Standardized Screening in Neonates with Abnormal Cord Blood Gases

July 27, 2020

Disclosures

We have no financial disclosures.
Objectives

1. Review evidence behind screening infants with abnormal cord gases to evaluate for risk of neonatal encephalopathy.
2. Share an algorithm that standardizes clinical management of infants with abnormal cord gases
3. Discuss how to perform and score a Sarnat Exam

Background

- Neonatal encephalopathy estimated in 8.5 per 1,000 live births globally
- By 2 years of age, up to 60% of infants with encephalopathy will die or have severe disabilities
- Neuroprotective cooling is standard of care for newborns with moderate to severe hypoxic ischemic encephalopathy (HIE)
- Infants at risk of HIE can have abnormal cord blood gases

Background

- For effective treatment, infants need to be evaluated within the first hour of life
- Timely evaluation ensures cooling can start within 6 hours
- Cord gases and clinical exam together are essential for diagnosis. There needs to be clear communication and ownership of who monitors and evaluates these infants.
What does a cord gas measure?

- It measures the acid-base status of the infant prior to delivery
- Can show signs of fetal hypoxic stress

<table>
<thead>
<tr>
<th>Table 1: Normal Fetal Cord Blood Gas Values*</th>
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</thead>
<tbody>
<tr>
<td>Variable</td>
</tr>
<tr>
<td>pH</td>
</tr>
<tr>
<td>PaO₂</td>
</tr>
</tbody>
</table>

*Where indicated, values are means ± standard error.

ACOG Recommendations for Obtaining Cord Gases

1. C-section for fetal distress
2. Abnormal heart tracing
3. Chorioamnionitis/intrapartum fever
4. Low Apgar at 5 minutes
5. Placental abruption
6. Pre-eclampsia
7. Multiple Gestations
8. Maternal Thyroid Disease

Cooling is an Effective Treatment

Cooling reduced the composite outcome of risk of death or major neurodevelopmental disability at 18 months by 24%. The NNT was 7.
Delivery Room Case

You are called to a c-section due to failure to progress for a 32 yo F, G2P1 at 40+2 with meconium and maternal chorioamnionitis diagnosed shortly prior to delivery. The infant is born floppy and apneic and is immediately taken to the warmer. The infant requires PPV just over 1 minute but then has spontaneous respirations. The tone continues to be diminished but over the first 5 minutes of life shows continued improvement. By 5 minutes of life, the infant is placed skin to skin with its mother. Apgars are 0 and 5 at 1 and 5 minutes, respectively. At 30 minutes of life, you get a call from the L&D nurse with the following cord gases:

- Arterial cord blood gas: pH 7.1, BD 14
- Venous cord blood gas: pH 7.12, BD 13

What do you do next?

A: Nothing, the infant looks clinically well
B: Examine infant in the mother’s room
C: Bring infant to the newborn nursery, exam the infant and get an infant blood gas
D: Transfer infant to higher level of care for evaluation
E: None of the above

Clinical Exam to Corroborate Cord Gas Findings

Cord gas

- pH < 7.0
- or
- BD ≥10

Standardized Screening for Abnormal Cord Gas
OUR CASE
Arterial cord blood gas:
pH 7.1, BD 14
Venous cord blood gas:
pH 7.12, BD 13

Our Case
Unilateral cord blood
pH 7.3, BD 16
Venous cord blood gas:
pH 7.12, BD 13
Normal Sarnat exam
Repeat Gas normal

Modified Sarnat Exam

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>MODERATE HE</th>
<th>SEVERE HE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Level of consciousness</td>
<td>2 = Alert</td>
<td>3 = Stupor</td>
</tr>
<tr>
<td>2. Spontaneous Activity</td>
<td>2 = Decreased activity</td>
<td>3 = Absent</td>
</tr>
<tr>
<td>3. Posture</td>
<td>2 = Dors flexion, complete extension</td>
<td>3 = Dorsiflexion</td>
</tr>
<tr>
<td>4. Tone</td>
<td>2a = Hypotonia (focal or general)</td>
<td>3a = Flaccid</td>
</tr>
<tr>
<td>5. Vomiting</td>
<td>2 = Vomits or has bile</td>
<td>3 = Vomits</td>
</tr>
<tr>
<td>6. Respiratory System</td>
<td>2 = Breath rate 1, 2</td>
<td>3 = Vomits</td>
</tr>
<tr>
<td>7. Pulse rate</td>
<td>2 = Heart rate / Respirations</td>
<td>3 = Absent</td>
</tr>
<tr>
<td>8. Abnormalities in birth</td>
<td>2 = Abnormal</td>
<td>3 = Abnormal</td>
</tr>
<tr>
<td>Respiratory System</td>
<td>2 = Hypopnea</td>
<td>3 = Apnea</td>
</tr>
</tbody>
</table>

https://wusthoff.people.stanford.edu/
Quality Improvement Metrics

% Infants with 'Abnormal' Cord Gas who had Direct Lab-to-Neonatal Hospitalist Call Notification

% Infants with 'Abnormal' Cord Gas who had a Postnatal Blood Gas and a documented Sarnat exam

Standardized Screening for Abnormal Cord Gas

Future Considerations

- Is there a potential scenario on our algorithm where it would be appropriate to perform a Sarnat exam without needing to repeat a gas?
- The role of cooling in infants who have mild encephalopathy based on Sarnat exam
Take-Home Points

1. Pediatricians in the Delivery Room and Newborn Nursery have a key role in identifying and monitoring infants with abnormal cord blood gases to determine those at risk for neonatal encephalopathy.
2. A timely Sarnat exam in addition to the cord gas is essential when evaluating these infants.
3. Having a standardized approach to clinically managing these infants leads to appropriate identification and treatment.

Acknowledgements

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References


Time  Session Title  Presenters  Moderator

11:00-11:05 CST  Introduction  Arun Gupta (Stanford)  Mariana Maternovsky (Children’s National)

11:05-12:00 CST  Top Newborn Articles:  • NAS  • Early Onset Sepsis  • CCHD Screening  • Hypoglycemia  • Delivery Room  Chandani DeZure (Stanford)  Neha Joshi (Stanford)  Gina Gallizzi (Children’s National)  Rakhi Gupta Basuray (Nationwide Children’s)  Stephanie Todd (Children’s National)

12:00-12:05 CST  Break

12:05-12:35 CST  CMV Screening  Nichole Wang (Stanford)  Arun Gupta (Stanford)

12:35-1:05 CST  Cord Blood Gas Management  Elizabeth Blecharczyk (Stanford)  Lucy Lee (Stanford - PAMF)  Allison Markowsky (Children’s National)

1:05-1:10 CST  Break

1:10-1:50 CST  COVID-19 andエネルギー: A Panel  Arun Gupta (Stanford)  Mariana Maternovsky (Children’s National)  Lanre Ilera (Children’s National)

1:50-2:00 CST  Wrap-Up  Arun Gupta (Stanford)