. Particular attention is given to therapeutic hypothermia, respiratory management, circulatory support, seizure control, and long-term neuroprotective strategies. Understanding prognostic factors and applying timely, structured resuscitation interventions significantly improve survival and reduce long-term neurodevelopmental impairments in asphyxiated newborns.

Keywords: Perinatal asphyxia, neonatal hypoxia, APGAR score, hypoxic-ischemic encephalopathy, NRP, therapeutic hypothermia, neonatal resuscitation, prognostic markers.

MAIN BODY

1. Introduction

Perinatal asphyxia refers to impaired gas exchange leading to hypoxemia, hypercapnia, and metabolic acidosis in the fetus or newborn. It remains a major global health issue, responsible for approximately 25% of neonatal deaths and a significant portion of long-term neurodevelopmental disorders, including cerebral palsy and cognitive impairment. Early identification of severe asphyxia and immediate, effective resuscitation measures are crucial to improving clinical outcomes.

This article reviews prognostic indicators and summarizes modern resuscitation strategies aimed at minimizing hypoxic-ischemic brain injury.

2. Prognostic Indicators of Perinatal Asphyxia

2.1. APGAR Score

Although APGAR scoring at 1 and 5 minutes is widely used, it should not be the sole determinant of prognosis.

- **APGAR < 3 at 5 minutes** is associated with severe hypoxia and increased risk of neurological complications.

- Persistent low APGAR at 10 minutes suggests a higher likelihood of hypoxic-ischemic encephalopathy (HIE).

2.2. Biochemical Markers

Certain laboratory findings provide objective evidence of asphyxia severity:

- **Umbilical cord blood pH < 7.0**
 - **Base deficit > 12 mmol/L**
 - Elevated **lactate**, indicating anaerobic metabolism
 - High levels of **troponin**, **CK-MB**, and **LDH**, suggesting multi-organ damage
- These markers correlate with mortality and long-term neurologic sequelae.

2.3. Neurological Assessment

Neurologic evaluation is fundamental for diagnosing HIE:

- **Sarnat staging (I–III)** categorizes HIE severity:

- *Stage I*: mild irritability, hyperalertness
- *Stage II*: lethargy, hypotonia, seizures
- *Stage III*: coma, flaccidity, absent reflexes

- Abnormal primitive reflexes (Moro, sucking)
- Altered tone, seizures, poor feeding

Sarnat Stage II–III is strongly predictive of poor neurological outcome.

2.4. Neuroimaging

Imaging provides structural and functional insight:

- **Cranial ultrasound**: useful for early detection of edema or hemorrhage
- **MRI with diffusion-weighted imaging (DWI)**: gold standard for assessing hypoxic-ischemic injury
- **Amplitude-integrated EEG (aEEG)**: detects abnormal brain activity and subclinical seizures

MRI abnormalities within 3–7 days strongly correlate with long-term developmental impairment.

3. Resuscitation Approaches in Perinatal Asphyxia

3.1. Initial Steps (NRP Guidelines)

Immediately at birth:

1. **Warm, dry, and stimulate the newborn**
2. **Position the airway and clear secretions if needed**
3. Evaluate breathing and heart rate
4. Begin **positive pressure ventilation (PPV)** if HR < 100 bpm or apnea is present

Effective ventilation is the most critical factor for survival.

3.2. Ventilatory Support

- **PPV with room air (21% O₂)** is recommended initially; high oxygen may worsen oxidative injury.

- Continuous Positive Airway Pressure (**CPAP**) may be used for spontaneous breathing with respiratory distress.

- Intubation is indicated for severe depression or ineffective PPV.

3.3. Circulatory Support

- Chest compressions are initiated if **HR < 60 bpm** after 30 seconds of effective ventilation.

- Epinephrine administration (IV or endotracheal) is required if compressions and ventilation fail to restore circulation.

- Volume expansion (normal saline) is indicated for suspected hypovolemia.

3.4. Therapeutic Hypothermia

Therapeutic hypothermia is the only proven neuroprotective intervention for moderate to severe HIE.

- Initiate within **6 hours of birth**

- Cool to **33–34°C** for *72 hours*

- Gradually rewarm over 6–12 hours

Benefits: reduced neuronal apoptosis, decreased cerebral edema, improved neurological outcomes.

3.5. Seizure Management

- Seizures are common in asphyxiated infants.

- First-line treatment: **Phenobarbital**

- Additional options: **levetiracetam, phenytoin**

- Continuous aEEG monitoring is recommended for accurate detection.

3.6. Supportive and Long-Term Neuroprotective Care

Includes:

- Optimal glucose control (avoid hypoglycemia and hyperglycemia)

- Correcting electrolyte imbalances (Ca, Mg)

- Maintaining normothermia post-cooling

- Nutritional support via parenteral or enteral feeding

- Long-term follow-up for motor, cognitive, and hearing assessment

4. Discussion

Perinatal asphyxia requires rapid diagnosis and structured resuscitation to minimize hypoxic-ischemic injury. Prognostic indicators such as APGAR scoring, cord blood gases, neurological examination, and MRI assist clinicians in predicting outcomes and planning interventions. Modern approaches like therapeutic hypothermia, optimized ventilation strategies, prompt seizure control, and comprehensive supportive care significantly increase survival rates and reduce disability.

Integration of these strategies into neonatal intensive care units (NICUs) remains essential for improving global neonatal outcomes.

CONCLUSION

Perinatal asphyxia remains a significant cause of neonatal morbidity and mortality, but its outcomes can be improved through early recognition, precise prognostic evaluation, and evidence-based resuscitation. Prognostic markers—including pH values, lactate, Sarnat staging, MRI findings, and seizure patterns—help identify infants at highest risk of brain injury. Timely interventions such as therapeutic hypothermia, effective ventilation, cardiovascular support, and seizure management are crucial for neuroprotection. A comprehensive, structured approach based on international neonatal resuscitation guidelines markedly improves survival and reduces long-term neurological impairment.

REFERENCES

1. American Academy of Pediatrics & American Heart Association. *Neonatal Resuscitation Program (NRP) Guidelines*, 2021.
2. Perlman J. et al. “Neonatal Asphyxia: Mechanisms and Management.” *Pediatrics*, 2019.
3. Shankaran S. et al. “Therapeutic Hypothermia for Neonatal Hypoxic-Ischemic Encephalopathy.” *New England Journal of Medicine*, 2017.
4. Volpe J. *Neurology of the Newborn*. Elsevier, 2018.
5. World Health Organization. *Managing Newborn Problems.*, WHO Press, 2020.
6. Barkovich A.J. “MRI in Neonatal Hypoxic-Ischemic Brain Injury.” *Radiology*, 2019.
7. Lawn J. et al. “Global Burden of Birth Asphyxia.” *Lancet*, 2017.