

CHAPTER 21 CARE OF THE NEWBORN AND RESUSCITATION

NORMAL NEWBORN CARE

Learning Objectives

By the end of this section, the participant will:

1. Differentiate between a healthy newborn and a newborn requiring resuscitation
2. Describe immediate care of the healthy newborn and how this differs with the immediate care required of an at-risk newborn.
3. Explain the steps for neonatal resuscitation, including chest compressions.
4. Describe the components of a comprehensive assessment in the follow-up care of the newborn.

Introduction

Worldwide there are over 4 million neonatal deaths per year and another 4 million stillbirths. The newly born infant is the most vulnerable and needs most careful attention during the first hours and days of life. About two-thirds of infant deaths occur during the newborn period. About two-thirds of newborn deaths occur during the first week of life. Of these deaths, two-thirds occur within the first 24 hours of life.

Nearly three-quarters of all neonatal deaths could be prevented if women were adequately nourished and received appropriate care during pregnancy, childbirth, and the postnatal period. It is critical to improve the training and skill of health care providers in neonatal resuscitation, post-resuscitation management, and the recognition and management of the danger signs presenting in the newborn period. It is also important to improve maternal education in basic newborn care and prompt recognition of danger signs.

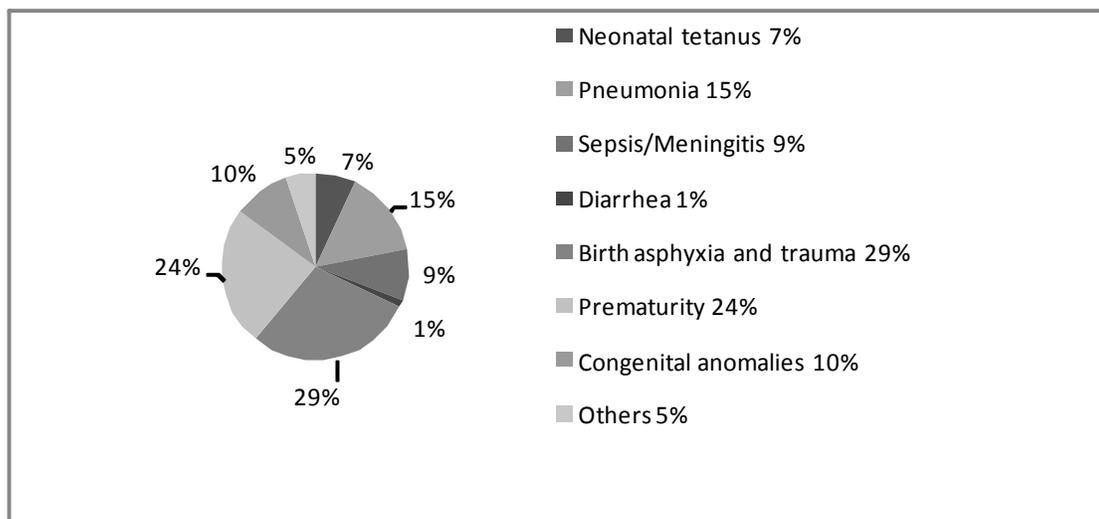


Figure 1 - Main causes of infant mortality
Source: WHO, 2001

Definitions

Neonatal death: Death of a live-born baby within 28 days of life.

Early neonatal mortality: Death of a live-born baby within the first 7 days of life.

Late neonatal mortality: Death of a live-born baby after the 7th day of life and before 29 days of life.

Infant mortality rate covers the remaining 11 months of the 1st year of life.

Perinatal mortality rate: The number of perinatal deaths per 1,000 total births. It is usually reported on an annual basis. It is a major marker to assess the quality of health care delivery. Comparisons among the rates reported by different countries or regions may be hampered by varying definitions, registration bias, and differences in the underlying risks of the populations.

Normal Newborn Care

Care of future mothers

- Improve the health, nutrition, and status of girls and women.
- Provide opportunities for education of females, and access to appropriate information and services relating to pregnancy, delivery, and newborn care.
- Discourage early marriages and early childbearing.
- Promote safe sexual practices.

Care during pregnancy

- Promote antenatal care.
- Improve the nutrition of pregnant women.
- Immunize against tetanus.
- Screen for and treat infections such as syphilis, malaria, and HIV.
- Monitor and treat pregnancy complications such as anaemia, preeclampsia, and antepartum bleeding.
- Provide information and counselling about preparation for birth, and the danger signs during pregnancy and childbirth.
- Promote immediate and exclusive breastfeeding. Provide women living with HIV information about infant feeding options including breastfeeding, wet-nursing, and the use of breast milk substitutes during the antenatal period so that they are able to make the best possible decisions for themselves and their babies.
- Develop a birthing plan with every woman that addresses issues such as transportation in the event of emergencies and the payment of health care fees.
- Recognize pregnancies that may need neonatal intervention at delivery.
- Improve access to skilled attendance at time of birth.
- Promote postnatal care and breastfeeding support clinics.

Safe delivery practices

- Ensure skilled attendance at delivery.
- Provide for clean delivery: clean hands, clean delivery surface, clean cord-cutting technique, and clean bedding.
- Educate health care providers in recognizing danger signs in both mother and baby.
- Educate women, their families, and the community to avoid delay in seeking care and accepting referral, when needed.
- Develop a community-wide or health facility plan for consultation, referral, and transfer, when needed
- Practice neonatal resuscitation techniques on a regular basis.
- Educate health care providers to recognize a baby that needs resuscitation and initiate procedures without delay.

Immediate care at birth

a) *Prevention of heat loss*

- Maintain delivery room temperature in the range of 23–25°C.
- Avoid cold air from a fan.
- Dry the baby at birth with pre-warmed bedding. Removing wet blankets, cloths, and towels to reduce heat loss by evaporation.
- Dry the head first to prevent heat loss. The baby can lose 25% of its body heat through its head, the largest part of its body at birth.
- Ensure early skin-to-skin contact. This assists conductive heat transfer from mother to baby.
- Keep the baby on the mother’s abdomen or chest during routine assessment of newborn and mother’s conditions.
- Delay immediate weighing and measurements to prevent heat loss.

b) *Immediate assessment*

- Evaluate the condition of the newborn while simultaneously drying the infant. Ask the following questions:
 - Is the baby breathing or crying?
 - Is there good muscle tone
 - Does the baby appear to be at term?
- Provide normal care accordingly or proceed to resuscitation (as described in the “Newborn Resuscitation” section of this chapter).

c) *APGAR scoring*

- Used to assess baby’s general condition and is taken at 1, 5, and 10 minutes after birth.
- Important for further management of resuscitation but should not delay immediate steps of resuscitation, if needed

The meaning of the APGAR acronym is as follows:

- A** **A**ppearance (colour)
- P** **P**ulse (heart rate)
- G** **G**rimace (response to stimuli, also called reflex irritability)
- A** **A**ctive (tone)
- R** **R**espirations (breathing)

Table 1 – APGAR scoring

Sign	Score		
	0	1	2
Heart rate	Absent	< 100 bpm	>100 bpm
Breathing	Absent	Gasping	Crying
Tone	Limp	Some flexion	Active
Reflex irritability	No response	Grimace	Cough, sneeze, cry
Colour	Blue or pale	Pink body, blue extremities	Completely pink

d) Cutting the cord

- Securely clamp the cord before cutting.
- Delay cord clamping and cutting until baby's respirations are established and cord pulsation has ceased. This ensures that baby receives a placental transfusion.

Recent evidence, as demonstrated in a 2007 meta-analysis, supports the practice of leaving the cord intact and non-clamped until **a full two minutes** following birth (Hutton et al, 2007). The baby may be put up onto the mother's abdomen during this time. There is clear evidence of important benefits to the newborn by increasing the iron stores which has a lasting effect later infancy in reducing anaemia.

e) Initiate breastfeeding**Benefits for the baby**

- Early and exclusive breastfeeding should be encouraged within 1 hour of birth.
- Baby receives immunological advantages of colostrum from early feeding.
- Sucking reflex is the most intense 45 minutes through 2nd hour after birth.
- Early feeding at the breast stimulates digestive system, promoting elimination of byproducts and hemoglobin breakdown.
- Jaundice is most likely to occur when breastfeeding is delayed.
- Baby's nutritional needs can be completely met by breast milk. No supplements are required, not even water!
- Both small and big babies are at risk for hypoglycemia, and require immediate and frequent feedings.

Benefits for mother

- Breastfeeding stimulates uterus contractibility.
- Women breastfeed for a longer duration if feeding is initiated early.

General guidelines

- Proper latch, as shown in Figure 2, will help prevent cracked nipples and decrease pain.
 - Baby's head should be tilted back slightly, with chin pointed toward breast.
 - With wide open mouth, aim lower lip as far from the nipple as possible.
 - Some areola may show above top lip.
- Mothers should be encouraged to feed on demand because milk production is stimulated by suckling.
- One breast should be completely emptied before offering the next breast to take advantage of hind milk.
- Adequate feeding involves 8 to 12 feeds in 24 hours.
- After the first 24 hours, the baby is receiving adequate nutrition if there are 6 to 8 wet diapers per day, and if the baby has frequent bowel movements and is gaining weight.

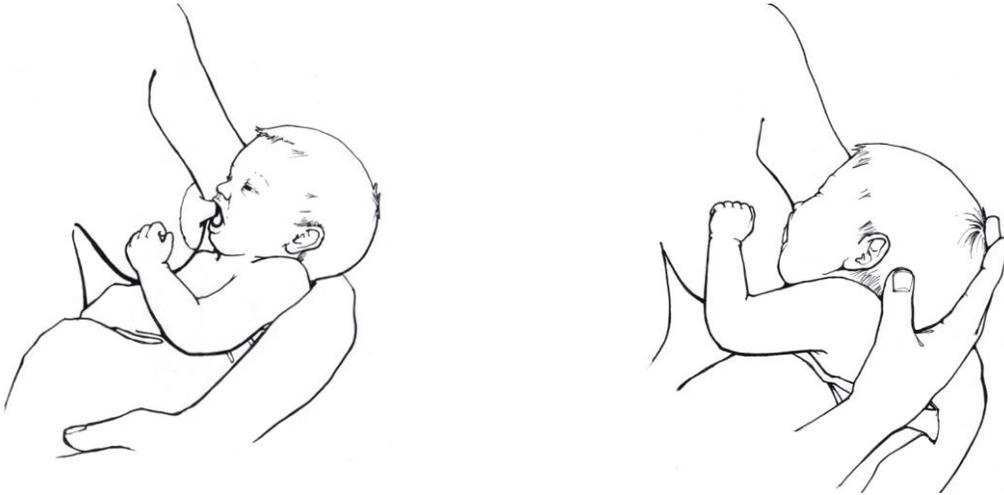


Figure 2 - Positioning the baby at the breast

Care of the breastfeeding woman

- If cracked nipples occur, cover with expressed colostrum and allow to the nipple to air-dry. Do not use creams on nipples.
- If breasts are engorged, try a tight-fitting bra or wrap and use warm cloths or towels on breasts. Expressing a small amount of milk prior to a feed will alleviate some discomfort and allow a proper latch.
- Breastfeeding women need to increase their caloric and fluid intake to maintain lactation.
- Care for breastfeeding woman living with HIV
 - Maintaining healthy breasts is very important for women living with HIV. For the health of the woman and her baby, it is important to avoid:
 - Cracked nipples
 - Engorgement
 - Blocked ducts
 - Mastitis

All women should receive instruction about proper latching and positioning, feeding frequency, and adequate nutrition. The woman with HIV should receive additional emphasis on the signs and symptoms of blocked ducts and mastitis and when to seek health care.

If breast milk is not available

If the baby is able to tolerate milk, give:

- Formula prepared according to the recommendations on the container
- Goat's milk: Goat's milk is deficient in folic acid; supplement with 50 micrograms of folic acid per day

If the baby cannot tolerate milk, administer IV fluids. See under "Intravenous Fluid Management" in the section, Recognition and Management of the At-Risk Newborn, of this chapter.

f) Perform newborn exam, including obtaining weight and measurements

- Most parts of the newborn exam can be done in the mother's arms or at her bedside. Babies should not be removed from the mother's care unless absolutely necessary for treatment.
- Weighing and measuring the baby may be done when bathing the baby.
- Keep the baby warm by performing these activities in a heated space away from draughts. Dry and wrap the baby or return to the mother immediately.

g) Administer medications

Eye care

Clean the eyes of all newborns with plain water.

Apply eye treatment within 1 hour after birth.

- Prophylactic eye care can help prevent infectious conjunctivitis of the newborn in 85% to 90% of newborns.
- Neonatal ophthalmia is conjunctivitis with discharge <4 weeks after birth.
 - Most frequent within 2 to 5 days of birth
 - May result in corneal ulcer or permanent visual impairment if not treated
 - Infectious agents include:
 - Neisseria gonorrhoeae: Mother-to-child transmission rate of 30–40%
 - Chlamydia trachomatis: Mother-to-child transmission rate of 18–40%; 3–18% of newborns will have pneumonia.
 - Staphylococcus, *Streptococcus*, *Haemophilus*
- Prophylactic agents:
 - Tetracycline ointment 1%: Failure rate 0.012%
 - Erythromycin ointment 0.5%: Failure rate 0.005%
- Causes of prophylactic agent failure:
 - Administration after 1 hour
 - Use of inefficient chemical products
 - Irrigation after use
 - Improper application: The medication should be placed directly onto conjunctival sac by opening eyelids.

Preventing hemorrhagic disease: Vitamin K1

- Vitamin K1: 1 mg should be given IM to help prevent hemorrhagic disease within 6 hours after birth.
- Every newborn with excessive bleeding should be treated as having possible sepsis.

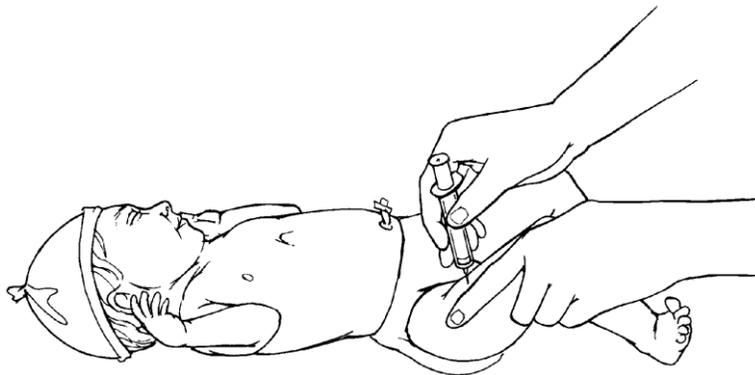


Figure 3 - Intramuscular injection

HIV-exposed infants

- Follow your local or national protocols for administration of appropriate antiretroviral medications to infants who have been born to HIV-positive mothers; ensure that the infant's family are able to access the appropriate drug regimen.
- Consult and refer the woman and her infant to the appropriate follow-up care before discharge; if possible, ensure the woman and her family are introduced to the care providers who will provide follow-up care before discharge. Facilitating the relationship between the woman, her infant, and the care providers increases the likelihood of the family returning for follow-up care.

Infants exposed to other bloodborne pathogens

- Follow your local or national protocols for administration of appropriate follow-up for who have been exposed to other blood-borne pathogens, such as hepatitis C. Ensure that the infant's family is able to access the appropriate drug regimen.
- Consult and refer the woman and her infant to the appropriate follow-up care before discharge; if possible, ensure the woman and her family are introduced to the care providers who will provide follow-up care before discharge. Facilitating the relationship between the woman, her infant and the care providers increases the likelihood of the family returning for follow-up care.

Immunization before discharge

- Oral polio vaccine should be administered to all newborns
- Bacille Calmette-Guérin (BCG) in all populations at risk of tuberculosis
- Hepatitis B vaccine or immunizations, if indicated

If the mother has been diagnosed with tuberculosis and started treatment less than 2 months prior to delivery, before leaving the health care facility, she should be offered the follow-up care.

- Give 5 mg/kg isoniazid (INH) orally once a day for 6 months (1 tab = 200 mg).
- Delay BCG until INH treatment is completed, or repeat BCG.
- Reassure the mother that breastfeeding is a safe and preferred method of feeding her baby.
- Weigh baby every 2 weeks to monitor growth

h) Cleaning the baby

- Vernix is a protective barrier and should not be wiped off at birth.
- Delay bathing for 24 hours, except when baby is born to an HIV positive mother.
- Bathe the baby of a woman who is HIV positive shortly after the birth.
- Prevent heat loss by performing the bath in a heated space away from draughts.
- Dry and wrap the baby or return it to the mother's chest immediately. Cover the head adequately to prevent heat loss.

i) Cord care

- Cord stump should be kept clean and left uncovered to dry and fall off.
- Antiseptics do not need to be applied routinely.
- Educate the mother about cord care and possible signs and symptoms of infections of the cord stump.
- If symptoms of localised infection develop, use 1% gentian violet to treat.

Common Problems after Birth

Most newborns who experience a difficult transition to extrauterine life will improve over a few hours. However, newborns with underlying pathology will deteriorate over time instead of improving. Health care providers should be aware that progressive worsening of symptoms indicates a baby who will require increasing levels of support to maintain stability.

Thermal instability

- Cold stress can lead to metabolic acidosis, hypoglycemia, decreased surfactant production, and increased caloric requirements,
- Signs and Symptoms of Hypothermia:
 - Temperature <36.5°C, colour changes, decreased activity, feeding intolerance, apnea and bradycardia, grunting, increased respiratory rate

Adequate blood glucose levels

- Symptoms of Hypoglycemia
 - Abnormal high-pitched cry, apnoea, cyanosis, poor feeding, hypothermia, vomiting, temperature instability, lethargy, hypotonia, jitteriness, poor tone, poor suck, seizures, tachycardia, tachypnoea
- Infants at Risk
 - Diabetic mother, birth weight >4,500 grams, birth weight <2,500 grams, prematurity, postmaturity, prolonged perinatal stress, sepsis, endocrine and metabolic disorders

Adequate oxygenation

At term, the fetal lung is filled with approximately 30ml/kg of an ultrafiltrate of fetal serum fluid. During and after birth, this fluid must be removed and replaced with air. Passage through the vagina or birth canal squeezes the thorax and 25–33% of fetal lung fluid is expelled. Over the next few hours, pulmonary capillaries and the lymphatics remove the remaining fluid. Babies born by elective cesarean section, where the woman did not labour, do not have the benefit of epinephrine present during labour; the baby is born with most of the fetal lung fluid present.

Clearing the Airway

- Routine suctioning is not recommended.
- Placing the baby prone and skin-to-skin on the mother facilitates drainage of gastric contents as well as residual upper airway secretions.
- If there is blood or meconium in the baby's mouth, suction to prevent aspiration.
- Use a bulb syringe to suction in the baby's mouth. Facilitate drainage by positioning the baby prone and skin-to-skin on the mother's chest.
- Suctioning can cause a vagal response which can result in an increase in blood pressure, decrease in heart rate, vomiting and retching, and apnoea.
- Vigorous suctioning of the nares (nasal openings) with a catheter should be avoided because it can lead to oedema and respiratory distress.
- Gastric suctioning is also not recommended. The risk of gastric aspiration in the first hours of life is negligible if the infant is placed in the prone position.

Cyanosis and Oxygen

A period of cyanosis lasting several minutes and transient dusky episodes during crying is considered a normal part of newborn transition. Persistent central cyanosis in room air or the need for supplemental oxygen after 2 hours of age represents an abnormal transition to extrauterine life.

**Key Message**

1. Immediate care of the newborn consists of careful and systematic observation and assessment.

Resources:

- Essential Newborn Care. Family and Reproductive Health, Maternal and Newborn Health/Safe Motherhood Paediatrics Vol. 106 No.3, September 2000 pages 1 – 16.
- Hutton EK, Hassan ES. Late vs Early Clamping of the Umbilical Cord in Full-term Neonates - Systematic Review and Meta-analysis of Controlled Trials. JAMA. 2007;297:1241-1252.
- The Maternal and Neonatal Health Program: Building a Legacy for Improved Maternal and Newborn Care. A Review to Date January 2002.
- WHO. Managing Complications in Pregnancy and Childbirth: A guide for midwives and doctors. WHO Department of Reproductive Health and Research, 2002. Available from: <http://www.who.int/reproductive-health/impac/mcpc.pdf>

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- World Health Organization. Basic Newborn Resuscitation: A Practical Guide. WHO: WHO/RHT/MSM/98.1, 1998
- World Health Organization. Estimates: Saving Newborn Lives. State of the world's newborns. Washington, DC: Save the Children Federation-US; 2001. p. 1–49.
- World Health Organization. Thermal Protection of the Newborn: A Practical Guide. WHO: WHORHT/MSM/97.2, 1997.

NEWBORN RESUSCITATION

Learning Objectives

By the end of this section, the participant will:

1. Recognize which babies require resuscitation.
2. Describe how to initiate resuscitation measures, including chest compressions.
3. Describe the signs and symptoms that suggest a baby needs ongoing special assistance.

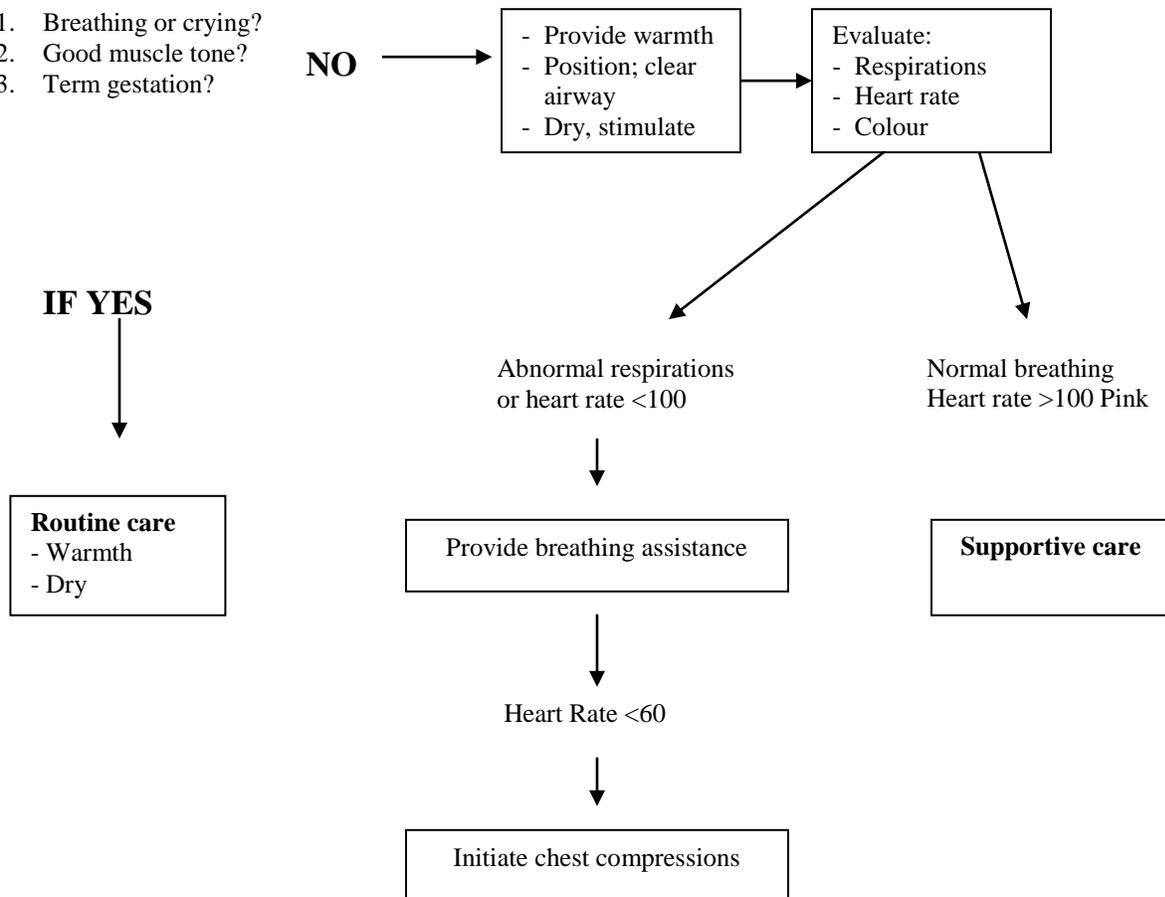
What is Necessary to Prepare for Resuscitation?

1. Appropriate equipment
2. Skill to use equipment
3. Ability to recognize which baby needs resuscitation and chest compressions

Which Baby Needs Resuscitation?

At the time of the birth, ask the following three questions. **IF THE ANSWER IS NO FOR BREATHING OR TONE, THE BABY REQUIRES RESUSCITATION. IF THE BABY IS NOT TERM, THE BABY NEEDS EVALUATION/OBSERVATION AND POSSIBLE RESUSCITATION.**

1. Breathing or crying?
2. Good muscle tone?
3. Term gestation?



How to assess a baby

Whether in the community or in a health-care facility initial assessments of the baby are the same. Assess the following:

- **Breathing or Crying:** Breathing will be evident by watching the baby's chest rise. Normal rate of breathing (respiratory rate [RR]) is 40 to 60 breaths per minute. A vigorous cry also indicates breathing.

Abnormal breathing may be indicated by:

- Absence of breathing
 - Shallow respirations where the chest moves very little
 - Gasping respirations: Extreme effort to inhale associated with a slow RR
- **Muscle Tone:** Healthy term babies have a flexed position
 - **Term Gestation:** A baby at term presents less risk. Information about the probable length of gestation is obtained by history or from the woman's chart

Additional evaluations to conduct during resuscitation:

- **Colour:** While recognizing that healthy babies may take several minutes to achieve adequate oxygen levels, the main area of the baby's body should be pink. Looking at the lips and mucous membranes, a dusky blue hue of lips and mucous membranes indicates central cyanosis, i.e. the baby is not getting enough oxygen. Babies may have bluish discoloration of hands and feet; this is acrocyanosis and is normal.
- **Heart Rate:** Normal heart rate (HR) 120–160 beats per minute (bpm) determined by auscultation of the heart or by holding the base of the umbilical cord where it attaches to the baby's abdomen with a thumb and forefinger. The pulsations felt in the cord are the baby's HR.

How to provide resuscitation

Provide warmth

- Consider use of a warmer (see Figure 4).
- Keep the delivery room warm:
 - Temperature: 25–28°C (77–82.4°F)
 - No fans or draughts
- Dry baby immediately, head first, then remove wet towel or cloth, replace with a clean dry towel or cloth
- Warm linen, including two towels, cloths, blankets, sheets, hat, and clothing for baby should be available.



Figure 4 -
Caring for baby under radiant warmer



Figure 5 - “Kangaroo care”

- Consider “Kangaroo care”: Even premature babies can maintain their temperature with skin-to-skin contact. Keeping a small or premature baby warm will help regulate breathing.

Stimulate

If the baby is not breathing

- Dry the baby.
- Gently rub the back.
- Flick, slap, or stroke the baby’s feet.



Figure 6 - Drying the baby



Figure 7 - Remove wet cloths and replace them with dry ones



**Figure 8 - Gently rub the baby's back
(keep baby warm under radiant warmer or by using dry cloths to cover the baby)**



Figure 9 - Flick the sole of the baby's feet



Figure 10 - Gently slap the sole of the baby's foot

Open the airway

- Place the baby on her or his back;
- Position the baby's head in a slightly extended position to open the airway (the neck should not be as extended as for adults). A rolled up piece of cloth under the baby's shoulders may be used to extend the head.

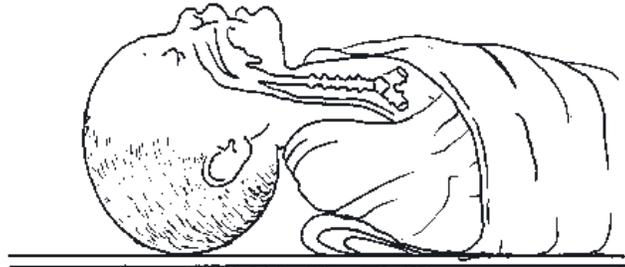


Figure 11 - Positioning the baby to open the airway

Suction

- Routine suctioning should be avoided.
- Deep suctioning may cause bradycardia.
- Suction the mouth and nostrils if the baby is having difficulty breathing.

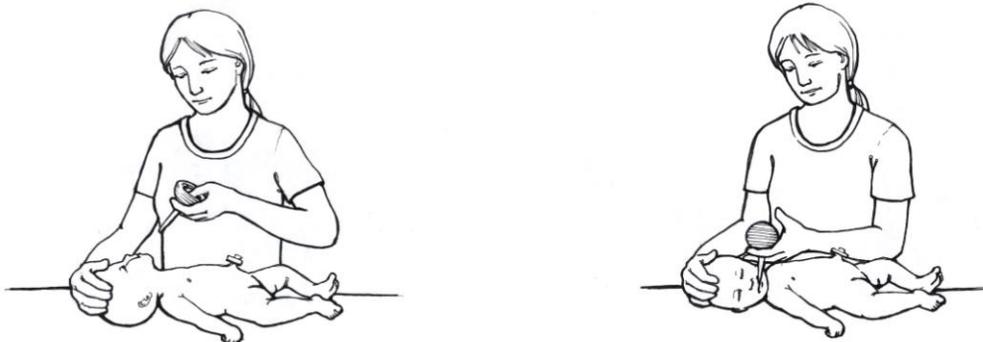


Figure 12 - Suctioning technique

- **Remember the mouth is to be suctioned before the nose.**
- If there is no bulb syringe or suction catheter available, wipe the baby's mouth gently with a cloth and place the baby on its side.

Initiating ventilation

Using a bag and mask

Indication:

- Not breathing
- HR <100 bpm

Equipment:

- Self-inflating bag
- Infant mask
- Ensure equipment is functional before using; get into a routine of checking equipment before each birth.



Figure 13 - Correct size and position of mask

Technique:

- Position baby's head with open airway (slight extension).
- Cover mouth and nostrils with mask.

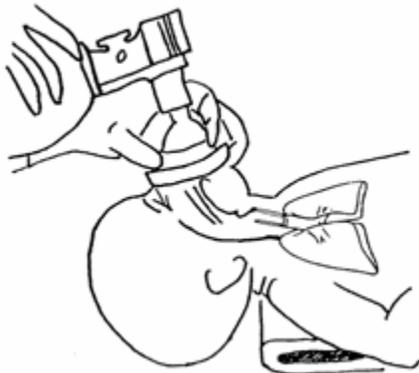


Figure 14 - Correct bag and mask ventilation



Figure 15 - Inadequate seal of mask on face

With one hand gently squeeze bag 40 to 60 times per minute while holding the mask with the other hand

- Watch for chest movement and if NO movement:
 - Check the mask seal and ensure that it is covering mouth and nose.
 - Reposition the head.
 - Reapply the mask.
 - Check for blocked airway, and suction if necessary.
- Continue bag and mask ventilation.

Using a tube and mask

- Position baby's head with open airway (light extension).
- Cover mouth and nostrils with mask, ensuring a good seal.
- Breathe 40 to 60 times per minute into the tube by blowing into it.
- Watch for chest movement, if NO movement:
 - Check the mask seal and ensure that it is covering mouth and nose.
 - Reposition the head.
 - Reapply the mask.
 - Check for blocked airway, and suction if necessary.
- Continue tube and mask ventilation.





Figure 16 - Two correct positions for visualizing chest movement during assisted ventilation

Technique of assisted ventilation

- Assisted ventilation should be performed for 1 minute, then stopped. Quickly assess if the newborn is breathing spontaneously.
 - If breathing is normal (30–60 breaths per minute) and there is no indrawing of the chest and no grunting for 1 minute, no further resuscitation is needed. Proceed with initial care of the newborn.
 - If the newborn is not breathing or the breathing necessary. is weak, continue ventilating until spontaneous breathing begins.
- If the newborn starts crying, stop ventilating and continue observing breathing for 5 minutes after crying stops.
 - If breathing is normal (30–60 breaths per minute) and there is no indrawing of the chest and no grunting for 1 minute, no further resuscitation is needed. Proceed with initial care of the newborn.
 - If the frequency of breathing is <30 breaths per minute, continue ventilating.
 - If there is severe indrawing of the chest, ventilate with oxygen, if available. Arrange to transfer the baby to the most appropriate service for the care of sick newborns.
- If the newborn is not breathing regularly after 20 minutes of ventilation:
 - Transfer the baby to the most appropriate service for the care of sick newborns.
 - During the transfer, keep the newborn warm and continue ventilation, if necessary.
- If there is no gasping or breathing at all after 20 minutes of ventilation, stop ventilating; the baby is stillborn. Inform the woman and her family. Provide emotional support to the family. Refer to appropriate after care. Initiate newborn death audit process.

Use of oxygen

When using oxygen, remember:

- Supplemental oxygen should only be used when the baby is having difficulty in breathing or if there is cyanosis.
- If the baby is having severe indrawing of the chest, is gasping for breath or is persistently cyanotic, increase the concentration of oxygen by using a nasal catheter, nasal prongs, or an oxygen hood.

Note: *Assisted ventilation can save the life of many newborns if performed adequately and without delay*

When to Proceed to Chest Compressions

Most babies needing help at birth will respond to assisted ventilation with an increase in their HR, followed quickly by normal breathing. In some cases, chest compressions become necessary. Chest compressions push blood that has been oxygenated (by the bag and mask ventilations) from the left ventricle of the baby's heart into the ascending aorta to perfuse the coronary arteries. Once that blood has reached the coronary arteries, the heart will push the oxygenated blood out into the baby's body.

After having provided assisted ventilation for more than 1 minute, stop to assess the baby's HR. The best way to do this is to either palpate the base of the umbilicus where it joins the baby's abdomen or to auscultate the baby's chest. Count the HR for 6 seconds and multiply by 10 to give a rate per minute.

If the baby's HR ≤ 60 bpm, begin chest compressions.

- Ideally, two health care providers work together to combine assisted ventilation with chest compressions, as shown in Figure 17.
 - One health care provider continues with assisted ventilation
 - A second health care provider initiates chest compressions.
 - The most effective method of delivering chest compression is to grip the chest in both hands in such a way that the two thumbs can press on the lower third of the sternum, just below an imaginary line joining the baby's nipples, with the fingers over the spine at the back.
 - Compress the chest quickly and firmly, reducing the anteroposterior diameter of the chest by about one-third.
 - After each third chest compression, the second health care provider pauses so that the other health care provider can provide one ventilation, i.e. the rate of chest compressions to ventilations is 3:1. To put this in verbal form: one and two and three and breathe. If you say this out loud as you compress the heart, your timing will be approximately correct. Each cycle of three compressions to one ventilation should take about 2 seconds.
 - Pause after 30 seconds, and assess for any changes in the baby's HR and RR.
 - If the HR is ≥ 60 , stop chest compressions and continue with assisted ventilation until the RR ≥ 30 /min. Observe the condition of the newborn carefully (HR, RR, tone, coloration).
 - If the HR ≥ 60 /min and RR ≥ 30 /min, you should stop both assisted ventilation and chest compressions, and observe the baby's condition.
 - Transfer the baby to the most appropriate service for the care of sick newborns if available in the facility. If no specialized service is available on site, consider referral, and transfer to higher-level care facility.
- The second method of chest compressions may be used if you are the sole health care provider at the delivery, as shown in Figure 18.
 - Stand to one side of the baby.
 - Using two fingers press down firmly on the lower third of the sternum, just below an imaginary line joining the baby's nipples.
 - Depress the chest quickly and firmly, reducing the anteroposterior diameter of the chest by about one-third.
 - After each third compression, pause and provide the baby with one ventilation.
 - Proceed as described above pausing to reassess changes in the baby's well-being.

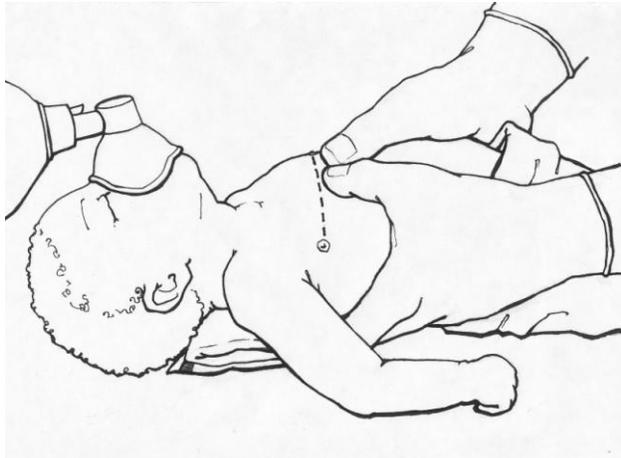


Figure 17 - Two person method

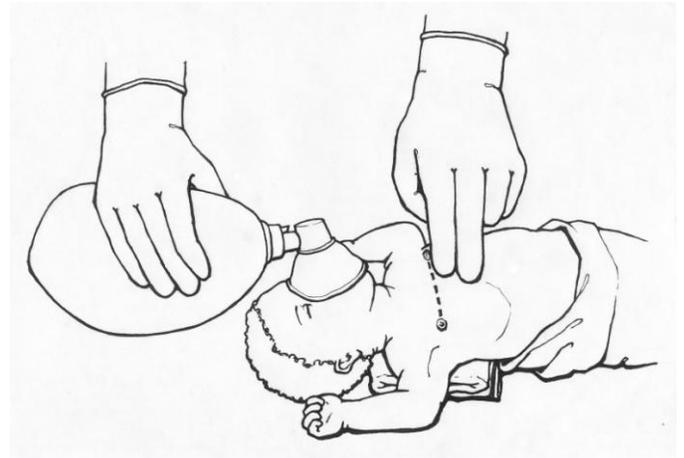


Figure 18 - Single provider option

When Does the Baby Require Continuing Observation and Additional Attention?

A baby with any of the following danger signs will require additional assessment. Continued observation may result in consultation, referral, and or transfer of care to a higher level of care, inside the same health care facility or to another health care facility with specialized newborn care services.

Danger signs

- Ineffective breathing or laboured breathing: RR >60 breaths per minute
- HR <100 bpm
- Cyanosis (blue coloured skin)
- Pale, mottled, or gray skin
- Abnormal tone
- Jitteriness
- Seizures
- Cool or warm baby
- Not feeding
- At risk for infection

Documentation

See the Neonatal Resuscitation Program 2006 Flow Diagram in Appendix 1 that may be used to both document and to assess the quality of care and resuscitation measures for the newborn.



Key Messages

1. All health care providers present at delivery should possess the basic competencies in newborn care and resuscitation, including chest compressions.
2. Continued follow-up of the newborn post resuscitation is required to prevent potential deterioration of the baby's condition.

RECOGNITION AND MANAGEMENT OF THE AT-RISK NEWBORN

Learning Objectives

By the end of this section, the participant will:

1. Identify the high-risk neonate at birth.
2. Recognize the danger signs present at delivery and in the early neonatal period.
3. Relate the main danger signs to the most common neonatal problems.
4. Determine the appropriate management of a baby presenting with danger signs.

Recognizing Danger Signs

The danger signs are signs and symptoms identified from historical facts of the mother, the pregnancy, the delivery, and the neonatal period, as well as physical findings on the baby, which indicate that he/she may be in trouble and need urgent evaluation.

A. Maternal History

Maternal fever, untreated maternal infection
Maternal HIV, TB, syphilis, malaria
Incomplete maternal immunization status (especially tetanus)

B. Delivery History

Prolonged rupture of membranes
Prolonged labour
Bleeding
Unclean delivery
Foul amniotic fluid or vaginal discharge
Need for neonatal resuscitation

C. Assessment of the Newborn

The danger signs that a baby may present can be classified according to the main organ system involved, but **remember**: signs and symptoms of disease are non-specific during the neonatal period.

1. General features

- Weight: A small baby weighs <2,500 grams at term
- Gestational age: A premature baby is born more than 3 weeks early, but those at higher risk are usually born ≥ 6 weeks early
- More than one baby: There is a trend toward smaller babies and/or more prematurity in multiple gestations.
- Congenital anomalies: There can be abnormal physical features or internal malformations. The spectrum goes from minor—not life-threatening, not requiring immediate intervention—to severe lethal conditions requiring compassionate care.
- Temperature:
 - Normal axillary temperature: 36°C to 37°C
 - Abnormality of temperature: too low, too high, or unstable
- After the first day of life, a healthy baby should feed 8 to 12 times a day. The baby should wake up for feeding and show an interest in feeding.

2. Specific assessment

Respiratory system

- Normal RR: 40 to 60 breaths per minute in a quiet baby
- Normal respiratory pattern: Easy chest and abdominal wall motion
- Abnormalities:
 - RR too fast (tachypnoea), too slow, or irregular
 - Respiratory pauses and apnoea. An apnoeic spell is a respiratory pause greater than 15 to 20 seconds, or less if the heart rate (HR) drops or the baby's colour changes (i.e. cyanosis)
 - Laboured breathing: with effort, creating inward movement of the muscles in the neck and between the ribs (retraction), and/or a moaning sound during breathing (grunting)
 - Bluish colour of skin and oral mucosa (cyanosis)

Cardiac system

- Normal HR: 120 to 160 beats per minute (bpm). It is not uncommon for the HR to be more than 160 bpm for short periods of time during the first few days of life, especially if the baby is crying or in pain. The HR is assessed by counting the femoral or the brachial pulsations or by auscultation. The HR of a baby is faster than that of the mother.
- Abnormalities:
 - HR too slow or bradycardia (slower than maternal HR), or too fast or tachycardia
 - Weak pulses: Difficult to feel
 - Poor skin colour: Pale, mottled (lacy, bluish skin pattern), cyanosed
 - Poor skin perfusion: Measured by the capillary refill, or time it takes for the skin to return to its normal colour after the pressure applied to the skin (limb, chest) by a finger is released. The normal value is 3 seconds or less.

Neurologic system

- Normal newborn: A term baby usually lies on his back with elbows, hips, and knees flexed (normal muscle tone). A healthy baby moves (extends arms and legs) spontaneously and symmetrically. The baby reacts and withdraws from pain. When a healthy baby cries, the cry is vigorous and sustained. The baby sucks forcefully.
- Normal premature baby: Muscle tone compared with a term baby is decreased.



Figure 19 - Normal tone in term infant



Figure 20 - Normal tone in premature infant

Abnormalities

- Abnormalities of movement
 - Seizures: Rhythmic movements of one or more limbs, or of facial muscles, that cannot be stopped by touch
 - Tremors: Rapid shaking movement of a limb that can be stopped by touch
 - Jitteriness: Excess movement
- Abnormality of muscle tone: A baby may be stiff (hypertonia) or flaccid (hypotonia).
- Irritability: The baby cries a lot and cannot be consoled.
- Lethargy or lack of spontaneous activity
- Poor sucking reflex or no interest in sucking
- Abnormal cry: The baby cries a lot or has a weak cry.
- Abnormal fontanel: The fontanel is the soft spot on the head. A firm or bulging fontanel is usually a sign of meningitis. A depressed fontanel is a sign of dehydration.

Skin abnormalities

- Jaundice: Yellow discoloration of the skin, sclera (white part of the eye), and mucous membranes. Most babies develop some level of mild jaundice in the first 2 to 4 days of life. It is abnormal in the first day of life. It may accompany severe infections.
- Pustules: Pustules represent a skin infection, usually due to *Staphylococcus aureus*. They are small and contain yellow pus, and are most often in skin folds or creases. They should not be confused with a common benign skin condition of the newborn, called erythema toxicum, which are pustules with clear fluid in the middle of a pink–red base.
- Redness and/or pus from the umbilicus
- Pus draining from the eyes, usually due to gonorrhoea (abundant), or *Staphylococcus aureus*

Other danger signs

- Abdominal distension
- Diarrhea, stools with blood or foul smelling
- Vomiting
- Oral thrush: White plaques on the tongue or oral cavity due to a fungal infection
- Spontaneous bleeding

These danger signs can be organized into probable diagnoses as listed in the following table:

Table 2 - Causes of some of the most common danger signs

Danger Signs	Causes
Not feeding well	<ul style="list-style-type: none"> • Prematurity and/or low birth weight • Hypoglycemia • Asphyxia • Cardio-respiratory problems • Infection, including tetanus • Congenital disorder (cardiac, neurologic, metabolic) • Thrush
Cardio-respiratory problems	<ul style="list-style-type: none"> • Hypo- or hyperthermia • Hypoglycemia • Prematurity • Asphyxia • Infection • Congenital heart disease
Temperature instability	<ul style="list-style-type: none"> • Environment • Prematurity and/or low birth weight • Hypoglycemia • Infection
Seizures or abnormal neurologic exam	<ul style="list-style-type: none"> • Asphyxia • Traumatic delivery • Hypoglycemia • Hypocalcaemia • Sepsis, meningitis, including tetanus • Congenital disorder
Severe jaundice	<ul style="list-style-type: none"> • Blood group incompatibility • Dehydration or not feeding well • Severe infection, malaria
Abdominal distension ± diarrhea	<ul style="list-style-type: none"> • Sepsis • Gastroenteritis • Necrotizing enterocolitis • Bowel obstruction

These diagnoses encompass the most common causes of mortality and morbidity in the early neonatal period. Recognizing that the baby is in danger, relating the danger sign to a common neonatal problem, and managing the problem in the best possible way will improve neonatal survival.

Table 3 - Signs and symptoms of common neonatal problems

Clinical Presentation of the Most Common Neonatal Problems	Condition of the Newborn
Not feeding well, thus risk of hypoglycemia	<ul style="list-style-type: none"> • Temperature instability • Poor colour, cyanosis • Respiratory distress or apnoea • Jitteriness, high-pitched cry • Seizures • Jaundice
Infections	<ul style="list-style-type: none"> • Pneumonia <ul style="list-style-type: none"> - RR >60 breaths per minute - Retractions, nasal flaring - Grunting, cough • Sepsis, meningitis <ul style="list-style-type: none"> - All of the danger signs mentioned above
Prematurity and/or low birth weight	<ul style="list-style-type: none"> • Low birth weight <2,500 grams • Physical immaturity • Respiratory difficulties (distress, pauses, apnoea), especially in the premature infant • Poor temperature control (especially low temperature) • Risk of hypoglycemia • Poor feeding (poor suck) • Higher risk of infection • Higher risk of jaundice
Asphyxia (with or without difficult delivery)	<ul style="list-style-type: none"> • Poor respiratory effort • Poor muscle tone • Poor colour • Poor sucking reflex • Irritability • Lethargy, poor activity • Seizures, jitteriness, tremors

Management of the Most Common Neonatal Problems

Initial care can be provided at home, in a local health care facility, or at a hospital center with specialized newborn care facilities

At birth, some babies will be identified as requiring immediate special care, while others may present in the **following days**. Any recognized danger sign needs prompt evaluation and management.

If a danger sign is present

- Review the maternal history.
- Review the baby’s behaviour and history.
- Examine the baby carefully.
- From history and examination, determine the most likely diagnostic cause.
- Treat and transfer, if necessary. (See information on management that follows.)
- If no treatment: Follow-up in 24 to 48 hours following maternal education on danger-sign recognition

Keep the baby and mother together to promote breastfeeding, temperature control, and prevention of infection.

Table 4 - Management of the most common neonatal problems

Problem	Solution
Not feeding well, but no other danger signs	<ul style="list-style-type: none"> • Evaluate breastfeeding technique (See the earlier section, Normal Newborn Care, of this chapter.) • Spoon, cup, or syringe feeding of expressed breast milk • Treat oral thrush with gentian violet 0.5%; apply on the tongue and oral mucosa.
Severe infection (pneumonia, sepsis, meningitis, cellulitis, and pus from umbilicus)	<ul style="list-style-type: none"> • Antibiotics: PO septrin for 10 days and IM gentamicin for 7 days (See Table 5 for doses.) • Temperature control • Prevention of hypoglycemia: Give breast milk. • If possible, transfer to a hospital.
Local infection	<ul style="list-style-type: none"> • Eyes <ul style="list-style-type: none"> - 1 dose of IM cefotaxime or ceftriaxone, or penicillin for 7 days if cephalosporins not available • Umbilical cord <ul style="list-style-type: none"> - If the redness is mild and not extending: Observation - If the redness is extending or pus is draining, or the baby has any other danger signs, see under preceding problem “Severe infection” in this table. • Skin pustules <ul style="list-style-type: none"> - Hygiene and oral antibiotics (cloxacillin) - If not improving with oral treatment or any other danger sign present, see under preceding problem “Severe infection” in this table.
Prematurity and/or low birth weight	<ul style="list-style-type: none"> • Gentle handling and care • Temperature control (See the earlier section, Normal Newborn Care, of this chapter.) • Early and frequent feedings: Every 2 to 3 hours • Spoon, cup, or syringe feeding of expressed colostrums and breast milk if difficulty feeding • Check skin for jaundice • Close observation for signs of infection
Asphyxia or seizures	<ul style="list-style-type: none"> • Stop the seizures with phenobarbital. • Treat with antibiotics (See under the preceding problem “Severe infection” in this table.) • Treat or prevent hypoglycemia: Give breast milk once seizures have stopped. • Temperature control (See the earlier section, Normal Newborn Care, of this chapter.) • Transfer to health care facility with capacity to manage at-risk newborn
Jaundice	<ul style="list-style-type: none"> • Evaluate for possible infection • Severe jaundice not due to severe infection needs further evaluation
Bleeding	<ul style="list-style-type: none"> • Give Vitamin K1 (See under “Preventing haemorrhagic disease” in the earlier section, Normal Newborn Care, in this chapter.) • May be a sign of infection

Some newborns may benefit from care in a specialized hospital facility where more extensive evaluation and treatment may be offered.

Management of a Newborn Who is not Feeding Well

If the baby is not feeding well, and has no other danger signs, consider spoon, cup, or syringe feeding of expressed breast milk. Babies born prematurely may not be able to suck adequately and will require spoon, cup, or syringe feeding until they develop a stronger suck reflex. Alternate feeding methods or supplemental feeds may help a low birth weight baby grow more quickly.

If the baby is unable to suck or sucks poorly, expressed breast milk can be given by spoon, cup, or syringe.

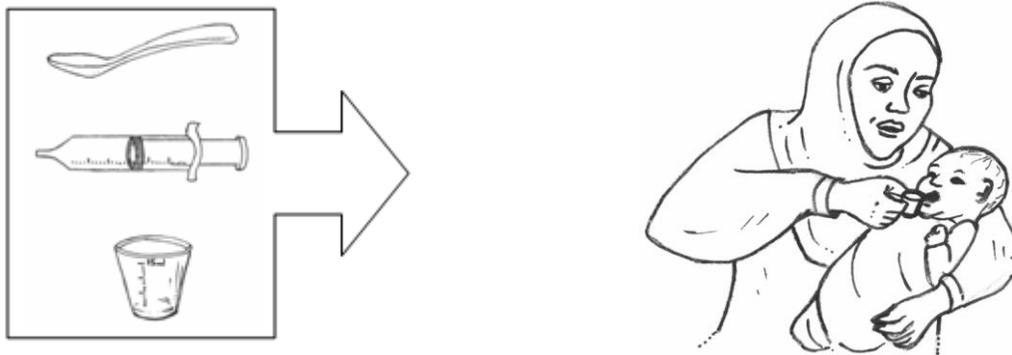


Figure 21 - Feeding expressed breast milk using a spoon, syringe or cup

Babies are usually fed every 2 to 3 hours if they are low birth weight or are premature, and every 3 to 4 hours when they are term.

Examples

Term baby of 3 kg

- Feeding every 3 hours, i.e. 8 feedings per 24 hours
- Amount: Day 1: 30 ml/feeding. Increase daily up to a minimum of 60 ml/feeding by 4 to 5 days of age

Preterm baby weighing 1.7 kg

- Feeding every 2 hours, i.e. 12 feedings per 24 hours
- Amount: Day 1: 12 ml/feeding. Increase daily up to a minimum of 24 ml/feeding by 4 to 5 days of age

How to spoon- or cup-feed a baby

These techniques should not be used for the floppy baby who is not able to swallow.

- If a cup is used, fill it up to half its content.
- Hold the baby in an upright position.
- Bring the tip of the cup or spoon up onto the lower lip and tilt until milk reaches the lip.
- The baby will lap up the milk and swallow it at his or her own pace.
- Do not pour the milk into the baby's mouth.

How to syringe-feed a baby

This technique should not be used for the floppy baby who is not able to swallow.

- Fill the syringe with milk.
- Hold the baby in an upright position.
- Place the tip of the syringe in the mouth on the tongue, and slowly push the plunger.

Not Feeding Well (<6 Feeds/Day)

General

Low birth weight <2.5 kg
 Prematurity <34 weeks
 Twins
 Congenital anomalies, dysmorphism
 Hypothermia, cold
 (axillary temperature <36°C)
 Hyperthermia, warm
 (axillary temperature >37.5°C)

Respiratory

Tachypnea: Respiratory rate
 >60
 Laboured breathing
 Irregular breathing
 Grunting, retractions, moaning
 Cyanosis (blue skin colour)
 Requiring bag and mask
 ventilation
 Cough

Risk of Infection

Prolonged rupture of
 membranes
 Prolonged labour
 Unclean delivery
 Maternal fever

**DANGER
 SIGNS**



Cardiac

Tachycardia: Heart rate >200
 Bradycardia: Heart rate <100
 Pale, mottled
 Poorly perfused (capillary
 refill >3 seconds)
 Cyanosis (blue skin colour)

Skin

Jaundice (especially <24
 hours)
 Pustules
 Pus from the umbilicus
 Redness around the
 umbilicus
 Purulent discharge from
 the eyes

Neurologic

Seizures
 Abnormalities of tone
 Jitteriness, irritability
 Lethargy, lack of spontaneous
 activity
 Poor suck
 Bulging fontanel
 Abnormal cry

Other

Abdominal distension
 Diarrhea
 Vomiting
 Bleeding
 Oral thrush

Management of Neonatal Infections

- Blood culture, if laboratory capacity available. (The identification of organisms affects the choice and length of treatment, and is of epidemiologic interest.)
- Lumbar puncture, if meningitis is suspected
- Chest radiography
- IV antibiotics i.e. ampicillin (or penicillin) and gentamicin for 10 to 14 days for sepsis; 14 to 21 days for meningitis
- IV fluid replacement if the baby is unable to tolerate any milk (See under "Intravenous Fluid Management" in the section, Recognition and Management of the At-Risk Newborn, of this chapter.)
- Oxygen and assisted ventilation or breathing, if needed

Table 5 - Suitable medications for the newborn (< 8 days old)

Medication	Dose and Route of Administration
Ampicillin	50mg/kg/dose IM or IV every 8–12 hours 75 mg/kg/dose IV every 6 hours for meningitis
Cefotaxime	50mg/kg/dose IM or IV every 12 hours
Ceftriaxone	50mg/kg/day/dose IM or IV every 24 hours
Cloxacillin	15mg/kg/dose PO every 8 hours
Gentamicin	4mg/kg/day/dose IM or IV every 24 hours
Penicillin G potassium aqueous	25 000–50 000U/kg/dose IM or IV every 12 hours
Co-trimoxazole (Trimethoprim 40mg, Sulfamethoxazole 200mg/5ml)	1.25 ml PO every 12 hours
Phenobarbital	Loading dose: 20mg/kg/dose, IV over 15 minutes or IM. If no response, 5mg/kg up to a maximum loading dose of 40mg/kg Maintenance dose: 2.5–4mg/kg/dose PO, IM, or IV every 12 hours

How to Give Intramuscular Medications

IM administration of medications is done using a sterile technique, with a 23- or 25-gauge needle. The preferred site for injection is the anterior-lateral upper thigh.



Figure 22 - Performing an intramuscular injection

Figure 22 shows a health care provider giving an older baby an IM injection. Having the mother hold the newborn or older baby in her lap restricts the baby’s movements, provides comfort to the baby, and enables the health care provider to complete injections easily and quickly.

Intravenous Fluid Management

Type of fluid

- **Day 1** (first 24 hours): Dextrose 10%
- **Day 2 and onward:** Dextrose 10% with electrolytes (Na^+ : 3 mEq/kg/day and K^+ : 2 mEq/kg/day)

Amount of fluid

- **Day 1:** 80 ml/kg/day (average for term and preterm babies)
- **Day 2 and onward:** increase by 20 ml/kg/day up to 150 ml/kg/day

Example

For a normal term infant with a birth weight of around 3 kg, the amount of fluid in the first day is 240 ml, which is equivalent to 10 ml/hr. The daily increase should be 2 to 3 ml/hr. The baseline intake after 4 days will be 18 ml/hr.

Management of Hypoglycemia

If the blood sugar is <2.2 mmol/L (40 mg/dL):

- Immediately feed the baby and recheck the blood sugar after 1 hour. If the blood sugar remains low, start IV dextrose 10% infusion and check the blood sugar after 30 minutes.
- If unable to feed the baby:
 - Start an intravenous line.
 - Give a bolus of 2 ml /kg of dextrose 10%, followed by a continuous infusion of dextrose 10% at 80 ml/kg/day if day 1. (See under preceding "Intravenous Fluid Management.")
 - Recheck the blood sugar in 30 minutes. If still low, repeat the bolus, and recheck the blood sugar after 30 minutes.
 - If after a third bolus the blood sugar remains low, increase the infusion rate by 20 ml/kg increments until the blood sugar stabilizes above 2.2 mmol/L (40 mg/dL) on two consecutive evaluations 30 minutes apart.

Discharge and Follow-Up

- The healthy newborn may be discharged with the mother when she is ready.
- Plan the discharge with the woman and her family, as culturally appropriate:
 - Provide any immunizations necessary.
 - Provide instructions for general care.
 - Provide advice on breastfeeding, and ensure that the baby is feeding well. At minimum, one breastfeed should be observed the prior to discharge.
- Schedule follow-up visits, for specific conditions, if necessary, and to monitor feeding and growth.
- The at-risk newborn will need additional assessment and discharge planning.

Documentation

A summary of the mother's health during the pregnancy, labour, birth, and immediate postpartum should be recorded in the baby's chart.

This is a suggested format for chart notes. Detailed notes should be incorporated into both the woman's and the baby's charts. This may also serve as a template to dictate a delivery summary. If the newborn was referred from another lower level health care facility, this information should be included in a report letter to be sent to the referral facility.

- Date and time of birth
- Name of primary health care provider
- Brief summary of the labour and birth

- APGAR scores
- Results of cord blood analysis, if done
- Neonatal resuscitation activities, if done
- Date, timing, and results of initial newborn exam
 - Estimated gestational age
 - Birth weight and measurements
 - Description of any birth injuries
 - Description of any congenital anomalies
 - Medications administered:
 - Vitamin K
 - Eye treatment
 - Immunizations
 - Other(s)
- Date, timing, and results of discharge exam
- Feeding method: Breast; expressed breast milk by spoon, cup, or syringe; or breast milk substitute
- Specialized follow-up care, i.e. for babies born to mothers who have tuberculosis or are HIV positive
 - Yes/No: Describe details.
- Standard follow-up care
 - Follow-up appointment made: Yes/No
 - Education on newborn care provided: Yes/No
 - Education on breast milk or other feeding provided: Yes/No
 - Education on danger signs in the newborn provided: Yes/No
 - Education on immunization schedule provided: Yes/No
- Baby discharged with mother: Yes/No
- Baby discharged with other family member: Yes/No
 - Reason: Maternal death OR mother too ill to care for baby Or other reason



Key Messages

1. At-risk newborns need prompt assessment and treatment. This may include transfer to a health care facility with increased capacity to meet the needs of the sick baby. Consultation, referral and transfer may become necessary following any birth. Be prepared.
2. Continued follow-up of the at-risk newborn is required to monitor for and to prevent future health problems.

Suggestion for Applying the Sexual and Reproductive Rights Approach to this Chapter

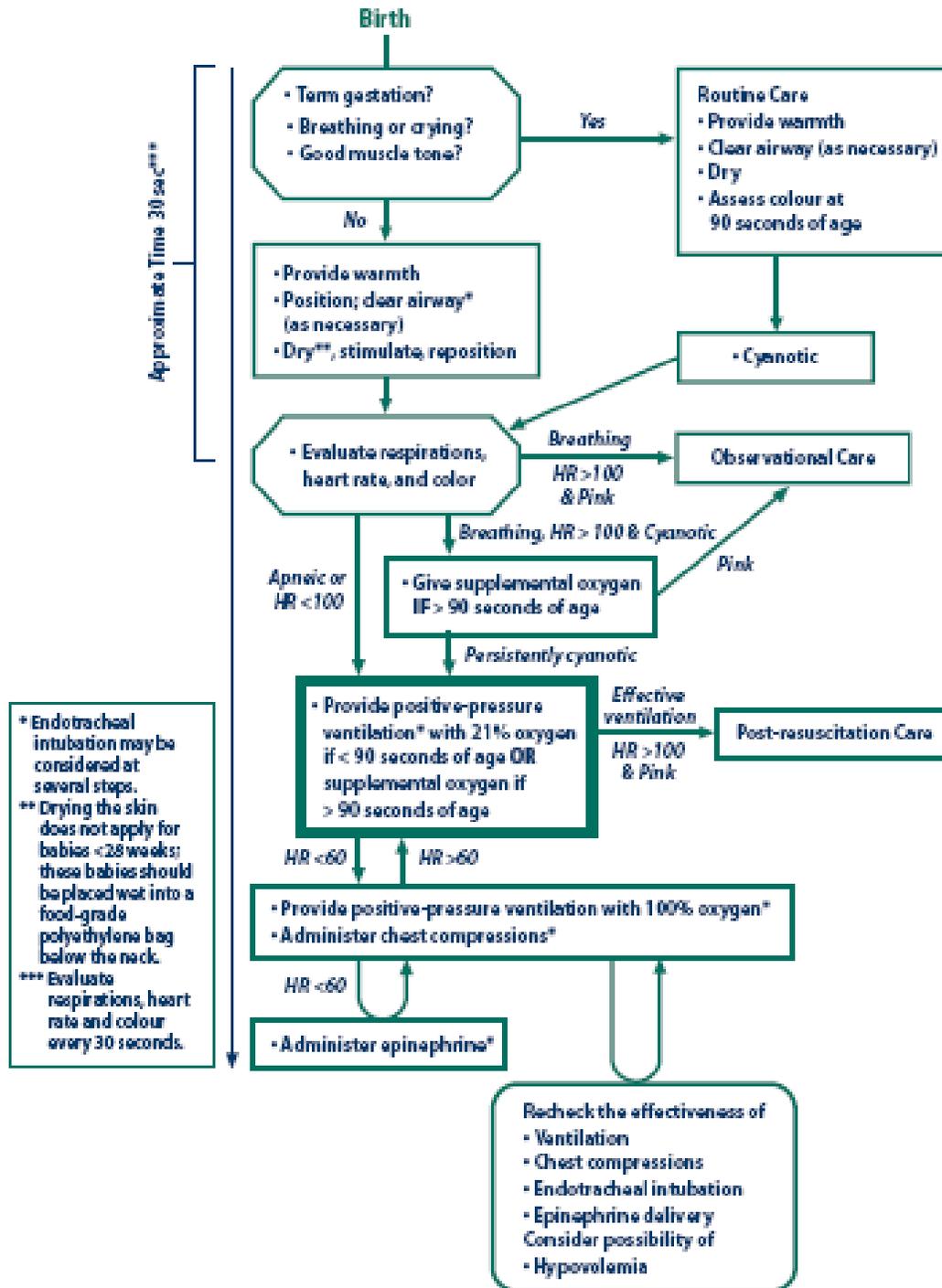
When a baby needs to be resuscitated, the delivery room can become very busy. The woman who has just delivered can sometimes be forgotten because everyone is concerned about the baby's well-being. During this time, it is important to talk to the woman about what is happening with her baby and keep her informed of her baby's condition.

The woman is responsible for all decision about the baby's care and must be consulted. If her condition makes it impossible for her to give consent, her spouse or family must be consulted.

Resources:

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APPENDIX 1



NRP: Neonatal Resuscitation Program as described in the Canadian Paediatric Society
http://www.cps.ca/English/ProEdu/NRP/Flow_diagram.pdf