Chapter 20
Immunologic Emergencies

Lecture
National EMS Education Standard Competencies (1 of 2)

Medicine

Applies fundamental knowledge to provide basic emergency care and transportation based on assessment findings for an acutely ill patient.
Immunology

• Recognition and management of shock and difficulty breathing related to
  – Anaphylactic reactions

• Anatomy, physiology, pathophysiology, assessment, and management of
  – Hypersensitivity disorders and/or emergencies
  – Anaphylactic reactions
Introduction (1 of 2)

• EMTs often respond to calls involving allergic reactions.

• Allergy-related emergencies may involve:
  – Acute airway obstruction
  – Cardiovascular collapse
You must be able to:

- Treat these life-threatening complications
- Distinguish between the body’s usual response to an allergen and an allergic reaction

Immunology is the study of the body’s immune system.
Anatomy and Physiology

• The immune system protects the body from foreign substances and organisms.
• When a foreign substance invades the body:
  – The body goes on alert.
  – The body initiates a series of responses to inactivate the invader.
An allergic reaction is an exaggerated immune response to any substance.

Not caused directly by an outside stimulus

Caused by the body’s immune system
  - Releases chemicals to combat stimulus
  - Includes histamines and leukotrienes
Some patients may not know what is causing their reaction, so you must:

- Recognize the signs and symptoms
- Maintain a high index of suspicion

An allergic reaction may be mild and local or severe and systemic.
• Anaphylaxis is an extreme, life-threatening allergic reaction.
  – Involves multiple organ systems
  – Can rapidly result in shock and death
• Three common signs of anaphylaxis:
  – Urticaria (hives)
  • Small areas of generalized itching or burning that appear as multiple, small, raised areas on the skin

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Pathophysiology (5 of 6)

Three common signs of anaphylaxis (cont’d):

- Angioedema
  - Areas of localized swelling
- Wheezing
  - High-pitched, whistling breath on expiration

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• You may also note:
  – Hypotension due to vasodilation and increased capillary permeability
  – Gastrointestinal dysfunction (eg, nausea, vomiting, and abdominal cramps)
Common Allergens (1 of 4)

• Food
  – May take more than 30 minutes to appear
  – Shellfish, nuts

• Medication
  – Antibiotics (eg, penicillin)
  – Nonsteroidal anti-inflammatory drugs (NSAIDs)
• Medication (cont’d)
  – If medication is injected, the reaction may be immediate and severe.
  – Reactions to oral medications may take more than 30 minutes to appear, but can also be very severe.
Common Allergens (3 of 4)

- **Plants**
  - Dusts, pollens, and other plant materials
  - Ragweed, ryegrass, maple, and oak

- **Chemicals**
  - Makeup, soap, and hair dye
  - Latex is of particular concern to health care providers
    - Nitrile gloves are an alternative.
Insect bites and stings

- When an insect bites and injects the bite with its venom, this is called envenomation.
- The reaction may be localized (swelling and itchiness) or systemic (involving the entire body).
• Approximately 3% of adults and 1% of children are allergic to the venom of bees, wasps, and hornets.

• Allergic reactions to insect stings cause at least 50 deaths/year in the United States.
**Insect Stings** (2 of 8)

- The stinging organ of most insects is a small hollow spine projecting from the abdomen.
- Venom can be injected directly into skin.
Honeybees cannot withdraw their stinger.  
  – Fly away and die

Wasps and hornets can sting multiple times.
Insect Stings (4 of 8)

- Some ants, especially the fire ant, strike repeatedly.
  - Inject a particularly irritating toxin at bite sites

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Insect Stings (5 of 8)

• Signs and symptoms:
  – Sudden pain
  – Swelling
  – Localized heat
  – Urticaria
  – Redness in light-skinned individuals
  – Itching and a wheal
Applying ice sometimes helps
- Swelling may be dramatic and frightening.
- Localized manifestations are not serious.
In severe (anaphylactic) cases, patients may experience:

- Bronchospasm and wheezing
- Chest tightness and coughing
- Dyspnea
- Anxiety
- Gastrointestinal complaints
- Hypotension
Insect Stings (8 of 8)

- Patients may occasionally experience respiratory failure.
- If untreated, anaphylactic reaction can proceed rapidly to death.
Patient Assessment in an Immunologic Emergency (1 of 2)

• Scene size-up

• Scene safety
  - The patient’s environment or recent activity may indicate the source of the reaction.
    • Sting or bite
    • Food allergy
    • New medication regimen
Patient Assessment in an Immunologic Emergency (2 of 2)

• Scene safety (cont’d)
  – Be mindful of other potential causes of respiratory distress.
  – Traumatic injury may also be present.
  – Follow standard precautions, with a minimum of gloves and eye protection.
  – Consider the need for additional resources, such as advanced life support (ALS) personnel.
Primary Assessment (1 of 7)

- Quickly identify and treat any immediate or potential life threats.
- Form a general impression.
  - May present as respiratory or cardiovascular distress in the form of shock
  - Patients often appear very anxious.
  - Call for ALS backup if available.
  - Look for a medical identification tag.
Primary Assessment (2 of 7)

• Airway and breathing
  – Anaphylaxis can cause rapid swelling of the upper airway.
  – You have only a few minutes to assess the airway and provide life-saving measures.
  – Work quickly to determine the severity of the symptoms.
• Airway and breathing (cont’d)
  – Quickly assess for:
    • Increased work of breathing
    • Use of accessory muscles
    • Head bobbing
    • Tripod positioning
    • Nostril flaring
    • Abnormal breath sounds
Airway and breathing (cont’d)

- Assist the patient into high Fowler’s position to maximize ventilations.
- If signs of shock, place the patient in supine position.
- Do not hesitate to initiate high-flow oxygen.
- In severe situations, assist using bag-valve mask, attached to oxygen.
Primary Assessment (5 of 7)

- Circulation
  - May present with hypotension
  - Palpate for presence and quality of radial pulse
    - Assess for rapid pulse rate; cool, cyanotic, or red, moist skin; delayed capillary refill
    - May indicate hypoperfusion
Primary Assessment (6 of 7)

• Treatment
  – Oxygen
  – Positioning (recumbent or supine)
  – Preventing the loss of body heat

• Definitive treatment for anaphylactic shock is epinephrine.
Transport decision

- Always provide prompt transport for any patient who may be having an allergic reaction.
- Take along the patient’s medications.
- If the patient does not exhibit severe symptoms, consider continuing the assessment; err on the side of emergency transport.
History Taking (1 of 4)

- Investigate:
  - Chief complaint
  - History of present illness
- Identify:
  - Associated signs and symptoms
### Table 20-1  Additional Signs and Symptoms of an Allergic Reaction

<table>
<thead>
<tr>
<th>Respiratory System</th>
<th>Cardiovascular System</th>
<th>Skin</th>
<th>Other Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Sneezing or an itchy, runny nose (early sign)</td>
<td>- Increase in pulse rate (tachycardia; early sign)</td>
<td>- Flushing, itching, or burning skin, especially common over the face and upper chest</td>
<td></td>
</tr>
<tr>
<td>- Shortness of breath (dyspnea)</td>
<td>- Red, flushed, hot skin (early sign) or pale, cyanotic, cool skin (late sign) as the vascular system fails</td>
<td>- Urticaria over large areas of the body; may be internal or external</td>
<td>- Decreasing mental status (early sign of hypoperfusion), from mild confusion or lethargy to loss of consciousness or coma</td>
</tr>
<tr>
<td>- Tightness in the chest or throat</td>
<td>- Decrease in blood pressure (hypotension) as the blood vessels dilate (late sign)</td>
<td>- Swelling, especially of the face, neck, hands, feet, and/or tongue, either local (angioedema) or generalized</td>
<td>- Anxiety; a sense of impending doom</td>
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<tr>
<td>- Irritating, persistent dry cough</td>
<td></td>
<td>- Cyanosis or pallor around the lips</td>
<td>- Gastrointestinal problems, including nausea, vomiting, or abdominal cramps</td>
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<tr>
<td>- Hoarseness</td>
<td></td>
<td>- Warm, tingling feeling in the face, mouth, chest, feet, and hands</td>
<td>- Headache</td>
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<td>- Rapid, labored, or noisy respirations</td>
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<td></td>
<td>- Itchy, watery eyes</td>
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<tr>
<td>- Wheezing and/or stridor (which may progress to a silent chest with anaphylaxis; late sign)</td>
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<td></td>
<td>- Dizziness</td>
</tr>
</tbody>
</table>

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History Taking (3 of 4)

- SAMPLE history
- If possible, ask the following questions:
  - Have any interventions already been completed?
  - Has the patient experienced a severe allergic reaction in the past?
• Be alert for any statements regarding ingestion of foods that cause allergic reactions.

• Ask about gastrointestinal complaints (nausea or vomiting).
Secondary Assessment (1 of 3)

- Physical examination
  - Includes a systemic head-to-toe or focused assessment
  - Auscultate for abnormal breath sounds:
    - Wheezing or stridor
  - Inspect the skin
    - Swelling, rashes, or urticaria
Secondary Assessment (2 of 3)

• Physical examination (cont’d)
  – Assess baseline vital signs
    • Pulse and respiratory rates
    • Blood pressure
    • Pupillary response
    • Oxygen saturation
  – Skin signs may be unreliable.
Secondary Assessment (3 of 3)

• Monitoring devices
  – Pulse oximetry can be a useful method to assess the patient’s perfusion status.
  – Decision to apply oxygen should be based on:
    • Airway patency
    • Work of breathing
    • Abnormal lung sounds
• Repeat the primary assessment, reassess the patient’s vital signs, and repeat the focused physical exam.

  – If patient is unstable, reassess every 5 minutes; if stable, every 15 minutes.
  – Deterioration of the patient’s condition could be rapid and fatal.
  – Monitor the patient’s anxiety level/mental status.
  – Watch for signs of shock.
Interventions

- Determine the severity of the reaction.
- Mild reactions require supportive care and monitoring.
- Anaphylaxis requires epinephrine and ventilatory support.
- Transport to a medical facility.
- Recheck your interventions.
Reassessment (3 of 3)

• Communication and documentation
  – Documentation should include:
    • Signs and symptoms
    • Reasons why you chose to provide the care you did
    • Patient’s response to the treatment
• If patient appears to be having a severe allergic (or anaphylactic) reaction:
  – Administer BLS.
  – Provide prompt transport to the hospital.
• If a stinger is present, scrape the skin with the edge of a sharp, stiff object such as a credit card.

• Do not use tweezers or forceps.
• Wash the area with soap or antiseptic.
• Remove any jewelry from the area.
• Position the injection site below the heart.
• Apply ice or cold packs.
• Be alert for signs of airway swelling and other signs of anaphylaxis.
• Place the patient in supine position, and give oxygen as needed.
• Monitor the patient’s vital signs.
Emergency Medical Care of Immunologic Emergencies
(5 of 9)

• Epinephrine
  – Mimics the sympathetic (fight-or-flight) response
  – Causes the blood vessels to constrict
  – Reverses vasodilation and hypotension
  – Increases cardiac contractility and relieves bronchospasm
  – Rapidly reverses the effects of anaphylaxis
• Epinephrine is prescribed by a physician and comes pre-dosed in an epinephrine injector (EpiPen).

• Your EMS service may or may not allow you to assist the patient in the administration of epinephrine.

• Refer to local protocols or consult medical control.
• All kits should contain a prepared, auto-injectable syringe of epinephrine.

• Adult EpiPen delivers 0.3 mg of epinephrine; infant–child system delivers 0.15 mg
• Side effects of epinephrine:
  – High blood pressure
  – Increased pulse rate
  – Anxiety
  – Cardiac arrhythmias
  – Pallor
  – Dizziness
  – Chest pain
  – Headache
  – Nausea
  – Vomiting
• Do not give epinephrine to:
  – Patients without signs of respiratory compromise or hypotension
  – Those who do not meet the criteria for a diagnosis of anaphylaxis
1. The signs and symptoms of an allergic reaction are caused by the release of:

A. histamine.
B. epinephrine.
C. leukotrienes.
D. both histamine and leukotrienes.
Answer: D

Response: The two chief chemicals released by the body that result in the signs and symptoms of an allergic reaction are histamines and leukotrienes. Epinephrine (adrenaline) is used to treat allergic reactions. Glucagon is a hormone secreted by the pancreas that helps control metabolism.
1. The signs and symptoms of an allergic reaction are caused by the release of:

A. histamine.
   **Rationale:** Histamine is a chemical that, along with leukotrienes, is released to cause an allergic reaction.

B. epinephrine.
   **Rationale:** Epinephrine is used to treat anaphylaxis.
1. The signs and symptoms of an allergic reaction are caused by the release of:

   C. leukotrienes.
   **Rationale:** Leukotrienes are a chemical that is released, along with histamine, to cause an allergic reaction.

   D. both histamine and leukotrienes.
   **Rationale:** Correct answer
2. The negative effects associated with anaphylactic shock are the result of:

A. severe internal fluid loss.
B. inadequate pumping of the heart.
C. vasodilation and bronchoconstriction.
D. the nervous system’s release of adrenaline.
Review

Answer: C

Rationale: Anaphylaxis is an extreme allergic reaction that is life threatening and involves multiple organ systems. In severe cases, anaphylaxis can rapidly result in death. One of the most common signs of anaphylaxis is wheezing, a high-pitched, whistling breath sound that is typically heard on expiration, usually resulting from bronchospasm/bronchoconstriction and increased mucus production.
2. The negative effects associated with anaphylactic shock are the result of:

A. severe internal fluid loss.
   **Rationale:** The body does not lose fluid; blood pools in the dilated circulatory system and causes less blood flow back to the heart.

B. inadequate pumping of the heart.
   **Rationale:** Inadequate pumping is not the problem; the cardiac output is decreased due to poor return to the heart.
2. The negative effects associated with anaphylactic shock are the result of:

C. vasodilation and bronchoconstriction.  
**Rationale:** Correct answer

D. the nervous system’s release of adrenaline.  
**Rationale:** Adrenaline is the treatment for anaphylaxis.
3. You are called to a local baseball park for a 23-year-old man with difficulty breathing. He states that he ate a package of peanuts approximately 30 minutes ago and denies any allergies or past medical history. Your assessment reveals widespread urticaria, tachycardia, and a BP of 90/60 mm Hg. You can hear him wheezing, even without a stethoscope. You should be MOST suspicious of a(n):

A. acute asthma attack.
B. mild allergic reaction.
C. anaphylactic reaction.
D. moderate allergic reaction.
Answer: C

Rationale: The patient’s signs and symptoms indicate an anaphylactic reaction. Signs and symptoms of an anaphylactic reaction include difficulty breathing, urticaria (hives) over large parts of the body, and signs of shock (eg, tachycardia, hypotension). Certain foods, such as shellfish and nuts, may result in a relatively slow onset of symptoms, but the symptoms can become just as severe.
You are called to a local baseball park for a 23-year-old man with difficulty breathing. He states that he ate a package of peanuts approximately 30 minutes ago, and denies any allergies or past medical history. Your assessment reveals widespread urticaria, tachycardia, and a BP of 90/60 mm Hg. You can hear him wheezing, even without a stethoscope. You should be MOST suspicious of a(n):

A. acute asthma attack.

**Rationale:** Asthma presents with difficulty breathing, but patients will not have urticaria (hives).
3. You are called to a local baseball park for a 23-year-old man with difficulty breathing. He states that he ate a package of peanuts approximately 30 minutes ago, and denies any allergies or past medical history. Your assessment reveals widespread urticaria, tachycardia, and a BP of 90/60 mm Hg. You can hear him wheezing, even without a stethoscope. You should be MOST suspicious of a(n):

B. mild allergic reaction.

**Rationale:** Mild reactions usually appear with urticaria, itching, and some swelling, but not hypotension and breathing difficulties.
3. You are called to a local baseball park for a 23-year-old man with difficulty breathing. He states that he ate a package of peanuts approximately 30 minutes ago and denies any allergies or past medical history. Your assessment reveals widespread urticaria, tachycardia, and a BP of 90/60 mm Hg. You can hear him wheezing, even without a stethoscope. You should be MOST suspicious of a(n):

   C. anaphylactic reaction.

   **Rationale:** Correct answer
3. You are called to a local baseball park for a 23-year-old man with difficulty breathing. He states that he ate a package of peanuts approximately 30 minutes ago and denies any allergies or past medical history. Your assessment reveals widespread urticaria, tachycardia, and a BP of 90/60 mm Hg. You can hear him wheezing, even without a stethoscope. You should be MOST suspicious of a(n):

D. moderate allergic reaction.

**Rationale:** The designation is mild or severe reaction (anaphylaxis)—not moderate.
4. What is a wheal?

A. A raised, swollen, well-defined area on the skin

B. An area of localized swelling involving the lips, tongue, and larynx

C. Generalized itching or burning that appears as multiple, small, raised areas on the skin

D. An exaggerated immune response to any substance
Answer: A

Rationale: Insect stings and bites can cause a wheal, which is a raised, swollen, well-defined area on the skin. There is no specific treatment for these injuries, although applying ice sometimes makes them less irritating.
4. What is a wheal?

A. A raised, swollen, well-defined area on the skin  
   **Rationale:** Correct answer

B. An area of localized swelling involving the lips, tongue, and larynx  
   **Rationale:** This is the definition of angioedema.
4. What is a wheal?

C. Generalized itching or burning that appears as multiple, small, raised areas on the skin
   **Rationale:** This is the definition of urticaria.

D. An exaggerated immune response to any substance
   **Rationale:** This is the definition of an allergic reaction.
5. You are treating a woman who was stung numerous times by hornets. On assessment, you note that some of the stingers are still embedded in her skin. You should:

A. leave the stingers in place.
B. scrape the stingers from her skin.
C. pull the stingers out with tweezers.
D. cover the stings with tight dressings.
Answer: B

Rationale: Because of the venom left in the sac located at the end of the stinger, you should not grab the stingers in an attempt to remove them. Instead, scrape them off with a rigid object such as a credit card.
5. You are treating a woman who was stung numerous times by hornets. On assessment, you note that some of the stingers are still embedded in her skin. You should:

A. leave the stingers in place. **Rationale:** A stinger will continue to inject venom even when the stinger is no longer attached to the insect.

B. scrape the stingers from her skin. **Rationale:** Correct answer
5. You are treating a woman who was stung numerous times by hornets. On assessment, you note that some of the stingers are still embedded in her skin. You should:

C. pull the stingers out with tweezers.
   **Rationale:** Using tweezers may squeeze more venom into the patient.

D. cover the stings with tight dressings.
   **Rationale:** Remove the stingers—do not leave them in place.
A young male is experiencing signs and symptoms of anaphylactic shock after being stung by a scorpion. His level of consciousness is diminished, his breathing is severely labored, you can hear inspiratory stridor, and his face is cyanotic. The patient has a prescribed epinephrine auto-injector. What should you do first?

A. Assist him in administering his epinephrine.
B. Apply high-flow oxygen via nonrebreathing mask.
C. Provide ventilatory assistance with a bag-valve mask.
D. Elevate his legs and cover him with a warm blanket.
Review

Answer: C

Rationale: The patient is not breathing adequately, as noted by his decreased level of consciousness, severely labored breathing, inspiratory stridor, and cyanosis. Therefore, you should first assist his ventilations with a bag-valve mask. He clearly requires epinephrine, but not before restoring adequate breathing first. Regardless of the situation, a patient’s airway must be patent and his or her breathing must remain adequate at all times.
6. A young male is experiencing signs and symptoms of anaphylactic shock after being stung by a scorpion. His level of consciousness is diminished, his breathing is severely labored, you can hear inspiratory stridor, and his face is cyanotic. The patient has a prescribed epinephrine auto-injector. What should you do first?

A. Assist him in administering his epinephrine.
   **Rationale:** This is part of the treatment, but only after his breathing has been addressed.

B. Apply high-flow oxygen via nonrebreathing mask.
   **Rationale:** Respirations need assistance due to labored breathing and a diminished level of consciousness.
6. A young male is experiencing signs and symptoms of anaphylactic shock after being stung by a scorpion. His level of consciousness is diminished, his breathing is severely labored, you can hear inspiratory stridor, and his face is cyanotic. The patient has a prescribed epinephrine auto-injector. What should you do first?

C. Provide ventilatory assistance with a bag-valve mask.
   **Rationale:** Correct answer

D. Elevate his legs and cover him with a warm blanket.
   **Rationale:** You should treat for shock, but breathing is the first priority.
7. The MOST reliable indicator of upper airway swelling during a severe allergic reaction is:
   A. stridor.
   B. anxiety.
   C. cyanosis.
   D. wheezing.
Answer: A

Rationale: Stridor is a high-pitched sound that is most often heard during inhalation. It indicates swelling of the upper airway. Wheezing, a whistling sound, is caused by narrowed bronchioles; it indicates narrowing or swelling of the lower airway. Anxiety and cyanosis can occur from a variety of causes; they are not exclusive to airway swelling.
7. The MOST reliable indicator of upper airway swelling during a severe allergic reaction is:

A. stridor.  
**Rationale:** Correct answer

B. anxiety.  
**Rationale:** This is typically a symptom of hypoxia or decreased oxygenation to the brain.
7. The MOST reliable indicator of upper airway swelling during a severe allergic reaction is:

C. cyanosis.  
**Rationale:** This is a sign of hypoxia and inadequate tissue perfusion.

D. wheezing.  
**Rationale:** This is a sign of lower airway constriction or narrowing.
8. The most common trigger of anaphylaxis is:
   A. plants.
   B. chemicals.
   C. medications.
   D. food.
Answer: D

Rationale: Foods such as shellfish and peanuts are the most common triggers of anaphylaxis. These foods account for 30% of deaths from anaphylaxis, especially in adolescents and young adults.
8. The most common trigger of anaphylaxis is:
   
   A. plants.  
   **Rationale:** Although plants can cause a severe anaphylactic reaction, they are a less common trigger compared to food.

   B. chemicals.  
   **Rationale:** While several chemicals can cause a severe anaphylactic reaction, they do not lead to as many as food.
8. The most common trigger of anaphylaxis is:

C. medications.
   **Rationale:** Medications are the second most common source of anaphylactic reactions.

D. food.
   **Rationale:** Correct answer
9. The adult EpiPen system delivers _____ mg of epinephrine, and the infant–child system delivers _____ mg.

A. 0.15, 0.3  
B. 0.3, 0.15  
C. 0.15, 0.5  
D. 0.5, 0.2
Answer: B

Rationale: The adult EpiPen system delivers 0.3 mg of epinephrine via an automatic needle and syringe system; the infant–child system delivers 0.15 mg.
Review

9. The adult EpiPen system delivers _____ mg of epinephrine, and the infant–child system delivers _____ mg.

A. 0.15, 0.3
   **Rationale:** This is not the correct dosage.

B. 0.3, 0.15
   **Rationale:** Correct answer

C. 0.15, 0.5
   **Rationale:** This is not the correct dosage.

D. 0.5, 0.2
   **Rationale:** This is not the correct dosage.
10. When administering epinephrine by auto-injector, the EMT should hold the injector in place for:

   A. 5 seconds.
   B. 10 seconds.
   C. 20 seconds.
   D. 30 seconds.
Answer: B

Rationale: When administering epinephrine via auto-injector, push the injector firmly against the thigh until it activates. Hold the injector in place for 10 seconds to ensure that all the medication is injected.
10. When administering epinephrine by auto-injector, the EMT should hold the injector in place for:

A. 5 seconds.
   **Rationale:** The injector should be held in place for 10 seconds.

B. 10 seconds.
   **Rationale:** Correct answer
10. When administering epinephrine by auto-injector, the EMT should hold the injector in place for:

C. 20 seconds.  
**Rationale:** The injector should be held in place for 10 seconds.

D. 30 seconds.  
**Rationale:** The injector should be held in place for 10 seconds.