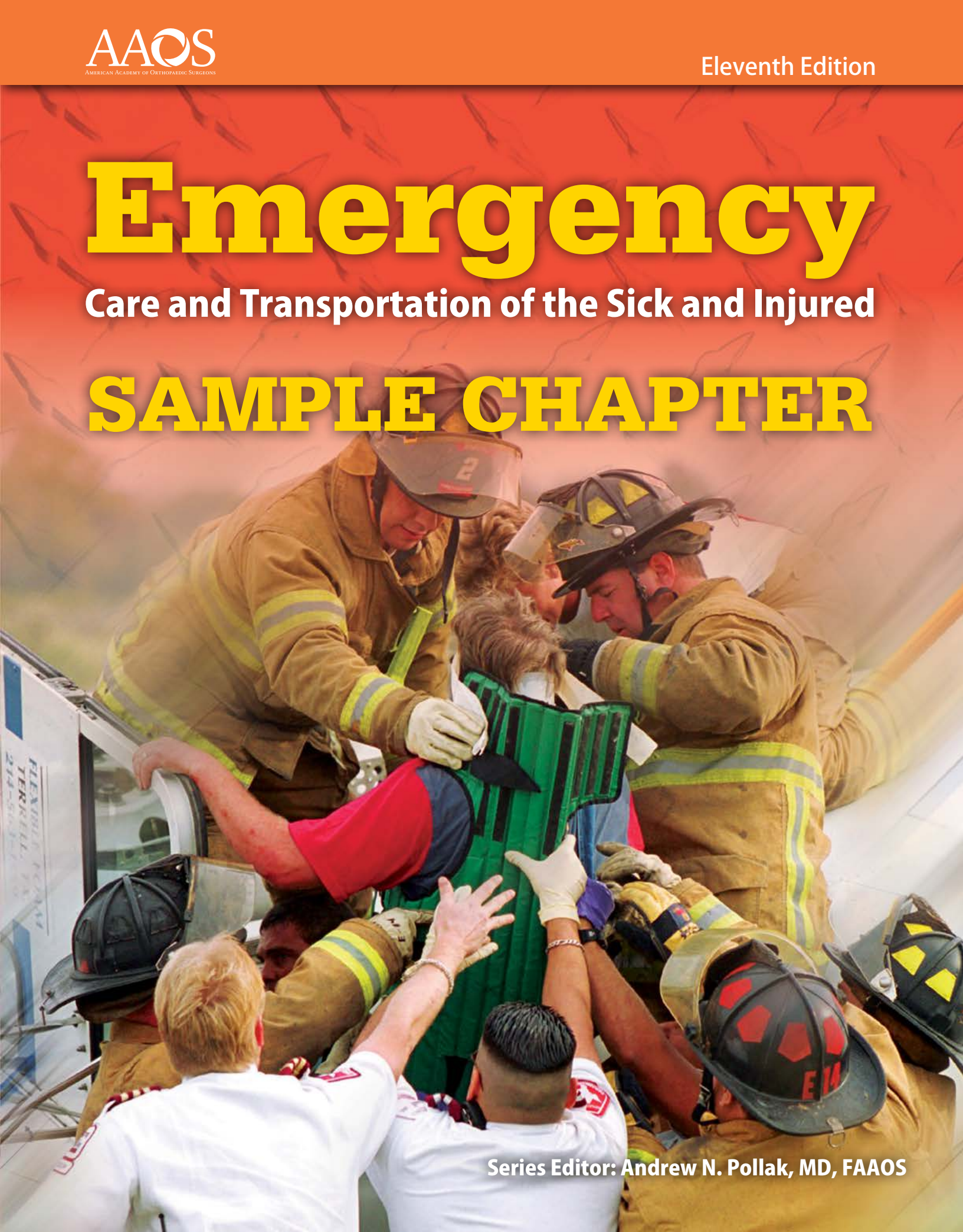
AAOS
American Academy of Orthopaedic Surgeons

Eleventh Edition

Emergency

Care and Transportation of the Sick and Injured

SAMPLE CHAPTER



Series Editor: Andrew N. Pollak, MD, FAAOS

Dear EMS Educator

Welcome to the *Eleventh Edition* of the premier EMT education program! When the American Academy of Orthopaedic Surgeons (AAOS) published the first text for prehospital personnel in 1971, the book quickly set the standard for EMS education. Now the centerpiece of an entire series of educational teaching and learning resources, *Emergency Care and Transportation of the Sick and Injured*—also known as the "Orange Book" for its trademark orange cover—continues to serve as a driving force in EMS education.

The *Eleventh Edition* of *Emergency Care and Transportation of the Sick and Injured* offers instructors and students comprehensive coverage of every competency statement in the *National EMS Education Standards* in an engaging format.

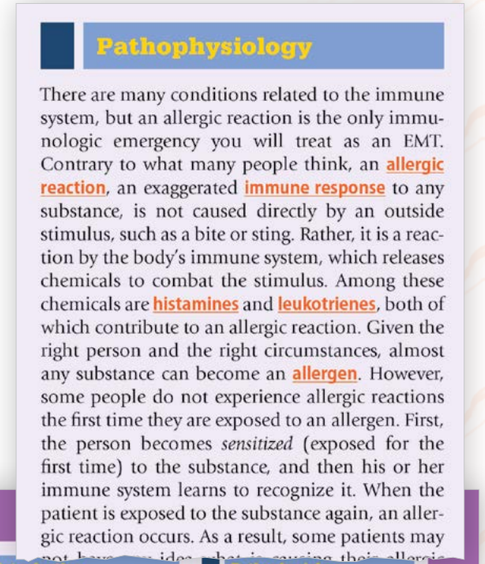
an effect within 1 minute, it is the primary way to save the life of someone having a severe anaphylactic reaction.

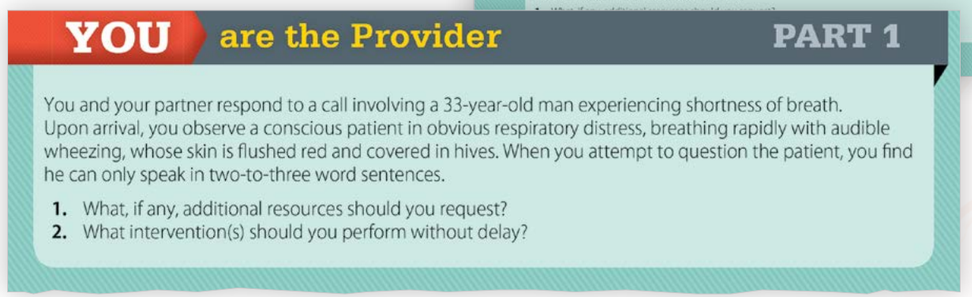
Because epinephrine constricts blood vessels, it may cause the patient's blood pressure to rise significantly. Other side effects include increased pulse rate, anxiety, cardiac arrhythmias, pallor, dizziness, chest pain, headache, nausea, and vomiting. In a life-threatening situation, the administration of epinephrine outweighs the risk of side effects. Remember that *patients who do not exhibit signs of respiratory compromise or hypotension and do not meet the criteria for a diagnosis of anaphylaxis should not be given epinephrine.*

With the *Eleventh Edition*, Students Will Appreciate:

Current, State-of-the-Art Medical Content—
Medicine is constantly changing and prehospital medicine varies across states and regions. The content of the *Eleventh Edition* reflects the guidance and recommendations of an extremely experienced, geographically diverse group of authors. Supporting the efforts of this outstanding group is a team of medical editors from the AAOS. Students can feel confident that their course materials present the most cutting-edge content possible.

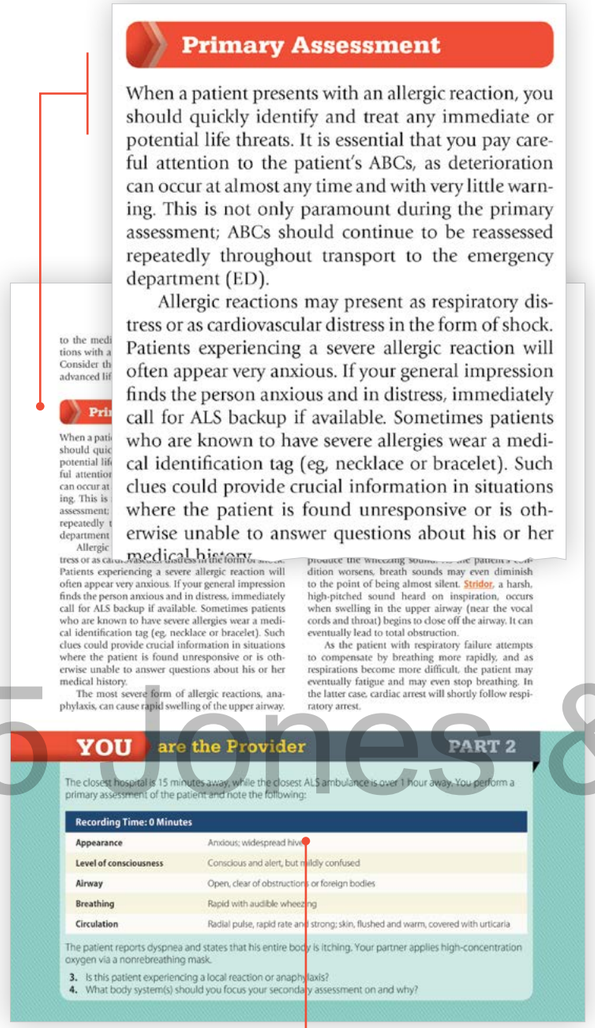
Targeted Reinforcement of Concepts—
Health care education can be complicated, and for many students, the EMT class is their first exposure to anatomy, physiology, medical terminology, and medical care. The *Eleventh Edition* is built on the premise that students need a solid foundation in the basics and then appropriate reinforcement of that content.
For example, Chapter 6, *The Human Body* provides students with a comprehensive understanding of the entire anatomy, physiology, and pathophysiology of the human body. At the beginning of Chapter 16, *Cardiovascular Emergencies*, the text briefly revisits the relevant anatomy, physiology, and pathophysiology of the cardiovascular system, thus solidifying this knowledge in the students' minds and offering them context when studying specific emergencies.





The *Eleventh Edition* also applies this unique approach of concept reinforcement to **Patient Assessment**. This critical topic is presented in a single, comprehensive chapter, ensuring that students understand patient assessment as a single, integrated process.

This also allows instructors to teach patient assessment the way that students will actually practice it in the field. Recognizing the importance of assessment-based care, each medical and trauma chapter reflects the patient assessment algorithm, using the same language and visual cues to strengthen students' command of this process.



Primary Assessment

When a patient presents with an allergic reaction, you should quickly identify and treat any immediate or potential life threats. It is essential that you pay careful attention to the patient's ABCs, as deterioration can occur at almost any time and with very little warning. This is not only paramount during the primary assessment; ABCs should continue to be reassessed repeatedly throughout transport to the emergency department (ED).

Allergic reactions may present as respiratory distress or as cardiovascular distress in the form of shock. Patients experiencing a severe allergic reaction will often appear very anxious. If your general impression finds the person anxious and in distress, immediately call for ALS backup if available. Sometimes patients who are known to have severe allergies wear a medical identification tag (eg, necklace or bracelet). Such clues could provide crucial information in situations where the patient is found unresponsive or is otherwise unable to answer questions about his or her medical history.

The most severe form of allergic reactions, anaphylaxis, can cause rapid swelling of the upper airway.

YOU are the Provider PART 2

The closest hospital is 15 minutes away, while the closest ALS ambulance is over 1 hour away. You perform a primary assessment of the patient and note the following:

Recording Time: 0 Minutes	
Appearance	Anxious; widespread hives
Level of consciousness	Conscious and alert, but mildly confused
Airway	Open, clear of obstructions or foreign bodies
Breathing	Rapid with audible wheezing
Circulation	Radial pulse, rapid rate and strong; skin, flushed and warm, covered with urticaria

The patient reports dyspnea and states that his entire body is itching. Your partner applies high-concentration oxygen via a nonrebreathing mask.

3. Is this patient experiencing a local reaction or anaphylaxis?
4. What body system(s) should you focus your secondary assessment on and why?

Recording Time: 0 Minutes	
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Accessible Content Presented With a Clear, Direct Voice—
The *Eleventh Edition* talks to students; not at them. Each concise chapter creates an accessible learning environment where students achieve a clear understanding and retention of the material. This strong foundation ultimately leads to better pass rates.

Skill Drill 20-1 Using an EpiPen Auto-injector

Step 1
Remove the auto-injector's safety cap, and quickly wipe the thigh with antiseptic, if possible.

Step 2
Place the tip of the auto-injector against the lateral part of the thigh. Push the auto-injector firmly against the thigh until a click is heard. Hold it in place until all the medication has been injected (10 seconds).

Step 3
Rub the area for 10 seconds.

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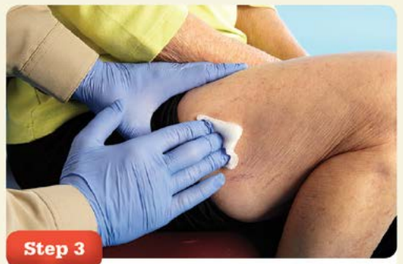
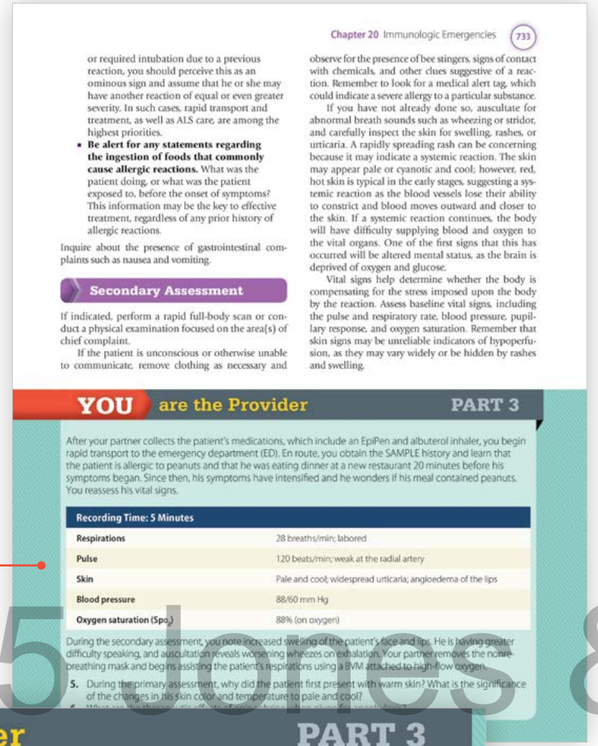


Step 3
Rub the area for 10 seconds.

Clear Application of Material to Real-World EMS Situations— Students who want to become EMTs are focused on learning to help people. They need to know why information is important to learn. "How will this help me in the field?" Through evolving patient case studies in each chapter and additional critical thinking scenarios throughout the program resources, the *Eleventh Edition* gives students a genuine context for the application of knowledge. This approach makes it clear how all of this new information will be used to help them and their patients in the field.



or required intubation due to a previous reaction, you should perceive this as an ominous sign and assume that he or she may have another reaction of equal or even greater severity. In such cases, rapid transport and treatment, as well as ALS care, are among the highest priorities.

- **Be alert for any statements regarding the ingestion of foods that commonly cause allergic reactions.** What was the patient doing, or what was the patient exposed to, before the onset of symptoms? This information may be the key to effective treatment, regardless of any prior history of allergic reactions.

Inquire about the presence of gastrointestinal complaints such as nausea and vomiting.

Secondary Assessment

If indicated, perform a rapid full-body scan or conduct a physical examination focused on the area(s) of chief complaint.

If the patient is unconscious or otherwise unable to communicate, remove clothing as necessary and observe for the presence of bee stingers, signs of contact with chemicals, and other clues suggestive of a reaction. Remember to look for a medical alert tag, which could indicate a severe allergy to a particular substance.

If you have not already done so, auscultate for abnormal breath sounds such as wheezing or stridor, and carefully inspect the skin for swelling, rashes, or urticaria. A rapidly spreading rash can be concerning because it may indicate a systemic reaction. The skin may appear pale or cyanotic and cool; however, red, hot skin is typical in the early stages, suggesting a systemic reaction as the blood vessels lose their ability to constrict and blood moves outward and closer to the skin. If a systemic reaction continues, the body will have difficulty supplying blood and oxygen to the vital organs. One of the first signs that this has occurred will be altered mental status, as the brain is deprived of oxygen and glucose.

Vital signs help determine whether the body is compensating for the stress imposed upon the body by the reaction. Assess baseline vital signs, including the pulse and respiratory rate, blood pressure, pupillary response, and oxygen saturation. Remember that skin signs may be unreliable indicators of hypoperfusion, as they may vary widely or be hidden by rashes and swelling.

YOU are the Provider PART 3

After your partner collects the patient's medications, which include an EpiPen and albuterol inhaler, you begin rapid transport to the emergency department (ED). En route, you obtain the SAMPLE history and learn that the patient is allergic to peanuts and that he was eating dinner at a new restaurant 20 minutes before his symptoms began. Since then, his symptoms have intensified and he wonders if his meal contained peanuts. You reassess his vital signs.

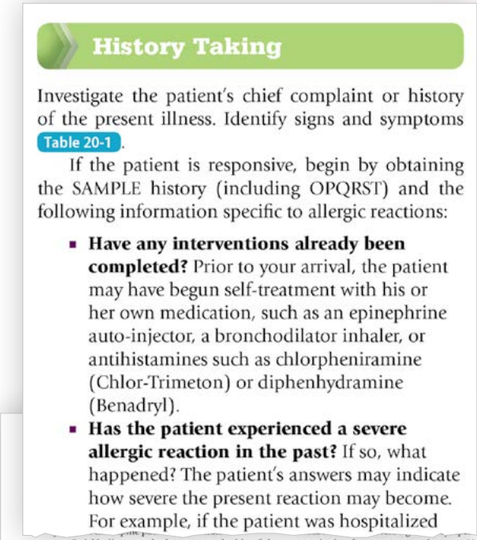
Recording Time: 5 Minutes	
Respirations	28 breaths/min; labored
Pulse	120 beats/min; weak at the radial artery
Skin	Pale and cool; widespread urticaria; angioedema of the lips
Blood pressure	88/60 mm Hg
Oxygen saturation (Spo_2)	88% (on oxygen)

During the secondary assessment, you note increased swelling of the patient's face and lips. He is having greater difficulty speaking, and auscultation reveals worsening wheezes on exhalation. Your partner removes the nonrebreathing mask and begins assisting the patient's respirations using a BVM attached to high-flow oxygen.

5. During the primary assessment, why did the patient first present with warm skin? What is the significance of the changes in his skin color and temperature to pale and cool?
6. What are the therapeutic effects of epinephrine when given for anaphylaxis?

Educators Will Appreciate:

A Textbook that Reflects the Expertise of its Author Team— The *Eleventh Edition* authors are seasoned EMS practitioners with decades of experience in both the care of patients in the prehospital setting and the education of future EMS practitioners.



History Taking

Investigate the patient's chief complaint or history of the present illness. Identify signs and symptoms Table 20-1.

If the patient is responsive, begin by obtaining the SAMPLE history (including OPQRST) and the following information specific to allergic reactions:

- **Have any interventions already been completed?** Prior to your arrival, the patient may have begun self-treatment with his or her own medication, such as an epinephrine auto-injector, a bronchodilator inhaler, or antihistamines such as chlorpheniramine (Chlor-Trimeton) or diphenhydramine (Benadryl).
- **Has the patient experienced a severe allergic reaction in the past?** If so, what happened? The patient's answers may indicate how severe the present reaction may become. For example, if the patient was hospitalized

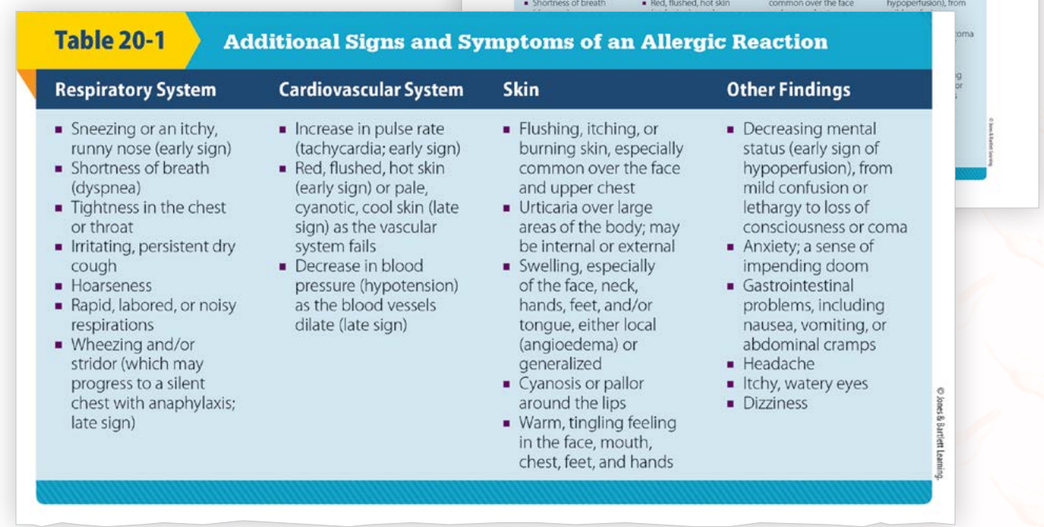
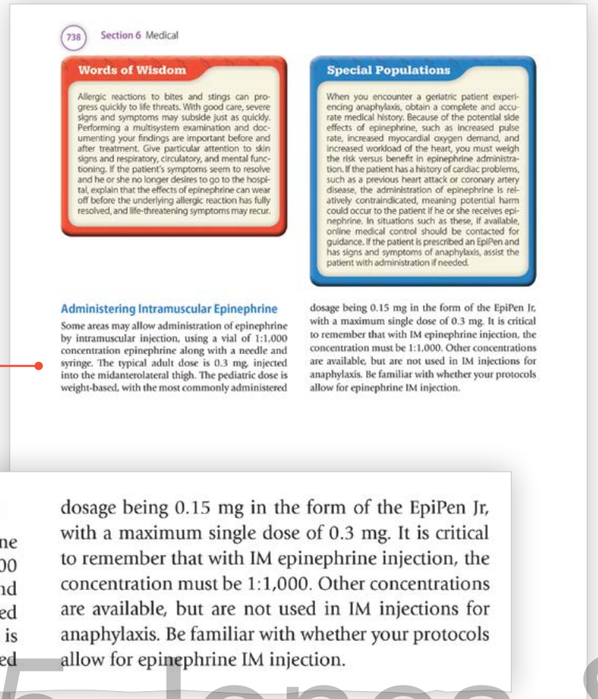


Table 20-1 Additional Signs and Symptoms of an Allergic Reaction

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

Current, State-of-the-Art Medical Content—
EMS has long struggled to prove that the care delivered in the field has real impact on patients' lives. The *Eleventh Edition* incorporates evidence-based medical concepts to ensure that students are taught assessment and treatment modalities that will help patients today—not simply recycle what has been taught year after year.


738 Section 6 Medical

Words of Wisdom

Allergic reactions to bites and stings can progress quickly to life threats. With good care, severe signs and symptoms may subside just as quickly. Performing a multisystem examination and documenting your findings are important before and after treatment. Give particular attention to skin signs and respiratory, circulatory, and mental functioning. If the patient's symptoms seem to resolve and he or she no longer desires to go to the hospital, explain that the effects of epinephrine can wear off before the underlying allergic reaction has fully resolved, and life-threatening symptoms may recur.

Special Populations

When you encounter a geriatric patient experiencing anaphylaxis, obtain a complete and accurate medical history. Because of the potential side effects of epinephrine, such as increased pulse rate, increased myocardial oxygen demand, and increased workload of the heart, you must weigh the risk versus benefit in epinephrine administration. If the patient has a history of cardiac problems, such as a previous heart attack or coronary artery disease, the administration of epinephrine is relatively contraindicated, meaning potential harm could occur to the patient if he or she receives epinephrine. In situations such as these, if available, online medical control should be contacted for guidance. If the patient is prescribed an EpiPen and has signs and symptoms of anaphylaxis, assist the patient with administration if needed.

Administering Intramuscular Epinephrine

Some areas may allow administration of epinephrine by intramuscular injection, using a vial of 1:1,000 concentration epinephrine along with a needle and syringe. The typical adult dose is 0.3 mg, injected into the midanterolateral thigh. The pediatric dose is weight-based, with the most commonly administered dosage being 0.15 mg in the form of the EpiPen Jr, with a maximum single dose of 0.3 mg. It is critical to remember that with IM epinephrine injection, the concentration must be 1:1,000. Other concentrations are available, but are not used in IM injections for anaphylaxis. Be familiar with whether your protocols allow for epinephrine IM injection.

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This new edition has been carefully correlated to the latest standards and expert guidance documents, including the National Model EMS Clinical Guidelines (National Association of State EMS Officials), the American College of Surgeons' Committee on Trauma recommendations, the National Registry of Emergency Medical Technicians' Psychomotor Examination Skill Sheets, and the *2015 ECC/CPR Guidelines*.


Chapter 20 Immunologic Emergencies 739

YOU are the Provider

1. **What, if any, additional resources should you request?**

You should consider requesting the response of an advanced life support (ALS) unit. Consider the time it will take to reach the nearest hospital versus the time needed to rendezvous with an ALS unit, the feasibility of requesting transport by helicopter, etc. Understand and follow your local protocols.

2. **What intervention(s) should you perform without delay?**

Because the patient's respiratory distress is an immediate life threat, providing high-concentration oxygen is the first action you should take.

3. **Is this patient experiencing a local reaction or anaphylaxis?**

The presence of widespread urticaria (hives) indicates that the patient is experiencing a systemic allergic reaction. Systemic reactions vary in severity and can range from diffuse (widespread) hives and itching to cardiovascular collapse and death.

A local reaction is characterized by tenderness, redness, itching, and swelling at and immediately adjacent to the bite or sting. In many cases, the reaction is not "allergic" in nature—it is simply irritation and inflammation that is caused by the bite or sting itself.

It is important to perform a careful and thorough assessment of patients who are exposed to something to which they have a confirmed allergy. A seemingly local and mild reaction can become systemic and severe within a matter of minutes.

4. **What body system(s) should you focus your secondary assessment on and why?**

Further assessment of the patient should focus on body systems that are commonly affected by an allergic reaction—the respiratory and circulatory systems and the skin. In most cases, a severe allergic reaction occurs within minutes of exposure; however, it may be delayed for up to an hour in some patients.

Your primary assessment has revealed no immediate threats to your patient's airway, breathing, or circulation; however, the presence of a widespread rash indicates a systemic reaction and warrants a more thorough assessment. As you continue to assess the patient, look for clinical signs that indicate a worsening reaction and be prepared to assist ventilations and treat for shock.

Signs of respiratory system involvement include stridor; an irritating, persistent dry cough; hoarseness; and tightness in the chest or throat.

Signs of circulatory system involvement include tachycardia (initially), followed by pallor, dizziness, and hypotension. A decreasing level of consciousness indicates a decrease in cerebral blood flow; this is usually secondary to vascular dilation and hypotension.

The patient already has widespread hives, and his skin is flushed. However, you should further assess the skin by looking for swelling—especially of the face, tongue, neck, hands, and feet. If the patient reports a warm, tingling feeling in the face, mouth, chest, feet, and hands, this should also be cause for concern.

5. **During the primary assessment, why did the patient first present with warm skin? What is the significance of the changes in his skin color and temperature to pale and cool?**

When vasodilation and increased capillary permeability occur in the early stages of an allergic reaction, fluid leaks out of the bloodstream and into the subcutaneous (fatty) layer of the skin. This causes swelling, redness, warmth, and urticaria of the skin. But as the reaction progresses, bronchoconstriction impairs oxygenation and ventilation, producing hypoxemia. Clinical signs of hypoxemia, include altered mental status, tachycardia, cyanosis, and a low oxygen saturation (Spo_2).

Tachycardia indicates that the body is attempting to compensate for decreased perfusion and hypoxemia by releasing more epinephrine (adrenaline) into the bloodstream to pump more blood to the body's organs, tissues, and cells.

Hypotension occurs because of widespread vasodilation and a decrease in arterial pressure—again, in response to the body's massive release of histamines. As the blood pressure falls, the brain and other vital organs are deprived of oxygen.

6. **What are the therapeutic effects of epinephrine when given for anaphylaxis?**

Epinephrine (adrenaline)—a hormone that is normally produced by the body—works to rapidly increase the heart rate; dilate the bronchioles in the lungs, and raise the blood pressure by constricting the blood vessels. During anaphylaxis, however, the body may not produce enough epinephrine to enable these actions; therefore, epinephrine is administered to compensate for the body's slow response.

SUMMARY

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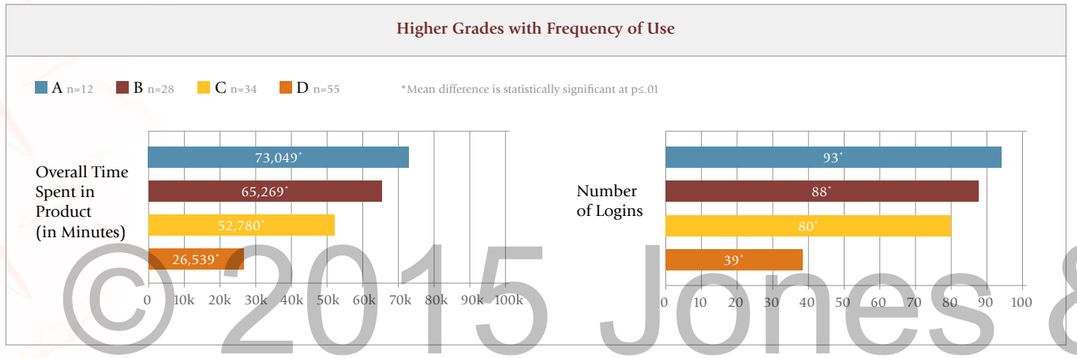
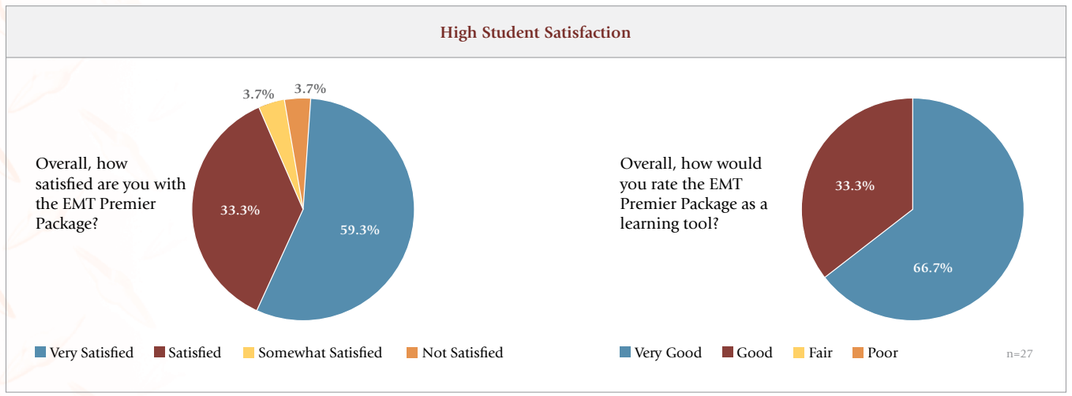


Research shows that students who spent more time in the resources had higher course grades. Overall, instructors and students alike were highly satisfied with the Premier Package and agree that it is an invaluable learning tool.



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CHAPTER 20

Immunologic Emergencies

National EMS Education Standard Competencies

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 (pp 730–738)

Anatomy, physiology, pathophysiology, assessment, and management of

- Hypersensitivity disorders and/or emergencies (pp 727–730)
- Anaphylactic reactions (pp 727–738)

Knowledge Objectives

1. Define the terms allergic reaction and anaphylaxis. (pp 727–729)
2. Explain the difference between a local and a systemic response to allergens. (pp 727, 733)
3. Differentiate the primary assessment for a patient with a systemic allergic or anaphylactic reaction and a local reaction. (pp 731–733)
4. List the five categories of stimuli that could cause an allergic reaction or an extreme allergic reaction. (p 729)
5. Discuss the steps in the primary assessment that are specific to a patient who is having an allergic reaction. (pp 731–732)
6. Explain the importance of managing the ABCs of a patient who is having an allergic reaction. (pp 731–732)
7. Explain the factors involved when making a transport decision for a patient having an allergic reaction. (p 732)
8. Explain the rationale, including communication and documentation considerations, when determining whether to administer epinephrine to a patient who is having an allergic reaction. (pp 734–735)
9. Review the process for providing emergency medical care to a patient who is experiencing an allergic reaction. (pp 734–738)
10. Describe some age-related contraindications to using epinephrine to treat an allergic reaction in a geriatric patient. (p 738)

Skills Objectives

1. Demonstrate how to remove the stinger from a honeybee sting and proper patient management following its removal. (pp 734–735)
2. Demonstrate how to use an EpiPen auto-injector. (pp 736–737, Skill Drill 20-1)

The National EMS Education Standards Competencies along with the chapter's Knowledge Objectives and Skills Objectives are listed at the beginning of each chapter with corresponding page references.

Introduction

Death as a result of allergic reaction is rare, but is possible. As an EMT, you will often respond to calls involving an allergic reaction. When managing allergy-related emergencies, you must be aware of the possibility of acute airway obstruction and cardiovascular collapse and be prepared to treat these life-threatening complications. You must also be able to distinguish between the body's usual response to a sting or bite and an allergic reaction, which may require epinephrine. Your ability to recognize and manage the many signs and symptoms of allergic reactions may be the only thi... between a patient's life and ...

This chapter describes i... of the body's immune syster... ries of stimuli that may provo... in particular, insect bites and ... what to look for in assessin... be having an allergic reactio... them, including administratio...

Reinforcement of the anatomy and physiology presented in Chapter 6, *The Human Body*, occurs throughout the text.

Anatomy and Physiology

The **immune system** protects the human body from substances and organisms that are foreign to the body. Without the immune system for protection, life as you know it would not exist. You would be under constant attack from any type of invader, such as a bacterium or virus, that wanted to make your body a home. Fortunately, most people have immune systems that are well equipped to detect unauthorized visits or invading attacks by foreign substances. Once a foreign substance invades the body, the body goes on alert and initiates a series of responses to inactivate the invader.

Pathophysiology

There are many conditions related to the immune system, but an allergic reaction is the only immunologic emergency you will treat as an EMT. Contrary to what many people think, an **allergic reaction**, an exaggerated **immune response** to any substance, is not caused directly by an outside stimulus, such as a bite or sting. Rather, it is a reaction by the body's immune system, which releases chemicals to combat the stimulus. Among these chemicals are **histamines** and **leukotrienes**, both of which contribute to an allergic reaction. Given the ...ght person and the right circumstances, almost ...y substance can become an **allergen**. However, ...me people do not experience allergic reactions ...e first time they are exposed to an allergen. First, ...e person becomes *sensitized* (exposed for the ...t time) to the substance, and then his or her ...mune system learns to recognize it. When the ...tient is exposed to the substance again, an allergic reaction occurs. As a result, some patients may not have any idea what is causing their allergic reaction—or may not realize they are having one at all—so you must be able to recognize the signs and symptoms and maintain a high index of suspicion. An allergic reaction may be mild and local—characterized by itching, redness, or tenderness—or it may be severe and systemic, a condition known as **anaphylaxis** Figure 20-1.

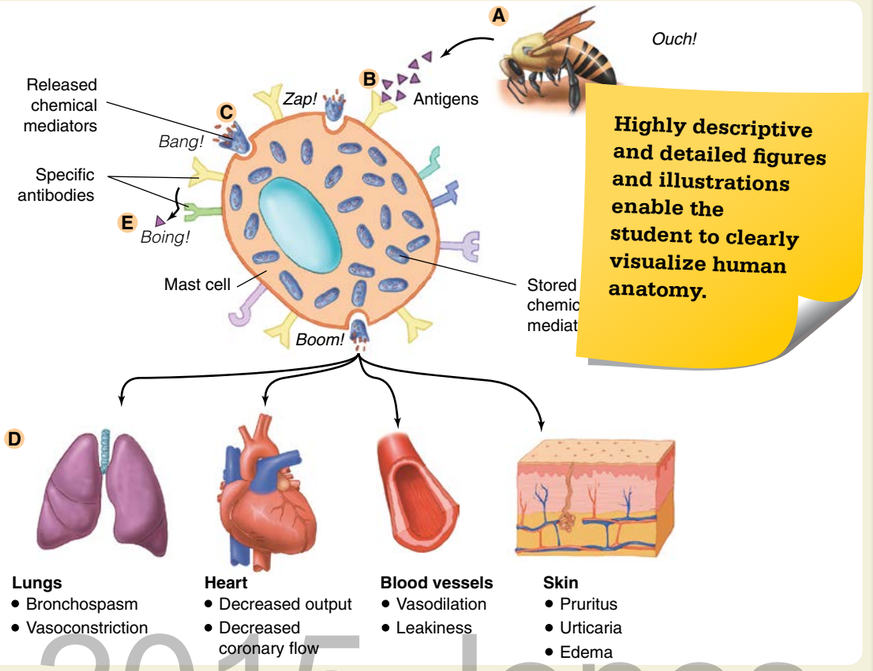
Anaphylaxis is an extreme allergic reaction that is life threatening and involves multiple organ systems. In severe cases, anaphylaxis can rapidly result in shock and death. Two of the most common signs of anaphylaxis are widespread **urticaria**, or hives, small areas of generalized itching or burning that appear as multiple, small, raised areas on the skin Figure 20-2, and **angioedema**, areas of localized swelling Figure 20-3. Another often-observed

YOU are the Provider

You and your partner respond to a call involving a 33-year-old man experiencing ...
Upon arrival, you observe a conscious patient in obvious respiratory distress, bre... wheezing, whose skin is flushed red and covered in hives. When you attempt to ... he can only speak in two-to-three word sentences.

1. What, if any, additional resources should you request?
2. What intervention(s) should you perform without delay?

Progressive case studies capture the student's attention and offer an authentic context for students to apply their knowledge.



Highly descriptive and detailed figures and illustrations enable the student to clearly visualize human anatomy.

Figure 20-1 The sequence of events in anaphylaxis. **A.** The antigen is introduced into the body. **B.** The antigen-antibody reaction at the surface of a mast cell. **C.** The release of mast cell chemical mediators. **D.** Chemical mediators exert their effects on end organs. **E.** Specific antibody reacts with its corresponding antigen.

Figure 20-2 Urticaria, or hives, may appear following exposure to an allergen and is characterized by multiple, small, raised areas on the skin. Urticaria may be one of the warning signs of an impending anaphylactic reaction.

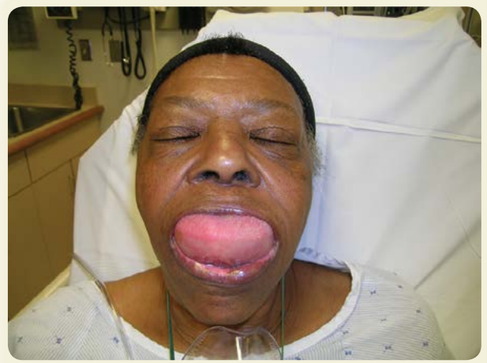


Figure 20-3 Angioedema, localized swelling associated with allergic reactions. If the site of swelling includes the lips, tongue, larynx, or other such structures, airway obstruction may occur.

sign is **wheezing**, a high-pitched, whistling breath sound that is typically heard on expiration, usually resulting from bronchospasm/bronchoconstriction and increased mucus production. You may also note hypotension due to vasodilation, as well as increased capillary permeability (wherein fluid from the bloodstream seeps into the tissues). One symptom that is often overlooked in patients experiencing an allergic reaction is persistent gastrointestinal dysfunction (eg, nausea, vomiting, and abdominal cramps).

Common Allergens

The most common allergens fall into one of the following five general categories:

- **Food.** Certain foods, such as shellfish and peanuts, may be the most common trigger of anaphylaxis. These foods account for 30% of deaths from anaphylaxis, most commonly in adolescents and young adults. Symptoms of a food allergy may take more than 30 minutes to appear and may not include the presence of skin signs, such as hives. However, the reaction can be quite severe and involve the respiratory and/or cardiovascular systems. It is possible for a patient to be unaware of the exposure; for example, a person allergic to peanuts may eat something without knowing that one of the ingredients is peanuts.
- **Medication.** The second most common source of anaphylactic reactions is medication, particularly antibiotics (eg, penicillin) and nonsteroidal anti-inflammatory drugs (NSAIDs). If the medication is injected, the reaction may be immediate (within 30 minutes) and severe Figure 20-4. Reactions to oral medications may take more than 30 minutes to appear, but can also be very severe.
- **Plants.** People who inhale dust, pollen, mold, mildew, or other organic materials to which they are sensitive may experience an allergic reaction. Some common plant allergens include ragweed, ryegrass, maple, and oak.
- **Chemicals.** Certain chemicals, makeup, soap, hair dye, latex, and various other substances can cause severe allergic reactions. Latex is of particular concern to health care providers; patients can be sensitive to it, but so can you! Up to 12% of health care providers will become sensitized to latex. For some, simply being in the same room as someone wearing powdered latex gloves can cause a reaction. It is a good practice to routinely use latex alternatives such as nitrile gloves. Follow your local protocol.
- **Insect bites and stings.** When an insect bites or stings you, the act of injecting its venom is called **envenomation**. Envenomation by a honeybee, wasp, ant, yellow jacket, or hornet may cause a localized reaction, causing swelling and itching at the site, or a severe and systemic reaction (ie, anaphylaxis).

Figure 20-4 A severe allergic reaction to medication.

Insect Stings

There are more than 100,000 species of bees, wasps, and hornets in the world. According to the Cleveland Clinic Center for Continuing Education, approximately 3% of adults and 1% of children are allergic to the venom of these stinging insects, accounting for at least 50 deaths in the United States per year. Deaths from anaphylactic reactions to stinging insects far outnumber deaths from snake bites. In about half of these deaths, the victim had never experienced a reaction to prior stings.

The stinging organ of most bees, wasps, and hornets is a small, hollow spine projecting from the abdomen. Venom can be injected through this spine directly into the skin. The stinger of the honeybee is barbed, so the bee cannot withdraw it Figure 20-5A. Therefore, the bee leaves a part of its abdomen embedded with the stinger and dies shortly after flying away. If the stinger is not removed from the skin (discussed later in this chapter), it can continue to inject venom for up to 20 minutes. Wasps and hornets do not have this handicap; they can sting repeatedly Figure 20-5B. Because these insects usually fly away after stinging, it is often impossible to identify which species was responsible for the injury.

Figure 20-5 Most stinging insects inject venom through a small, hollow spine that projects from the abdomen. **A.** The stinger of the honeybee is barbed; the honeybee cannot withdraw its stinger once it has stung someone. **B.** The wasp's stinger is unbarbed, meaning that it can inflict multiple stings.

(A) © manfredxy/ShutterStock, Inc.; (B) © Heintje Joseph T. Lee/ShutterStock, Inc.

Some ants, especially the fire ant (Figure 20-6A), also strike repeatedly, injecting a particularly irritating **toxin**, or poison, at the bite sites. It is not uncommon for a patient to rapidly sustain multiple ant bites, usually on the feet and legs (Figure 20-6B).

Signs and symptoms of insect stings and bites include sudden pain, swelling, localized heat, widespread urticaria, and redness in light-skinned people, usually at the site of injury. There may be itching and sometimes a **wheal**, which is a raised, swollen, well-defined area on the skin (Figure 20-7). Applying ice sometir[...]ing. The swelling ass[...] may be dramatic and s[...] patient or to you. How[...]ifestations remain loc[...] serious.

Covers scene safety, mechanism of injury/nature of illness, standard precautions, number of patients, c-spine stabilization, and additional resources.

In more severe (ana[...] experience bronchospas[...]ness and coughing, dysp[...] complaints, and hypote[...]tory failure occurs. If unt[...] reac-tion can proceed rapidly [...]re than two-thirds of patients who die of anaphylaxis do so within the first 30 minutes, so rapid treatment and transport is essential.

Figure 20-6 **A.** The fire ant. **B.** Fire ants inject an irritating toxin at multiple sites. Bites are generally found on the feet and the legs and appear as multiple small, raised pustules.

(A) Courtesy of Scott Bauer/USDA; (B) © Scott Camazine/Alamy.

Figure 20-7 A wheal is a whitish, firm elevation of the skin that occurs after an insect sting or bite.

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Patient Assessment of an Immunologic Emergency

Scene Size-up

First and foremost, ensure the scene is safe. The patient's environment or recent activity may indicate the source of the reaction, such as a sting or bite from an insect, a food allergy at a restaurant, or a new medication. A respiratory problem reported by dispatch may be an allergic reaction, but until a field impression of allergic reaction is firmly established, be mindful of other potential causes of respiratory distress as well. Do not neglect the possibility that traumatic injury may also be present, secondary to the medical emergency. 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

When a patient presents with an allergic rea[...] should quickly identify and treat any imm[...] potential life threats. It is essential that you[...] ful attention to the patient's ABCs, as det[...] can occur at almost any time and with very l[...]ing. This is not only paramount during th[...] assessment; ABCs should continue to be [...] repeatedly throughout transport to the e[...] department (ED).

Discusses the general impression; treatment of life threats; airway, breathing, and circulation considerations; and determination of transport priority.

Allergic reactions may present as respi[...]tress or as cardiovascular distress in the form[...] Patients experiencing a severe allergic rea[...] often appear very anxious. If your general impression finds the person anxious and in distress, immediately call for ALS backup if available. Sometimes patients who are known to have severe allergies wear a medical identification tag (eg, necklace or bracelet). Such clues could provide crucial information in situations where the patient is found unresponsive or is otherwise unable to answer questions about his or her medical history.

The most severe form of allergic reactions, anaphylaxis, can cause rapid swelling of the upper airway. You may have only a few minutes to assess the airway and provide lifesaving measures; however, not all allergic reactions are anaphylactic reactions. So, work quickly to assess the patient to determine the severity of the symptoms and the number of body systems affected.

Quickly assess for increased work of breathing, use of accessory muscles, head bobbing, tripod posi[...]l flaring, and abnormal breath sounds. [...]eezing occurs because of narrowing of [...]es, which is mainly the result of con[...]uscles around the bronchioles in reac[...]rgen, and mobilization of mucus in an [...]ush out" the allergen. Exhalation, nor[...]ive, relaxed part of breathing, becomes [...] patient tries to cough up the secretions [...]ast the constricted airways. The fluid in [...]es and the constricted bronchi together [...]e wheezing sound. As the patient's con[...]worsens, breath sounds may even diminish to the point of being almost silent. **Stridor**, a harsh, high-pitched sound heard on inspiration, occurs when swelling in the upper airway (near the vocal cords and throat) begins to close off the airway. It can eventually lead to total obstruction.

As the patient with respiratory failure attempts to compensate by breathing more rapidly, and as respirations become more difficult, the patient may eventually fatigue and may even stop breathing. In the latter case, cardiac arrest will shortly follow respiratory arrest.

YOU are the Provider — PART 2

The closest hospital is 15 minutes away, while the closest ALS ambulance is over 1 hour away. You perform a primary assessment of the patient and note the following:

Recording Time: 0 Minutes	
Appearance	Anxious; widespread hives
Level of consciousness	Conscious and alert, but mildly confused
Airway	Open, clear of obstructions or foreign bodies
Breathing	Rapid with audible wheezing
Circulation	Radial pulse, rapid rate and strong; skin, flushed and warm, covered with urticaria

The patient reports dyspnea and states that his entire body is itching. Your partner applies high-concentration oxygen via a nonrebreathing mask.

3. Is this patient experiencing a local reaction or anaphylaxis?
4. What body system(s) should you focus your secondary assessment on and why?

Assist the patient into a comfortable position, generally in a high-Fowler position to maximize ventilations. This will help oxygenate the brain while easing respiratory effort. If signs of shock emerge, the patient should be placed in the supine position as tolerated.

Quickly listen to the lungs and chest. Do not hesitate to initiate oxygen therapy. For a patient in severe respiratory distress, you may have to assist ventilations with a bag-valve mask (BVM), attached to a high-concentration of oxygen. This can be done in an unresponsive patient or a patient with an altered level of consciousness. The positive-pressure ventilations you provide will force air beyond the swelling in the airway and into the lungs while you await more definitive treatment.

Although respiratory complaints are most common, some patients in anaphylaxis may not present with severe respiratory symptoms but primarily with signs and symptoms of circulatory distress, such as hypotension. Palpating for the presence and quality of a radial pulse will help you quickly identify how the circulatory system is responding to the reaction.

Assess for a rapid pulse rate; pale, cool, cyanotic or red, moist skin; and delayed capillary refill, all of which may indicate hypoperfusion. Treatment for shock includes oxygen, proper positioning, (ie, recumbent or supine as tolerated), and preventing the loss of body heat. The definitive treatment for shock resulting from anaphylaxis is epinephrine.

Investigation of the chief complaint and obtaining a SAMPLE history to gain a more complete picture of the patient's signs and symptoms.

If anaphylaxis is suspected, or if a relatively mild allergic reaction appears to be worsening, immediate transport is warranted. Before leaving the scene, be sure to take along the patient's medications (eg, auto-injectors and inhalers). If the patient is calm and does not exhibit severe signs and symptoms, consider continuing the assessment at the scene. However, if in doubt, always err on the side of emergency transport.

History Taking

Investigate the patient's chief complaint or history of the present illness. Identify signs and symptoms Table 20-1.

If the patient is responsive, begin by obtaining the SAMPLE history (including OPQRST) and the following information specific to allergic reactions:

- **Have any interventions already been completed?** Prior to your arrival, the patient may have begun self-treatment with his or her own medication, such as an epinephrine auto-injector, a bronchodilator inhaler, or antihistamines such as chlorpheniramine (Chlor-Trimeton) or diphenhydramine (Benadryl).
- **Has the patient experienced a severe allergic reaction in the past?** If so, what happened? The patient's answers may indicate how severe the present reaction may become. For example, if the patient was hospitalized or required intubation due to a previous reaction, you should perceive this as an ominous sign and assume that he or she may have another reaction of equal or even greater severity. In such cases, rapid transport and treatment, as well as ALS care, are among the highest priorities.
- **Be alert for any statements regarding the ingestion of foods that commonly cause allergic reactions.** What was the patient doing, or what was the patient exposed to, before the onset of symptoms? This information may be the key to effective treatment, regardless of any prior history of allergic reactions.

Inquire about the presence of gastrointestinal complaints such as nausea and vomiting.

Tables organize information so students can quickly locate and retain critical information.

Table 20-1 Additional Signs and Symptoms

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

Depending on whether the patient has a medical or trauma emergency, these sections discuss how to most appropriately assess the specific patient conditions or injuries for optimal treatment and transport time, and how to use relevant monitoring devices.

Secondary Assessment

If indicated, perform a rapid full-body scan or conduct a physical examination focused on the area(s) of the chief complaint.

If the patient is unconscious or otherwise unable to communicate, remove clothing as necessary and observe for the presence of bee stingers, signs of contact with chemicals, and other clues suggestive of a reaction. Remember to look for a medical alert tag, which could indicate a severe allergy to a particular substance.

If you have not already done so, auscultate for abnormal breath sounds such as wheezing or stridor, ...the skin for swelling, rashes, or ...reading rash can be concerning ...te a systemic reaction. The skin ...yanotic and cool; however, red, ...he early stages, suggesting a sys- ... blood vessels lose their ability ...d moves outward and closer to ...c reaction continues, the body ...upplying blood and oxygen to ... of the first signs that this has ...ed mental status, as the brain is ...nd glucose.

...determine whether the body is ... stress imposed upon the body ...sess baseline vital signs, including ...espiratory rate, blood pressure, pupil- ...sponse, and oxygen saturation. Remember that skin signs may be unreliable indicators of hypoperfusion, as they may vary widely or be hidden by rashes and swelling.

YOU are the Provider PART 3

After your partner collects the patient's medications, which include an EpiPen and albuterol inhaler, you begin rapid transport to the emergency department (ED). En route, you obtain the SAMPLE history and learn that the patient is allergic to peanuts and that he was eating dinner at a new restaurant 20 minutes before his symptoms began. Since then, his symptoms have intensified and he wonders if his meal contained peanuts. You reassess his vital signs.

Recording Time: 5 Minutes	
Respirations	28 breaths/min; labored
Pulse	120 beats/min; weak at the radial artery
Skin	Pale and cool; widespread urticaria; angioedema of the lips
Blood pressure	88/60 mm Hg
Oxygen saturation (Spo_2)	88% (on oxygen)

During the secondary assessment, you note increased swelling of the patient's face and lips. He is having greater difficulty speaking, and auscultation reveals worsening wheezes on exhalation. Your partner removes the nonrebreathing mask and begins assisting the patient's respirations using a BVM attached to high-flow oxygen.

5. During the primary assessment, why did the patient first present with warm skin? What is the significance of the changes in his skin color and temperature to pale and cool?
6. What are the therapeutic effects of epinephrine when given for anaphylaxis?

In a patient experiencing an allergic reaction, pulse oximetry can be a useful method to assess the patient's perfusion status. However, it is important to remember that pulse oximetry is just another tool in your toolbox. The decision to apply oxygen to a patient experiencing an allergic reaction should be based on a careful assessment of the patient's air- way patency, work of breathing, and abnor- sounds upon auscultation, not solely on t oximetry readings.

Reassessment

Covers how to reassess a patient en route, from repeating the primary assessment, to rechecking and adjusting interventions.

En route to the receiving hospital, repeat the assessment. Reassess vital signs, and repeat a physical examination of the affected body s If the patient is unstable, conduct this reassessment every 5 minutes. If the patient is stable, reassess every 15 minutes. The patient experiencing a suspected allergic reaction should be monitored with vigilance. Deterioration of the patient's condition can be rapid and fatal, so special attention should be given to any signs of airway compromise. The patient's anxiety level and mental status should be monitored as well, as these may provide additional indications of the course of the reaction. Monitor for signs of shock, and, if present, treat immediately.

To treat allergic reactions, you must first identify the severity of the reaction. Mild reactions may only require supportive care and monitoring. On the other hand, anaphylaxis can produce severe or rapidly progressing signs and symptoms, requiring more aggressive treatment, including epinephrine and ventilatory support. In either situation, the patient should be transported to a medical facility for further evaluation.

Recheck your interventions. If you administered epi- hat was the effect? Has the patient's oved? Does the patient need a second member to consult medical control ering any subsequent doses for which already obtained authorization. Also, hat even if the patient experiences the administration of epinephrine, e ED is still warranted, as the medi- t will wear off and the symptoms may

Your documentation should not only include the signs and symptoms found during your assessment, but should also clearly show *why* you chose the care you provided. Finally, be certain to record the patient's response to your treatment.

Emergency Medical Care of Immunologic Emergencies

If the patient appears to be having a severe allergic or anaphylactic reaction, you should administer basic life support and provide prompt transport to the hospital. If the allergic reaction was caused by an insect sting and the stinger is still in place, attempt to remove the

YOU are the Provider PART 4

Per standing orders, you have online medical control authorization to administer epinephrine. After confirming that the EpiPen is prescribed to the patient and is not beyond its expiration date, you administer it in the lateral aspect of his thigh. Then, as you continue transport, you reassess the patient and note the following:

Recording Time: 10 Minutes	
Level of consciousness	Conscious and alert
Respirations	22 breaths/min; less labored; wheezing continues
Pulse	124 beats/min; stronger at the radial artery
Skin	Pink, warm, and dry; hives are still present
Blood pressure	104/66 mm Hg
Spo_2	95% (on oxygen)

7. In addition to the patient's vital signs, what else should you reassess?
8. How often should you reassess this patient?

Figure 20-8 To remove the stinger of a honeybee, gently scrape the skin with the edge of a sharp, stiff object such as a credit card.

stinger by scraping the skin with the edge of a sharp, stiff object such as a credit card Figure 20-8. Do not use tweezers or forceps to remove the stinger because this may squeeze more venom into the wound. Gently wash the area with soap and water or a mild antiseptic. Try to remove any jewelry from the area before swelling begins. Position the injection site slightly below the level of the heart, and apply ice or cold packs to the area. Placing ice over the injury site may slow absorption of the toxin, diminish swelling, and relieve pain, but like any other attempt to reduce swelling with ice, you should be careful not to place the ice pack directly on the skin or leave it in place for too long, as doing so may cause more damage. It is not recommended that ice be placed for longer than 10 minutes at a time.

Be alert for signs of airway swelling and other signs of anaphylaxis such as nausea, vomiting, and abdominal cramps, and do not give the patient anything by mouth. Place the pa tion as indicated, and give ox the patient's vital signs, and further support as needed.

Table 20-2 Epinephrine

Indications	Severe allergic reaction causing airway, breathing, or circulatory compromise or an anaphylactic reaction
Contraindications	None in a life-threatening emergency; however, consult medical control when the patient has a history of heart disease or acute coronary syndrome
Actions	Vasoconstriction and increased cardiac contractility, bronchodilation
Side effects	Tachycardia, sweating, pale skin, dizziness, headache, palpitations
Typical dose	Adults: 0.3 mg (EpiPen) Children: 0.15 mg (EpiPen Jr)

Epinephrine

Key Terms are easily identified and defined within the text. A vocabulary list concludes each chapter, and a comprehensive glossary appears at the end of the textbook.

The body normally produces Epinephrine is a sympatho means it mimics the symp response. Epinephrine has cause the blood vessels to vasodilation and hypotensio ates the diastolic pressure and improves coronary blood flow. Other properties of epinephrine increase cardiac contractility and relieve bronchospasm in the lungs. Because epinephrine has immediate action, it can rapidly reverse the effects of anaphylaxis. Epinephrine is prescribed by a physician and comes predosed in an epinephrine auto-injector (EpiPen). In some EMS systems, you may be authorized to carry epinephrine as part of your regular on-board medications; in others, you may be permitted to help patients self-administer their own medication. Refer to local protocols or consult online medical control.

Administering an Epinephrine Auto-Injector

All allergic emergency kits should contain a prepared, auto-injectable syringe of epinephrine, ready for intramuscular (IM) injection, along with instructions for its use Figure 20-9.

The adult EpiPen system delivers 0.3 mg of epinephrine via a spring-loaded needle and syringe system; the infant-child system (EpiPen Jr) delivers 0.15 mg. The spring-loaded needle automatically injects the epinephrine when the user firmly presses the device into the lateral thigh (thus the term auto-injector). If the patient is known to have an allergy, he or she may carry his or her own EpiPen. If the patient is able to use the auto-injector on his or her own, your role is limited to assisting him or her if needed.

To use, or help the patient use, the auto-injector, you should first receive a direct order from medical control or follow local protocol. Follow standard

Figure 20-9 Patients who experience severe allergic reactions often carry their own prescription epinephrine, which comes predosed in an auto-injector or a prefilled syringe.

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precautions, and make sure the medication has been prescribed specifically for that patient. If it has expired or is discolored, do not give the medication. In such an instance, you should inform medical control, and continue to provide emergency transport.

Once you have done these things, follow the steps in Skill Drill 20-1.

1. Remove the safety cap from the auto-injector, and, if possible, quickly wipe the patient's thigh with alcohol or some other antiseptic Step 1. (Note: though it is best practice to clean the site, do not delay administration of the drug to do so.) If the patient is displaying signs of life-threatening anaphylaxis, it is possible to administer the auto-injector directly through the patient's clothing.
2. Place the tip of the auto-injector against the lateral part of the patient's thigh, midway between the groin and the knee Step 2.
3. Push the injector firmly against the thigh until a click is heard. This indicates that the injector has activated and medication is being administered. Maintain steady pressure to prevent kickback from the spring in the syringe, and prevent the needle from being pushed out of the injection site too soon. Hold the injector in place until the medication has been injected (10 seconds).
4. Remove the injector from the patient's thigh and dispose of it in the proper biohazard container.
5. Rub the area for 10 seconds Step 3.

YOU are the Provider

Following standing orders, you administer a dose of albuterol from the patient's inhaler to treat the bronchospasm responsible for his wheezing. A few minutes later, you reassess and supply your radio report, including the most recent set of vital signs:

Recording Time: 20 Minutes	
Level of consciousness	Conscious and alert
Respirations	18 breaths/min; unlabored; wheezing
Pulse	114 beats/min; strong and regular
Skin	Pink, warm, and dry; scattered hives
Blood pressure	128/72 mm Hg
SpO_2	97% (on oxygen by nonrebreathing mask; patient no longer requires positive-pressure assistance)

You deliver the patient to the ED, where the attending physician asks you how much epinephrine the patient has received.

9. What is the dose and concentration of epinephrine contained in an adult EpiPen?

Progressive case studies introduce patients and follow their progress from dispatch to delivery at the emergency department. The cases become progressively more detailed as new medical information is presented.

Skill Drill 20-1 Using an EpiPen Auto-injector

Step 1

Remove the auto-injector's safety cap, and quickly wipe the thigh with antiseptic, if possible.

Step 2

Place the tip of the auto-injector against the lateral part of the thigh. Push the auto-injector firmly against the thigh until a click is heard. Hold it in place until all the medication has been injected (10 seconds).

Provides a visual summary of important skills and procedures.

Step 3

Rub the area for 10 seconds.

6. Record the time and dose of the injection on your patient care report.
7. Reassess and record the patient's vital signs after using the auto-injector.
8. If the patient's signs and symptoms do not improve after 5 minutes and the patient has another auto-injector, consider assisting the patient with the administration of a second (and final) dose of epinephrine.

Other allergy kits may contain oral or IM antihistamines, agents that block the effect of histamine. These work relatively slowly, within several minutes to 1 hour. Because epinephrine can have an effect within 1 minute, it is the primary way to save the life of someone having a severe anaphylactic reaction.

Because epinephrine constricts blood vessels, it may cause the patient's blood pressure to rise significantly. Other side effects include increased pulse rate, anxiety, cardiac arrhythmias, pallor, dizziness, chest pain, headache, nausea, and vomiting. In a life-threatening situation, the administration of epinephrine outweighs the risk of side effects. Remember that *patients who do not exhibit signs of respiratory compromise or hypotension and do not meet the criteria for a diagnosis of anaphylaxis should not be given epinephrine.*

Words of Wisdom

Allergic reactions to bites and stings can progress quickly to life threats. With good care, severe signs and symptoms may subside just as quickly. Performing a multisystem examination and documenting your findings are important before and after treatment. Give particular attention to skin signs and respiratory, circulatory, and mental functioning. If the patient's symptoms seem to resolve and he or she no longer desires to go to the hospital, explain that the effects of epinephrine can wear off before the underlying allergic reaction has fully resolved, and life-threatening symptoms may recur.

Words of Wisdom provide real-world advice from experienced field providers.

Special Populations

When you encounter a geriatric patient experiencing anaphylaxis, obtain a complete and accurate medical history. Because of the potential side effects of epinephrine, such as increased pulse rate, increased myocardial oxygen demand, and increased workload of the heart, you must weigh the risk versus benefit in epinephrine administration. If the patient has a history of cardiac problems, such as a previous heart attack or coronary artery disease, the administration of epinephrine is relatively contraindicated, meaning potential harm could occur to the patient if he or she receives epinephrine. In situations such as these, if available, online medical control should be contacted for guidance. If the patient is prescribed an EpiPen and has signs and symptoms of anaphylaxis, assist the patient with administration if needed.

Administering In…e

Some areas may allo… …ephrine by intramuscular i… …of 1:1,000 concentration epinephrine along with a needle and syringe. The typical adult dose is 0.3 mg, injected into the midanterolateral thigh. The pediatric dose is weight-based, with the most commonly administered dosage being 0.15 mg in the form of the EpiPen Jr, with a maximum single dose of 0.3 mg. It is critical to remember that with IM epinephrine injection, the concentration must be 1:1,000. Other concentrations are available, but are not used in IM injections for anaphylaxis. Be familiar with whether your protocols allow for epinephrine IM injection.

YOU are the Provider SUMMARY

1. What, if any, additional resources should you request?

You should consider requesting the response of an advanced life support (ALS) unit. Consider the time it will take to reach the nearest hospital versus the time needed to rendezvous with an ALS unit, the feasibility of requesting transport by helicopter, etc. Understand and follow your local protocols.

2. What intervention(s) should you perform without delay?

Because the patient's respiratory distress is an immediate life threat, providing high-concentration oxygen is the first action you should take.

3. Is this patient experiencing a local reaction or anaphylaxis?

The presence of widespread urticaria (hives … that the patient is experiencing a system… reaction. Systemic reactions vary in severity… range from diffuse (widespread) hives and … cardiovascular collapse and death.

A local reaction is characterized by tender… ness, itching, and swelling at and immedia… cent to the bite or sting. In many cases, the… is not "allergic" in nature—it is simply irrit… inflammation that is caused by the bite or sti…

It is important to perform a careful and thorough assessment of patients who are exposed to something to which they have a confirmed allergy. A seemingly local and mild reaction can become systemic and severe within a matter of minutes.

4. What body system(s) should you focus your secondary assessment on and why?

Further assessment of the patient should focus on body systems that are commonly affected by an allergic reaction—the respiratory and circulatory systems and the skin. In most cases, a severe allergic reaction occurs within minutes of exposure; however, it may be delayed for up to an hour in some patients.

Your primary assessment has revealed no immediate threats to your patient's airway, breathing, or circulation; however, the presence of a widespread rash indicates a systemic reaction and warrants a more thorough assessment. As you continue to assess the patient, look for clinical signs that indicate a worsening reaction and be prepared to assist ventilations and treat for shock.

Signs of respiratory system involvement include respirations that become rapid, labored, or noisy; wheezing; stridor; an irritating, persistent dry cough; hoarseness; and tightness in the chest or throat.

Signs of circulatory system involvement include tachycardia (initially), followed by pallor, dizziness, and hypotension. A decreasing level of consciousness indicates a decrease in cerebral blood flow; this is usually secondary to vascular dilation and hypotension.

The patient already has widespread hives, and his skin is flushed. However, you should further assess the skin by looking for swelling—especially of the face, tongue, neck, hands, and feet. If the patient reports a warm, tingling feeling in the face, mouth, chest, feet, and hands, this should also be cause for concern.

5. During the primary assessment, why did the patient first present with warm skin? …e significance of the changes … color and temperature to pale

…ilation and increased capillary permeabil… …e early stages of an allergic reaction, fluid …he bloodstream and into the subcutane… …er of the skin. This causes swelling, redness, … urticaria of the skin. But as the reaction … bronchoconstriction impairs oxygenation …ilation, producing hypoxemia. Clinical signs of …xemia, include altered mental status, tachycardia, cyanosis, and a low oxygen saturation (Spo_2).

Tachycardia indicates that the body is attempting to compensate for decreased perfusion and hypoxemia by releasing more epinephrine (adrenaline) into the bloodstream to pump more blood to the body's organs, tissues, and cells.

Hypotension occurs because of widespread vasodilation and a decrease in arterial pressure—again, in response to the body's massive release of histamines. As the blood pressure falls, the brain and other vital organs are deprived of oxygen.

6. What are the therapeutic effects of epinephrine when given for anaphylaxis?

Epinephrine (adrenaline)—a hormone that is normally produced by the body—works to rapidly increase the heart rate, dilate the bronchioles in the lungs, and raise the blood pressure by constricting the blood vessels. During anaphylaxis, however, the body may not produce enough epinephrine to enable these actions; therefore, epinephrine is administered to compensate for the body's slow response.

Epinephrine does not stop the allergic reaction itself; it reverses the negative effects of bronchoconstriction and vasodilation, which are caused by the reaction.

Progressive case studies are followed by a summary of answers to the critical-thinking questions.

YOU are the Provider SUMMARY (continued)

Therefore, when epinephrine is administered to the patient, it dilates the bronchioles, which improves breathing, and constricts the blood vessels, which increases the blood pressure and improves perfusion.

7. In addition to the patient's vital signs, what else should you reassess?

Ask him if he still feels like he has a lump in his throat; this was likely the result of mild upper airway swelling caused by angioedema and *must* be reassessed. Even though he did not present with obvious external angioedema, you should still reassess his face, lips, tongue, neck, and other parts of his body for swelling.

Auscultate his breath sounds to determine if wheezing is still present. Scattered wheezing may still be heard, even though the patient is not exhibiting any outward signs of respiratory distress.

Reassess his skin to determine if his hives are resolving or if they are still present. In most cases, hives will persist, at least to some degree, following the administration of epinephrine. You will usually notice improvement in the patient's breathing and perfusion status (eg, mental status, blood pressure, peripheral pulse quality) before you see resolution of hives.

8. How often should you reassess this patient?

This patient should be considered high-priority or critical and, therefore, should be reassessed every 5 minutes en route to the receiving facility.

9. What is the dose and concentration of epinephrine contained in an adult EpiPen?

The adult EpiPen contains 0.3 milligrams (mg) of a 1:1,000 concentration for intramuscular injection. A 1:1,000 concentration contains 1 mg of epinephrine per 1 milliliter (mL). Therefore, 0.3 mL contains 0.3 mg of epinephrine—all of which is injected into the patient's thigh.

YOU are the Provider SUMMARY (continued)

EMS Patient Care Report (PCR)

Date: 01-3-16	**Incident No.:** 011709	**Nature of Call:** Shortness of breath		**Location:** 1444 City Park Drive	
Dispatched: 1310	**En Route:** 1310	**At Scene:** 1316	**Transport:** 1322	**At Hospital:** 1339	**In Service:** 1350

Patient Information

Age: 33 **Sex:** M **Weight (in kg [lb]):** 73 kg (160 lb)	**Allergies:** Peanuts; no known drug allergies **Medications:** Prescribed EpiPen and albuterol inhaler **Past Medical History:** Previous allergic reaction to peanuts; required hospitalization **Chief Complaint:** Dyspnea, urticaria, and itching

Vital Signs

Time: 1322	**BP:** 88/60	**Pulse:** 120	**Respirations:** 28	**Spo$_2$:** 88%
Time: 1327	**BP:** 104/66	**Pulse:** 124	**Respirations:** 22	**Spo$_2$:** 95%
Time: 1332	**BP:** 128/72	**Pulse:** 114	**Respirations:** 18	**Spo$_2$:** 97%

EMS Treatment (circle all that apply)

Oxygen @ 15 **L/min via (circle one):** **NC** **(NRM)** **(BVM)**		**(Assisted Ventilation)**	**Airway Adjunct**	**CPR**
Defibrillation	**Bleeding Control**	**Bandaging**	**Splinting**	**Other** (Epinephrine 0.3 mg via EpiPen, albuterol inhaler)

Narrative

Medic 85 responded to a local restaurant where a 33-year-old man presented with dyspnea, generalized urticaria, and itching approximately 20 minutes after eating his meal. The patient was conscious and alert; his airway was patent and his breathing was rapid with audible wheezes. The patient was placed on oxygen via nonrebreathing mask. He stated that he was uncertain whether or not his meal had contained peanuts, a food to which he is severely allergic. He further stated that the last time he ingested a product containing peanuts, he had to be hospitalized. Partner retrieved patient's EpiPen and albuterol inhaler while further assessment was performed. Patient was then placed onto the stretcher, loaded into the ambulance, and transported to the hospital. As assessment continued en route, patient's condition began to deteriorate. He remained conscious, but became confused. He began experiencing increasing respiratory distress, as well as hypotension and a falling oxygen saturation. Auscultation revealed bilateral expiratory wheezing in all lung fields. The patient's face and lips began to show signs of swelling. At that time, the nonrebreathing mask was exchanged for a BVM attached to 15 L/min of oxygen, and his respirations were assisted. Patient denied chest discomfort and other past medical history. The patient was unable to self-administer his EpiPen; therefore, it was given by EMS, following standing orders, in the lateral aspect of his right thigh; dose given was 0.3 mg of 1:1,000 concentration. Reassessment showed that his symptoms had begun to resolve; his mental status had improved and he stated that it was easier to breathe. Blood pressure and oxygen saturation also improved. Hives were still present, although they appeared to be resolving. However, the wheezing continued; thus, per standing orders, the patient was assisted in the administration of his albuterol inhaler. Continued to monitor patient's condition throughout transport; he continued to improve and was delivered to the ED staff without incident. Gave verbal report to charge nurse and returned to service. **End of report**

Prep Kit

Ready for Review

- An allergic reaction is a response to chemicals the body releases to combat certain stimuli, called allergens.
- Allergic reactions occur most of… to five categories of stimuli: foo… plants, chemicals, and insect bit…
- The reaction may be mild and … itching, redness, and tenderness… severe and systemic, including s… ratory failure.
- Anaphylaxis is a life-threatenin… tion mounted by multiple organ… must be treated with epinephrin…
- Wheezing and skin wheals can be signs of anaphylaxis.
- All patients with suspected anaphylaxis require oxygen.
- When assessing a person who may be having an allergic reaction, you should check for flushing, itching, and swelling skin, hives, wheezing and stridor, a persistent cough, a decrease in blood pressure, a weak pulse, dizziness, abdominal cramps, and headache.
- Because epinephrine can have an effect within … ute, it is the primary way to save the life of …one having a severe anaphylactic reaction. …ay help a patient to administer an epi…ine auto-injector (EpiPen) with authori… from medical control.
- …s provide prompt transport to the hospi… any patient who is having an allergic reac… Remember that signs and symptoms can …idly become more severe. Carefully monitor the patient's vital signs en route; be especially alert for airway compromise.

Summarizes chapter content in a comprehensive bulleted list.

Vital Vocabulary

allergen Substance that cause an allergic reaction.

allergic reaction The body's exaggerated immune response to an internal or surface agent.

anaphylaxis An extreme, life-threatening, systemic allergic reaction that may include shock and respiratory failure.

angioedema Localized areas of swelling beneath the skin, often around the eyes and lips, but it can also involve other body areas as well.

envenomation The act of injecting venom.

epinephrine A substance produced by the body (commonly called adrenaline), and a drug produced by pharmaceutical companies that in… pulse rate and blood p… for an anaphylactic rea…

histamines Chemical s… immune system in allerg… sible for many of the … such as vasodilation.

immune response The … stance perceived by the …

immune system The b… …ncludes all of the structures and processes designed to mount a defense against foreign substances and disease-causing agents.

immunology The study of the body's immune system.

leukotrienes Chemical substances that contribute to anaphylaxis; released by the immune system in allergic reactions.

stridor A harsh, high-pitched respiratory sound, generally heard during inspiration, that is caused by partial blockage or narrowing of the upper airway; may be audible without a stethoscope.

toxin A poison or harmful substance.

urticaria Small areas of generalized itching and/or burning that appear as multiple raised areas on the skin; hives.

wheal A raised, swollen, well-defined area on the skin resulting from an insect bite or allergic reaction.

wheezing A high-pitched, whistling breath sound that is most prominent on expiration, and which suggests an obstruction or narrowing of the lower airways; occurs in asthma and bronchiolitis.

Provides a list of key terms and definitions from the chapter.

Assessment in Action

You and your partner are dispatched to 1284 NW 152 Avenue for a child experiencing respiratory distress. On arrival, a frantic woman meets you at the door and begs you to hurry. She informs you that her 12-year-old son was playing in the backyard when he felt a sudden pain on the back of his leg. You ÿnd the child on the back porch, in obvious distress, leaning forward in a chair with his elbows on his knees, struggling to catch his breath. Due to severe dyspnea, he is unable to answer your questions. You also no… …st. Your partner immediately applies a nonrebreathing mask as you complet… child's respirations are rapid and shallow, and his pulse is rapid and thre… …ches of raised red spots on his hands, arms, and face. Your partner condu… …l exam as you obtain vital signs and a SAMPLE history from the mother. W… …gies, the mother tells you the child had a very mild reaction to a bee sting sev… history also includes asthma, anxiety, and a recent fracture of his arm. You… …e heard wheezes in all lung ÿelds and observed additional raised red spots …

A short case study with both critical-thinking and multiple-choice questions allow students to synthesize and apply what they have learned in the chapter.

1. The raised red spots are most likely:
   - **A.** angioedema.
   - **B.** acne.
   - **C.** urticaria.
   - **D.** a fungal infection.
2. What should you do ÿrst?
   - **A.** Administer albuterol.
   - **B.** Transport to the hospital.
   - **C.** Administer epinephrine.
   - **D.** Coach the patient to slow his breathing.
3. What possible chemical is being released into this patient's body during this reaction?
   - **A.** Histamine
   - **B.** Antihistamine
   - **C.** Epinephrine
   - **D.** Glucose
4. Which medication should be administered ÿrst for this patient?
   - **A.** Albuterol
   - **B.** Epinephrine
   - **C.** Acetaminophen (Tylenol)
   - **D.** Diphenhydramine (Benadryl)
5. Your pa… …he hear?
   - **A.** A h… …ound caused by bronchoconstriction
   - **B.** A coarse, low-pitched breath sound heard in patients with chronic mucus in the upper airways
   - **C.** A high-pitched noise heard primarily on inspiration
   - **D.** Crackling, moist breath sounds
6. Your partner notes the presence of a medical alert bracelet around the patient's wrist. What should be done and why?
7. Your partner suggests that, in addition to epinephrine, the two of you should assist the patient in using his albuterol inhaler. How should you respond? Why?
8. Following the administration of epinephrine, the patient reports that his heart is beating "very fast." How should you respond?
9. Besides an allergic reaction, provide an example of another illness or injury you should consider as part of the differential diagnosis.

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