MODULE 7

Delivery and Immediate Neonatal Care

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INTRODUCTION

Approximately 1 million neonatal deaths occur each year due to perinatal asphyxia. It is one of the leading causes of perinatal and neonatal mortality and is associated with a very high incidence of irreversible neurologic damage. Prompt and skilled resuscitation can prevent many of these deaths and reduce disability in survivors. Under ordinary circumstances, about 1 in 10 newly born infants will require some resuscitation intervention. This proportion is higher during periods of social and environmental stress.

The ABC principles of resuscitation are the same for all age groups. The airway must be open, breathing must be adequate, whether spontaneous or assisted, and circulation of oxygenated blood must take place.

Neonatal jaundice is also extremely common and since it can be associated with serious pathologies, this module will address the management of this complication.
DELIVERY AND IMMEDIATE NEONATAL CARE

OBJECTIVES

- List the elements needed to successfully carry out neonatal resuscitation, including recognition of risk factors associated with the need for neonatal resuscitation and preparation of the environment, personnel, and the equipment necessary for neonatal resuscitation.
- Identify the newborn who is making a normal transition immediately after birth.
- Recognize the newborn who requires resuscitation.
- Describe and apply effective neonatal resuscitation interventions.

Anticipation, preparation, recognition, and intervention

A successful resuscitation relies on anticipation based on prenatal and intrapartum risk factors, preparation for all deliveries, recognition of the need for resuscitation, and adequately skilled intervention.

Make an obstetrical assessment for any pregnant woman who has a fever or other illness, or who is in labor or premature rupture of membranes (PROM) before the onset of labor. Refer to a maternal and child health service whenever feasible and appropriate. Give all human immunodeficiency virus (HIV)-positive pregnant women antiretroviral medications as indicated.

Anticipatory planning

Every disaster situation is likely to involve pregnant women and their newborns. Because more than 10% of newly born infants will require resus-

CASE.

You are delivering health care at a shelter for people displaced following an earthquake. A 15-year-old comes to the health care post. She is in labor and had spontaneous rupture of membranes 2 hours earlier. The amniotic fluid is clear. She has had only one prenatal checkup, at 5 months of pregnancy. According to the date of her last period, she is in the 39th week of gestation. Immediate assessment reveals that she is currently hypertensive, and fetal bradycardia is detected through auscultation.

- Which are the risk factors in this patient?
- Which elements are crucial to ensure adequate neonatal care?
citation, anticipatory planning will be fundamental for these interventions to be successful.

What personnel should be available?
If possible, notify personnel with skills in neonatal resuscitation. At least one person who is capable of initiating resuscitation should be present at each birth and immediately available to the newborn. Others who might function as part of a resuscitation team should be available as the need arises. It is important to prepare the area in which the delivery will occur, check the equipment and review the functions of personnel immediately prior to the delivery. Personnel should review the emergency plan for communication and transportation if either mother or infant needs an advanced level of care.

What maternal, fetal, and neonatal conditions might indicate a higher risk of neonatal depression?
The need for resuscitation cannot always be predicted; it must be kept in mind that prompt neonatal resuscitation might be necessary after any birth. However, some perinatal conditions associated with a need for resuscitation can be recognized in advance. Some of those conditions are shown in Box 1. Thorough assessment of the risk factors allows for the identification of more than half of the deliveries that will need neonatal resuscitation. Prospective identification of perinatal high-risk factors should prompt

### BOX 1. Risk factors associated with probable need for neonatal resuscitation

#### Before delivery
- Maternal diabetes
- Maternal hypertension
- Anemia or isoimmunization
- Previous fetal/neonatal death
- Post-term gestation
- Multiple gestation
- Polyhydramnios or oligohydramnios
- Premature (pre-labor) rupture of membranes (PROM)
- Maternal infection
- Maternal consumption of drugs or medications
- Any other maternal illness
- Diminished fetal activity
- Known fetal malformations
- Lack of prenatal care
- Maternal age <19 or >35 years old

#### During delivery
- Labor at less than 8 completed months of pregnancy
- Rapid labor
- Emergency cesarean section or use of forceps
- Prolonged PROM
- Fetal distress (alterations in the fetal heart rate)
- Significant vaginal bleeding
- Placental abruption
- Prolonged labor according to evaluation by partogram
- Meconium-stained amniotic fluid
- Umbilical cord prolapse and tight nuchal cord
- Anticipated low birth weight
- Anticipated high birth weight
the transfer of the pregnant woman or the mother and her newly born infant to facilities with enhanced care resources. Keep the mother and baby together, especially if transfer is necessary. The Integrated Management of Childhood Illness (IMCI) strategy from the Pan American Health Organization (PAHO) and the World Health Organization (WHO) includes the assessment and classification of pregnancies in order to determine the risk level and adequate treatment (Table 1). Identification of high-risk factors can also facilitate communication with the family and timely mobilization of the resuscitation and maternal health care team.

What equipment should be available?
It is recommended that sterile delivery kits be available. An example of the contents of a delivery kit is provided in Box 2.

A neonatal-sized resuscitation bag or other device capable of giving controlled positive pressure with appropriately sized face masks should also be available. The use of endotracheal tubes, laryngoscopes, intravenous administration sets, and medications is dictated by availability of supplies and personnel skilled in their use. For further details consult a more advanced source, such as the sixth edition of *Textbook of Neonatal Resuscitation* from the American Academy of Pediatrics (AAP) and the American Heart Association (AHA).

### BOX 2. Sample delivery kit

**Before delivery**
- Cord clamps or ties (at least 2)
- Razor blade or sharp scissors
- Material for hand hygiene—either an alcohol-based hand-cleaning solution or a bar of soap and clean water
- Clean cloths (at least 2) to be used for drying and wrapping the infant

**What are the appropriate delivery procedures?**
It is essential to utilize appropriate personal protection; personnel should use sterile gloves to the extent possible.

Clamp or securely tie the umbilical cord with sterile string about 2 and 5 finger breadths from the abdomen. Cut the cord between the occluded sites with a sterile blade or scissors; avoid contamination. A short delay of 1 to 3 minutes between birth and cord ligature or clamping benefits vigorous infants. Some recommend that, if time allows, the cord be clamped only after visible pulsation has stopped.

Remember to perform adequate identification procedures for the newborn (take the infant’s footprints in a form together with the mother’s fingerprint and provide the newborn with an identification bracelet, if avail-
**TABLE 1.** Classification to assess and determine pregnancy risk

<table>
<thead>
<tr>
<th>Assess signs</th>
<th>Classify as</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(RED)</strong> One of the following signs:</td>
<td><strong>(RED) Pregnancy with imminent risk</strong></td>
<td>• Refer URGENTLY to hospital of higher level of complexity, lying on the left side</td>
</tr>
<tr>
<td>• Labor at &lt;37 w</td>
<td></td>
<td>• Prevent hypotension</td>
</tr>
<tr>
<td>• Pregnancy at &gt;41 w</td>
<td></td>
<td>• Treat hypertension</td>
</tr>
<tr>
<td>• Reduced or absent fetal movements</td>
<td></td>
<td>• In case of preterm labor: inhibit contractions and give corticoids</td>
</tr>
<tr>
<td>• Severe systemic disease</td>
<td></td>
<td>• If PROM with fever: give first dose of adequate antibiotic</td>
</tr>
<tr>
<td>• Infection with fever (UTI, bacterial or viral sepsis, chorioamnionitis, malaria)</td>
<td></td>
<td>• Administer oxygen as necessary</td>
</tr>
<tr>
<td>• Uncontrolled diabetes</td>
<td></td>
<td>• Refer to specialist clinics</td>
</tr>
<tr>
<td>• Vaginal bleeding</td>
<td><strong>(YELLOW) High-risk pregnancy</strong></td>
<td>• If multiple gestation: refer before week 30</td>
</tr>
<tr>
<td>• Pre-labor rupture of membranes (PROM) &gt;12 h</td>
<td></td>
<td>• If VDRL positive: start treatment with penicillin benzathine</td>
</tr>
<tr>
<td>• Uncontrolled hypertension and/or seizures, blurred vision, loss of consciousness or intense headache</td>
<td></td>
<td>• Counsel the mother to follow the indicated treatment</td>
</tr>
<tr>
<td>• Changes in fetal cardiac frequency (FCF)</td>
<td></td>
<td>• Vaccinate with tetanus toxoid</td>
</tr>
<tr>
<td>• Intense palm pallor and/or Hb &lt;7 g/dL</td>
<td></td>
<td>• Counsel on HIV-AIDS and sexually transmitted diseases (STD)</td>
</tr>
<tr>
<td>• Swollen face, hands and legs</td>
<td></td>
<td>• Schedule next visit</td>
</tr>
<tr>
<td>**(YELLOW) One of the following signs:</td>
<td><strong>(YELLOW) High-risk pregnancy</strong></td>
<td>• Counsel on nutrition, pregnancy care, and breastfeeding</td>
</tr>
<tr>
<td>• Less than 19 or more than 35 y of age</td>
<td></td>
<td>• Teach danger signs</td>
</tr>
<tr>
<td>• Primiparity or grand multiparity</td>
<td></td>
<td>• Plan referral with the family in advance, according to risk factors and feasibility of the solutions</td>
</tr>
<tr>
<td>• No prenatal care</td>
<td></td>
<td>• Counsel on nutrition, pregnancy care, and breastfeeding</td>
</tr>
<tr>
<td>• Less than 2 years between pregnancies</td>
<td></td>
<td>• Teach danger signs</td>
</tr>
<tr>
<td>• Uterine height does not correlate with gestational age</td>
<td></td>
<td>• Plan referral with the family in advance, according to risk factors and feasibility of the solutions</td>
</tr>
<tr>
<td>• Previous cesarean section</td>
<td></td>
<td>• Counsel the mother to follow the indicated treatment</td>
</tr>
<tr>
<td>• History of prematurity, low-birth weight or malformations</td>
<td></td>
<td>• Vaccinate with tetanus toxoid</td>
</tr>
<tr>
<td>• History of recurrent abortions, fetal or early neonatal death</td>
<td></td>
<td>• Counsel on HIV-AIDS and sexually transmitted diseases (STD)</td>
</tr>
<tr>
<td>• Controlled systemic disease</td>
<td></td>
<td>• Schedule next visit</td>
</tr>
<tr>
<td>• Urinary infection without fever</td>
<td></td>
<td>• Counsel on nutrition, pregnancy care, and breastfeeding</td>
</tr>
<tr>
<td>• Controlled diabetes</td>
<td></td>
<td>• Teach danger signs</td>
</tr>
<tr>
<td>• Palm pallor and/or Hb 8-10 g/dL</td>
<td></td>
<td>• Plan referral with the family in advance, according to risk factors and feasibility of the solutions</td>
</tr>
<tr>
<td>• Vaginal discharge</td>
<td></td>
<td>• Counsel the mother to follow the indicated treatment</td>
</tr>
<tr>
<td>• On teratogenic medications</td>
<td></td>
<td>• Vaccinate with tetanus toxoid</td>
</tr>
<tr>
<td>• Alcoholism, drug-addiction or smoker</td>
<td></td>
<td>• Counsel on nutrition, pregnancy care, and breastfeeding</td>
</tr>
<tr>
<td>• Controlled hypertension</td>
<td></td>
<td>• Teach danger signs</td>
</tr>
<tr>
<td>• Inadequate weight gain</td>
<td></td>
<td>• Plan referral with the family in advance, according to risk factors and feasibility of the solutions</td>
</tr>
<tr>
<td>• Abnormal fetal presentation</td>
<td></td>
<td>• Counsel the mother to follow the indicated treatment</td>
</tr>
<tr>
<td>• Multiple gestation</td>
<td></td>
<td>• Vaccinate with tetanus toxoid</td>
</tr>
<tr>
<td>• Rh negative mother</td>
<td></td>
<td>• Counsel on nutrition, pregnancy care, and breastfeeding</td>
</tr>
<tr>
<td>• VDRL, HIV or HBV positive</td>
<td></td>
<td>• Teach danger signs</td>
</tr>
</tbody>
</table>

**Note:** Adapted from Integrated Management of Childhood Illness (IMCI). Model chapter for textbooks. PAHO/WHO. Washington, DC; 2004.
able). This issue takes on added importance in situations of administrative disorder, as is usually the case in acute humanitarian emergencies.

Provide the child with an environment as warm as possible. It is essential to dry the infant immediately. Leaving the baby wet may result in cold stress. Early skin-to-skin contact with the mother has been shown to be effective and desirable. Immediate breastfeeding following delivery is advisable for healthy infants. Even if the newborn requires resuscitation and ongoing care, present him to the mother at least briefly.

**Recognition**

Three major questions should be asked about every newly born child to define the need for resuscitation:

- **Is this a full-term gestation?** For a variety of reasons, a preterm baby is much more likely to require interventions. Moreover, in case resuscitation is needed, preterm newborns’ anatomic and physiologic characteristics are different from those in term newborns, and these differences should be taken into consideration: pulmonary surfactant is often insufficient, which leads to difficult ventilation; skin is thinner and permeable; skin area is larger and there is less subcutaneous tissue, which increases heat dissipation; more vulnerability to infection; more fragile cerebral capillaries, with increased probability of CNS hemorrhage under situations of stress.

- **Is the baby breathing or crying?** Absent respiratory effort (apnea) or inadequate respiratory effort (gasping: breathing with superficial and ineffective inspiratory movements) is the first reason to initiate resuscitation.

- **Is there good muscle tone?** Poor muscle tone might indicate hypoxemia. Preterm newborns normally have a lower muscle tone than term babies. Term infants with good respiratory effort and muscle tone can be dried and placed over the mother’s body for better thermal protection and suckling under continued observation.

**Resuscitation treatment**

The sequence of neonatal resuscitation for the baby with identified risks (preterm, poor or no respiratory effort, or poor muscle tone) begins with thermal protection, proper positioning of the newborn, and brief stimulation. Attending personnel should observe hand hygiene and protect the baby from contamination at all times.

- **Thermal protection.** Dry the baby rapidly to reduce evaporation. A radiant heater can be used if available. If a warming device is used, hyperthermia must be avoided. If resuscitation interventions are required, wrapping a very preterm infant in clear food-grade plastic film is effective in reducing cold stress while allowing access to the infant. Cover the baby’s head with a cap. A sick baby who needs to be transported can be protected from cold by placing an exothermic chemical mattress under a blanket,
skin-to-skin contact with an adult, or swaddling in warm blankets covered by a windproof, reflective outer layer. Heating pads, hot water bottles, and surgical gloves filled with hot water should be avoided because they can cause extensive burns.

- **Position.** The airway of the hypotonic baby is vulnerable to obstruction with flexion or extension of the neck. Position the infant on the back or side, with the head slightly extended in the “sniffing” position (Figure 1). A small roll of cloth placed under the shoulders may be helpful in maintaining head position.

- **Airway clearing.** Remove secretions that obstruct the airway by wiping the nose and mouth with a cloth or by using a suction device. Suction the mouth before the nose (Figure 2). Suction must be gentle and not very deep. Roughly suctioning or touching the posterior wall of the pharynx with the suctioning device may cause apnea and bradycardia through vagal stimulation. The presence of meconium in the amniotic fluid can be a sign of fetal distress. Pharyngeal suctioning during birth has not been demonstrated to reduce the incidence of meconium aspiration syndrome. When the baby is meconium-stained and not immediately vigorous (vigorous = strong cry, good muscle tone, and heart rate above 100 beats/min), tracheal suctioning should be considered. Personnel skilled in neonatal tracheal intubation and proper equipment would be required for this step.

- **Stimulation.** Drying an infant thoroughly generally provides sufficient stimulation of breathing in a healthy newborn. Additional stimulation—flicking the soles of the feet or

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**FIGURE 1.** Correct and incorrect head positions for resuscitation

![Correct and Incorrect Head Positions](image-url)

rubbing the back, for example—may encourage the initial respiratory effort and continued breathing during the early transitional period if needed. Vigorous or prolonged stimulation may cause great harm to the baby and is not part of skillful resuscitation. Table 2 lists some inadequate stimulation procedures and the harmful consequences that may ensue.

**If supplemental oxygen is available, when is it indicated?**

A number of studies have demonstrated that for most neonatal resuscitations requiring positive-pressure ventilation, room air is as effective as 100% oxygen. Data also indicate that in the first several minutes after birth cyanosis is common in babies who have normal outcomes.

The AAP Neonatal Resuscitation Program 2011 update includes the following recommendations for oxygen supply during resuscitation:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Consequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clapping on the back</td>
<td>Contusions</td>
</tr>
<tr>
<td>Squeezing the chest wall</td>
<td>Fractures, pneumothorax, severe difficult breathing, death</td>
</tr>
<tr>
<td>Pressing the lower extremities over the abdomen</td>
<td>Liver or spleen rupture</td>
</tr>
<tr>
<td>Anal sphincter dilation</td>
<td>Sphincter lesion</td>
</tr>
<tr>
<td>Cold or hot compresses or bathing</td>
<td>Hyperthermia, hypothermia, burns</td>
</tr>
<tr>
<td>Shaking</td>
<td>Hemorrhages or brain damage</td>
</tr>
</tbody>
</table>


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**FIGURE 2.** Suctioning the mouth and nose; “M” [mouth] before “N” [nose]

**Mouth first**

**Then nose**

Room air to initiate positive-pressure ventilation in term infants and availability of moderate oxygen concentrations for initiation of PPV in very preterm infants.

Oximetry when
- Resuscitation can be anticipated
- Positive pressure is administered for more than a few breaths
- Cyanosis is persistent
- Supplementary oxygen is administered

Targets for oxygen saturation correspond to preductal saturations of healthy term babies in the first minutes after vaginal birth at sea level.

These initial steps and possible subsequent actions are outlined in the flow diagram shown in Figure 3. Further steps in resuscitation are discussed in the following paragraphs.

**FIGURE 3. Flow diagram for neonatal resuscitation**

*Epinephrine IV 0.01–0.03 mg/kg. Adapted from Katwinkel J, ed. Textbook of Neonatal Resuscitation. 6th ed. AAP/AHA; 2011.*
Additional neonatal resuscitation procedures

Evaluation for further resuscitation interventions

At the completion of the initial steps (thermal protection, positioning, clearing of the airway, and stimulation), respirations and heart rate.

Respiration

There should be adequate respiration as judged by chest movements and respiratory rate.

Ventilation

Poor respiratory effort, as manifested by apnea or gasping (deep, intermittent, slow, spasmodic inspiratory efforts), is the major indication to initiate neonatal resuscitation, and ventilation is the key to successful resuscitation. If the newborn does not rapidly establish effective spontaneous respiration, positive-pressure ventilation must be administered immediately.

What are the elements of positive-pressure ventilation?

The goal of positive-pressure ventilation is to inflate the lungs with an adequate breath. Inspirations that are too small will be ineffective for those in most need, and inspirations that are too large can damage the lungs. The effectiveness of ventilation can be judged as outlined in Box 3.

Many kinds of devices deliver positive-pressure ventilation for neonatal resuscitation. Flow-inflating bags, T-piece devices, one-way valve masks, and laryngeal masks are some of these devices. Most critical is the skill of the person who is operating any of these devices. Potential resuscitators should review the operation of the available devices, practice mock resuscitations, and test the operation of all bags, valves, connections, and safety features. Figure 4 illustrates the use of a self-inflating bag with a mask. The head is slightly extended. The mask covers the mouth and the nose. The fingers of the left hand lift the chin forward and upward and partially encircle the mask, placing light and even pressure downward onto the face to help create an adequate seal. The best indication of adequate lung inflation is the improvement in heart rate, color, and muscle tone.

How is positive pressure delivered?

A good seal with the mask and good positioning are essential. The recommended respiratory rate is 40 to 60 breaths per minute. If the patient is not improving, the most frequent cause is poor delivery of positive pressure.

BOX 3. Signs of effective positive pressure ventilation

- Patient responds
  - Rapid improvement in heart rate
  - Improvement in skin color and muscle tone
- Breath sounds heard by auscultation over the chest
- Slight rise and fall in the chest
60 breaths per minute as illustrated in Figure 5.

**What if bag and mask ventilation is not effective?**

If the patient is not improving, the most frequent cause is poor delivery of positive pressure. Failure to administer adequate positive pressure may be due to one of three common problems:

- An inadequate seal of the mask to the face:
  - Reapply the mask to the face and lift the jaw up towards the mask.
- A blocked airway:
  - Reposition the head to regain slight extension.
  - Then check for secretions in the nose and the mouth.
  - Then slightly open the mouth and continue positive-pressure ventilation.

**FIGURE 4.** Light pressure on the mask when lifting upward on the chin will help create a seal. Anterior pressure on the posterior rim of the mandible (not shown) may also help open the airway.

**FIGURE 5.** Counting out loud to maintain a rate of 40 to 60 breaths per minute

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• Need for larger breath:
  - Increase the inflation pressure to achieve a slight rise and fall in the chest with each breath.

What if the requirement for bag and mask ventilation is prolonged?
The inflations might distend the stomach and interfere with ventilation. In this case, insert a small plastic or rubber catheter through the mouth, aspirate the stomach contents, and fix the open end of the tube to allow continuous drainage.

Ask an assistant to check the heart rate during positive-pressure ventilation or pause ventilation after 1 minute to check the heart rate if you are alone. The normal heart rate is greater than 100 beats per minute. The pulse at this time can be felt easiest at the base of the umbilical cord or can be heard with a stethoscope over the left side of the chest.

Chest compressions
When should chest compressions be initiated?
Chest compressions are added to positive-pressure ventilation if the heart rate stays below 60 beats per minute after 1 minute of positive-pressure ventilation.

How should chest compressions be performed?
Encircle the chest with both hands, thumbs on the lower third of the sternum, and quickly compress to one third of the chest depth to generate a palpable pulse. Note that ventilation should be continued and coordinated with the compressions. The thumbs are never lifted off the chest during the compression cycles (Figure 6).

How is positive-pressure ventilation coordinated with chest compressions?
In order to adequately perform both resuscitation procedures, have a second person available to give cardiac compressions. Coordinate the procedures to perform 1 breath every 3 compressions, and count aloud following a rhythm of: “one and two and three and breathe, one and two and three and breathe….” The recommended rate is to deliver 90 compressions and 30 ventilations per minute.

The baby should attain a pink color in the trunk and mucous membranes. If cyanosis persists in these areas, the infant is hypoxemic. Blended oxygen should be administered as guided by pulse oximetry.

Other common questions regarding neonatal resuscitation
How quickly should resuscitation be started?
Prompt resuscitation is the most effective. If the infant is apneic, gasping, or breathing ineffectively after drying, clearing the airway, and providing additional stimulation, begin positive-pressure ventilation. Usually the new-
born will be less than 1 minute old (Figure 3).

How quickly should cardiac compressions be initiated?
Initiate cardiac compressions if the heart rate remains <60 beats per minute after the first minute of positive-pressure ventilation (Figure 3).

Are delays or interruptions of resuscitation harmful?
Animal data indicate that delays in resuscitation significantly diminish its effectiveness. Experiences with adults show that even brief interruptions in resuscitation support are harmful.

Are there indications for not starting resuscitation?
Dramatic circumstances, such as extreme prematurity or severe congenital malformations, may be such indications. Clinical judgment and discussion with the parents should be emphasized.

If resuscitation has been done and life-sustaining therapies then seem undesirable, can treatments be stopped?
Most experts agree that resuscitation does not commit a child to future non-beneficial treatment.

If a baby does not respond to resuscitation, how long should the procedures be continued?
Current data indicate that after 10 minutes with no heart rate in a newborn, an infant’s survival without very severe damage is unlikely.

Post-resuscitation management
The child must be thoroughly monitored and evaluated in the hours and days following resuscitation. Consider arrangements for advanced care for any of the following:
- Birth weight <1500 g
- Difficult breathing
- Unstable temperature (normal axillary temperature: 36.5–37.5°C), persistent cyanosis, pallor, recurrent apnea, seizures, poor responsiveness, poor feeding, persistent alterations of muscle tone, or weight loss greater that 10% to 12% of birth weight.

Record details of resuscitation procedures and results as part of a permanent document for the child.
Jaundice

Neonatal jaundice is extremely common. Physiologic jaundice, the most frequent form of neonatal jaundice, is due to immaturity involving bilirubin metabolism in the liver combined with certain features in the newborn’s intestinal function (delayed intestinal transit, enhanced intestinal bilirubin reabsorption causing overload of the enterohepatic circuit). It may also relate to the newborn’s feeding. Jaundice associated with breastfeeding is another form of usually benign neonatal jaundice that can prolong physiologic jaundice. It is interesting to note that indirect bilirubin (the one that accumulates in physiologic jaundice) is a powerful antioxidant, so during the neonatal period, when the infant is exposed to oxidative stress, moderate levels of bilirubin may be a protective factor.

Assessment of the newborn with jaundice

Information gathered when assessing an infant with jaundice must include age, gestational age, birth weight, current weight, onset and duration of the jaundice, characteristics of the stools (quantity and color), and urine color. Newborns with pathologic perinatal history or a family history of another newborn with significant jaundice are at higher risk of developing severe jaundice. In addition, jaundice that appears within the first 24 hours after birth or persists for more than 10 days should be assumed to be severe, unless the opposite is proven. (Breastfeeding jaundice is a diagnosis made when no other cause has been found.)

On physical examination, danger signs of severity in an infant with jaundice include: poor suck, lethar-
Jaundice that appears within the first 24 hours after birth or persists for more than 10 days should be assumed to be severe, unless the opposite is proven.

A variety of hematologic, metabolic and infectious diseases that require early recognition and treatment can present with hyperbilirubinemia.

**FIGURE 7.** Estimates of bilirubin blood levels according to skin involvement

**ASK**

- How old is the child?
- What was his/her birth weight?
- Since when is he/she yellow?
- Has he/she been passing stools?
- What color are the stools?
- What color is the urine?
- Is there a family history of significant neonatal jaundice?

**EXAMINE**

- **Degree of jaundice**
  1. Only in the face
  2. Up to the navel
  3. Up to the knees
  4. Up to the ankles
  5. Palms/soles

- **State of consciousness**
  Lethargic, irritable, normal

- **Assess:**
  - Current weight

- **Estimate of indirect bilirubin, according to compromised zone**
  - Zone 1 = 6 mg/dL
  - Zone 2 = 9-12 mg/dL
  - Zone 3 = 12-15 mg/dL
  - Zone 4 = >15 mg/dL
  - Zone 5 = >18 mg/dL

## TABLE 3. Classification of jaundice

<table>
<thead>
<tr>
<th>Signs</th>
<th>Classify as</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>(RED)</strong>&lt;br&gt;Jaundice and one of the following characteristics:&lt;br&gt;- Any visible jaundice starting before 24 hours after birth&lt;br&gt;- No stool evacuation&lt;br&gt;- Jaundice up to ankles or palms and soles (zones 4 and 5)&lt;br&gt;- Lethargic or irritable&lt;br&gt;- Pathologic perinatal history&lt;br&gt;- More than 10 days of jaundice of any degree</td>
<td><strong>(RED)</strong>&lt;br&gt;Severe jaundice</td>
<td><strong>(RED)</strong>&lt;br&gt;- Continue breastfeeding the infant&lt;br&gt;- Refer URGENTLY to hospital, observing the guidelines for stabilization and transportation&lt;br&gt;- If transportation is needed, counsel the mother to keep the newborn warm during the trip</td>
</tr>
<tr>
<td><strong>(YELLOW)</strong>&lt;br&gt;- Jaundice up to the knees (zone 3)&lt;br&gt;- No signs of severe jaundice</td>
<td><strong>(YELLOW)</strong>&lt;br&gt;Moderate jaundice</td>
<td><strong>(YELLOW)</strong>&lt;br&gt;- Counsel the mother to continue breastfeeding the infant and keep him/her warm&lt;br&gt;- Specify signs of alarm and schedule a control visit in 24 hours</td>
</tr>
<tr>
<td><strong>(YELLOW)</strong>&lt;br&gt;- Jaundice in the face or up to the navel (zones 1 and 2)&lt;br&gt;- No signs of severe jaundice</td>
<td><strong>(YELLOW)</strong>&lt;br&gt;Mild jaundice</td>
<td><strong>(YELLOW)</strong>&lt;br&gt;- Counsel the mother to continue breastfeeding and keep the infant warm&lt;br&gt;- Specify signs of alarm and schedule a control visit in 48 hours</td>
</tr>
<tr>
<td><strong>(GREEN)</strong>&lt;br&gt;- No jaundice</td>
<td><strong>(GREEN)</strong>&lt;br&gt;No jaundice</td>
<td><strong>(GREEN)</strong>&lt;br&gt;- Counsel the mother to continue breastfeeding the infant&lt;br&gt;- Check vaccination&lt;br&gt;- Teach the mother how to care for the infant at home&lt;br&gt;- Specify danger signs&lt;br&gt;- Schedule a control visit in the clinics for healthy children</td>
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SUMMARY

When treating newborns, good hand hygiene must be observed, and babies must be protected from contamination.

If gestation is not full-term, breathing is not vigorous, or muscle tone is poor, the first step is to ensure thermal protection and dry the infant thoroughly; next, position the head, clear the airway as necessary, and stimulate the breathing child. Evaluate breathing. If apnea, gasping, or inadequate breathing is observed, give positive-pressure ventilation and mobilize additional resuscitation team members. The child is evaluated again after 1 minute of positive-pressure ventilation and steps to improve ventilation (if necessary). If apneic, support is continued. If heart rate is <60 beats per minute, then cardiac compressions are added. If heart rate is >60 beats per minute on reevaluation, cardiac compressions are discontinued. On further evaluation, if heart rate is >100 beats per minute and spontaneous respirations are adequate, positive-pressure ventilation is discontinued.

Jaundice can be associated with severe pathologies and can lead to irreversible consequences. Observe closely patients with jaundice and evaluate them over subsequent hours and days.

Communication with and emotional support for the mother is of high priority. Mothers and babies should be kept together, if at all possible. Infants with ongoing problems or high-risk conditions should be referred to a higher level of care as appropriate.

SUGGESTED READING

Case resolution

In this case, several risk factors are associated with the need for neonatal resuscitation: patient’s age, inadequate prenatal care, maternal hypertension, and alterations in fetal cardiac frequency. A newborn exhibiting these risk factors is likely to need advanced resuscitation procedures. Ideally, refer the patient to a high-complexity mother-child care center. If that is not possible, it would be preferable to rely upon trained personnel and adequate equipment for an advanced resuscitation. It would be important to transport the child to a neonatal specialized center immediately after initial resuscitation for further care.
MODULE REVIEW

SECTION I- DELIVERY AND IMMEDIATE NEONATAL CARE

1. What are the key steps for a successful resuscitation?
2. What equipment and supplies are needed to perform neonatal resuscitation?
3. What maternal, obstetric, and fetal (or neonatal) factors indicate a high probability of needing advanced neonatal resuscitation?
4. What are the steps in initial resuscitation (reception) of the newborn?
5. What are the indications for oxygen administration and how should it be administered?
6. What signs are used to gauge the need for advanced neonatal resuscitation?
7. When and how should assisted respiration (ventilation) be administered to the newborn?
8. When and how should chest compressions be performed during neonatal resuscitation?
9. When and for how long should resuscitation procedures be performed?
10. Under what circumstances is neonatal resuscitation contraindicated?
11. What elements are necessary to assess and treat the infant with neonatal jaundice?

SECTION II- JAUNDICE

1. What signs should be assessed to determine the intensity and severity of jaundice?
2. How is bilirubin blood level estimated according to the extent of cutaneous jaundice?
3. What treatment corresponds to severe, moderate, and mild jaundice?