## UNIT TERMINAL OBJECTIVE

6-2 At the completion of this unit, the EMT-Critical Care Technician student will be able to utilize assessment findings to formulate a field impression and implement the treatment plan for the resuscitation of a neonatal patient.

## COGNITIVE OBJECTIVES

At the completion of this unit, the EMT-Critical Care Technician student will be able to:

6-2.1 Define the term newborn. (C-1)
6-2.2 Define the term neonate. (C-1)
6-2.3 Identify important antepartum factors that can affect childbirth. (C-1)
6-2.4 Identify important intrapartum factors that can term the newborn high risk. (C-1)
6-2.5 Identify the primary signs utilized for evaluating a newborn during resuscitation. (C-1)
6-2.6 Formulate an appropriate treatment plan for providing initial care to a newborn. (C-3)
6-2.7 Identify the appropriate use of the APGAR score in caring for a newborn. (C-1)
6-2.8 Calculate the APGAR score given various newborn situations. (C-3)
6-2.9 Determine when ventilatory assistance is appropriate for a newborn. (C-1)
6-2.10 Prepare appropriate ventilation equipment, adjuncts and technique for a newborn. (C-1)
6-2.11 Determine when chest compressions are appropriate for a newborn. (C-1)
6-2.12 Discuss appropriate chest compression techniques for a newborn. (C-1)
6-2.13 Reassess a patient following chest compressions and ventilations. (C-1)
6-2.14 Determine when blow-by oxygen delivery is appropriate for a newborn. (C-1)
6-2.15 Discuss appropriate blow-by oxygen delivery devices and technique for a newborn. (C-1)
6-2.16 Assess patient improvement due to assisted ventilations. (C-1)
6-2.17 Discuss the initial steps in resuscitation of a newborn. (C-1)
6-2.18 Assess patient improvement due to blow-by oxygen delivery. (C-1)
6-2.19 Discuss appropriate transport guidelines for a newborn. (C-1)
6-2.20 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for meconium aspiration in the neonate. (C-1)
6-2.21 Discuss the pathophysiology of meconium aspiration in the neonate. (C-1)
6-2.22 Discuss the assessment findings associated with meconium aspiration in the neonate. (C-1)
6-2.23 Discuss the management/ treatment plan for meconium aspiration in the neonate. (C-1)
6-2.24 Describe the epidemiology, including the incidence, morbidity/ mortality and risk factors for bradycardia in the neonate. (C-1)
6-2.25 Discuss the pathophysiology of bradycardia in the neonate. (C-1)
6-2.26 Discuss the assessment findings associated with bradycardia in the neonate. (C-1)
6-2.27 Discuss the management/ treatment plan for bradycardia in the neonate. (C-1)
6-2.28 Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for respiratory distress/ cyanosis in the neonate. (C-1)
6-2.29 Discuss the pathophysiology of respiratory distress/ cyanosis in the neonate. (C-1)
6-2.30 Discuss the assessment findings associated with respiratory distress/ cyanosis in the neonate. (C-1)
6-2.31 Discuss the management/ treatment plan for respiratory distress/ cyanosis in the neonate. (C-1)
6-2.32 Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for hypothermia in the neonate. (C-1)
6-2.33 Discuss the pathophysiology of hypothermia in the neonate. (C-1)
6-2.34 Discuss the assessment findings associated with hypothermia in the neonate. (C-1)
6-2.35 Discuss the management/ treatment plan for hypothermia in the neonate. (C-1)
6-2.36 Describe the epidemiology, including the incidence, morbidity/ mortality, and risk factors for cardiac arrest in the neonate. (C-1)

6-2.37 Discuss the pathophysiology of cardiac arrest in the neonate. (C-1)
6-2.38 Discuss the assessment findings associated with cardiac arrest in the neonate. (C-1)
6-2.39 Discuss the management/ treatment plan for cardiac arrest in the neonate. (C-1)

**AFFECTIVE OBJECTIVES**
At the completion of this unit, the EMT-Critical Care Technician student will be able to:

6-1.40 Demonstrate and advocate appropriate interaction with a newborn/ neonate that conveys respect for their position in life. (A-3)
6-1.41 Recognize the emotional impact of newborn/ neonate injuries/ illnesses on parents/ guardians. (A-1)
6-1.42 Recognize and appreciate the physical and emotional difficulties associated with separation of the parent/ guardian and a newborn/ neonate. (A-3)
6-1.43 Listen to the concerns expressed by parents/ guardians. (A-1)
6-1.44 Attend to the need for reassurance, empathy and compassion for the parent/ guardian. (A-1)

**PSYCHOMOTOR OBJECTIVES**
At the completion of this unit, the EMT-Critical Care Technician student will be able to:

6-2.45 Demonstrate preparation of a newborn resuscitation area. (P-2)
6-2.46 Demonstrate appropriate assessment technique for examining a newborn. (P-2)
6-2.47 Demonstrate appropriate assisted ventilations for a newborn. (P-2)
6-2.48 Demonstrate appropriate insertion of an orogastric tube. (P-2)
6-2.49 Demonstrate appropriate chest compression and ventilation technique for a newborn. (P-2)
6-2.50 Demonstrate the initial steps in resuscitation of a newborn. (P-2)
6-2.51 Demonstrate blow-by oxygen delivery for a newborn. (P-2)

**DECLARATIVE**

I. Introduction
- A. Newborn
  - 1. A recently born infant; usually considered the first few hours of life
- B. Neonate
  - 1. Considered the first 28 days of life

II. General pathophysiology, assessment, and management
- A. Epidemiology
  - 1. Incidence
    - a. Approximately 6% of deliveries require life support
    - b. Incidence of complications increases as birth weight decreases
  - 2. Risk factors
    - a. Antepartum factors
      - (1) Multiple gestation
      - (2) Inadequate prenatal care
      - (3) Mother's age <16 or >35
      - (4) History of perinatal morbidity or mortality
      - (5) Post-term gestation
      - (6) Drugs/ medications
      - (7) Toxemia, hypertension, diabetes
    - b. Intrapartum factors
      - (1) Premature labor
      - (2) Meconium-stained amniotic fluid
      - (3) Rupture of membranes greater than 24 hours prior to delivery
      - (4) Use of narcotics within four hours of delivery
      - (5) Abnormal presentation
      - (6) Prolonged labor or precipitous delivery
      - (7) Prolapsed cord
      - (8) Bleeding
  - 3. Treatment strategies
    - a. Preparation of resuscitation equipment
    - b. Determine appropriate destination
- B. Pathophysiology
  - 1. Transition from fetal to neonatal circulation
  - 2. Respiratory system must suddenly initiate and maintain oxygenation
  - 3. Infants are very sensitive to hypoxia
  - 4. Permanent brain damage will occur with hypoxemia
  - 5. Apnea in newborns
  - 6. Congenital anomalies
- C. Assessment
  - 1. Time of delivery
  - 2. Normal/ abnormal vital signs
  - 3. Airway and ventilation
    - a. Respiratory rate
      - (1) Normal
      - (2) Rhythm
      - (3) Crying

(4) Apneic
b. Respiratory effort
(1) Normal
(2) Retractions
(3) Grunting
(4) Nasal flaring
(5) Periodic breathing
(6) Lung sounds
4. Circulation
a. Heart rate
(1) Normal
b. Color/ cyanosis
(1) Normal
(2) Central versus peripheral
(3) Mucosal membranes
c. End organ perfusion
(1) Compare strength of central pulses versus peripheral
(2) Capillary refill
5. APGAR
a. **A**ppearance - skin color
(1) Completely pink - 2
(2) Body pink, extremities blue - 1
(3) Blue, pale - 0
b. **P**ulse rate
(1) Above 100 - 2
(2) Below 100 - 1
(3) Absent - 0
c. **G**rimace - irritability
(1) Cries - 2
(2) Grimaces - 1
(3) No response - 0
d. **A**ctivity - muscle tone
(1) Active motion - 2
(2) Some flexion of extremities - 1
(3) Limp - 0
e. **R**espiratory - effort
(1) Strong cry - 2
(2) Slow and irregular - 1
(3) Absent - 0

D. Treatment
1. Prior to delivery, prepare environment and equipment
2. During delivery, suction mouth and nose as head delivers
3. After delivery
a. Airway and ventilatory support
(1) Drying
(a) Head and face
(b) Body
(2) Warming
(a) Appropriate techniques

(3) Position
(4) Suction
  (a) Technique
    i) Mouth first, than nares
    ii) Nasal suctioning is a stimulus to breathe
  (b) Equipment
    i) Bulb suction
    ii) Suction catheters
    iii) Meconium aspirator
(5) Stimulation
  (a) Flicking soles of feet
  (b) Stroking back
(6) Blow-by oxygen
  (a) Never withhold oxygen
  (b) Oxygen should be warmed
  (c) Use when
    i) Newborn is cyanotic and
    ii) Heart rate greater than 100 and
    iii) Adequate respiratory rate and effort
  (d) 5 liters/ minute maximum
    i) Complications due to hypothermia
  (e) Appropriate techniques
(7) Oral airways - rarely used for neonates
  (a) Necessary to keep mouth open for ventilation
(8) Bag-valve-mask
  (a) Mask characteristics
    i) Appropriate size
    ii) Minimize dead space
  (b) Bag characteristics
    i) Pop-off valve should be disabled
  (c) Use when
    i) Apneic
    ii) Inadequate respiratory rate or effort
    iii) Heart rate less than 100
  (d) Technique
    i) Initial ventilations require higher pressure to expand lungs
(9) Gastric decompression
  (a) Abdominal distention is impeding ventilation
  (b) Presence of diaphragmatic hernia

b. Circulation
(1) Intraosseous cannulation
(2) Chest compression (in addition to assisted ventilation with BVM)
  (a) Indications
    i) Heart rate less than 60
    ii) Heart rate between 60 and 80 and not increasing with adequate oxygenation
  (b) Technique
    i) Two finger technique
    ii) Thumb technique

- (c) Rate
  - i) 120 per minute
- (d) Depth
  - i) 1/2 - 3/4 inches
- (e) Compression-to-ventilation ratio
  - i) 3 compressions to 1 ventilation

c. Interventions
- (1) Temperature control
  - (a) Ambient air temperature control
  - (b) Dry with warm towel
    - i) Discard towel when it becomes wet
  - (c) Place naked infant on mother's skin; drape with warm blanket
  - (d) Wrap in dry, warm towel or blanket
  - (e) Stockinette
  - (f) Warm packs
    - i) Do not apply directly to infant
    - ii) Do not place wrapped infant on warm packs
- (2) Positioning
  - (a) On side
  - (b) Supine
    - i) Place towel roll under shoulders and thorax
  - (c) Mild Trendelenburg
    - i) Place towel roll under shoulders and thorax
- (3) Bradycardia
  - (a) blow by oxygen
  - (b) ventilation
- (4) Low blood volume

d. Transport consideration
- (1) Rapid transportation of the distressed infant
- (2) Position newborn on side to prevent aspiration

e. Psychological support/ communication strategies
- (1) Allow healthy newborn to bond with mother if possible

III. Specific situations

A. Meconium stained amniotic fluid

1. Epidemiology

a. Incidence
- (1) Approximately 10 - 15% of deliveries

b. Morbidity/ mortality
- (1) High mortality
- (2) Hypoxemia
- (3) Aspiration pneumonia
- (4) Pneumothorax
- (5) Pulmonary hypertension

2. Assessment findings

a. Thin and watery

b. Thick and particulate
- (1) Dark green-black amniotic fluid

3. Management considerations for thick or particulate meconium

a. Airway and ventilatory support
   (1) Do not stimulate the infant to breathe
      (a) Encircle the chest to prevent inhalation
   (2) Oral suction until
      (a) Airway is clear
      (b) Infant breathes on own
      (c) Bradycardia
   (3) Ventilate with 100% oxygen
b. Circulatory support
   (1) Assure adequate perfusion
c. Pharmacological interventions
   (1) If hypotensive, administer fluid challenge
d. Non-pharmacological interventions
   (1) Needle decompression may be required
   (2) Hypothermia prevention
e. Transport consideration
   (1) Identify facility to handle high-risk newborn
f. Psychological support/ communication strategies
   (1) Do not discuss "chances of survival" with family
   (2) Explain what is being done for the newborn

B. Bradycardia
1. Epidemiology
   a. Incidence
      (1) Most commonly caused by hypoxia
      (2) Increased intracranial pressure
      (3) Hypothyroidism
      (4) Acidosis
   b. Morbidity/ mortality
      (1) Minimal risk if hypoxia is corrected quickly
   c. Risk factors
      (1)Treatment via pharmacological measures alone
2. Anatomy and physiology r½ew
3. Pathophysiology
   a. Primarily caused by hypoxia
4. Assessment findings
   a. Assess upper airway for obstruction
      (1) Secretions
      (2) Tongue and soft tissue positioning
      (3) Foreign body
   b. Assess patient for hypoventilation
   c. Palpate umbilical stump or brachial artery
5. Management considerations
   a. Airway and ventilatory support
      (1) Suction
      (2) Positive pressure ventilation with 100% oxygen
   b. Circulatory support
      (1) Heart rate less than 100
         (a) BVM ventilation with 100% oxygen and reassess
      (2) Heart rate less than 60

(a) Begin chest compressions
(3) Heart rate between 60 and 80 but not responding to assisted ventilations with BVM
(a) Begin chest compressions
(4) Discontinue chest compressions when heart rate reaches 100
c. Non-pharmacological interventions
(1) Maintain temperature
d. Transport consideration
(1) Identify facility to handle high-risk newborn
e. Psychological support/ communication strategies
(1) Explain what is being done for the infant

C. Respiratory distress/ cyanosis
1. Pathophysiology
a. Lung or heart disease
b. Primary pulmonary hypertension
c. CNS disorders
d. Mucous obstruction of nasal passages
e. Spontaneous pneumothorax
f. Choanal atresia
g. Meconium aspiration
h. Amniotic fluid aspiration
i. Lung immaturity
j. Pneumonia
k. Shock and sepsis
l. Metabolic acidosis
m. Diaphragmatic hernia
n. Can lead to cardiac arrest
2. Assessment findings
a. Tachypnea
b. Paradoxical breathing
c. Periodic breathing
d. Intercostal retractions
e. Nasal flaring
f. Expiratory grunt
3. Management considerations
a. Airway and ventilatory support
(1) Suction
(2) High concentration oxygen
(3) BVM
b. Circulatory support
(1) Chest compressions if indicated
c. Non-pharmacological interventions
(1) Maintain normal body temperature
d. Transport consideration
e. Psychological support/ communication strategies
(1) Explain what is being done for the infant

D. Hypothermia
1. Body temperature drops below 35 degrees C
2. Epidemiology

a. Incidence
b. Morbidity/ mortality
   (1) Infants may die of cold exposure at temperatures adults find comfortable
c. Risk factors
   (1) Four methods of heat loss need to be controlled
      (a) Evaporation
      (b) Conduction
      (c) Convection
      (d) Radiation

3. Assessment findings
   a. Pale color
   b. Cool to touch, particular in extremities
   c. Acrocyanosis
   d. Respiratory distress
   e. Apnea
   f. Bradycardia
   g. Central cyanosis
   h. Irritability initially
   i. Lethargy in late stage
   j. Generally do not shiver
4. Management considerations
   a. Airway and ventilatory support
      (1) Assure adequate oxygenation and ventilation
   b. Circulatory support
      (1) Perform chest compressions if indicated
   c. Pharmacological interventions
      (1) Warm IV fluids
   d. Non-pharmacological interventions
      (1) Environmental conditions should be 24 to 26.5 degrees C
      (2) Warm hands prior to touching patient
   e. Transport consideration
      (1) Identify facility to handle high-risk newborn
   f. Psychological support/ communication strategies
      (1) Explain what is being done for the infant

IV. Resuscitation and post resuscitation and stabilization
   A. Epidemiology
      1. Incidence
         a. Primarily related to hypoxia
      2. Morbidity/ mortality
         a. Outcome is poor if interventions are not initiated quickly
         b. Increased likelihood of brain and organ damage
      3. Risk factors
         a. Intrauterine asphyxia
         b. Prematurity
         c. Drugs administered to or taken by the mother
         d. Congenital neuromuscular diseases
         e. Congenital malformations
         f. Intrapartum hypoxemia

B. Anatomy and physiology review
C. Pathophysiology
    1. Primary apnea
    2. Secondary apnea
    3. Bradycardia
    4. Persistent fetal circulation
    5. Pulmonary hypertension
D. Assessment findings
    1. Peripheral cyanosis
    2. Inadequate respiratory effort
    3. Ineffective or absent heart rate
E. Management considerations
    1. Airway and ventilatory support
        a. Assure adequate oxygenation and ventilation
            (1) Blow-by oxygenation is required if peripheral cyanosis is present and despite adequate respiratory effort and heart rate greater than 100 beats/ min
            (2) Ventilations are required if respiratory effort is inadequate, ineffective, or absent or heart rate is less than 80 beats/ min
            (3) Ventilate at a rate of 40 to 60 breaths per minute
            (4) Administer a tidal volume sufficient to expand the chest
    2. Chest compressions are indicated if pulse is less than 60 beats/ min, or between 60 and 80 beats/ min and not improving despite assisted ventilations with BVM
        a. Suction airway thoroughly
    3. Circulatory support
        a. Perform chest compression
            (1) Depth of ½ to 3/4 inches
            (2) Rate of 120 compressions per minute
            (3) Ratio of 3 compressions to one ventilation
            (4) Pause to intersperse ventilation
    4. Non-pharmacological interventions
        a. Maintain normal body temperature
    5. Transport consideration
        a. Identify facility to handle high-risk newborn
    6. Psychological support/ communication strategies

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