



TRANSITION SERIES  
**TOPICS FOR THE EMT**

TOPIC **50**

**Neonatology**

ALWAYS LEARNING

PEARSON



## Objectives

- Identify rates of neonatal complications.
- Discuss assessment format for a newborn child.
- Review a mnemonic to assist the EMT in remembering steps and interventions on a neonate.

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Review objectives.



# Introduction

- In utero, the fetus is totally dependent on the mother for survival.
- Once born, the neonate now needs to rely on his own body processes for survival.
- Many times, there are congenital or acquired anomalies that disturb the body's processes.

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In utero, the fetus can:

- See
- Feel
- Hear
- Breathe

Although simultaneously, the infant is totally dependent on the mother for:

- Protection
- Warmth
- Oxygen
- Nutrition
- Waste removal
- Immune function

After birth the infant must:

- Begin to fend for themselves by breathing air
- Depend on their own circulatory and respiratory systems for an adequate cardiac output and oxygen delivery
- Be capable of feeding effectively to allow for rapid growth
- Develop an immune system that can protect them from the many bacterial, viral, and fungal pathogens that they will encounter from the moment of birth



## Epidemiology

- 2%–5% of all live births have some type of congenital anomalies.
- 20% to 30% of perinatal deaths are the result of congenital anomalies.
- 10% of births will need some medical help at birth to begin life.
- 1% will need aggressive resuscitation to survive the neonatal period.

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Review basic statistics.

**Figure 50-1** Ten leading causes of death by age group. Courtesy of the Centers for Disease Control and Prevention. Source: Morbidity and Mortality Weekly Report, Vol. 58, No RR-1, (2009)

### 10 Leading Causes of Death by Age Group-2001


Rank	Age Groups										Total
	<1	1-4	5-9	10-14	15-24	25-34	35-44	45-54	55-64	65+	
1	Congenital Anomalies 5,513	Unintentional Injury 1,714	Unintentional Injury 1,263	Unintentional Injury 1,553	Unintentional Injury 14,411	Unintentional Injury 11,839	Malignant Neoplasms 16,559	Malignant Neoplasms 49,562	Malignant Neoplasms 90,223	Heart Disease 582,730	Heart Disease 700,142
2	Short Gestation 4,410	Congenital Anomalies 557	Malignant Neoplasms 493	Malignant Neoplasms 515	Homicide 5,237	Homicide 5,204	Unintentional Injury 15,945	Heart Disease 38,399	Heart Disease 62,486	Malignant Neoplasms 390,214	Malignant Neoplasms 553,768
3	SIDS 2,234	Malignant Neoplasms 420	Congenital Anomalies 182	Suicide 272	Suicide 3,971	Suicide 5,070	Heart Disease 13,326	Unintentional Injury 13,344	Chronic Low Respiratory Disease 11,166	Cerebrovascular Disease 144,466	Cerebrovascular Disease 163,536
4	Maternal Pregnancy Comp. 1,499	Homicide 415	Homicide 137	Congenital Anomalies 194	Malignant Neoplasms 1,704	Malignant Neoplasms 3,394	Suicide 6,655	Liver Disease 7,259	Cerebrovascular Disease 9,608	Chronic Low Respiratory Disease 106,504	Chronic Low Respiratory Disease 123,013
5	Placenta Cord Membranes 1,018	Heart Disease 225	Heart Disease 98	Homicide 189	Heart Disease 999	Heart Disease 3,100	HIV 5,867	Suicide 5,942	Diabetes Mellitus 9,570	Influenza & Pneumonia 55,518	Unintentional Injury 101,537
6	Respiratory Distress 1,011	Influenza & Pneumonia 112	Benign Neoplasms 52	Heart Disease 174	Congenital Anomalies 505	HIV 2,101	Homicide 4,268	Cerebrovascular 5,910	Unintentional Injury 7,658	Diabetes Mellitus 53,707	Diabetes Mellitus 71,372
7	Unintentional Injury 779	Septicemia 108	Influenza & Pneumonia 46	Chronic Low Respiratory Disease 92	HIV 225	Cerebrovascular 601	Liver Disease 3,336	Diabetes Mellitus 5,343	Liver Disease 5,750	Alzheimer's Disease 53,246	Influenza & Pneumonia 62,034
8	Bacterial Sepsis 698	Perinatal Period 72	Chronic Low Respiratory Disease 42	Benign Neoplasms 53	Cerebrovascular 196	Diabetes Mellitus 595	Cerebrovascular 2,491	HIV 4,120	Suicide 3,317	Nephritis 33,121	Alzheimer's Disease 53,852
9	Circulatory System Disease 622	Benign Neoplasms 58	Cerebrovascular 38	Influenza & Pneumonia 48	Influenza & Pneumonia 181	Congenital Anomalies 458	Diabetes Mellitus 1,958	Chronic Low Respiratory Disease 3,324	Nephritis 3,284	Unintentional Injury 37,624	Nephritis 39,480
10	Intrauterine Hypoxia 534	Cerebrovascular 54	Septicemia 29	Cerebrovascular 42	Chronic Low Respiratory Disease 171	Liver Disease 387	Influenza & Pneumonia 983	Homicide 2,467	Septicemia 3,111	Septicemia 25,418	Septicemia 32,236

Note: Homicide and suicide counts include terrorism deaths associated with the events of September 11, 2001, that occurred in New York City, Pennsylvania, and Virginia. A total of 2,938 U.S. residents lost their lives in these acts of terrorism in 2001, of which 2,322 were classified as (transportation-related) homicides and 4 were classified as suicides.  
Source: National Center for Health Statistics, ICD-10 and Statistics Systems.  
Produced by: Office of Statistics and Programming, National Center for Injury Prevention and Control, CDC.



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# Terminology


- Review of terminology related to newborns
  - Fetal or in utero
  - Gestational period
  - Premature
  - Term
  - Late term
  - Perinatal
  - Infancy

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Review terms with students.



## ABCs “In That Order, Every Time”

- Airway
  - Anatomical differences make PPV challenging
  - Use of BVM does not require much force or strength
  - Do not place pressure on trachea
  - Use of OPA/NPA may help airway

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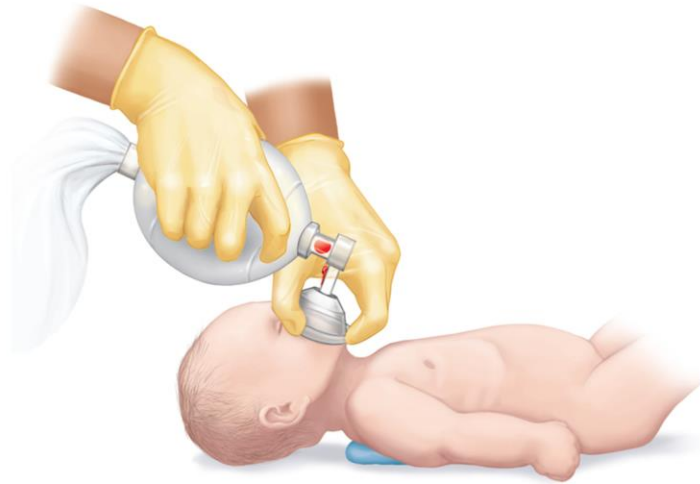
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Review the anatomical differences between the neonate and the adult airway.

Stress BVM should not be a difficult technique.

Early use of manual techniques and simple mechanical will help keep a closing airway open.

**Figure 50-2** To provide positive pressure ventilation, use a bag-valve mask. Maintain a good mask seal. Ventilate with just enough force to raise the infant's chest. Ventilate at a rate of 40–60 per minute for 30 seconds, then reassess.



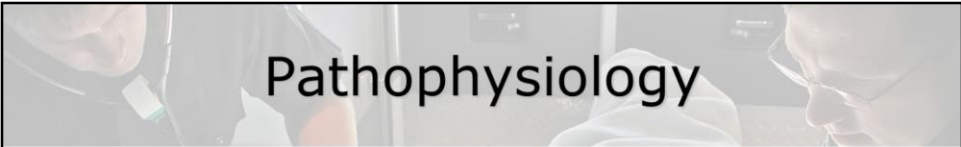
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You are transporting an infant who is having periods of apnea, but you don't have the appropriate size mask to provide assisted ventilations. Before starting mouth to mouth nose assisted ventilations, you could try an adult size mask creating a seal over the infants entire face.





# Pathophysiology

- Breathing
  - Assist breathing if neonate shows apnea, severe respiratory distress, hypotonia
  - Rate of 40-60 per minute
    - 30-40 for older neonate
  - Tidal volumes
    - 15-25 mL for a newborn
    - 25-50 for neonate up to 1 month of age
    - “Just enough to move the chest”

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When the airway patency has been established, assisted ventilation should be performed in any neonate with significant respiratory distress, apnea, or significant hypotonia (e.g., a floppy baby).

# Pathophysiology

- Breathing
  - Use manometer to keep airway pressure <30 cmH<sub>2</sub>O

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When the airway patency has been established, assisted ventilation should be performed in any neonate with significant respiratory distress, apnea, or significant hypotonia (e.g., a floppy baby).

# Pathophysiology

- Breathing
  - If adequate
    - Rapid improvement in color and perfusion
    - Heart rate will normalize
    - Spontaneous respirations may return
    - Blended mix of oxygen to achieve a desired pulse ox level

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Blended oxygen to achieve SpO<sub>2</sub> levels:

- 60 to 65 percent after 1 minute
- 65 to 70 percent after 2 minutes
- 70 to 75 percent after 3 minutes
- 75 to 80 percent after 4 minutes
- 80 to 85 percent after 5 minutes
- 85 to 95 percent after 10 minutes

If the heart rate is less than 60 bpm after 90 seconds of resuscitation, the oxygen concentration should be increased to 100 percent until the heart rate increases to more than 100 bpm.

# Pathophysiology

- Circulation
  - If persistently bradycardic (<60 bpm), signs of poor perfusion after 1 minute of BVM with oxygen, start compressions
  - “Thumb technique” recommended
  - Compression:Breath ratio 3:1

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Discuss the importance of gauging peripheral perfusion in a neonate as a measure of cardiovascular function.

If bradycardic and poorly perfusing after a trial of PPV, start compressions.

# Pathophysiology

- Circulation
  - Determination of poor perfusion
    - Heart rate >180
    - Poor peripheral perfusion
    - Blood pressure determination not necessary

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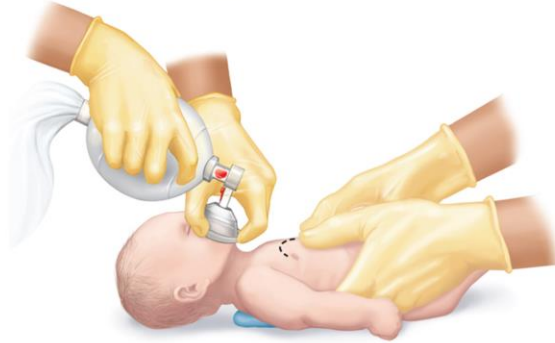
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Discuss the importance of gauging peripheral perfusion in a neonate as a measure of cardiovascular function.

If bradycardic and poorly perfusing after a trial of PPV, start compressions.

**Figure 50-3** To provide chest compressions, circle the torso with the fingers and place both thumbs on the lower third of the infant's sternum. If the infant is very small, you may need to overlap the thumbs. If the infant is very large, compress the sternum with the ring and middle fingers placed one finger's depth below the nipple line. In the newborn, compress the chest one-third the depth of the chest at the rate of 120 per minute and a ratio of 3:1 compressions to ventilations.



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## What is after ABC? DEFG “Don't Ever Forget Glucose”

- Fuel stores in infants quickly exhausted
  - Coordinating feeding and breathing is exercise enough for a sick infant
  - Ascertain feeding and sleeping patterns
  - Always make BGL assessment one of your differentials

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Feeding for newborns and infants is their exercise.

It can be exhausting for a sick infant to feed, to coordinate the muscles of respiration and those of swallowing.

This is especially true for premature or fragile infants with medical conditions.

For this reason, questions around the infant's feeding (amount, duration, frequency, and whether there was any emesis, sweating, or frequent coughing) can be very important clues to the underlying problem.

In a sense, the newborn infant's “day” can be reduced to four hour cycles of sleeping, crying to communicate discomfort, feeding, and some period of alertness before sleeping again.



## H is for Hypothermia

- Hypothermia
  - Environmental temperature important
  - Best resuscitation efforts will fail on a cold neonate
  - If the temp in the back of the ambulance is comfortable for you, then it's too cold for the neonate

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Once again, it cannot be overemphasized how important attention to the environmental temperature is to the care of an infant.

Even the best resuscitation skills and efforts will fail if the infant is cold.

A corollary to the old EMS adage “They're not dead until they're warm and dead” is that the infant will not survive until they are warm.



# I is for Infection

- Infection
  - Major killer of neonates
  - ANY of the following requires physician evaluation
    - ANY history of fever, cyanosis, apnea, rapid or shallow breathing
    - ANY history of poor feeding, decreased urine output, vomiting
    - ANY blood in stool, urine, or emesis
    - ANY rash beyond “baby acne”

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Infection is a major killer of neonates and can have a very rapid presentation.

Sometimes the history is only of a fussy baby who was not feeding very well, whose breathing became more labored and then would stop occasionally (apnea) and have episodes of turning blue (cyanosis).

This is the common introduction to the story of a potentially very sick and dying neonate and cannot be overlooked or discounted by health care professionals.

## Safe Transport of the Infant

- Transport in parent's arms is not acceptable
- Use a commercially available age-appropriate car seat, or an integrated car seat

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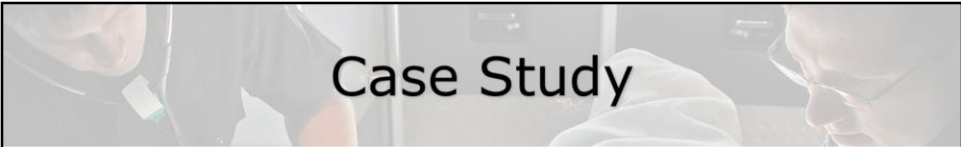
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Having a convertible child passenger restraint system (car seat) with two belt paths and a five-point harness system that can be adjusted to the size of the child is standard of care.

Transporting the neonate in an isolette is ideal, as the chamber can be heated. In the absence of that, a car bed that lies across the stretcher and is strapped down using the stretcher's harnessing is next best.

Few EMS systems have these, however, and most may not even have car seats (although that should change).



## Case Study

You are called to care for a 3-week-old baby who has “stopped breathing.” Upon your arrival, you are met at the door by a frantic young mother holding a limp baby. The mother is crying and, through her sobs, you can barely understand her saying something about “sleeping,” “blue,” and “not breathing.”

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Present case study.



## Case Study

- What kinds of problems could this neonate have?

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A limp infant is the worse case scenario.

It may be circling cardiac arrest or be in cardiac arrest.

The problem could be airway (the number one cause for arrest in infants), the problem could be a congenital problem with the heart, the problem could stem from poor feeding and dehydration, or from some traumatic event.

That being said, the goal is to first assess ABC's and support lost function.

The differential diagnosis will come eventually, but not if the baby is dies first!



## Case Study

- Scene Size-Up
  - Standard precautions taken
  - Scene is safe, no entry or egress problems
  - 3-week-old male, about 6 or 7 pounds
  - Patient found in mother's arms, limp
  - NOI is unresponsiveness
  - First child, no prenatal care, minimal hospital stay at birth

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Present case study.



## Case Study

- Primary Assessment Findings
  - Patient unresponsive
  - Airway looks clear with manual technique
  - Breathing slow and irregular
  - Carotid pulse 98/min, peripheral pulse absent
  - Peripheral skin cool and blue
  - Poor muscle tone, neonate is very limp

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Discuss case presentation.



## Case Study

- Is this patient a high or low priority? Why?
- What are the patient's life threats, if any?
- What care should be administered immediately?

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This patient would be categorized as unstable due to color, pulse, breathing, and mental status.

The primary life threat is that the infant is not breathing effectively, which will quickly turn into cardiopulmonary arrest (that carries with it dismal resuscitation outcomes).

The patient should be laid down supine and the airway opened carefully using a manual technique. Positive pressure ventilations should be initiated at 30/min with supplemental oxygen, providing just enough tidal volume to create chest rise and fall.

Cover the infant to help preserve/promote normothermia.



## Case Study

- Medical History
  - Born 1 week early, recent diagnosis of URI
- Medications
  - Nebulized med for upper respiratory infection
- Allergies
  - Mother doesn't think infant has any

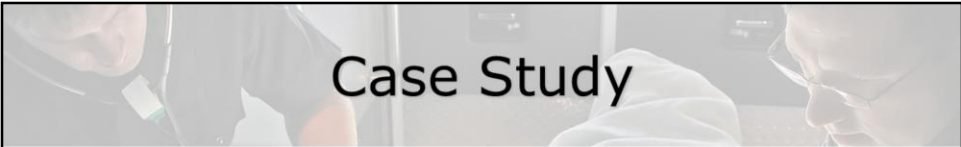
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Discuss case study.





## Case Study

- Pertinent Secondary Assessment Findings
  - Pupils sluggish to respond to light
  - Airway patent, patient being ventilated at 30/min
  - Central pulse present now only 78/minute
  - Skin is still cool, cyanosis has resolved some
  - Pulse ox only 90% with PPV and supplemental oxygen
  - Patient still limp, no response to interventions

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Discuss case study.



## Case Study

- Is the infant improving or deteriorating?
- Is there any additional treatment or change in treatment required?
- What is the likely underlying cause for the emergency?

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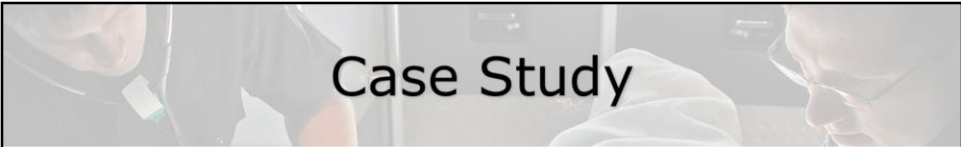
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Although the color improved slightly, more importantly the body is still limp and the heart rate is now declining.

The EMT should initiate external compressions at a 3:1 ratio, at a rate of 120/min.

The patient was probably fatigued and weak from trying to breath with the URI.

The patient just got to a spot where they could no longer maintain and started to acutely deteriorate.



## Case Study

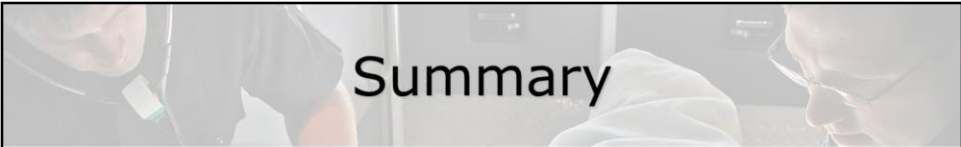
- Care provided:
  - Patient positioned supine, secured for transport
  - Ongoing PPV with oxygen
  - Compressions administered when heart rate dropped below 100/min with poor perfusion
  - Temperature maintained with ambulance heater and warm blankets
  - Rapid transport with ALS intercept en route

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Discuss management.



## Summary

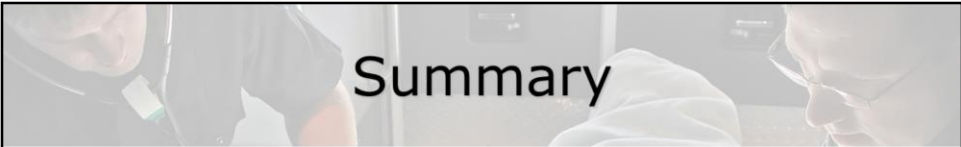
- Neonatal emergencies are stressful for the parent as well as EMS providers.
- Remember the mnemonics for assessing and managing:
  - ABCs “In that order every time”
  - DEFG “Don't ever forget glucose”
  - H is for hypothermia
  - I is for infection

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Review as appropriate.



## Summary

- Also ensure proper and secure transport to hospital in ambulance.

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Review as appropriate.