I. Introduction
   A. The use of an organized, structured approach is critical when caring for a very low birth weight (VLBW) neonate during the Golden Hours.
   B. Basic to this systemic method is a comprehensive assessment, which, depending on the clinical condition of the neonate, may take place in the delivery room, the stabilization area, or the NICU.
   C. It may be possible to perform an entire assessment at one time or it may be necessary to complete the examination in stages, depending on the stability and tolerance of the patient.
   D. The assessment should be performed as a team activity to protect the infant from multiple examinations during a very vulnerable time period.

II. Neonatal Resuscitation Program (NRP) and Apgar score
   A. Assessment of the neonate begins in the delivery room.
   B. Immediately upon delivery, emphasis is placed on cardiorespiratory stabilization, which is guided by the principles of the NRP.
   C. Assignment of the Apgar score represents another component of the initial newborn assessment.

III. Assessment: A continuous process
   A. Overview
      1. Once initial cardiorespiratory stabilization is achieved, consideration must be given to other aspects of care, including:
         a. Risk and prevention of thermal challenges and injury to the central nervous system
         b. Predisposition to sepsis and bleeding
         c. Fluid requirements
      2. Interventions are guided by the ongoing assessment of the neonate’s response to resuscitation and clinical condition.
      3. According to the American Academy of Pediatrics (AAP) and the American Heart Association (AHA), rapid systematic intervention for critically ill infants is key to preventing progression to more serious conditions, such as cardiorespiratory arrest.
4. Employing an organized approach to neonatal assessment enables the provider to rapidly identify cardiorespiratory instability (respiratory distress or hypotension), facilitating immediate interventions.

5. Clinical compromise and deterioration (respiratory arrest, shock) can result from failure to provide expeditious treatment.

B. Approach
1. Assessment is an important aspect of the Golden Hours bundle.
2. This bundle incorporates and expands on NRP guidelines to ensure that the unique needs of the VLBW population are addressed.
3. A systematic approach to assessment is not ideally suited for the needs of the neonate <1,500 g, however, it can be modified and used as a framework for neonatal assessment during the Golden Hours.

C. Evaluation
1. A structured yet flexible process is suggested, which coordinates evaluation with intervention.
2. This facilitates emergent intervention but also allows treatment to be delayed, if appropriate, until the assessment is complete.
3. The cyclic nature of the assessment process, in which each step flows into the next, is illustrated in Fig. 3-1.
4. Evaluation, identification, and management should continue:
   a. Until stabilization is achieved
   b. After any intervention
   c. When the patient’s condition changes
5. An essential skill for neonatal care providers is the ability to identify and differentiate between life-threatening and non-life-threatening problems.
6. In addition to cardiac arrest, advanced management or emergency responses should be activated per NRP or unit protocol for life-threatening problems, such as:
   a. Airway obstruction
   b. Apnea/bradypnea that is unresponsive to simple interventions (suctioning, repositioning)
   c. Significantly increased work of breathing
   d. Pneumothorax
   e. Absence of palpable pulses
   f. Poor perfusion
g. Bradycardia accompanied by other signs of cardiovascular instability
h. Hypotension
i. Severe hypothermia
j. Bleeding

7. Once the infant is clinically stable, secondary assessment can begin.
8. Physical evaluation can continue in the face of non-life-threatening problems.
9. Examples of life-threatening conditions are listed in Box 3-1.

FIGURE 3-1 Suggested Approach to Neonatal Evaluation During the Golden Hours

A structured yet flexible process is suggested to evaluate the neonate during the Golden Hours to facilitate emergent management while allowing treatment to be delayed, if appropriate, until assessment is complete. Evaluation, identification, and management should continue until stabilization is achieved, after any intervention, and when the patient's condition changes.
IV. Primary evaluation of ABCO (airway, breathing, circulation, and other) (Fig. 3-2)

A. Upper airway patency
   1. Observe chest and abdominal movement.
   2. Auscultate air movement and breath sounds.
   3. Suspect obstruction if there is increased work of breathing, retractions, adventitious inspiratory sounds (stridor, snorting), apparent respiratory efforts without breath sounds, difficulty passing catheter through one or both nares, and copious oral or nasal secretions.
      a. If there is concern regarding obstructed nares, a suction catheter may be gently inserted through one or both nares.
      b. Routine passage of suction catheters in an asymptomatic neonate is not recommended, as it could result in swelling and edema that leads to an obstruction that was not originally present.

**BOX 3-1**

**Life-Threatening Conditions**

<table>
<thead>
<tr>
<th>REQUIRE IMMEDIATE INTERVENTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Any condition or abnormality that causes cardiorespiratory instability</td>
</tr>
<tr>
<td>Obstructed airway not restored by simple measures (positioning/suctioning)</td>
</tr>
<tr>
<td>Cardiorespiratory arrest</td>
</tr>
<tr>
<td>Agonal breathing, gasping</td>
</tr>
<tr>
<td>Absent breath sounds (unilateral, bilateral)</td>
</tr>
<tr>
<td>Bilateral choanal atresia</td>
</tr>
<tr>
<td>Cyanosis, grunting, retracting, nasal flaring</td>
</tr>
<tr>
<td>Sustained bradycardia, tachycardia</td>
</tr>
<tr>
<td>Hypotension, shock, hypoperfusion, pallor, absent pulses</td>
</tr>
<tr>
<td>Bleeding</td>
</tr>
<tr>
<td>Scaphoid abdomen with barrel chest (diaphragmatic hernia)</td>
</tr>
<tr>
<td>Severe hypothermia</td>
</tr>
<tr>
<td>Symptomatic hypoglycemia</td>
</tr>
<tr>
<td>Seizures</td>
</tr>
<tr>
<td>Abdominal wall defects (gastroschisis, omphalocele, bladder extrophy)</td>
</tr>
<tr>
<td>Dermatological problems (epidermolysis bullosa, ichthyosis)</td>
</tr>
</tbody>
</table>
B. Breathing/respiratory rate
1. The normal rate is 30–60 breaths/min, with wide variations.
   a. Abnormalities include tachypnea, bradypnea, apnea, or gasping.
   b. A sustained increase or decrease from the infant’s baseline respiratory rate can be suggestive of problems.
   c. Increased respiratory effort can be caused by increased resistance to airflow or by non-compliant lungs.
   d. Nasal flaring and retractions are signs of respiratory distress.
2. Evaluate chest expansion, air movement, and lung/airway sounds.
   a. Expansion should be bilaterally symmetric and readily visible during inspiration.
   b. Evaluate the intensity of breath sounds and the quality of air movement; diminished distal air entry suggests airflow obstruction or lung disease.

FIGURE 3-2
Aspects of Primary Evaluation (ABCO)

Primary evaluation of ABCO includes: upper airway patency; breathing/respiratory rate; chest expansion, air movement, and lung/airway sounds; circulation; and other considerations, such as skin color, hypothermia, glucose levels, and birth defects.
c. Stridor can indicate upper airway obstruction or congenital airway abnormalities.
d. Grunting is a compensatory mechanism that may signal lung disease or pulmonary edema; the cause should be identified and treated rapidly.
e. Gurgling signals upper airway obstruction due to secretions.
f. Crackles can be caused by fluid accumulation and are most generally associated with lung disease or atelectasis.
g. Rhonchi are caused by secretions or aspirated matter in large airways.
h. Diminished or unilateral breath sounds can be noted in pneumothorax or misplaced endotracheal tubes.
i. A barrel-shaped chest is the result of air trapping in pleural spaces (pneumomediastinum), space-occupying lesions (diaphragmatic hernia), or over-distention from mechanical ventilation.

C. Circulation
1. Heart rate typically ranges from 120–160 beats/min (bpm), depending on the infant’s state and gestational age.
2. Resting heart rate is most representative; premature babies have higher resting heart rates; rhythm should be regular.
3. Sustained bradycardia, tachycardia, or asystole may be due to shock, asphyxia, or conduction defects.
4. Brief asymptomatic irregularities in rate and rhythm are not unusual. Sinus bradycardia and tachycardia and premature atrial or ventricular contractions are commonly benign.
5. Blood pressure (BP) varies according to chronologic and gestational age.
a. Hypotension is defined as mean arterial pressure (MAP) <10th percentile for gestational age, weight, and postnatal age or MAP <gestational age in weeks during the Golden Hours.
b. BP alone should not be the sole parameter prompting treatment for hypotension; consideration should be given to signs of cardiac instability before volume expanders or inotropic agents are employed:
   (1) Heart rate
   (2) Perfusion
   (3) Capillary refill time (CRT)
   (4) Pulses
(5) Oxygenation
(6) pH
(7) Hypothermia

6. If hypotension exists, management is needed to prevent development of shock and end organ damage or irreversible shock and death.

7. Pulses reflect perfusion status.
   a. Palpate central (femoral) and peripheral (radial, brachial) pulses.
   b. Central pulses are generally stronger than peripheral; differences in quality can occur in shock.
   c. Peripheral pulses can be diminished in a cool environment.
   d. CRT should be <3 sec and is inversely proportional to tissue perfusion; hypovolemia, shock, and hypothermia can prolong CRT.
   e. Weak central pulses and decreased perfusion should prompt rapid management.

8. Hemorrhage or bleeding may be visible or covert.
   a. Sources/sites of blood loss include, but are not limited to: subgaleal bleeding, lacerations, gastrointestinal tract, intracranial, intradermal (purpura, petechiae), and coagulopathy.
   b. Emergent management may be needed to prevent the development of hypotension and shock.

9. Neonates should be evaluated for signs and symptoms of congenital heart disease/heart failure, as well as heart murmurs or other adventitious cardiac sounds (rubs, gallops, clicks). It may be necessary to differentiate between innocent murmurs and pathologic murmurs.

D. Other considerations

1. Skin color
   a. Acrocyanosis is common in the first 24 hours; beyond this time period, cyanosis of extremities may be due to shock, sepsis, or congestive heart failure.
   b. Vasomotor instability after birth may cause mottling (cutis marmorata), which can be benign; if accompanied by other signs of cardiovascular compromise (bradycardia, decreased perfusion), it can signify a more serious condition.
   c. Pallor suggests blood loss or poor perfusion.
   d. Cyanosis is never normal and may indicate pulmonary disease, shock, or cardiac defect.
e. True mottling, pallor, and cyanosis suggest life-threatening problems and should prompt rapid intervention before further evaluation proceeds.

2. Hypothermia
   a. Hypothermia is life threatening in VLBW infants.
   b. If low temperature is detected, interrupt the evaluation and perform interventions to prevent heat loss.
   c. Place the neonate in a neutral thermal environment.

3. Glucose levels
   a. Hypoglycemia can lead to hypothermia and hypoxia.
   b. Serum glucose measurement is essential within 30–60 min of birth to detect the need for supplemental glucose.

4. Birth defects
   a. Birth defects may be minor or life threatening.
   b. Conditions that require immediate attention to prevent further injury or harm include: cyanotic heart disease, choanal atresia, meningomyelocele, encephalocele, omphalocele, gastroschisis, exstrophy of the bladder, diaphragmatic hernia, epidermolysis bullosa, ichthyosis, and seizures.

5. Jaundice appearing directly at birth is not normal and warrants management, evaluation, and possible treatment.

V. Secondary evaluation: When the neonate is stable and/or all appropriate interventions have been instituted

A. History
   1. Frequently, the neonatal team obtains a comprehensive history prior to delivery.
   2. In an emergency or unexpected delivery, it may be necessary to proceed with care without a complete history.
   3. Regardless of when or where the history is obtained, the following elements should be included:
      a. Maternal history
         (1) Age
         (2) Obstetric and medical histories
         (3) History of present pregnancy: prenatal labs and testing, medications, antenatal management (cerclage, antibiotics, tocolysis, steroids, etc.)
         (4) Events surrounding labor and delivery: length of ruptured membranes, electronic fetal monitoring, analgesia/anesthesia, type of delivery, use of instrumentation (forceps, vacuum)
(5) Family history: chronic illnesses, hereditary diseases, genetic abnormalities

(6) Comprehensive physical examination

B. Neonatal examination
1. Weight, measurements (head circumference, length)
2. Gestational age (GA) evaluation
   a. GA evaluation is important to help determine particular neonatal risk factors and establish treatment plans.
   b. There are medical, ethical, and social issues that necessitate accurate GA assessment, especially for extremely low birth weight (ELBW) babies born at or near the threshold of viability.
   c. Data regarding mortality and morbidity are frequently used to advise parents in deciding on treatment options.
3. Head-to-toe examination
   a. Extremely premature infants will have physical characteristics that are uniquely different from a term baby.
   b. Breast buds are often imperceptible or barely perceptible.
4. Head, eyes, ears, nose, throat (HEENT)
   a. Petechiae of the face and facial bruising may be seen with trauma and venostasis, as in vertex deliveries or with tight nuchal cords.
   b. Fusion of eyelids may be noted in neonates <23 weeks gestation, precluding examination of the eyes.
   c. Ears are usually flat and, when you fold them, will stay folded.
5. Cardiovascular system (CVS)/respiratory
   a. Soft murmurs may be audible prior to ductal closure and should be evaluated clinically and re-evaluated at 24 hours of age.
6. Respiratory
   a. Coarse crackles, tachypnea, grunting and retracting may be present until lung fluid clears or with respiratory distress syndrome (with or without cyanosis) and must be monitored.
   b. Respiratory rates of 30–60/min are normal after transition and higher rates should be evaluated.
7. Gastrointestinal/abdomen  
   a. Bowel sounds are absent at birth but begin to be audible at ~15 min–1 hour of age

8. Genitalia and anus  
   a. Discoloration of the testes may be a hematoma or torsion and should be evaluated immediately. Keep in mind, however, that in VLBW neonates the testes may be completely undescended or in the inguinal canal.
   b. Attention should be paid to findings that are suggestive of ambiguous genitalia.
   c. Extremely premature males will have flat, smooth scrotum or only faint rugae with testes in the canals.
   d. Extremely premature female infants will have a prominent clitoris and flat labia; as they mature, the labia minora will be small and increase in size with age.

9. Musculoskeletal: extremities, back

10. Skin  
   a. Jaundice at birth is always abnormal and requires immediate further investigation and follow-up.
   b. The dermis and epidermis in ELBW neonates are thin and fragile. Gentle handling is necessary to avoid denuding areas of skin by drying or rubbing.
      (1) The skin may be sticky, friable, and transparent or gelatinous, red, and translucent; based on gestational age.

11. Neurologic  
   a. The neurologic examination (state, tone, posture, reflexes, etc.) differs according to gestational age. ELBW and VLBW neonates have different neurologic characteristics, which should be appreciated when performing assessment of this system. Refer to texts listed in the references for more details.
   b. The ELBW infant has poor tone with little to no posture.
      (1) There is no arm recoil in premature infants when the arm is extended.
      (2) The heel can easily be brought up to the ears and the knee has full flexion.
      (3) The elbow crosses easily over the chest with little resistance.

C. Physical findings of concern (also see Section IV.D.):  
   1. Blue sclerae (osteogenesis imperfecta)
a. Sclerae may appear bluish in premature infants, but osteogenesis imperfecta should be ruled out if sclerae are deep blue.

2. Scaphoid abdomen (diaphragmatic hernia)

3. Dysmorphic features (trisomies, congenital anomalies, ambiguous/abnormal genitalia, syndromic features)
   a. Discovery should prompt a thorough assessment of other possible associated anomalies.
   b. Consider obtaining a genetics consult once the neonate is clinically stable. Speak to parents to inform them of the concerns.

4. Birth trauma (phrenic nerve injury, brachial plexus palsy, facial palsy, fractures)

5. Cleft lip and palate

6. Immobile cranial sutures (craniosynostosis)

7. Skeletal abnormalities: short limbs, syndactyly

VI. Diagnostic tests

A. Diagnostic tests assist in establishing a definitive diagnosis, identifying the presence and severity of cardiorespiratory problems and metabolic imbalances.

B. Some of these tests will have been done earlier in the neonate’s life.

C. There is no ideal timing for performing these tests; the time will vary according to the individual situation and unit protocol.

D. Baseline testing should be based on the infant’s condition and may include arterial blood gas (ABG), chest x-ray, complete blood count with differential, pulse oximetry, or invasive arterial monitoring.

E. Electrolytes are more helpful when obtained at 18–24 hours of age, although NICU policies may vary.
References


