CHAPTER 1

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Advanced Medical Life Support Assessment for the Medical Patient

In this chapter, providers will apply their knowledge of anatomy, physiology, pathophysiology, and epidemiology to the comprehensive, efficient Advanced Medical Life Support (AMLS) assessment process using their clinical reasoning to determine a list of differential diagnoses and formulate management strategies for a variety of medical emergencies.

LEARNING OBJECTIVES

At the conclusion of this chapter, you will be able to:

- Identify safety concerns in prehospital and in-hospital situations compromising the safety of the healthcare providers and patients.
- Understand the AMLS assessment pathway to identify emergent, nonemergent, potential, or actual life-threatening patient presentations.
- Identify the components of the first impression and the elements of the primary survey for patients with a variety of medical emergencies.
- Apply the AMLS assessment pathway to rule in or out differential diagnoses, based on a patient's initial presentation, assessment, and diagnostic findings.
- Integrate the patient's history (OPQRST and SAMPLER), pain assessment, and physical examination and diagnostic findings to determine working diagnoses and treatment interventions.
- Select appropriate diagnostic assessment tools, from basic to advanced, for a variety of medical emergencies.
- Correlate the symptoms of a patient's cardinal presentation to the appropriate body system to assess various emergent and nonemergent potential diagnoses.
- Discuss how cultural awareness can help counter any unconscious prejudices that might impede the assessment process.
- Compare and contrast the assessment concepts of clinical decision making and clinical reasoning.
- Understand the potential impact of cognitive bias on clinical decision making.
- Understand how basic life support (BLS) assessment and treatment combined with advanced life support (ALS) assessment and treatment supports an integrated team approach to patient care.

SCENARIO

EMS responds to a residence to care for an 86-year-old man. Dispatch indicates the patient is experiencing fatigue and feels faint when standing up from a sitting position. This patient was transported twice last week by EMS to the local hospital for vague, but similar complaints. On examination, the patient responds

(*continued*)

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SCENARIO (CONTINUED)

to verbal stimuli. He remains seated in a chair during the assessment and says he is unusually tired and agitated. He is not feeling any better after several days. His body positioning is not concerning, but you notice a walker beside the chair. No difficulty in breathing is noted. He slowly answers questions regarding his current symptoms, but is unsure if he took his medications today. His daughter provides his medications for hypertension and constipation. She tells you that "he takes some sort of blood thinner for an irregular heartbeat." When obtaining vital signs, the EMT and paramedic notice the patient's skin is pale and clammy. The patient's respirations are 22 breaths/min and regular, his blood pressure is 110/84 mm Hg, and his pulse rate is 126 beats/min and irregular. The providers determine differential diagnoses and begin the focused assessment.

- How will the provider's comprehensive assessment be complicated by the patient's age?
- Which conditions are you going to consider as possible diagnoses based on your findings in the primary survey?
- Which additional assessments will you perform based on this patient's chief complaint and the history you have obtained?
- Which concerns might the provider encounter as a result of the age of the patient?

This chapter provides guidance for all levels of healthcare providers on how to apply their knowledge of anatomy, physiology, pathophysiology, and epidemiology to the Advanced Medical Life Support (AMLS) assessment process. An accurate patient assessment relies not only on a provider's foundational knowledge and experience, but also on therapeutic communication techniques, clinical reasoning, and clinical decision-making skills.

An organized, systematic evaluation of the patient's initial presentation, medical history, physical exam findings, and diagnostic test results is essential. These findings help determine the criticality of the patient's condition, working diagnoses, and management strategies. The ability of the healthcare provider to communicate effectively and use clinical reasoning enables the provider to consider all the possible etiologies related to the presenting symptoms. A thorough patient assessment ensures appropriate interventions and better patient outcomes.

It is important to understand the foundation of the AMLS assessment pathway is based on effective therapeutic communication skills, keen clinical reasoning abilities, and expert clinical decision making. BLS and ALS providers working together efficiently as a team enhance the timeliness and quality of care of the patient.

Therapeutic Communication

Therapeutic communication uses various communication techniques and strategies, both verbal and nonverbal, to encourage patients to express how they are feeling and to achieve a positive, empathetic relationship with the patient. Obtaining a comprehensive medical history and being able to perform a thorough physical examination depend on good therapeutic interpersonal communication techniques. To obtain critical information about the patient's condition, BLS and ALS providers need to effectively communicate with the patient, family, bystanders, and the entire healthcare team. The information obtained can often provide clues to help identify the specific injuries sustained or point toward a particular diagnosis.

Effective Verbal and Nonverbal Communication

Effective verbal communication is a dynamic process. According to the Bayer Institute for Health Care Communication, EMS providers carry out four principal communication tasks called the four *E*s: engagement, empathy, education, and enlistment.

- *Engagement* is the connection between you and your patients. You must establish a comfortable rapport with patients in order to keep them calm and elicit a thorough, accurate history. Your words and actions convey your genuine concern. Failing to introduce yourself; grilling patients with aggressive, rapid-fire questions; and interrupting them when they are talking undermines the bond you need to develop and may cause the patient to disengage. When making contact with patients and their loved ones, be sure to introduce yourself, if circumstances allow. Developing a rapport with patients also assists in building their confidence in the healthcare provider and facilitates open communication. Make a positive first impression.

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- *Empathy* refers to your sincere identification with the patient's feelings of anxiety, pain, fear, panic, or loss. Empathy is rooted in a sense of compassion for what the patient is going through. Acknowledge to the patient what you hear and understand by summarizing or paraphrasing the information the patient has shared. Accept what the patient tells you, regardless of the circumstances surrounding the call. Empathy is especially important in situations such as suicide attempts, accidental drug overdoses, and cases of domestic assault. It is a skill that should be matured and improved upon throughout a provider's career.
- *Education* of your patients fortifies your bond by letting them know what is happening and what you are doing. Begin by asking what the patient already knows, and follow up with questions until you have all the information you need. Keep patients informed during the entire call. Describe tests and procedures in simple, straightforward terms, which will help minimize the patient's anxiety.
- *Enlistment* involves encouraging patients to participate in their own care and treatment decisions. When you ask for a patient's consent for treatment, be sure to explain fully any possible side effects or potential adverse outcomes associated with the intervention. For example, before giving the patient a nitroglycerin tablet, explain the purpose of the medication or intervention and that headaches are a frequent side effect of the medication. Explain to the patient how the benefits of the intervention outweigh the risks.

Nonverbal communication, which includes facial expressions, body language, and eye contact, is a powerful form of communication. It is important you are aware of your own body language and the body language of your patients. Your gestures, body movements, and attitude toward the patient are critically important in gaining the trust of each patient and his or her family. Look for nonverbal behaviors (cues), such as facial affect and body positioning, indicating whether the patient feels at ease. These findings can be key indicators of the levels of discomfort, pain, or fear. Keep in mind that patients may present with comorbid conditions complicating assessment and delaying implementation of appropriate management strategies. Patience is essential when such a complex assessment must be made.

Therapeutic communication is a skill developed over time. To assist in developing these skills, the following verbal and nonverbal communication techniques are important to incorporate into your daily interactions:

- Talk with the patient at the patient's eye level and maintain good eye contact while talking. This is especially important with patients who are frightened, hard of hearing, or elderly.
- Speak clearly and slowly. Even if the patient has a hearing impairment, only raise your voice if the patient asks.
- Maintain an open, attentive body position during the interview. Try not to appear rushed or flustered.
- Acknowledge your understanding of what the patient is saying by nodding and paraphrasing the patient's words.
- Avoid distracting mannerisms such as writing while the patient is talking, tapping or clicking a pen, or fidgeting with keys or coins in your pocket.
- Your nonverbal language should reassure patients you are there to help.
- Inform patients of what you and your colleagues are doing and why. Tell them where they are being transported and what to expect when they arrive.
- Ask "what" questions, because "why" questions can sound accusatory to patients and their families.
- Show empathy by acknowledging the patient's pain, distress, anger, and other feelings. Answer the patient's questions to assist in decreasing anxiety and fear.
- Respond to and reinforce empathetic and caring behavior.
- Respect the patient's right to confidentiality by keeping your voice down as much as possible in public or semiprivate settings, such as at the scene and in the receiving facility.
- Protect the patient's modesty by keeping the patient covered as much as possible during the physical examination. Doing so will increase the patient's level of trust in the care you are providing and make the patient more willing to share pertinent health information.
- If you suspect a patient may become violent, interact with the patient in a calm, reassuring manner and call for additional resources. Do not try to handle a violent patient alone.

Communicating in Special Situations

Adjustments in your communication technique or asking for assistance may be required in special situations, such as when sign language is necessary for a deaf patient. As a general rule, communicate with patients using terminology matched to their knowledge and understanding. For example, it may be more appropriate to ask the patient about a history of heart problems rather than asking about previous episodes of myocardial infarction.

Cultural and Language Differences

All healthcare providers encounter patients from diverse cultural backgrounds, including ethnicity, race, religion,

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or sexual orientation. For example, some cultures encourage people to express their emotions, whereas others see it as a sign of weakness. Proximity can indicate acceptance and familiarity, while others may be offended or intimidated. Some providers may consciously or subconsciously force their cultural values onto their patient because they believe their values are better. This attitude can bias your approach to treatment and impair developing a rapport with the patient and family, resulting in ineffective communication or even miscommunication and poor treatment.

In many areas, particularly large urban centers, major segments of the population may not speak English. It would be beneficial for you to learn some common words and phrases in the language spoken. Bilingual family members or bystanders may be able to offer assistance and interpret for you.

Hearing-Impaired Patients

People who are hearing impaired may communicate through sign language, gestures, writing, or lip reading—any or all of which may be difficult to do when they are ill or injured. Some people with deafness have partial speech or hearing. Try to determine what the patient's abilities are to communicate as effectively as possible.

The patient's family members or friends may be able to help. In addition, learning how to ask a few basic questions in sign language, and interpret the answers, can be helpful. You may also be able to exchange written questions and answers with the patient.

Clinical Reasoning

Most healthcare providers would agree that skills proficiency alone cannot ensure quality care. **Clinical reasoning** skills are also essential. Clinical reasoning involves good judgment combined with a knowledge of anatomy, physiology, and pathophysiology seasoned by clinical experience to direct questioning about the patient's complaints. An understanding of the epidemiology of human disease processes is essential for early diagnosis, particularly when the patient's signs and symptoms do not point to an obvious cause. Elements contributing to clinical reasoning are as follows:

- Knowledge in medical sciences
- Ability to gather and organize data
- Ability to focus on specific and multiple data
- Ability to identify medical ambiguity
- Ability to understand relevant/irrelevant data
- Ability to analyze and compare situations
- Ability to explain reasoning

As the interview questions are answered by your patient, you begin to analyze the answers based on your underlying medical knowledge. Once the chief complaint, history of the present illness, past medical history, and review of body systems have been completed, you can begin to formulate a **differential diagnosis**, which is a working hypothesis of the nature of the problem. As historical information, assessment findings, and test results are evaluated, a number of illnesses or conditions can be ruled out. The differential diagnosis therefore becomes narrowed until the provider formulates a **working diagnosis**—the presumed cause of the patient's condition. The working diagnosis becomes a definitive diagnosis pending confirmation by further diagnostic tests, usually performed at the receiving facility.

Scope of Clinical Reasoning

Creation of a mental list of differential diagnoses is not a static process. Vital signs, lung sounds, neurologic examination findings, oxygen saturation measurements, response to interventions, laboratory and radiographic test results, and other information are used to evaluate potential diagnoses. When you are developing differential diagnoses, start with broad possibilities—that is, which body systems might be contributing to the patient's complaint. For example, chest pain could involve the cardiac, respiratory, or gastrointestinal systems. This approach will help you to avoid tunnel vision, which is defined as locking into a diagnosis early before considering all the possibilities. Because chest pain could involve multiple systems, it is important for providers to consider all the possible diagnoses and rule each one out systematically in order to determine a diagnosis.

You should begin by considering the patient's chief complaint. A significant number of illnesses or injuries can be ruled out quickly by just determining the chief complaint. For example, suppose your patient reports chest pain. Your knowledge gives insight into the potential problems causing chest pain. Your differential diagnosis might include heart attack, gastroesophageal reflux, pulmonary embolism, or aortic dissection. A patient reporting chest pain is not likely to have gastrointestinal bleeding; therefore, you can use the chief complaint to immediately narrow the diagnosis. In addition to the chief complaint, the associated signs and symptoms along with the history will narrow the possible causes even further.

The physical exam (discussed in detail later in the chapter) is another important aspect of clinical reasoning. Tenderness or other specific exam findings that point you toward specific anatomic locations can help refine your diagnostic possibilities. Once you are able to identify the possible organ systems involved, you can use your knowledge of pathophysiology to determine the most likely diagnosis.

Of course, clinical reasoning is not an exact science. Just like a scientist, however, you can test your differential

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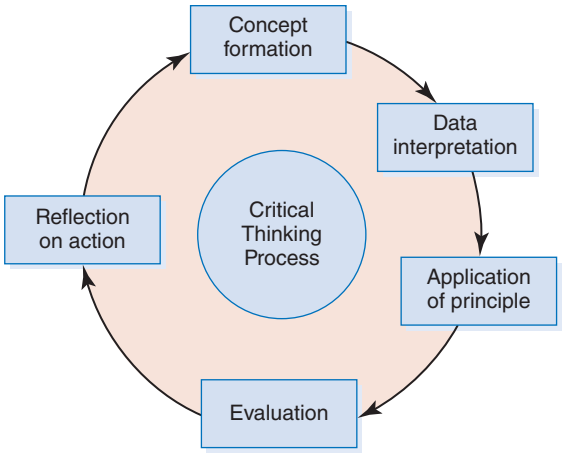


Figure 1-1 Critical thinking process.

Reproduced from Sanders MJ: *Mosby's paramedic textbook, revised reprint*, ed 3, St. Louis, 2007, Mosby.

diagnosis to determine whether it holds true. This is accomplished through further assessment and testing. The process evolves as different questions are asked based on the patient's answers. You may use various diagnostics to test these theories, such as a glucose check or a 12-lead electrocardiogram (ECG). The additional information is combined with the existing knowledge, and your differential diagnosis can be confirmed or modified.

To provide the best quality care for the patient, every provider must possess the core knowledge required in his or her level of training (**Figure 1-1**). This knowledge should be enhanced with experience and common sense to develop reliable clinical reasoning skills. A provider must be able to think and perform quickly and effectively under extreme pressure using critical reasoning to determine an accurate working diagnosis and treatment plan based on patient care protocols or standing orders.

Clinical Decision Making

Clinical decision making is a process in which decisions are made about a patient's healthcare problems and appropriate therapeutic interventions are considered and implemented to improve the patient's outcome. Like clinical reasoning, clinical decision making is an ongoing process that takes place at every stage of care, beginning with the creation of the differential diagnosis. Both require a sufficient knowledge of anatomy, physiology, and pathophysiology; an ability to perform specific assessment skills; and the resourcefulness to apply complex diagnostic tools to a broad range of medical emergencies. Though we are not always conscious of the process, clinical decision-making approaches include the following:

- **Pattern recognition**: a process of recognizing and classifying data (patterns) based on past knowledge and experience. The provider compares the patient's presentation with similar patient presentations previously encountered. Analyzing similar diagnoses and which strategies were effective and which were not is a useful foundation for clinical decision making.
- Hypothesis generation: This can be described as utilizing the scientific method by starting with the patient's chief complaint, generating possible explanations (i.e., the hypotheses), collecting and synthesizing information, and ultimately accepting or rejecting one or more hypotheses.
- **Likelihood and probability** estimates: These influence our processing of the information we collect during patient assessments. For example, we might rule out tropical causes of a chief complaint if we can confidently determine our patient has neither traveled out of the country nor come in contact with anyone who has.
- **Differential diagnoses**: These are integral to the orderly application of the AMLS pathway. We begin by generating an initial differential diagnosis. A differential is a list of potential causes for the patient's condition. It is structured with the most likely cause at the top of the list. The differential is then refined or reorganized as we obtain additional information from the patient's history, physical exam, and diagnostic testing. While we may not be able to completely refine our differential diagnosis down to a single diagnosis, the process of creating, revising, and refining is very helpful to clinical decision making and helps to avoid overlooking a diagnostic possibility.

The combination of well-honed therapeutic communication techniques, the ability to recognize patterns, generation of likely differential diagnoses as hypotheses, assessment of the likelihood of particular diagnoses, and dependable clinical reasoning skills enables prudent clinical decision making, allowing providers to gauge the severity of the patient's illness or injury and initiate appropriate, timely interventions. One's clinical decision-making skills become more and more reliable with experience. However, other processes can interfere with clinical decision making.

Cognitive Bias

Who has not heard an instructor, supervisor, or partner caution you not to "tunnel" on a particular cause or diagnosis? So-called tunnel vision can be attributed to the well-known **cognitive bias** constructs of anchoring bias, confirmation bias, and premature closure (**Table 1-1**). Cognitive scientists have defined two systems that manage our processing of information: intuitive and analytic. The interaction of these two systems of information

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Table 1-1 Common Cognitive Errors

Cognitive Bias Type	Description
Anchoring	The tendency to perceptually lock onto salient features in the patient's initial presentation too early in the diagnostic process and failing to adjust this initial impression in the light of later information.
Confirmation Bias	The tendency to look for confirming evidence to support a diagnosis rather than look for disconfirming evidence to refute it, despite the latter often being more persuasive and definitive.
Premature Closure	The tendency to apply premature closure to the decision-making process, accepting a diagnosis before it has been fully verified.

Modified from Saposnik, G., Redelmeier, D., Ruff, C. C., & Tobler, P. N. (2016). Cognitive biases associated with medical decisions: a systematic review. *BMC Med Inform Decis Mak*, 16(1), 138. doi:10.1186/s12911-016-0377-1

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The Six Rs

1. **R**ead the scene—Observe environmental conditions, safety hazards, and likely mechanisms of injury.
2. **R**ead the patient—Assess the patient's condition, take his or her vital signs, treat life threats, review the chief complaint, and record your general impression.
3. **R**eact—Manage life threats (ABCs) in the order in which they are discovered, and treat the patient based on his or her cardinal presentation.
4. **R**eevaluate—Reassess vital signs, and reconsider the patient's initial medical management.
5. **R**evise management plan—On the basis of your reevaluation and additional historical data, physical examination findings, diagnostic test results, and the patient's response to early interventions, revise your management plan to accord with the patient's new clinical picture.
6. **R**eview performance—Critiquing the call or patient encounter gives you a chance to reflect on your clinical decision making and target areas in which more advanced skills or a deeper level of knowledge is needed.

management can result in cognitive bias. Our intuitive system quickly processes information, connecting and integrating facts, feelings, and observations, often subconsciously, but not necessarily or always leading to objectively correct conclusions. "Trusting your gut" relies upon this intuitive system, and the result can be uncanny accuracy or dismaying error. Our slower analytic system is typically conscious and deliberate, processing stored facts. In an AMLS context, our intuitive system will quickly generate initial diagnoses of varying real-world accuracy, while our analytic system systematically processes the information gathered through patient assessment and diagnostic testing. The interplay of the systems leads us to a treatment path for a particular patient. Hasty action, prompted by our intuitive system, without confirmation by our analytic system, can lead us to nonoptimal approaches to patient care. The AMLS pathway provides a framework for careful, systematic processing of patient information, building on insights gained over time through assessment and treatment of numerous patients.

Cognitive science has also validated the notion that our analytic system can falter under pressure. Using the six *R*s can help the provider put it all together and make better judgments under pressure (Rapid Recall box). The AMLS assessment pathway gives you an efficient process to apply your clinical reasoning and clinical decision-making skills to effectively manage your patients.

AMLS Patient Assessment Pathway

The **Advanced Medical Life Support (AMLS) assessment pathway** is a reliable process for reducing patient morbidity and mortality by identifying a broad range of medical emergencies early and managing them effectively. Determination of an accurate field or in-hospital diagnosis and initiation of a timely, effective management plan hinges on a reliable patient assessment process.

The success of the AMLS pathway depends on the integration of BLS patient assessment and interventions and the early integration of ALS assessment and interventions. Taken together, the patient's initial presentation, history, chief complaint, physical exam findings, and diagnostic results should begin to suggest possible

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diagnoses. For example, if the chief complaint is low back pain, the provider should pursue that lead by asking patients follow-up questions such as:

- Have you recently sustained any injuries?
- Are you having weakness or numbness in your extremities or groin?
- Are you having any bowel or bladder dysfunction?
- Have you had a fever?
- Does the pain seem to move around or radiate anywhere?
- What makes it better or worse?
- Is the pain constant or does it wax and wane?
- Have you experienced these symptoms before?

The presence or absence of pertinent signs and symptoms associated with the initial presentation is equally important. Information gleaned from the patient's answers will help providers prioritize various differential diagnoses by using clinical decision-making skills. When providers have seen what a condition looks like repeatedly, they can identify similarities to past cases almost immediately based on experience. Active listening, generating differential diagnoses, identifying distinguishing signs and symptoms, and recalling past success with specific treatment approaches and considerations provide the basis for evaluation of the current patient's presentation. A healthcare provider's knowledge of pathophysiology and the knowledge gained from patient care experience enhance the effectiveness of this clinical decision-making approach.

As providers talk to the patient to obtain a history and perform a physical exam, they are looking for critical life-threatening and non–life-threatening problems that must be managed within their scope of practice and adherence to medical protocols and guidelines. They are also forming a general impression of the patient's condition. Of course, all findings should be thoroughly documented and clearly communicated to the receiving facility.

The AMLS assessment pathway supports **assessment-based patient management**. This process is not driven by rote performance skills. Instead, the AMLS pathway recognizes that although all components of the assessment process (**Figure 1-2**) are important to patient care, they are conducted based on the patient's unique presentation. For example, if you have a high index of suspicion the patient has sustained an injury, performing a rapid physical exam may be a higher priority than obtaining a past medical history. The history is not omitted, however; it is merely given a lower priority during the assessment process. The opposite is also true. With a medically ill patient it may be more appropriate to immediately obtain a history of the patient's present illness and a past medical history and perform the physical exam en route to the receiving facility. The physical exam and present and past medical history are not segregated entities. They are typically evaluated in tandem.

During the secondary survey, the healthcare provider should follow a dynamic, flexible approach to the patient assessment process. The process should be systematic, but it must remain dynamic and adaptable in order to confirm or eliminate diagnoses as more findings are noted and the patient's therapeutic response is observed.

Although the AMLS assessment pathway supports flexibility in deciding when to obtain specific details of a patient's history and physical exam, one important principle is the initial observations at the scene must be made to ensure the scene is safe before the **primary survey** is performed so any life-threatening medical emergencies can be identified and managed without delay. The discussion of the AMLS pathway that follows reflects the algorithm in Figure 1-2.

Initial Observations

Scene Safety Considerations

Prehospital providers reach the scene or situation before they reach the patient. For prehospital personnel, this gives them a moment to integrate what the dispatcher has stated with their own judicious observation of the scene. The scene and the potential for safety hazards or threats are continually evaluated until patient care has been transferred (**Figure 1-3**). In-hospital environments may also place patients in an unsafe set of circumstances, such as when side rails are left down and the patient has an altered level of consciousness.

Prehospital providers enter the patient's environment, which may be a home, office, or vehicle. Anger or anxiety may be part of the environment, particularly when a stressful event such as an injury or assault has just occurred. The presence of EMS, law enforcement, or fire department personnel may make a violent person feel threatened. Behavioral red flags may precede an angry outburst or assault. Staying alert to potential or real threats of violence is equally as important in any healthcare institution, even if there are security personnel on site. All healthcare personnel must be aware of a gradual acceleration of emotion or concerning behavioral clues, such as pacing, gesturing, and hostile words that indicate an escalation of a dangerous situation.

Before approaching the patient, survey the environment and the patient's affect. This vigilance is essential in prehospital and in-hospital situations. Determine the number of patients, family members, or bystanders present and whether any additional resources are needed, such as more ambulances, law enforcement, and fire or hazardous materials (hazmat) assistance. Evidence of weapons, alcohol, or drug paraphernalia can be an early indicator that the situation is unsafe and law enforcement backup is needed. Assess the situation for assistive devices, such as canes, wheelchairs, and oxygen

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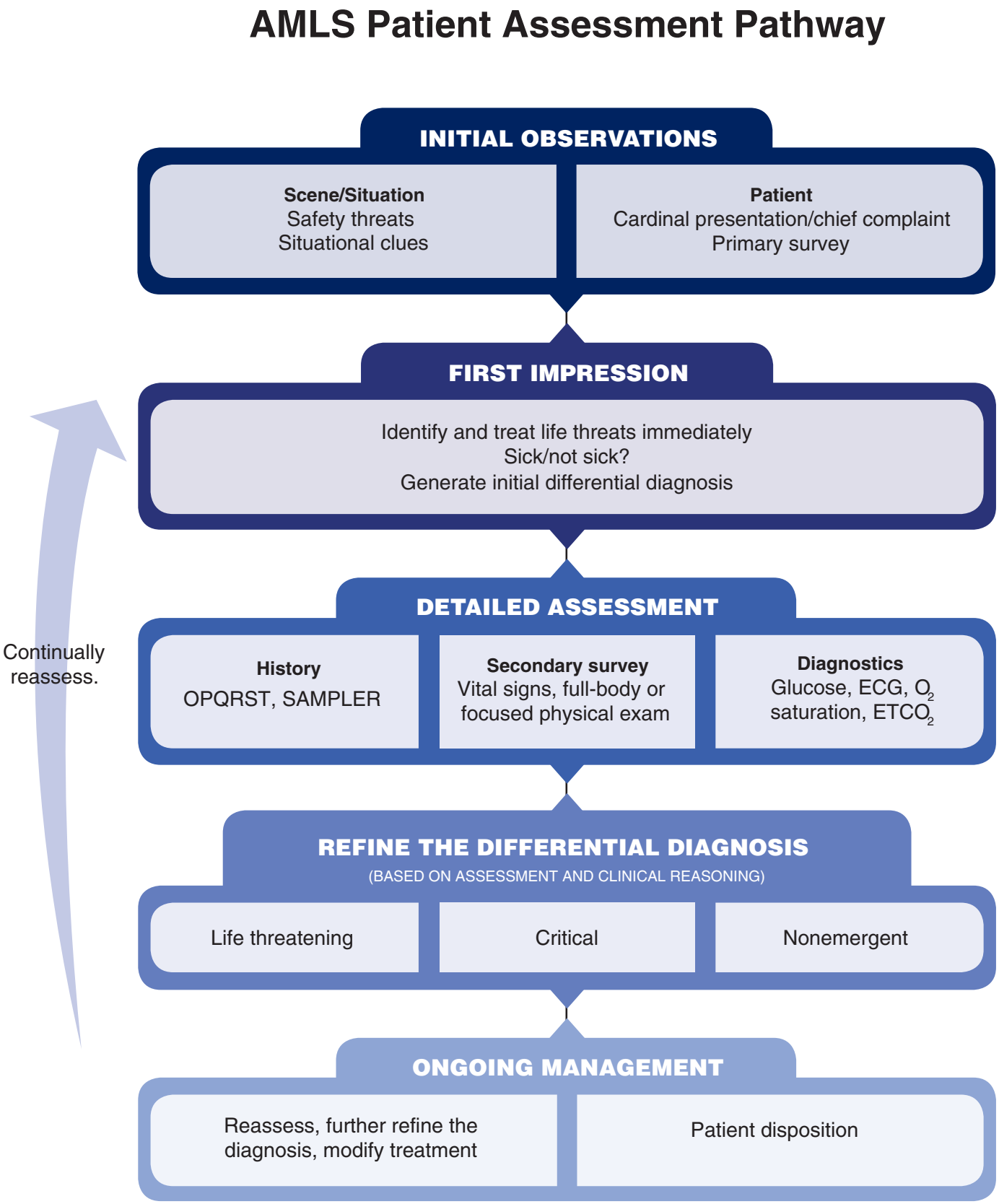


Figure 1-2 Algorithm for AMLS patient assessment.

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Figure 1-3 Throw rugs are a hazard; it is important to evaluate the safety of the patient's residence.

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Figure 1-4 When providing care at a possible crime scene, one provider should care for the patient while another provider remains alert for problems.

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concentrators, which indicate chronic conditions with the potential for poor perfusion presentations. In the prehospital setting, ominous background noise such as people arguing should cause enough concern for you to contact law enforcement to assist at the scene. Less-menacing distractions such as televisions should be turned off or otherwise eliminated.

It is important to protect the integrity of a crime scene and preservation of associated evidence, as well as the safety of the victim. Work with your colleagues to keep the scene safe. Designate one person to have contact with the patient while the other remains alert for problems, a practice followed in law enforcement (**Figure 1-4**).



Figure 1-5 Proper protective equipment is vital when you are called to a scene in which you may be exposed to blood or other body fluids.

Reprinted with permission from Crosby LA, Lewallen DG (eds): *Emergency Care and Transportation of the Sick and Injured*, ed 6. Rosemont, IL, American Academy of Orthopaedic Surgeons, 1995.

Keep your communication equipment with you. On calls involving overdose, violent crime, or potential hazardous materials exposure, stage at a reasonable distance and wait for law enforcement to advise you the scene is safe. Listen to your instincts—if the situation does not feel right, leave, if appropriate, and call for help. Always follow local or institutional protocols for such situations. Ensure documentation is timely and is an accurate reflection of the situation.

All personnel should evaluate each scene and patient situation as a potential threat to safety. Close observation of nonverbal behavior and communication with family members can lead to clues of a possibly unstable environment.

Standard Precautions

Standard precautions and personal protective equipment (PPE) need to be considered and adapted to the task at hand. PPE includes gloves, protective eyewear, gowns, face masks, and respirators (HEPA and N-95) (**Figure 1-5**). If weapons of mass destruction have been used or other

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hazardous materials have been dispersed, a higher level of PPE may be necessary to prevent contamination by potentially lethal materials.

The Centers for Disease Control and Prevention (CDC) recommends following standard precautions to prevent transmission of infectious diseases such as hepatitis B and C, human immunodeficiency virus (HIV), meningitis, pneumonia, mumps, tuberculosis, chickenpox, pertussis (whooping cough), and staphylococcal infections (including methicillin-resistant *Staphylococcus aureus* [MRSA]). These precautions apply to all patients in every healthcare setting, regardless of whether the patient is known to be infected or only suspected of having an infection. Standard precautions include the following:

- Use of proper hand hygiene techniques, including hand washing before and after every patient encounter and after removal of gloves and disinfection of equipment
- Use of gloves, gown, mask, eye protection, or face shield, depending on the anticipated exposure
- Safe injection and disposal practices
- Proper cleaning and disposal of equipment and items in the patient's environment likely to have been contaminated with infectious body fluids

Standard precautions protect not only healthcare providers, but also patients by ensuring healthcare personnel do not carry infectious agents from patient to patient on their hands or transmit them via equipment used during patient care (**Figure 1-6**). An exposure can occur by contact with blood or through inhalation or ingestion of respiratory secretions, airborne droplets, or saliva. Occupational Safety and Health Administration (OSHA) regulations specify training requirements, mandatory vaccinations, exposure control plans, and PPE. The Rapid Recall box is a reminder of the levels of PPE.



Figure 1-6 Standard precautions require that all healthcare personnel not carry infectious agents on their hands. Gloves are essential.

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Levels of Personal Protective Equipment

PPE is categorized by the Environmental Protection Agency (EPA) according to the level of protection it offers. Levels C, B, and A require specialized training before use. You should select a level higher than D if skin-damaging agents, such as corrosive substances, are or may be present. Emission of gases or vapors also requires a higher level of protection.

If you begin performing a different task at the same scene that brings you in closer contact with hazardous materials, you will need to upgrade your PPE accordingly. But you don't do not need to have a reason—if you feel uncomfortable using a lower level of protection, you should be allowed to upgrade on request.

A—Offers the greatest skin, eye, respiratory system, and mucous membrane protection.

B—Offers the highest level of respiratory system protection but less skin and eye protection. At least this level of protection should be selected until a reliable site analysis can be completed.

C—Used when the type and concentration of particulate matter are known, the criteria for using air-purifying respirators have been met, and skin and eye exposure is unlikely.

D—Used when no special protection from contaminants or hazards is needed; it is essentially a uniform consisting of coveralls and safety shoes or boots. It offers no protection from respiratory or skin hazards.

Other Hazards

Assess the scene for other hazards such as downed electrical lines, fires, imminent structural collapse, and presence of hazardous materials (**Figure 1-7**). Animals should be secured in advance of your entry. If you do receive an animal bite, contact local animal control authorities so the animal can be confined and tested for diseases. If toxic substances are present or you cannot rule out the possibility, call in the hazmat team. If you can do so at a safe distance, find out the name of the toxic substance from the Material Safety Data Sheet (MSDS) or placard numbers on containers. Networks such as WISER (Wireless Information System for Emergency Responders), from the National Library of Medicine, can provide suggestions for evacuating and information on medical toxidromes and treatments, depending on the kind of hazard present.

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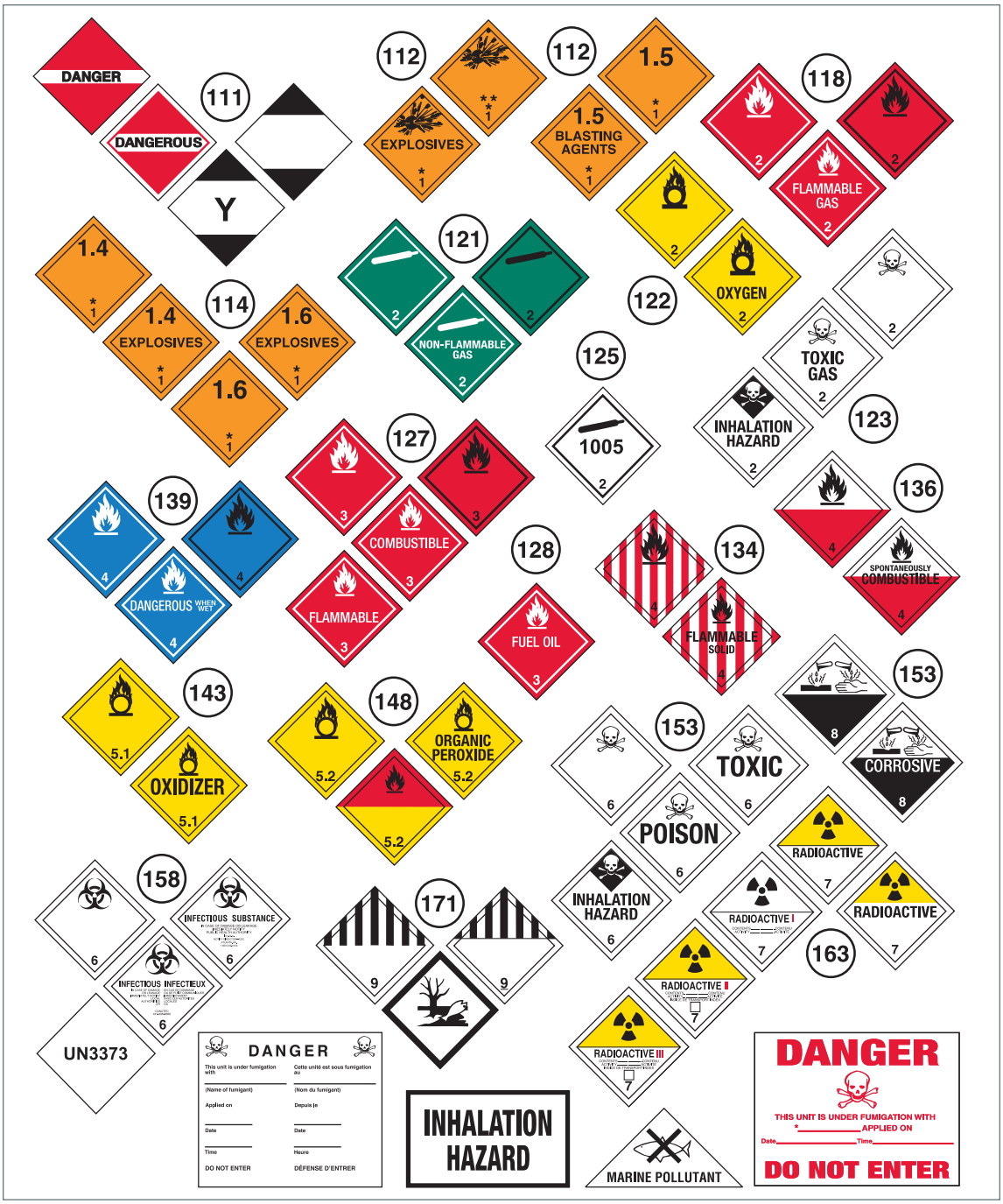


Figure 1-7 The Department of Transportation uses labels, placards, and markings to give responders a general idea of the hazard inside a particular container or cargo tank.

Courtesy of US Department of Transportation.

Patient Cardinal Presentation/Chief Complaint

The chief complaint is what the patient, family member, or friend reports to you as his or her primary concern. The chief complaint answers the question, "Why did you call for help?" Cardinal presentations are conditions and complaints recognized by medical providers as key concerns. Usually these will be based on the chief complaint, but sometimes will reflect your recognition of what is the most critical condition to be evaluated.

With a responsive medical patient, you must first identify the chief complaint. In most cases, some type of pain, discomfort, or body dysfunction prompts the call for

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help. In some cases, the complaint may be vague. Vague complaints also challenge you to ask the right questions and be a patient listener as you obtain the information you need to make appropriate care decisions.

Primary Survey

The primary survey identifies life-threatening presentations and establishes immediate management strategies. To conduct this assessment and continue to formulate an initial impression of the patient's condition, determine whether the patient's condition is emergent (the patient is injured or ill and in need of immediate medical attention) or nonemergent (the patient is not in need of immediate medical attention).

To determine the patient's status, providers must evaluate the patient's level of consciousness (LOC) and identify any airway, breathing, or circulation problems. If a life threat is identified, immediate interventions must be initiated before further assessment is performed. The remaining history taking and physical exam can be performed en route to the receiving facility.

The prehospital emergency medical team must then make transport decisions. Is the patient to be transported by ground or air? What are the implications of either mode of transportation? Which is the closest, most appropriate medical center?

If the assessment does not reveal an immediate life threat, the patient should be evaluated for critical or emergent conditions. An emergent patient has a poor general impression or decreased level of consciousness; is unresponsive; shows signs and symptoms of shock; complains of severe pain; has sustained multiple injuries; or is having trouble breathing, has chest pain with a systolic blood pressure of less than 100 mm Hg, or has uncontrolled bleeding.

At this point in the assessment process, providers may not be able to pinpoint a working diagnosis, but differential diagnoses should begin to be formulated. Keep in mind the various possible causes of the patient's signs and symptoms as further assessment data become available and are interpreted.

Level of Consciousness

Assessment of the patient's mental status, or LOC, involves evaluation of brain function. As providers approach the patient, they need to carefully observe the patient's LOC to immediately determine any potential life-threatening presentations. Observation of the patient's LOC is an important assessment tool. For example, if the patient is conscious, note the patient's responsiveness. A patient with a limited attention span or a patient who seems to be daydreaming should be assessed for hypoglycemia, dehydration, cardiovascular compromise, stroke, or head trauma.

LOC is associated with the function of the reticular activating system (RAS) and the cerebral hemispheres. The RAS is located in the upper brainstem and is responsible for maintenance of consciousness, specifically a person's level of arousal. The cerebral hemispheres are responsible for awareness and understanding. Reacting to the environment occurs through the cerebral hemispheres. The RAS alerts the cerebral hemispheres so they activate a response to the stimulus, such as an emotional or physical reaction. Coma can be caused by dysfunction of the RAS or both cerebral hemispheres.

The quickest and simplest way to assess the patient's LOC is to use the AVPU process:

- A *Alert* to person, place, and day
- V Responsive to *verbal* stimuli
- P Responsive to *pain*
- U *Unresponsive*

When you are classifying the response to stimuli, grade the patient according to the best response you can elicit. For example, a patient passed out on the street who moans in response to a loud shout from the provider would score a V on the AVPU scale. Response to tactile stimuli, such as pinching a nail bed, would be graded a P. No response to verbal or tactile stimuli would be classified as U. **Table 1-2** discusses the AVPU process in greater detail.

Awareness is a high-level neurologic function and demonstrates a response to person, place, and time. This is more commonly referred to as *alert and oriented* × *3*, or *AO*×*3*. A patient who is not AO×3 might be described as drowsy, confused, or disoriented. Of course, a patient can be awake but disoriented (not aware), indicating adequate RAS function but cerebral hemisphere dysfunction.

Table 1-2 Mental Status and AVPU

AVPU Level	Assessment Findings	
Alert	Responds spontaneously; further define mental status	
	Alert and oriented × 3	Person, place, and time
	Alert and oriented × 2	Person and place
	Alert and oriented × 1	Person
Verbal	Responds to verbal stimuli	
Pain	Responds to painful stimuli	
Unresponsive	Does not respond to stimuli	

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Table 1-3 Glasgow Coma Scale

Eye Opening	Score	Best Verbal Response	Score	Best Motor Response	Score
Spontaneous	4	Oriented and converses	5	Follows commands	6
To verbal command	3	Disoriented conversation	4	Localizes pain	5
To pain	2	Speaking but nonsensical	3	Withdraws to pain	4
No response	1	Moans or makes unintelligible sounds	2	Decorticate flexion	3
		No response	1	Decerebrate extension	2
				No response	1

Scores:
15: Indicates no neurologic disabilities
13–14: Mild dysfunction
9–12: Moderate to severe dysfunction
8 or less: Severe dysfunction (The lowest possible score is 3.)

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The Glasgow Coma Scale (GCS), used to assess victims of trauma or critical medical illness, is an effective tool for assessing neurologic function and is particularly important in establishing the patient's baseline LOC (**Table 1-3**). The score is also helpful in providing additional information on patients with changes in mental status. Documented changes in the GCS score that indicate diminishing neurologic function guide in-hospital diagnostic testing and inpatient placement.

GCS evaluates the patient's response to eye opening and best verbal and motor responses. The score for each of these responses should be documented (for example, E = 3, V = 4, M = 4, for a total GCS score of 11). A score of 8 or less often indicates the need for aggressive airway management. Although 15 is the highest score possible, this does not mean the patient has full mental capacity. Definitive care should not be based on the GCS findings alone, but in conjunction with other diagnostic and historical data obtained. It is also important to consider the presence of any medications you have given the patient when relaying the GCS; for example, ketamine can result in a GCS of 3, but this has far different implications than a GCS of 3 without ketamine.

Assessment of LOC helps determine whether the patient's neurologic and perfusion status is stable and allows life-threatening conditions to be identified and managed early. Patients with difficulties in mentation should receive a complete neurologic examination.

If the patient is unresponsive and flaccid with no signs of life, you should immediately check for the presence of

RAPID RECALL

Glasgow Coma Scale

The GCS was originally validated to provide reliable communication regarding trauma patients. It allows for consistent exchange of information and prediction of outcomes. Currently, many variations/modifications exist and many feel the motor component is adequate/reliable for determining a trauma patient's outcome. It is a tool designed for use in patients with a head injury.

Over the years, the GCS has morphed into a universal scale included in medical patient assessment to describe a level of consciousness. This tool has not been validated and therefore cannot be reliably used to predict outcomes. In its original form, a patient who has sustained a head injury and presents with a GCS of 5 could be reliably predicted to have a poor long-term outcome. A medical patient with an overdose, however, could have a GCS of 5 and with appropriate treatment such as naloxone could wake up and be completely normal.

Current use of the GCS has expanded from its original intent and become misused. It is universally utilized in the prehospital field and is a common examination question, but its utility in medical patients is unknown.

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a pulse. If you cannot detect a pulse within 10 seconds or if uncertain, begin chest compressions immediately and proceed with cardiopulmonary resuscitation.

Airway and Breathing

After assessing LOC and ensuring the patient has a pulse, the patient's airway status must be rapidly evaluated. Airway patency must be established and maintained. A patent airway allows good airflow and is free of fluids, secretions, teeth, and other types of foreign bodies (such as food or dentures) obstructing airflow. A patient's inability to maintain a patent airway is a life-threatening emergency and necessitates emergency interventions and immediate transport to an appropriate medical facility. Assessment of a patient's airway is completed in the same way regardless of the patient's age. In responsive patients of any age, talking or crying will give clues about the adequacy of the airway. For all unresponsive patients, you must establish responsiveness and assess breathing. Open the airway, and observe the mouth and upper airway for air movement. Performing a jaw-thrust maneuver on a trauma patient is appropriate if the potential for head, neck, or spine injury is noted. In cases of suspected trauma, manually protect the cervical spine from movement by positioning the patient in a neutral, in-line position. Look for evidence of upper airway problems, such as facial trauma, and check for the presence of vomitus and blood.

During the assessment of a patient's airway, BLS and ALS providers work together to observe the patient's position or posture to gather clues helping determine which interventions are most appropriate. Is the patient lying in an unnatural position on the ground or in bed? Does the patient seem to favor an upright position or the tripod position? Certain positions maximize airflow and indicate increased work of breathing and respiratory fatigue, distress, and imminent failure.

A compromised airway may require suctioning or removal of a foreign object. In the case of obstruction, such as by food, BLS procedures to clear the obstruction require no equipment and can be done quickly. Suctioning, however, may be necessary to clear the airway. Suctioning takes longer (because of the need to set up and use the equipment) and is a more complicated procedure than positioning a patient to improve airflow. If you suction the patient for too long, you may create new problems, such as hypoxia and bradycardia secondary to vagal stimulation.

If a mechanical means is required to keep the airway open and patent, you must choose an airway adjunct. If you decide to place an oropharyngeal or nasopharyngeal airway, you must measure and choose the right size for the specific patient and then properly insert the airway.

RAPID RECALL

BIAD

A blind insertion airway device (BIAD) is an airway management tool that can be placed without visualization of the glottis. Risk of aspiration may be higher with these devices in the prehospital field. Supraglottic airway devices refer to products that may be placed, such as a laryngeal mask airway or king LT airway, as an alternative to traditional endotracheal intubation.

If you determine the patient cannot maintain his or her airway and you cannot maintain it by any other means, you need to use a more invasive technique, such as endotracheal intubation. BLS and ALS adjuncts include the following:

- Basic life support adjuncts
  - Suction
  - Manual maneuvers
  - Oropharyngeal/nasopharyngeal device
  - Supraglottic airway devices (Combitube, laryngeal mask airway, or king LT)
- Advanced life support adjuncts
  - Intubation (oral, nasal)
  - Chest decompression
  - Needle or surgical cricothyrotomy

Initial BLS interventions can be used and, when appropriate, progress to definitive ALS interventions. A thorough assessment will determine the urgency of airway management and suggest which devices are most likely to be effective.

A person's breathing status is directly related to the adequacy of his or her airway. Breathing rate, rhythm, and effort are evaluated in the primary survey. A normal respiratory rate varies widely in adults, ranging from 12 to 20 breaths/min. Children breathe at even faster rates, 15 to 30 breaths/min. The provider assesses the patient's rate of breathing. With practice, you will be able to estimate the rate and determine whether it is too fast or too slow. Lung sounds may be auscultated in the primary survey if labored respirations are noted. Inadequate respiratory rates or irregular breathing patterns may require the application of supplemental oxygen devices. The patient's respiratory rhythm should be easy, regular, and pain free. Painful or irregular breaths may indicate a medical or trauma-related emergency and should be evaluated further to determine the cause of the abnormal breathing pattern (**Figure 1-8**). Symmetry of the chest rise and utilization of accessory muscles should be noted. Nasal flaring, agitation, and the ability to speak

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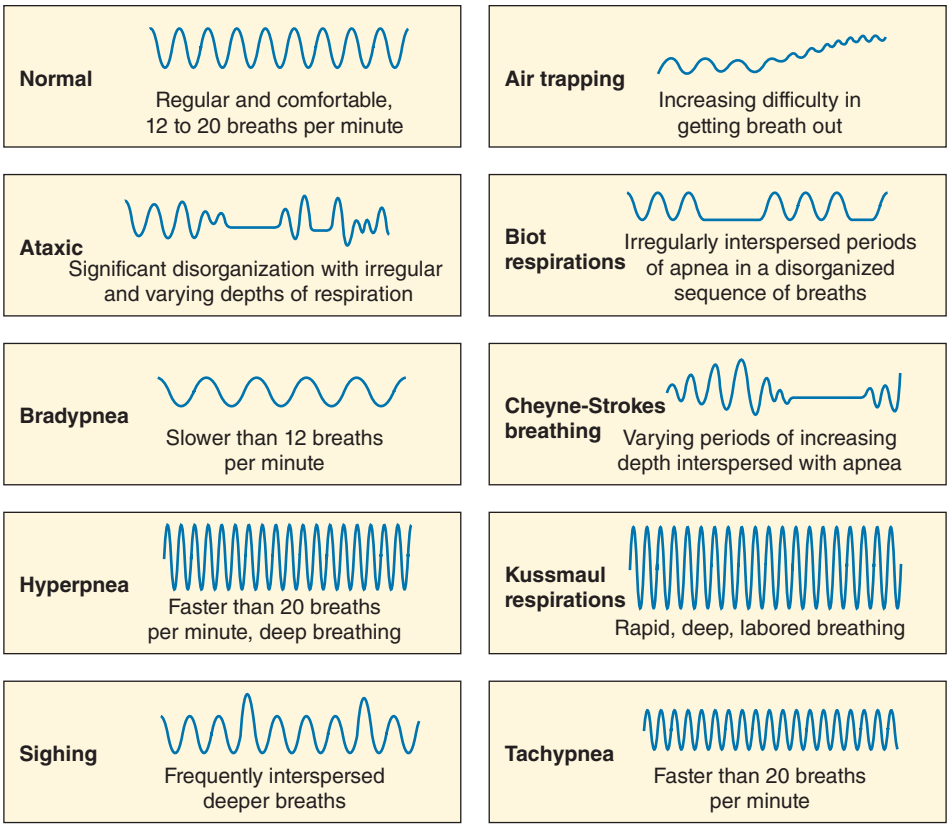


Figure 1-8 Breathing patterns you should be able to recognize.

Mosby's Guide to Physical Examination, Seidel HM, Ball JW, Dains JE, et al., Copyright Elsevier (Mosby) 1999.

only two or three words without stopping for a breath are indications of distress and compromised air exchange (**Table 1-4**).

Conditions and injuries causing a life-threatening compromise of the patient's ability to breathe include bilateral pneumothorax, tension pneumothorax, flail chest, cardiac tamponade, pulmonary embolus, or any other condition diminishing tidal and minute volume and increasing the work and effort of breathing.

Respiratory distress can result from hypoxia, a condition in which too little oxygen is available to the body's tissues. Hypoxia can be caused by any of the aforementioned conditions or by asthma; chronic obstructive pulmonary disease (COPD); airway obstruction; or any condition that restricts normal gas exchange by the alveoli, such as pneumonia, pulmonary edema, or abnormal mucous secretions.

When the patient's chief complaint is respiratory distress, another possible syndrome is hyperventilation, which will lead to respiratory alkalosis. Hyperventilation may be compensating for metabolic acidosis, anxiety, fear, or central nervous system (CNS) insult. Working diagnoses may include possible causes such as stroke and diabetic ketoacidosis.

An elevated level of carbon dioxide in the blood caused by hypoventilation is called hypercarbia. Hypercarbia occurs when the body cannot rid itself of carbon dioxide, causing it to build up in the bloodstream, leading to respiratory failure. Hypercarbia should be considered in every patient with decreased mental status, especially if the patient appears somnolent or very fatigued.

In the primary survey, midaxillary lung sounds are auscultated if the patient presents with a diminished level of consciousness, difficulty in breathing, or poor perfusion. Audible respiratory sounds such as wheezing are an important clinical finding. Gurgling and stridor are upper airway sounds (above the carina), and the other abnormal breath sounds are lower airway sounds. Abnormal breath sounds are as follows:

- *Gurgling*. A hollow bubbling sound; an upper airway condition
- *Stridor*. A harsh, high-pitched sound heard during inhalation; indicates narrowing, usually as a result of swelling in the upper airway
- *Wheezing*. High-pitched, whistling sounds made by air being forced through narrowed airways, which makes them vibrate, much like the reed in a musical

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Table 1-4 Irregular Breathing Patterns

Pattern	Description	Cause	Comments*
Tachypnea	Increased respiratory rate	Fever Respiratory distress Toxins Hypoperfusion Brain lesion Metabolic acidosis Anxiety	One of the body's coping mechanisms, but it can have a harmful effect by promoting respiratory alkalosis. Because of the rapid respiratory rate, the body does not complete oxygen/carbon dioxide exchange in the alveoli. Consequently, the patient may require both oxygen and ventilatory assistance.
Bradypnea	Slower-than-normal respiratory rate	Narcotic/sedative drugs, including alcohol Metabolic disorders Hypoperfusion Fatigue Brain injury	In addition to bradypnea, the patient may have episodes of apnea. The patient may require both oxygen and ventilatory assistance.
Cheyne-Stokes respiration	A respiratory pattern with alternating periods of increased and decreased rate and depth with brief periods of apnea	Increased intracranial pressure Congestive heart failure Renal failure Toxin Acidosis	Repeating pattern. May indicate spinal injury.
Biot's respiration	Similar to Cheyne-Stokes but with an irregular pattern instead of a repeating pattern	Meningitis Increased intracranial pressure Neurologic emergency	Think of it as the atrial fibrillation of the respiratory system (irregularly irregular).
Kussmaul's respiration	Deep and fast breaths lacking any apneic periods	Metabolic acidosis Renal failure Diabetic ketoacidosis	Deep, labored breathing that indicates severe acidosis.
Apneustic	A long, gasping inspiration followed by a very short expiration in which the breath is not completely expelled. The result is chest hyperinflation.	Brain lesion	Causes severe hypoxemia.
Central neurogenic hyperventilation	A very deep, rapid respiratory rate (> 25 breaths/min)	Tumor or lesion of the brainstem that causes increased intracranial pressure or direct injury to the brainstem Stroke	Central nervous system acidosis triggers rapid, deep breathing, leading to systemic alkalosis.

*NOTE: Record the patient's airway status, breathing rate, rhythm, and breath sounds.

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instrument; wheezing suggests the bronchi are swollen and constricted, such as in patients with asthma and foreign body obstruction.
- *Rales*. Typically described as the sound of hair rolling between your fingers.
- *Rhonchi*. Low-pitched crackles caused by secretions in the larger airways; rhonchi can be a sign of chronic obstructive pulmonary disease or an infectious process such as bronchitis and pneumonia.

Accessory muscle use and retraction can be seen at the suprasternal notch, beneath and between the ribs. If the work of breathing is increased, or the patient's breathing becomes progressively more difficult, the patient should be monitored for respiratory distress and imminent collapse. The combination of abnormal breath sounds and accessory muscle use or retraction is a more ominous sign than abnormal breath sounds alone. When you are assessing breathing, you must obtain the following information:

- Respiratory rate
- Rhythm: regular or irregular
- Quality/character of breathing
- Depth of breathing

As you assess the patient's breathing, ask yourself the following questions:

- Does the patient appear to be choking?
- Is the respiratory rate too fast or too slow?
- Are the patient's respirations shallow or deep?
- Is the patient cyanotic?
- Do you hear abnormal sounds when listening to the lungs?
- Is the patient moving air into and out of the lungs on both sides equally?

Other important questions the patient may be able to answer include:

- Did the difficulty breathing come on suddenly or get worse over several days?
- Is this problem chronic?
- Do you have any associated symptoms, such as a productive cough, chest pain, or a fever?
- Did you try to treat the condition on your own? If so, how?

Compromising breathing patterns should be identified and managed in the primary survey. If a patient seems to experience difficulty breathing after your primary assessment, you should immediately reevaluate the airway. Remember: Air exchange is the critical issue, not the number of breaths.

Circulation/Perfusion

Assessing circulation helps you to evaluate how well blood is circulating to the major organs, including the brain, lungs, heart, kidneys, and the rest of the body. The patient's pulse rate, quality, and regularity should be obtained. Palpating the radial, carotid, or femoral artery is essential. An apical pulse can be auscultated at the apex of the heart near the fifth intercostal space, a landmark known as the point of maximum impulse (PMI), but this does not allow assessment of pulse strength. The normal resting pulse rate for an adult is between 60 and 100 beats/min and could be as much as 100 beats/min in geriatric patients. In pediatric patients, the younger the patient, the faster the pulse will be.

Pulse quality is described as absent, weak, thready, bounding, or strong. A weak pulse may indicate poor perfusion. A bounding pulse may indicate increased pulse pressures, such as with aortic regurgitation or elevated systolic blood pressure. Factors that can decrease myocardial contractility include hypoxia, hyperkalemia, and hypercarbia. Early identification of irregular, weak, or thready pulses in the primary survey indicates poor perfusion and may prompt urgent application and interpretation of ECG findings.

The pulse should also be evaluated to determine whether it is regular or irregular. A normal rhythm is regular, like the ticking of a clock. If some beats come early or late or are skipped, the pulse is considered irregular. An irregular heartbeat may have a cardiac or respiratory cause, or it may be brought on by a toxic substance such as a drug.

If a patient has inadequate circulation, you must take immediate action to restore or improve circulation, control severe bleeding, and improve oxygen delivery to the tissues. At this point, perform a rapid exam to identify any major external bleeding. The rapid exam is a quick, thorough palpation of the body. You will take about 60 to 90 seconds and perform a rapid exam of the patient's body to identify injuries that must be managed and/or protected immediately. This is an abbreviated exam, as opposed to the more focused physical examination performed during the secondary assessment.

Once the pulse rate, quality, and regularity have been assessed, the skin needs to be assessed for color, temperature, moisture, and capillary refill. Capillary refill time is often evaluated to determine the status of the cardiovascular system. To perform this test, pressure is applied to the nail bed until it turns white. The provider then measures the time it takes for normal color to return. A blanching time of more than 2 seconds is considered an indicator that capillary blood is being inappropriately shunted. This test can be unreliable in adult patients for several reasons. Older adults, especially those who take many medications and those with immune system or renal disease, tend to have poor perfusion. The temperature of the environment can also reduce the accuracy of the capillary refill test; cooler environments cause vasoconstriction as a compensatory mechanism and may give a false impression of poor perfusion status.

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Pulse pressure is calculated by subtracting diastolic blood pressure from systolic blood pressure (110 [systolic] – 70 [diastolic] = 40 [pulse pressure]. Normal pulse pressure is 30 to 40 mm Hg. If pulse pressure is low (less than 25% of systolic blood pressure), the cause may be low stroke volume or increased peripheral resistance. *A narrowing pulse pressure may indicate shock or cardiac tamponade*. Identification of pulse pressure changes is used to identify increased intracranial pressure. Observation of hypertension with a widening pulse pressure, bradycardia, and an irregular breathing pattern is a key indicator and is identified as Cushing's triad.

Information from dispatch, the initial observations, the patient's chief complaint, patency of the airway and breathing, and circulation/perfusion status should suggest potential underlying diagnoses and initiate appropriate initial treatment interventions. Diagnoses and patient management are dynamic throughout the call. They are continually reevaluated and modified as additional patient history, physical exam findings, and diagnostic results are obtained. The patient's response to treatment is also considered a priority in modifying ongoing treatment.



Figure 1-9 Be aware that each patient will have different ways of dealing with his or her immediate situation. Some may be relieved to talk openly about how they feel, while others may have a greater sense of privacy or stoicism.

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First Impression

More often than not, you will form the first impression of your patient based on the **initial patient presentation** and chief complaint. Visual, olfactory, and kinesthetic observations at the scene will add valuable information to your patient assessment process to help determine the patient's differential diagnosis.

Visual Observation

You should think of your initial impression of the patient as a visual assessment (**Figure 1-9**). Extrinsic clues can include body positioning, expressions of pain, and abnormal breath sounds, which are all cause for concern. In adults, a decorticate or decerebrate posture, tripod position, or fetal body position can be signs of a life-threatening condition. Visual indications of extreme distress, such as a patient guarding his chest or abdomen or a chest pain patient holding a fist on the chest, known as Levine sign, indicates an emergent situation.

Look around for assistive devices indicating a chronic disease process. Walkers, canes, wheelchairs, oxygen concentrators, portable nebulizer devices, and hospital beds in private residences (**Figure 1-10**) are examples. Prosthetic and mobility devices indicate possible mobility problems associated with chronic respiratory, cardiovascular, musculoskeletal, or neurologic deficits.

Decorticate posturing indicates dysfunction of the cerebral cortex. In this rigid body position, the patient's elbows are bent, the arms are held close to the chest, and the fists are clenched. The toes point down, and the legs are extended (**Figure 1-11**). Decorticate posturing may progress to decerebrate posturing, a grave sign indicating significant brain injury. This body position is also



Figure 1-10 An elderly person on home oxygen indicates a chronic disease process.

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Figure 1-11 Decorticate posturing.
Courtesy of Chuck Sowerbrower MEd, NREMT-P.



Figure 1-12 Decerebrate posturing.
Courtesy of Chuck Sowerbrower MEd, NREMT-P.

characterized by rigidity. The patient's arms and legs are extended, the toes point downward, and the head and neck are arched (**Figure 1-12**).

Oxygen in the home can be stored as compressed gas or liquid oxygen or may be generated with an oxygen concentrator. Oxygen may be delivered by nasal cannula, oxygen mask, tracheostomy, ventilator, continuous positive airway pressure (CPAP), or biphasic positive airway pressure (BiPAP; **Figure 1-13**).

The care of patients dependent on technology such as ventilators can be complicated by chronic illness and poor perfusion. Some patients will require automatic transport ventilators. These ventilators should be identified on arrival. Patients are placed on these ventilators to provide extended positive-pressure ventilation. To ensure quality continuity of care, prehospital providers should disclose technology-dependent patient information to the receiving facility as soon as it is identified. Typically, patients and their family members are well versed in the operations of these machines. They can provide tremendous assistance if you are unfamiliar with the devices.

Olfactory Observation

Odors can also serve as warning signs of an unsafe environment even before patient contact is established. Evidence of gas fumes, especially with multiple patients complaining of similar distressing symptoms, indicates the need for immediate evacuation. Odors associated with spoiled food, mold, or insect or rodent infiltration



A



B



C

Figure 1-13 **A.** A peak flow meter. **B.** BiPAP machine. **C.** CPAP flow generator.

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may indicate an unhealthy environment for the patient and family members. This type of environment may indicate failure to thrive or may be evidence of neglect or domestic abuse. This observation should be reported to the proper authorities per local protocols and statutory requirements.

Also note unusual patient odors. Certain smells are associated with various acute or chronic disease processes, such as a fruity acetone breath odor with diabetic ketoacidosis. Observation of any excreted patient fluids such as blood, vomitus, urine, or feces may indicate dysfunction of the CNS. Other odors, such as a musty breath odor, can point toward chronic liver dysfunction. Significant body odor and uncleanliness may be evidence that the patient can no longer perform the activities of daily living without assistance.

Kinesthetic Observation

The sense of touch also gives clues to the patient's condition. Patients may have skin that feels cool, cold, warm, hot, or sweaty. Excessively warm or hot skin may indicate an elevated core body temperature. A hot day with high humidity can lead to hyperthermia. Intrinsic causes of hot skin include stroke, fever, and heat stroke.

Likewise, an extremely cold environment may cause hypothermia. However, in older adult patients, hypothermia can occur even in a warm environment. Immobility, compromised cardiovascular and neurologic systems, inappropriate clothing, drug toxicities, and comorbid conditions cause poor perfusion and diminished compensatory mechanisms. Cool, clammy skin can also be the result of shock or compensatory mechanisms such as vasoconstriction.

Moist or wet skin is typically found in patients with heat exhaustion, exertion, or drug toxicity. Patients with cardiovascular compromise leading to poor perfusion also present with moist skin. Patients who are dehydrated will have dry skin. Deterioration of thirst and taste mechanisms often accompany advancing age, so it is especially important to evaluate older adult patients for dry skin and dehydration.

Touch also provides essential assessment information by allowing you to feel the patient's pulse and determine the rate—too fast or too slow, weak, thready, or bounding. Touch can help identify an irregular pulse, which may indicate cardiovascular compromise.

In addition to obtaining information from initial sensory observations, the provider should ascertain the patient's reason for asking for medical assistance. Asking the patient what seems to be wrong (e.g., area of pain, discomfort, or abnormality), the chief complaint, assists in prioritizing the approach to obtaining historical and physical exam information. The patient may describe symptoms—chest pain or difficulty breathing—or an observed event such as syncope. Address any life-threatening problems immediately. Building on dispatch information, initial observations, and the patient's chief complaint, providers can begin to focus on the primary survey and continue to determine what happened.

Detailed Assessment

History Taking

For patients with medical emergencies, historical information can be obtained before the physical exam is performed. Modifying the approach to obtaining historical information before performing a physical exam is dependent on the patient's initial presentation. Many diagnostic assessments are ordered on the basis of additional information obtained during the patient interview. An efficient, systematic, comprehensive interview, then, can help providers eliminate differential diagnoses, establish a working diagnosis, and determine treatment interventions.

History of the Present Illness

The history of the present illness can be obtained by using the mnemonic *OPQRST*, which is summarized in the Rapid Recall box. This tool helps analyze the patient's complaint by focusing on obtaining a clear, chronologic account of the symptoms the patient is experiencing.

RAPID RECALL

History of the Present Illness: OPQRST

To assess the cause of a patient's injury or illness, providers need to know what brought it on and when, where, and how badly it hurts. The OPQRST mnemonic will help you remember which questions to ask in order to elicit the most pertinent answers from the patient:

- **O**nset—What were you doing when the pain started? Did the pain start all of a sudden or come on over a period of time?
- **P**alliation/provocation—Does anything make the pain go away or feel better or feel worse?
- **Q**uality—Describe the pain (burning, sharp, dull, ache, stabbing).
- **R**egion/radiation/referral—Can you point to the place where it hurts? Does the pain stay there or go somewhere else?
- **S**everity—On a scale of 1 to 10, with 1 being very minor and 10 the worst pain you have ever felt, how would you rate this?
- **T**ime/duration—How long have you felt this way?

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Onset

First, determine the time of onset and origin of the pain or discomfort. Find out what the patient was doing when symptoms began. Ask about any similar episodes the patient may have had. Obtaining the following information will assist you in determining a differential diagnosis:

- What the patient was doing when symptoms began. Pain or discomfort occurring on exertion may have a different origin than pain or discomfort occurring at rest.
- Whether the onset of symptoms was gradual or sudden.
- Any associated complaints, which may suggest the severity of the problem and indicate multiple body systems are involved. Associated symptoms of importance are:
  - Trouble breathing
  - Shortness of breath
  - Pain on deep inspiration
  - Chest pain or pressure
  - Palpitations
  - Nausea or vomiting
  - Syncope (fainting)
  - Numbness or tingling
  - Indigestion (epigastric pain, abdominal pain, or bloating)
  - Confusion or disorientation
  - General feeling of illness or being out of sorts
- Any information offered by bystanders.
- Whether the patient has experienced similar symptoms before. Ask whether the patient is under a doctor's care, and, if so, when the last visit was. Inquire about medications prescribed and other treatments given.

Palliation/Provocation

Palliation and provocation refer to factors making the patient's symptoms better (palliate them) or worse (provoke them). A patient whose chief complaint is dizziness, for example, might say the symptoms are better when lying down (palliation) and worse with movement, such as suddenly trying to get out of bed (provocation).

Quality

The patient's perception of the quality of the pain or discomfort can be an important diagnostic clue. Ask for a description of the type of pain or discomfort. Some common descriptions include terms such as *sharp*, *dull*, *tearing*, *ripping*, *crushing*, *pressure*, and *stabbing*. The patient's description can suggest whether the pain is of visceral or somatic origin, which will help in determining the differential diagnosis. Visceral pain is from internal organs and often vague and difficult to localize, whereas somatic pain can be precisely located and more likely to be sharp or stabbing in nature. Assessing whether the discomfort is constant or occurs only intermittently, either randomly or with certain breathing patterns or movements, can be a key indicator of the body system involved and the severity of the etiology. Along with palliation and provocation, how a patient describes the quality of the pain or discomfort can also indicate the underlying body system affected. In quotation marks, document exactly how patients describe their symptoms.

Region/Radiation/Referral

Region, radiation, and referral are all associated with the location of the pain or discomfort. Ask the patient to point to where it hurts or indicate whether the pain seems to radiate or move anywhere else (**Table 1-5**). Try to ascertain whether the pain is referred, such as abdominal distention with pain in the shoulder (Kehr sign).

Severity

The majority of patients seen by healthcare providers have experienced either acute or chronic pain or discomfort. Pain and discomfort can result from infection, inflammation, and neurologic dysfunction. Injury and overuse of muscles and the skeletal system can generate acute or chronic pain. Organs in every body system can elicit pain and discomfort. Activation of nociceptive pain fibers is the root cause of both chronic and acute pain. When the fibers are stimulated, the pain impulse will travel via nerve fibers to the spinal cord to the brain.

Table 1-5 Referred Pain

Location	Organ
Left shoulder pain	Diaphragm irritation (blood or air from rupture of other abdominal structures such as ovaries), ruptured spleen, myocardial infarction
Right shoulder pain	Liver irritation, gallbladder pain, diaphragm irritation
Right scapular pain	Liver and gallbladder
Epigastric	Stomach, lung, cardiac
Umbilical	Small intestine, appendix
Back	Aorta, stomach, pancreas
Flanks to groin	Kidney, ureter
Perineal	Bladder
Suprapubic	Bladder, colon

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Pain or discomfort can present with very vague signs and symptoms, especially in patients who are poor historians, as in the elderly. Oftentimes, patients are taking over-the-counter (OTC) medications, self-remedies, or multiple medications. Whether medications are OTC or prescribed, their effects may mask the quality and severity of pain. Historical information regarding pain may present differently based on the patient's cultural background and religious belief systems, making the assessment and management challenging.

Any and all complaints of pain or discomfort must be taken seriously. Exercise patience in determining the location, severity, and quality of pain. Precise patient descriptions of the pain can help you differentiate pain associated with a life-threatening medical emergency from less-critical pain and allow you to provide appropriate pain management.

Ask the patient to rate the level of the pain or discomfort on a scale from 1 to 10, with 1 being the least discomfort or pain and 10 the highest. This numeric scale is commonly used by both EMS and hospital personnel. Not only will the patient's report of the severity of the pain help narrow down its source, but it might also set a useful baseline by which to gauge whether the patient's condition is improving or worsening. The Wong-Baker FACES pain scale is a useful alternative for children or patients who may not be able to communicate verbally (**Figure 1-14**).

A variety of pain remedies may be encountered. Nonnarcotic analgesics control pain or diminish the perception of pain; acetaminophen (Tylenol) and nonsteroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen (Motrin/Advil) and naproxen (Aleve) are typical OTC medications taken by patients. Opioid analgesics, such as morphine, hydrocodone, and oxycodone, are prescribed for acute and chronic pain.

Obtain as much information as possible on which pain medications the patient has been taking and whether self-administration of those medications has been optimal. From the additional information gathered in the present illness history, diagnoses and treatment are evaluated and modified.

Time/Duration

Finally, ask patients how long (time/duration) they have had the pain or discomfort. If the patient cannot respond or is not sure, ask a family member or a bystander to tell you exactly how long ago the patient last seemed to be feeling normal. Narrowing down the time frame of the discomfort may become crucial for sound medical decision making about certain conditions, such as deciding whether to administer fibrinolytic agents to a stroke patient or whether to catheterize a patient with suspected myocardial infarction (MI).

Past Medical History

The past medical history gives the provider an opportunity to learn about any pertinent or chronic underlying medical conditions the patient may have. Whereas not all aspects of the past history may seem important at the present time, a careful and thorough history will help

RAPID RECALL

The SAMPLER Approach to Past Medical History

The SAMPLER mnemonic represents a sensible approach to inquiring about a patient's medical conditions:

- **S**igns/symptoms
- **A**llergies
- **M**edications
- **P**ertinent past medical history
- **L**ast oral intake (what and when)
- **E**vents preceding the current illness or injury
- **R**isk factors

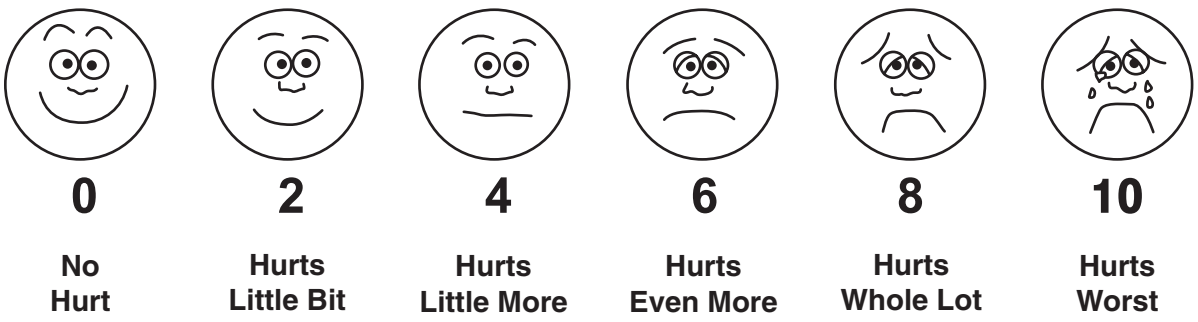


Figure 1-14 Wong-Baker FACES Pain Rating Scale. To use this scale, point to each face and use the words to describe the pain intensity. Ask the patient to choose the face that best describes his or her own pain, and document the number.

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paint a clear picture of the patient's overall health status. The SAMPLER mnemonic, summarized in the Rapid Recall box, can also be useful in the interviewing process.

Signs and Symptoms

Symptoms are the subjective perceptions of what the patient feels, such as nausea, or has experienced, such as a sensation of seeing flashing lights. **Signs** are objective data you or another healthcare professional have observed, felt, seen, heard, touched, or smelled and usually measured, such as data indicating tachycardia. A symptom reported by the patient, such as diarrhea, becomes a sign as well when observed by a healthcare provider. All signs and symptoms should be well documented (**Figure 1-15**).

In awake and alert patients with no cognitive deficits, it is appropriate to use open-ended questions when asking how they are feeling. Such patients are able to process the question and give a reply. Patients with speech, hearing, or cognitive difficulties may respond more easily to yes-or-no questions. Often a simple head nod or shake can communicate effectively enough to help you complete the history. For patients who are disabled and for older adults who are frail, have patience when obtaining information. Allowing enough time for the patient to answer the question can often be challenging. Rushing a patient's verbal response, however, will inhibit rapport, might be frustrating or intimidating, and could impede the willingness to share information. Use appropriate therapeutic communication techniques to obtain information from the patient.

Allergies

Many patients have allergies to prescribed or OTC medications, animals, or food. Ask the patient about any known causes of allergic reactions and which symptoms are normally experienced, such as hives or trouble breathing. Find out how quickly the symptoms tend to develop.



Figure 1-15 Be especially patient when you are obtaining information about a patient's symptoms.

Some symptoms are more worrisome than others. A patient who breaks out in a slight rash when around cats raises fewer concerns than a patient who develops stridor when a particular food is eaten. Some untoward responses are adverse reactions rather than true allergic responses. Many patients may misinterpret hypersensitivity to a food, animal, or medication as an allergy, so it becomes important to evaluate exactly how the patient responds to contact with the reported allergen or irritant. This information will help distinguish a hypersensitivity response from an allergic or anaphylactic reaction.

Medications

In written documentation, include a record of all medications the patient takes regularly—OTC drugs and medications prescribed by all the patient's doctors. Healthcare providers may or may not know what the patient's physician may have prescribed. Drug interactions and adverse reactions must be considered in the overall medication profile.

Some patients also take OTC drugs or dietary supplements, also known as holistic, herbal, or alternative medications. Trends in legalization of cannabis indicate inclusion of additional patient questioning regarding the use of cannabis for recreational or medicinal use. Remember to ask about liquid OTC drinks and herbal teas having a high content of caffeine, vitamins, or other ingredients that could cause the patient's signs and symptoms to be abnormal. Hypertensive patients who take OTC medications that contain dextromethorphan or guaifenesin, such as cough suppressants or antitussive agents, in conjunction with monoamine oxidase inhibitors (MAOIs) or selective serotonin reuptake inhibitors (SSRIs) can experience elevations in blood pressure.

Pertinent Past Medical History

Try to discern which medical history is pertinent to the presenting complaint. If the patient is having chest pain and had a stent recently placed, for example, that information is pertinent. A femur fracture occurring 2 years ago is most likely not essential information.

A description of past surgeries, especially recent ones, is important historical information to obtain. The risk of an embolus can be identified, for example, if the patient has recently undergone a cesarean section, hip or knee replacement, or gallstone removal. Gastric bypass surgical interventions should be identified for patients with unstable vital signs or history of gastrointestinal upset with fever, vomiting, constipation, or diarrhea.

Last Oral Intake

Ask patients when and what they last ate and drank. Be sure to document the response. Patients who have recently eaten or had something to drink may aspirate stomach contents into the lungs if they become unconscious

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and vomit or have to be anesthetized for emergency surgery and vomit while under anesthesia.

Events Preceding the Current Illness or Injury

Find out which events led to the decision to request an ambulance or go to the hospital. Ask the patient, bystanders, and family the following questions: What happened today? Why did you call EMS? What has made the discomfort better or worse? This last question is appropriate when the events elapsed slowly, such as when a patient has trouble breathing all night but does not call EMS or obtain medical care until symptoms begin to worsen.

Risk Factors

Risk factors for a patient's given condition can be environmental, social, psychological, or familial. Is the patient living alone and at risk for falls? Does the residence contain any fall-related hazards? Is the patient confined to bed and dependent on someone else for meals and care? Other significant risk factors for medical problems include recent travel, surgeries, diabetes, hypertension, gender, race, age, smoking, and obesity.

Does the patient adhere to a prescribed medication regimen? Is the patient able to differentiate medications and take them properly? Is there a list of medications, and is the dispensing routine clear to the patient? An often-helpful suggestion for patients taking several medications is to compile a complete list and post it in a visible place for themselves and their families. Doing so can reduce the likelihood of medication error and decrease the risk of drug toxicity.

Current Health Status

The personal habits of patients relevant to their overall health history can be important in determining the acuity of the current complaint. Frequent visits to their physician or emergency department for similar complaints may indicate the need for evaluation of a chronic condition and change in treatment regimens.

Alcohol or Substance Abuse and Tobacco Use

Asking patients about their use of drugs (licit or illicit, including the use of prescription drugs not prescribed to them), tobacco products, and alcohol may elicit important information about the potential for multiple underlying etiologies. Assure the patient of confidentiality when making such inquiries. The CAGE questionnaire, summarized in the Rapid Recall box, can be used to help identify alcohol abuse patterns of behavior. Such evaluation can indicate a chronic versus acute illness with the potential for traumatic injury. For example, a chronic alcoholic is at increased risk for subdural bleeding due to falling while intoxicated.

RAPID RECALL

CAGE Questionnaire

- **C:** Have you ever been concerned about your own or someone else's drinking? Have you ever found the need to cut down on drinking?
- **A:** Have you ever felt annoyed by criticism of your drinking?
- **G:** Have you ever felt guilty about your drinking? Have you ever felt guilty about something you said or did while you were drinking?
- **E:** Have you ever felt the need for a morning eye opener?

Modified from Ewing JA: Detecting alcoholism: the CAGE questionnaire, *JAMA* 252:1905, 1984.

Immunizations

Information about current screening tests and an immunization record help identify patients at risk for communicable diseases. Recent travel history outside the country or immigration status is also helpful in identifying conditions that should be included in the differential diagnosis.

Family History

Family history may be important if the differential diagnosis includes inherited conditions such as sickle cell disease or contagious diseases such as tuberculosis. Asking about family members with the following diseases may indicate high risk factors for the patient, aiding clinical reasoning and leading to more rapid diagnosis and treatment:

- Arthritis
- Cancer
- Headaches
- Hypertension
- Stroke
- Lung disease
- Tuberculosis
- Communicable and autoimmune diseases

Healthcare providers are patient advocates by seeking out family and friends who are supportive and may help the patient improve the safety of the home environment. Asking patients what they need to get through a difficult physical or psychological emergency is an empathetic and compassionate approach to patient care.

Patients who are able to develop a rapport with providers feel more trusting in answering questions and accepting decisions made about their care. Fostering an open, positive patient experience will help limit the associated stress of an illness or injury and make it easier for

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providers to obtain an accurate history, establish a working diagnosis, and begin prompt treatment. Therapeutic communication plays an important role in developing a rapport with your patients.

Once the patient's historical information is obtained, additional underlying etiologies and diagnoses should be modified and either disregarded or considered. Does the patient's response to initial treatment warrant modification? Let us look at the information you can obtain from the physical exam.

Secondary Survey

The **secondary survey** (also known as the physical exam) consists of two elements—obtaining vital signs measuring overall body function and performing a head-to-toe survey evaluating the workings of specific body organ systems. The survey is done in a sequential manner, starting with the head and moving down to the toes, ensuring every aspect of the body's function is evaluated. Of course, the conditions in the prehospital setting may determine precisely how the secondary survey is performed. Sometimes, it may be condensed. For example, for an unresponsive medical patient or a trauma patient with a significant mechanism of injury, there may only be time to perform a rapid exam. The amount of time spent on this exam and its thoroughness will be directly related to your scope of practice as a healthcare provider, the patient's status, and the diagnostic assessment tools available (e.g., reflex hammer, otoscope, ophthalmoscope).

In medical patients, vital signs are taken and a history is often obtained before a physical exam is performed. Depending on the severity of the patient's condition, the availability of healthcare personnel, and the estimated transport time to the appropriate healthcare facility, the physical exam may be performed either at the scene or en route to the receiving facility.

Vital Signs

Health care is a team effort, whether it is provided before the patient reaches the hospital or when the patient is in the hospital. Therefore, several healthcare providers can be involved simultaneously in the patient's assessment, obtaining diagnostic information, and providing patient care. Vital signs are generally the first component of the secondary survey. Vital signs traditionally include pulse rate, regularity, and quality; respiratory rate, regularity, and quality; blood pressure; and body temperature. You should measure these parameters frequently and continually. Even if the patient's initial presentation does not suggest an immediate life threat, the patient's condition may deteriorate. Establishing baseline vital signs and being alert for trends during ongoing monitoring can aid in early identification of any adverse change. Even if the patient's condition remains stable and nonemergent, vital signs are indispensable to sound medical decision making. They guide providers in establishing a specific diagnosis and formulating a treatment plan likely to be effective.

Pulse

Patients with suspected medical emergencies should be assessed for both central and peripheral pulses. The rate, regularity, and quality should be reevaluated, as previously discussed. Abnormal findings can lead to early application of ECG monitoring.

Respiration

The work of breathing should be assessed for symmetry, depth, rate, and quality (**Figure 1-16**). For a detailed discussion of breathing, see the earlier section.

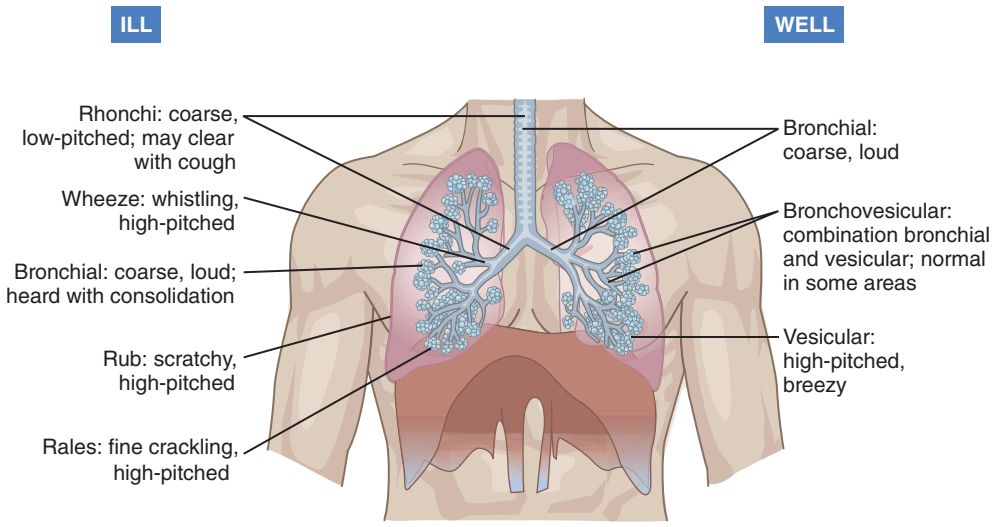


Figure 1-16 Lung sounds heard in an ill patient (at left) and a well patient (at right).

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Blood Pressure

Evaluation of this vital sign provides an estimate of the patient's perfusion status and can identify pulsus paradoxus and pulse pressure. **Blood pressure** is the tension exerted by blood on the arterial walls. Blood pressure is calculated using the following equation:

Blood pressure = Flow × Resistance

If flow or resistance is altered, blood pressure will increase or decrease. Resistance is altered when vessels narrow, increasing resistance and raising pressure, and when vessels dilate, decreasing resistance and lowering pressure.

In patients with cardiovascular disease or a life-threatening pulmonary condition, such as a pulmonary embolus or tension pneumothorax, pulsus paradoxus will be seen. Pulsus paradoxus is an irregularity occurring when systolic blood pressure falls more than 10 mm Hg on inspiration. It is caused by differences in intrathoracic pressure with respiration, such as backflow of blood into the lungs as a result of heart failure.

A baseline blood pressure should be taken during initial contact with the patient. Measure blood pressure a minimum of two times while treating the patient in the prehospital environment. Ideally, the second blood pressure reading is obtained once the patient has been secured in the ambulance or other transport vehicle. Depending on the status of the patient and transport time, a third measurement is taken en route to the receiving facility. An initial blood pressure should be taken manually, and reassessment of blood pressure can be done using an automated device (**Figure 1-17**). Generally, vital signs for patients in stable condition are obtained every 15 minutes. Vital signs for patients in unstable condition are obtained every 5 minutes.

Temperature

Oral, rectal, tympanic, or axillary temperature measurements may be taken, depending on the patient's injuries, age, and LOC. Some patients with a decreased LOC may be too agitated for an oral measurement. Facial or other injuries may also preclude use of an oral thermometer. Another way to assess temperature is simply by touching the skin.



Figure 1-17 A blood pressure device.

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TIP

Obtaining an accurate temperature seems to be a challenge for EMS providers. Reliance on skin temperature devices and axillary measurements do not help you in identifying patients with alterations in temperature regulation. A core temperature is preferred in patients who are ill. Work with your agencies to assure the ability to obtain an accurate temperature in the field.

Be sure to inspect the skin for diaphoresis (sweating) and assess the color of the skin and nail beds. The skin should be dry to the touch and feel neither cool nor hot. If the patient has anything but dry, pink, warm skin, you should look for the cause of the altered perfusion.

Hyperthermia can be caused by sepsis (infection) or by medications such as antibiotics, narcotics, barbiturates, and antihistamines. Other causes of fever include heart attack, stroke, heat exhaustion, heat stroke, and burns. Hypothermia can be caused by exposure, shock, alcohol or other drug use, or hypothyroidism, and it can occur in patients who are severely burned and unable to regulate their body temperature. The environment, whether too warm, cold, or humid, may affect the patient's skin temperature and should be considered when evaluating skin vital signs.

The vital signs should offer important information to help you formulate a more in-depth impression about the patient's health status and treatment needs. In patients with alterations in mentation, also assess the pupils and perform an abbreviated neurologic exam during the assessment of vital signs. Motor and sensory function, distal pulses, and capillary refill should be evaluated as well. In addition, blood glucose levels should be obtained.

Confirming or ruling out whether life threats and emergent or nonemergent conditions exist are core considerations for initiating care at the scene, prior to packaging for transport. Modifying or establishing a new care regimen will be based on continued information gathering during the secondary survey.

Physical Exam

The physical examination of a patient in the prehospital setting is the most important skill a healthcare provider can master. This ability is first developed as an EMT and should be refined as an advanced practitioner. The exam can be a full-body head-to-toe exam or a focused exam. The goal of this process is to identify hidden injuries or identify causes that may not have been found during the

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60- to 90-second rapid scan taking place during the primary survey. The healthcare provider must determine, based on the acuity of the patient, which exam is most appropriate. In most emergency response situations, a focused exam is appropriate in conscious patients. A full-body head-to-toe exam is necessary in patients who are unconscious or have a diminished LOC and in those whose presentation indicates possible substance abuse or toxicity. Detailed physical exams may be more practical in the hospital, although a detailed exam may be performed by prehospital personnel as transport time allows.

The physical exam findings should augment the historical data and diagnostic assessment information already obtained to rule in or rule out certain differential diagnoses. As information is gathered and critically evaluated, an appropriate treatment pathway will be identified and implemented.

Stethoscopes, otoscopes, and ophthalmoscopes are common equipment used to gather valuable information when performing a physical exam, but the tools are only as good as the examiner's scope of practice and observation skills. Therefore, inspection, auscultation, palpation, and percussion are critical components of the assessment process. The physical examination will help identify life threats in the primary or secondary survey. In an unconscious patient, the physical exam may be the only way to obtain clues to identify the problem.

In many medical patients, historical information is typically obtained before the physical exam is performed. Altering the order of the components of the assessment is dependent on the severity of symptoms, the criticality of the patient's status, and the initial presentation up to this point. The physical exam during the primary survey may be performed prior to obtaining the history or simultaneously with obtaining the history if enough personnel are present. The physical exam findings enable to provider to rule in or rule out conditions making up the differential diagnosis constructed during the history taking. The opposite may be true of traumatic injuries: In trauma patients, a rapid physical exam may be carried out before medical information is obtained.

Examination Techniques

Inspection is the visual assessment of the patient to look for abnormalities. You begin observing visual clues to the patient's condition during the initial observation period. This preliminary inspection can reveal the implications of the environment and the severity of the patient's condition before the history is taken or the physical exam performed. Other aspects readily apparent and worth noting include dress, hygiene, expression, overall size, posture, untoward odors, and overall state of health.

Significant injury should be identified during your visual exam. Bruising, abrasions, surgical scars (particularly evidence of previous surgeries such as cardiac surgery or lung removal, because they may be pertinent to dyspnea or other respiratory distress), and rashes should be noted. Note whether a stoma is present. Read and document any medical alert tags.

The trachea should be observed and potentially palpated to be midline. The shape of the patient's chest can offer the first clue to chronic lung disease. A barrel chest can indicate underlying COPD such as emphysema or chronic bronchitis.

A patient in a supine position with flattened neck veins may have hypovolemia. Look for any unusual neck masses, jugular venous distention (JVD), and swelling. JVD with diminished or absent breath sounds may indicate tension pneumothorax and cardiac tamponade. JVD increasing with palpation of the liver (hepatojugular reflex) may indicate fluid overload, as seen in congestive heart failure.

Assess the patient for vascular assistive devices (VADs) indicating chronic disease processes and the need for nutritional support or long-term vascular access, as in the case of chemotherapy regimens or frequent blood samples.

Tracheal tugging and use of intercostal and neck muscles are a sign of distress. Asymmetry, grunting, and deep or shallow respiratory movement are abnormal. Immediate intervention should be initiated to improve oxygenation and ventilation, stabilize the work of breathing, and promote adequate perfusion.

In patients with chronic renal failure, especially those on dialysis, you may note grafts or fistulae. Assess the patency of these grafts by feeling for a thrill (vibration felt over the graft from high flow) and listening for a bruit (sound of high-flow blood through the graft). Patients who receive peritoneal dialysis at home will have evidence of an abdominal catheter. In addition, a gastric tube may be used in the home setting to remove fluids and gas, instill irrigation solutions or medications, or administer enteral feedings. Be alert for the possibility the patient has aspirated gastric contents, and make sure the device is working properly.

With keen observation, providers will note any kyphosis (spinal curvature), pressure ulcers, moles, abrasions, rashes, ecchymosis or hematoma, bleeding, needle or track marks, and discoloration.

Auscultation is the use of a stethoscope or just your ears to evaluate the sounds the body makes, such as the flow of blood against the brachial artery with the head of the stethoscope. This is auscultation of blood pressure. Lung sounds, heart sounds, and bowel sounds can also be evaluated using auscultation.

The lungs initially should be auscultated in the upper and lower lung fields, both anteriorly and posteriorly. If the patient's initial presentation is dyspnea or respiratory distress, lung sounds can be auscultated in the midaxillary position (**Figure 1-18**). Performing auscultation early in the

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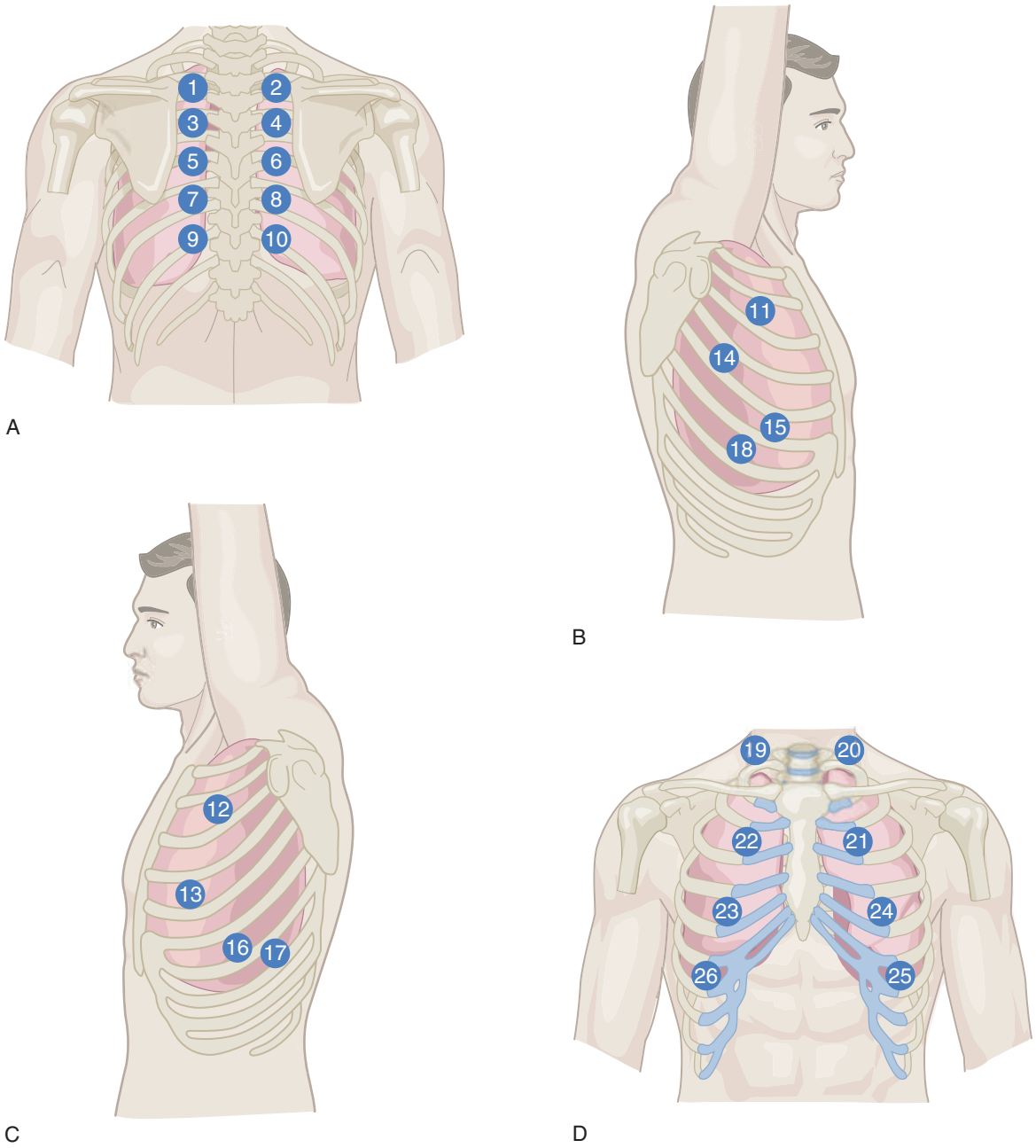


Figure 1-18 When you are listening to lung sounds, listen to one lung and then the other lung at the same location. Listen to at least one full inhalation and exhalation at each location—**(A)** posterior chest, **(B)** right lateral chest, **(C)** left lateral chest, and **(D)** anterior chest.

assessment can reveal life-threatening respiratory compromise attributable to acute asthma or pulmonary edema.

Lung sounds vary based on the part of the airway over which you are auscultating and the presence of abnormal conditions (see Figure 1–15):

- Vesicular lung sounds are auscultated over the anterior and posterior part of the chest. Normally these sounds are soft, low-pitched sounds heard over healthy lung tissue.
- Bronchovesicular sounds are auscultated over the main bronchi. These sounds are lower than the vesicular sounds and have a medium pitch.
- Bronchial sounds are heard over the trachea, near the manubrium of the sternum. They are typically high pitched.
- A sandpaper-like sound is an indication the visceral and parietal pleura are rubbing together. This sign is called a friction rub and is associated with pulmonary diseases such as pleurisy.

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- Adventitious lung sounds are audible sounds heard over the normal, nearly inaudible sound of breathing. They include rales, rhonchi, and wheezing, each of which reveals valuable clues about lower airway disease.

Ask the patient to take a deep breath. Patients having acute asthma attacks tend to have more trouble exhaling than inhaling. If deep breathing causes pain or discomfort, the patient may have underlying pleurisy or a pulmonary embolism. Feel the torso for instability of bony structures. Palpate the chest for subcutaneous emphysema. Palpate the trachea for proper midline positioning; deviation can be a late sign of pneumothorax.

Abnormal lung sounds can result from cardiovascular compromise affecting both the cardiovascular and respiratory systems. Rales can signal pulmonary congestion from ventricular heart failure.

Using the proper assessment tools will help you confirm or eliminate differential diagnoses related to the respiratory system. The findings of such supplemental assessments will aid your clinical reasoning and ensure your medical decision making is well informed and accurate.

As noted earlier in the chapter, some patients transported by prehospital personnel may require special transport ventilators. They may be intubated or have other preexisting respiratory system needs that will significantly affect EMS management and prehospital care.

Heart tones are auscultated for loudness (intensity), length (duration), pitch (frequency), and timing of the cardiac cycle. When listening at the fifth intercostal space, toward the apex of the heart, the normal heart sounds of S_1 and S_2 can be heard. These sounds are caused by heart valves closing and are best heard if the patient is leaning forward, sitting up, or in a left lateral recumbent position (and even supine). Positioning is best when the heart is closer to the left anterior chest wall. To better hear S_1, ask the patient to breathe normally, then hold his or her breath on expiration. To better hear S_2, ask the patient to breathe normally, then hold his or her breath on inspiration.

Abnormal heart sounds, such as murmurs, indicate a problem with the blood flow in and out of the heart. Bruits are abnormal sounds sometimes heard when the carotid arteries are auscultated; they produce high-pitched sounds indicating blood flow obstruction in those vessels. In the case of an aneurysm, a fine tremor or vibration that can identify a blockage can be felt; these are commonly called thrills. Murmurs, bruits, and thrills can be benign or life threatening.

In patients with a history of heart failure, additional heart sounds can be heard. Additional heart sounds occur in the presence of ventricular disease and are often identified as S_3 and S_4. These sounds are called gallops.

The S_3 sound, identified as a third heart sound, is an early clue to a diagnosis of left heart failure. Difficult to detect, it can be referred to as a gallop, which would sound similar to a horse's gallop. It appears approximately 0.12 to 0.16 second after the second heart sound and results from rapid expansion of the ventricles as they fill with blood.

The S_4 sound occurs during the second phase of ventricular filling, when the atrium contracts. This sound is thought to be caused by valvular and ventricular wall vibration. It is typically heard when there is increased resistance to ventricular filling.

Auscultation of bowel sounds, although not often performed during the prehospital evaluation, can help identify bowel obstruction. Bowel sounds should be auscultated for 30 to 60 seconds before palpation. A normal bowel makes a gurgling noise and sounds the same in each quadrant. High-pitched hyperactive bowel sounds in the presence of a distended abdomen may give warning of a bowel obstruction. An obstruction or accumulation of gases can rupture the intestinal wall.

Palpation is physical touching for the purpose of obtaining information, such as when you feel for a pulse. Some patients may feel palpation is a form of invasion of their personal space, so be sure to ask the patient for permission before you use this technique. Palpation should be gentle and respectful. A light touch to the outside and inside of the length of an extremity can assist with sensation status and bilateral muscle strength.

The abdomen should be palpated in all four quadrants. It should be soft and nontender, with no tension, swelling, or masses. Muscle guarding is an abnormal finding that indicates pain and possible underlying injury. Abdominal rigidity is a sign of a life threat, such as internal bleeding. Upper right quadrant tenderness that worsens with inspiration, known as Murphy's sign, is an indication of the presence of gallstones and cholecystitis (**Figure 1-19**).

The quadrant with the most reported discomfort should be palpated last. Palpation should be used to evaluate pain when gentle pressure is applied. It is also a means of identifying an increase in pain on removal of gentle pressure, known as rebound tenderness. This sign is a red flag for peritonitis.

McBurney's point is the name of the area over the right side of the abdomen, one-third of the distance from the anterior superior iliac spine to the umbilicus. Localized tenderness in this area is a sign of acute appendicitis. Palpation of the left lower quadrant eliciting pain in the right lower quadrant, called Rovsing's sign, can also be an indicator of appendicitis. Abdominal pain that cannot be elicited on palpation can be caused by renal calculi or a urinary tract infection. Flank and back pain often accompany both of these diagnoses.

Percussion entails gently striking the surface of the body, typically where it overlies various body cavities. Sound waves are heard as percussion tones, which change according to the density of the tissue.

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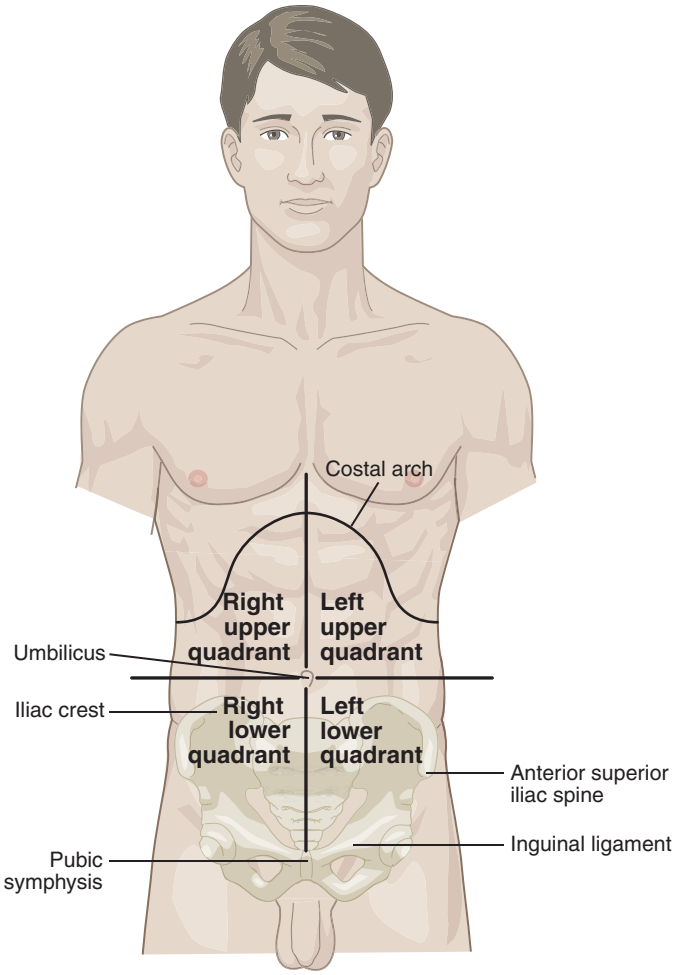


Figure 1-19 The four quadrants.

Percussion is not typically performed in the prehospital environment. However, this assessment provides important information regarding the abdominal cavity. If a dullness is heard during percussion, an abundance of fluid may be accumulating in this cavity, as occurs in liver failure. A hyperresonant sound may indicate air, as opposed to fluid, is abundant (**Table 1-6**).

Table 1-6 Percussion Tones and Examples

Percussion Tone	Example
Tympany (the loudest)	Gastric bubble
Hyperresonance	Air-filled lungs (COPD, pneumothorax)
Resonance	Healthy lungs
Dullness	Liver
Flat (the quietest)	Muscle

The Full-Body Physical Exam

The full-body physical exam is a systematic head-to-toe physical examination. Like the rapid exam, the full-body exam includes looking, listening where appropriate, and palpating. Any patient who has sustained a significant mechanism of injury, is unresponsive, or is in critical condition should receive this type of examination. To perform this physical exam of a patient with no suspected spinal injuries, follow the steps listed.

1. Look at the face for obvious swelling, lacerations, bruises, fluids, and deformities.
2. Inspect the area around the eyes and eyelids.
3. Examine the eyes for redness, contact lenses, and yellow or reddened sclera. Assess the pupils using a penlight.
4. Look behind the patient's ears to assess for bruising (Battle sign).
5. Use the penlight to look for drainage of spinal fluid or blood in the ears.
6. Look for bruising and lacerations about the head. Palpate for tenderness, depressions of the skull, and deformities.
7. Palpate the zygomas for tenderness, symmetry, and instability.
8. Palpate the stability of the maxilla.
9. Check the nose for blood, drainage, or nasal flaring.
10. Palpate the stability of the mandible.
11. Assess the mouth for cyanosis, foreign bodies (including loose or broken teeth or dentures), bleeding, lacerations, and deformities.
12. Check for unusual odors on the patient's breath.
13. Look at the neck for obvious lacerations, bruises, and deformities. Observe for JVD and/or tracheal deviation and thyroid gland enlargement.
14. Palpate the front and the back of the neck for tenderness and deformity. Auscultate for bruits if perfusion is compromised.
15. Look at the chest for obvious signs of injury before you begin palpation. Be sure to watch for movement of the chest with respirations. Assess for neck chains, bruising, and scars as evidence of a previous surgery. Observe placement of central line catheters, such as a peripherally inserted central catheter (PICC) (**Figure 1-20**) or a Hickman, Broviac, or Groshong catheter. Assess the work of breathing.
16. Gently palpate over the ribs to assess structural integrity and elicit tenderness. Avoid pressing over obvious bruises and fractures.

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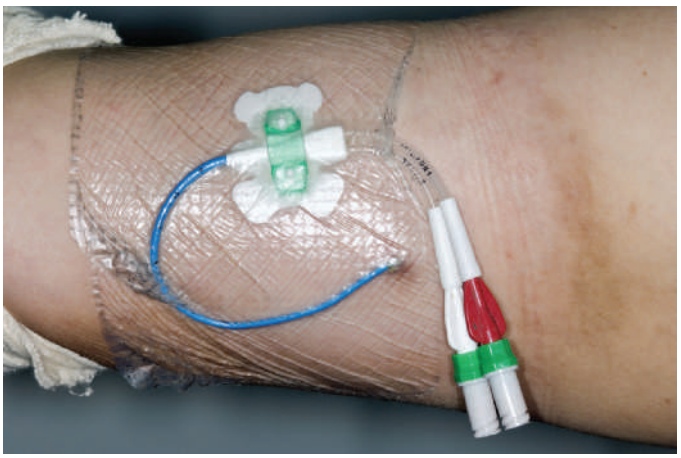


Figure 1-20 A peripherally inserted central catheter (PICC) secured to an extremity.

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17. Listen for breath sounds over the midaxillary and midclavicular lines—a minimum of four fields if you check the anterior chest, and six fields if you are assessing the posterior chest.
18. Lung assessment must include the bases and apices of the lungs. At this point, also assess the back for tenderness and deformities. Logroll the patient only once. Remember, if a spinal cord injury is suspected, use spinal precautions as you logroll the patient.
19. Look at the abdomen and pelvis for obvious lacerations, bruises, and deformities. Gently palpate the abdomen for pain on pressure or rebound tenderness. Observe for tenderness, guarding, rigidity, and pulsating masses.
20. Gently compress the pelvis and iliac crest from the sides to assess for tenderness, instability, and/or crepitus.
21. Inspect all four extremities for lacerations, bruises, swelling, deformities, ports or fistulae, and medical alert anklets or bracelets. Also assess distal pulses and motor and sensory function in all extremities. Compare right and left sides to determine strength and weakness variances.

The Focused Physical Assessment

A focused physical assessment is generally performed on patients who have sustained nonsignificant mechanisms of injury and on responsive medical patients. This type of examination is based on the cardinal presentation/chief complaint. For example, in a person reporting a headache, you should carefully and systematically assess the head and/or neurologic system. A person with a laceration on the arm may need to have only the arm evaluated. The focused assessment concentrates on the immediate problem. The most common complaints from a responsive medical patient will involve the head, heart, lungs, or abdomen, individually or in combination.

Mental Status

Evaluation of a patient's mental status involves assessing cognitive function (the patient's ability to use reasoning). At a minimum, evaluate the patient's degree of alertness. Use the AVPU mnemonic as described in the *Primary Survey* section to help identify the patient's level of consciousness. You can further assess mental status by considering whether the patient is alert and oriented in four areas (AOX4): person, place, day of the week, and the event itself. The most reliable and consistent method of assessing mental status and neurologic function is the Glasgow Coma Scale, which assigns a point value (score) for eye opening, verbal response, and motor response; these values are added together for a total score. The GCS score provides insight into the patient's overall neurologic function.

Skin, Hair, and Nails

The skin, which is the largest organ system in the body, serves three major functions: It regulates the temperature of the body, it transmits information from the environment to the brain, and it protects the body in the environment. Examination of the skin involves both inspection and palpation. Pay careful attention to the skin color, moisture, temperature, texture, turgor, and any significant lesions. Look for evidence of diminished perfusion, evaluate for pallor and cyanosis, and be wary of diaphoresis. Flushed skin is usually apparent in patients with fever, and it may be seen in patients who are experiencing an allergic reaction.

Examination of the hair is done by inspection and palpation. In this survey, note the quantity, distribution, and texture of the hair. Recent changes in the growth or loss of hair can indicate an underlying endocrine disorder, such as diabetes, or may result from treatment modalities, such as chemotherapy or radiation.

The examination of the fingernails and toenails can reveal many subtle findings. The color, shape, texture, and presence or absence of lesions should all be assessed. Normal changes to the nails with aging include the development of striation and a change in color (yellowish tint) related to the reduction in body calcium. Overly thick nails or nails that have lines running parallel to the finger often suggest a fungal infection.

Head, Eyes, Ears, Nose, and Throat

Physical exam of the head, eyes, ears, nose, and throat consists of a comprehensive evaluation of the head and related structures. It is crucial because the head contains the brain, numerous important sensory organs, and all of the upper airway anatomy. The eyes are a nervous

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system structure involving both motor pathways (lids, extraocular muscles, pupillary constrictors, corneal blink reflex) and sensory pathways. The ears provide for both hearing and balance control. The nose is a sensory organ involved with the senses of smell and taste. It also plays an important role in assisting with breathing. The throat consists of the mouth and posterior pharynx and all the structures intrinsic to them. This complicated structure simultaneously coordinates many motor and sensory functions, while also coordinating the initial activities of both the respiratory and digestive systems.

When you are examining the head, you should both feel it and inspect it visually. This step is important in the management of potential trauma patients and with patients who have altered mental status or are unresponsive. Inspect and feel the entire cranium for signs of deformity or asymmetry, being careful not to palpate any depressions because you do not want to push bone fragments into the cranial vault or the brain. If you find evidence of external bleeding, attempt to separate the hair manually and irrigate the clot. When you are evaluating the face, observe the color and moisture of the skin, as well as expression, symmetry, and contour of the face itself. Asymmetry of the face could suggest an underlying nervous system problem such as a stroke or facial nerve palsy. Take the following steps to examine the head:

1. Visually inspect the head, looking for any obvious deformities, contusions, abrasions, punctures, burns, tenderness, lacerations, and swelling.
2. Palpate the top and back of the head to locate any subtle abnormalities. Use a systematic approach, going from front to back, to ensure that nothing is missed.
3. Part the hair in several places to examine the condition of the scalp. Identify any lesions under the hair.
4. Note any pain or discomfort during the process. This exam should not cause the patient any pain.
5. Palpate the structure of the face, noting any deformities, contusions, abrasions, punctures, burns, tenderness, lacerations, and swelling.

The eyes are a tremendously complex sensory organ. They process light stimuli for the brain, so the brain is able to decode light impulses presenting to the eyes and form a visual image. The eyes are a critical link to the CNS—they give a useful glimpse into the patient's neurologic status. The eyes are assessed for a conjugate gaze. To do so, shine a penlight into the eye from the side of the face as the patient focuses on a distant object. In an awake and alert patient, the eyes should be open, should face in the same direction, and should move in tandem (**Figure 1-21**).

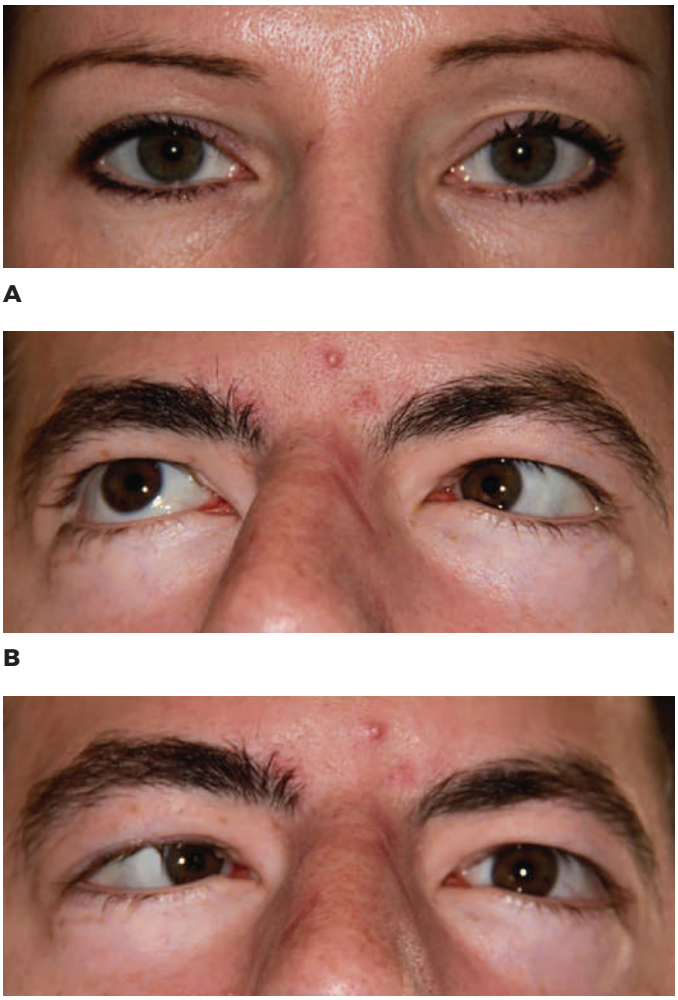


Figure 1-21 **A.** Baseline eye and lid position in central position. **B.** Right gaze with impaired abduction of the right eye. **C.** Left gaze with impaired abduction of the left eye.

Janet C. Rucker et al. Characterization of ocular motor deficits in congenital facial weakness: Moebius and related syndromes. *Brain*, April 2014, Vol. 137 (4), 1068–107. By permission of Oxford University Press.

Adequately perfused pupils are equal, round, and briskly reactive to stimulation with a penlight. Pinpoint pupils suggest opiate abuse or injury to the pons. Pupil dilation indicates toxicity or diminished neurologic function. Shining a light into the patient's eyes should cause the pupils to constrict quickly. Be sure to assess for this response in both eyes, observing whether the muscles of the eyes work synchronously so the pupils constrict simultaneously. Unilateral dilatation in an unconscious patient may be a sign of brain herniation. Some patients may present with anisocoria, a condition characterized by pupils that are noticeably unequal in size. Pupils appearing unequal in shape and size may also suggest glaucoma. Take the following steps to examine the eyes:

1. Examine the exterior portion of the eye. Look for any obvious trauma or deformity.

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2. Ask the patient about any pain, altered vision (blurred or double vision), discharge, or sensitivity to light. If the patient has double vision, determine if it is vertical (two objects on top of each other) or horizontal (two objects side by side).
3. Measure visual acuity by having the patient count the number of fingers you are holding up at varying distances from the patient (usually 6 ft, 3 ft, and 1 ft away from the patient). Check for visual field defects by checking if the patient can see your moving finger in each of four quadrants (top, bottom, right, left). Perform this exam on each eye independently of the other by testing one eye while the other eye is covered.
4. Examine the pupils for size, shape, and symmetry. They should be equal.
5. Test the pupils for their reaction to light. Both pupils should constrict when exposed to light, and they should be equal in their response.
6. Test the function of the 12 cranial nerves on patients exhibiting altered mentation, syncope, headache, and stroke.
7. Inspect the eyelids, lashes, and tear ducts for evidence of trauma, foreign bodies, or discharge.

Assessing the ears essentially involves checking for new aberrations in hearing perception plus inspecting and palpating for wounds, swelling, or drainage (blood, pus, cerebrospinal fluid). Abnormalities of the external canal and tympanic membrane are visualized by use of an otoscope. Take the following steps to examine the ears:

1. Select an appropriately sized speculum. Dim the lights as much as possible.
2. Ensure that the ear is free of foreign bodies.
3. Place your hand firmly against the patient's head and gently grasp the patient's auricle. Move the ear to best visualize the canal, usually upward and back in the adult patient.
4. Ask the patient not to move during the exam to avoid damaging the ear.
5. Turn on the otoscope, and insert the speculum into the ear. Insertion toward the patient's nose usually provides the best view. Do not insert the speculum deeply into the canal.
6. Inspect the canal for any lesions or discharge. A small amount of ear wax is normal.
7. Visualize the tympanic membrane (eardrum) and inspect it for integrity and color. Note any signs of inflammation.

Admittedly, using an otoscope is rarely performed in prehospital setting; however, it may be a critical skill for mobile integrated health medics.

When you are checking the nose, assess it both anteriorly and inferiorly. Look for evidence of asymmetry, deformity, wounds, foreign bodies, discharge or bleeding, and tenderness. Take the following steps to examine the nose:

1. Inspect the exterior of the nose, looking for color changes and structural abnormalities.
2. Examine the column of the nose; it should be midline with the face.
3. Inspect the septum for any deviation from midline or for a hematoma.
4. Note gross abnormalities and any drainage or discharge. Small amounts of mucosal discharge are normal, but large amounts of mucus and any blood or cerebrospinal fluid are serious findings.

Assessment of the throat should include an evaluation of the mouth, the pharynx, and sometimes the neck. The throat is a conduit for both respiration and digestion, and it is in close proximity to numerous vital neurovascular structures. As part of the assessment of overall hydration status, pay close attention to the lips, teeth, oral mucosa, and tongue. In patients who present with a markedly altered mental status, you will need to rapidly determine upper airway status. Prompt assessment of the throat and upper airway structures is mandatory. Always be ready to assist with clearing the pharynx using manual techniques and suction. Take the following steps to examine the throat:

1. If trauma is suspected, take precautions to protect the cervical spine.
2. Assess for usage of accessory muscles during respiration.
3. Palpate the neck to find any structural abnormalities or subcutaneous air, and ensure the trachea is midline. Begin at the suprasternal notch and work your way toward the head. Be careful about applying pressure to the area of the carotid arteries because it may stimulate a vagal response.
4. Assess the lymph nodes and note any swelling, which may indicate infection.
5. Assess the jugular veins for distention; this may indicate a problem with blood returning to the heart.

Cervical Spine

The cervical spine is the pathway by which the spinal cord makes its way out of the brain and into the torso, enabling the spinal nerves to emanate to and innervate the rest of the body. Cervical injury can present in a variety of ways, and the assessment for such injury must be conducted in a careful manner. Evaluate the patient first for the mechanism of injury and then for the presence of pain.

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When you are examining the cervical spine, inspect and palpate it, looking for evidence of tenderness and deformity. Pain is the single most reliable indicator of a spine injury or spinal cord injury. Any manipulations resulting in pain, tenderness, or tingling should prompt you to stop the exam immediately and provide spinal motion restriction. Continued assessment of a patient's range of motion should take place only when there is no potential for serious injury.

Chest

Typically, the chest exam proceeds in three phases: The chest wall is checked, a pulmonary evaluation is conducted, and finally the cardiovascular assessment is performed. The chest must be inspected for deformities in wall patency as well as to look for external clues of respiratory distress. Expose the chest and then begin the assessment, using the techniques of inspection, palpation, auscultation, and percussion. The examination of the posterior chest is the same as the examination of the anterior chest. Take the following steps to examine the chest:

1. Ensure the patient's privacy as best you can.
2. Inspect the chest for any obvious deformities, contusions, abrasions, punctures, burns, tenderness, lacerations, and swelling.
3. If you find any open wounds, dress them appropriately.
4. Note the shape of the patient's chest—it can give you clues to many underlying medical conditions, such as emphysema.
5. Look for any surgical scars or catheter ports indicating previous cardiac surgery and chronic illness.
6. Auscultate lung fields, noting any abnormal lung sounds.
7. Observe and palpate for subcutaneous emphysema.
8. Auscultate for heart tones.
9. Repeat the appropriate portions of the examination for the posterior aspect of the thorax.

Cardiovascular System

When you are examining a patient's cardiovascular system, pay attention to distal pulses, noting their location, rate, rhythm, and quality. Are the pulses fast or slow? Regular or irregular? Is the quality weak and thready or strong and bounding? Obtain an accurate blood pressure reading, and repeat this measurement periodically to assess the patient's hemodynamic stability. Note if the patient has a history of hypertension. Auscultate the carotid arteries with the bell of the stethoscope to assess for any bruits. While inspecting and palpating the chest, listen for heart sounds. Feel the chest wall to locate the point of maximum impulse and appreciate the apical pulse.

For a suspected heart problem, assess the pulse for regularity and strength, and examine the skin for signs of hypoperfusion (pallor, cool, wet) or oxygen desaturation (cyanosis). If the pulse feels irregular, assess it over 1 minute, rather than 30 seconds, in order to obtain a more accurate rate. Listen to breath sounds—many cardiac problems are associated with respiratory problems. Obtain baseline vital signs. Serious hypotension with sustained or progressive tachycardia is common in cardiogenic shock; stay alert for this condition because its mortality rate is more than 80%. Check for JVD because it can indicate heart failure, cardiac tamponade, or pneumothorax. Examine the extremities for signs of peripheral edema that may result from right-sided heart failure.

Abdomen

One of the most challenging complaints for you to assess in the field setting is abdominal pain, because it can result from multiple causes and often presents with few or no external signs. Always proceed with abdominal assessment in a systematic fashion, routinely performing inspection, auscultation, percussion, and palpation, quadrant by quadrant. Take the following steps to examine the abdomen:

1. Inspect the abdomen for any deformities, contusions, abrasions, punctures, burns, tenderness, lacerations, and swelling.
2. Note any surgical scars because they may be clues to an underlying illness.
3. Look for symmetry and the presence of distention.
4. Auscultate the abdomen for bowel sounds.
5. Perform percussion.
6. Palpate the four quadrants of the abdomen utilizing a systematic approach, beginning with the quadrant farthest from the patient's complaint of pain.
7. Note any tenderness or rigidity, and pay special attention to the patient's expressions because they may yield valuable information.

Female and Male Genitalia and Anus

In general, assessment of female genitalia is performed in a limited and discreet fashion. Reasons to examine the genitalia include concern over life-threatening hemorrhage or imminent delivery in childbirth (checking for crowning). Assessment of the female genitalia can be performed while you are assessing the abdomen. Palpate both the bilateral inguinal regions and the hypogastric region. If the decision is made to inspect the genitalia specifically, limit the examination to inspection only. Clinically significant causes of this pain include ectopic pregnancy, complications of third-trimester pregnancy, and nonpregnant ovarian problems or pelvic infections. Note any bleeding. In the case of injury involving

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intentional trauma, significant bleeding is possible. In general, make note of the amount and quality of any bleeding, as well as any inflammation, discharge, swelling, or lesions of the genitalia.

When you are examining the male genitalia, make certain the exam is performed in a limited and discreet fashion. Always assess the entire abdomen and note any pertinent findings, because occasionally lower abdominal problems are referred from the genitalia. Situations of testicular torsion or inguinal hernia sometimes present with a complaint of lower abdominal pain but minimal abdominal tenderness. In the case of a trauma patient, assess for the possibility of significant genital bleeding and injury or underlying fracture.

The anus is often evaluated at the same time as the genitalia. It is examined in only a limited number of circumstances. Examine the sacrococcygeal and perineal areas, noting obvious bleeding trauma, lumps, ulcers, inflammation, rash, abrasions, or evidence of fecal incontinence.

Examinations of the genitalia and anus should be performed with a partner or a witness present. This may not be practical in all scenarios, and your local policy should be followed.

Musculoskeletal System

When you are examining the skeleton and joints, pay attention to their structure and function. Consider how the joint and associated extremity look and how well they work. Does the extremity look normal, and does it move in a normal range of motion? In particular, note any limitation of range of motion, pain with range of motion, or bony crepitus. When you are assessing the joints and extremities, look for evidence of inflammation or injury, such as swelling, tenderness, increased heat, redness, ecchymosis, or decreased function. Also evaluate the joint or extremity for obvious deformity, diminished strength, atrophy, or asymmetry from one side to the other. The examination of the musculoskeletal system should not cause the patient any pain. If any pain occurs, it should be considered an abnormal finding. Take the following steps to examine the musculoskeletal system:

1. Beginning with the upper extremities, inspect the skin overlying the muscles, bones, and joints for soft-tissue damage.
2. Note any deformities or abnormal structure.
3. Check for adequate distal pulse, motor, and sensation to each extremity.
4. Inspect and palpate hands and wrists, noting any deformities, contusions, abrasions, punctures, burns, tenderness, lacerations, and swelling.
5. Ask the patient to flex and extend the joints of fingers, hands, and wrist, noting any abnormalities in range of motion. If the patient experiences any discomfort, stop that portion of the exam.
6. Inspect and palpate the elbows, noting any abnormalities. Ask the patient to flex and extend the elbow to determine range of motion.
7. Ask the patient to turn the hand from palm-down position to palm-up position and back again, noting any pain or abnormalities.
8. Inspect and palpate the shoulders. Ask the patient to shrug the shoulders and raise and extend both arms.
9. Inspect the skin overlying the lower extremities.
10. Ask the patient to point and bend the toes to establish the range of motion.
11. Ask the patient to rotate the ankle, checking for pain or restricted range of motion.
12. Inspect and palpate the knee joints and patella. Ask the patient to bend and straighten both to establish the range of motion.
13. Check for structural integrity of the pelvis by applying gentle pressure to the iliac crests and pushing in and then down.
14. Ask the patient to lift both legs by bending at the hip and then turning legs inward and outward. Note any abnormalities.

Peripheral Vascular System

When you are assessing the peripheral vascular system, pay attention to both the upper and lower extremities. Look for signs indicative of either acute or chronic vascular problems. A wide range of disorders can affect the peripheral vascular system—from chronic venous stasis and lymphedema to intermittent claudication (cramplike pain in the lower legs due to poor circulation or low potassium levels) and acute arterial occlusion. Peripheral vascular disease can manifest in many forms, depending on the point in the vasculature where the abnormality is located. Carotid artery disease can manifest as a stroke, for example, while arterial embolization involving the mesenteric vessels can result in bowel ischemia and necrosis. Take the following steps to examine the peripheral vascular system:

1. When you are examining the upper extremities, note any abnormalities in the radial pulse, skin color, or condition. Always compare one extremity to the opposing extremity.
2. If abnormalities are noted in the distal pulse, work your way proximally, checking pulse points and noting your findings.
3. Palpate the epitrochlear and brachial nodes of the lymphatic system, noting any swelling or tenderness.

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4. Examine the lower extremities, noting any abnormalities in the size and symmetry of the legs.
5. Inspect the skin color and condition, noting any abnormal venous patterns or enlargement.
6. Check distal pulses, noting any abnormalities.
7. Palpate the inguinal nodes for swelling and tenderness.
8. Evaluate the temperature of each leg relative to the rest of the body and to each other.
9. Evaluate for pitting edema in the legs and feet.

Spine

Assessment of the cervical spine was introduced after the section on examination of the throat and neck. This section lists the complete assessment steps for the examination of the spine.

1. Inspect the cervical, thoracic, and lumbar curves for any abnormalities.
2. Evaluate the heights of the shoulders and the iliac crests. Differences from one side to the other may indicate abnormal curvature of the spine.
3. Palpate the posterior portion of the cervical spine, noting any point tenderness or structural abnormalities.
4. In the nontrauma patient and in the absence of reported pain, ask the patient to move the head forward, backward, and from side to side.
5. Move down the spine, palpating each vertebra with the thumbs to note any tenderness or instability.
6. In the absence of pain or trauma, ask the patient to bend at the waist in each direction to establish the range of motion.

Nervous System

The nervous system includes two portions: the central nervous system, which consists of the brain and spinal cord, and the peripheral nervous system, which includes the remaining motor and sensory nerves. Motor and sensory function should be evaluated in all patients whether they are conscious, unconscious, or have altered mental status. If the patient is conscious, gently touch the hands and feet to determine the ability to feel light touch, indicating that distal perfusion is adequate and sensory nerve tracts are functioning properly. Withdrawal of an extremity may indicate pain or discomfort. Assessing for sensation will determine the function of the afferent sensory nerve tracts in the posterior spinal column. The check of the nervous system is one of the most time-consuming elements of the physical exam.

All levels of healthcare providers should be proficient in performing a cranial nerve assessment as part of their physical exam. The cranial nerves play roles in a wide variety of motor and sensory functions involving both the voluntary and autonomic nervous systems. Findings identify cranial nerve impairment and glean timely information about the patient's neurologic status. The cranial nerves and their functions are summarized in **Table 1-7**.

Motor function in all extremities should be evaluated for bilateral equality and strength. Unequal responses of left and right limbs should be considered a sign of hemiparesis (unilateral paralysis) or hemiplegia (unilateral

Table 1-7 Cranial Nerves and Their Functions

Nerve No.	Name	Function	Assessment
I	Olfactory	Sense of smell	Ask the patient to close his or her eyes. Place spirits of ammonia or an alcohol wipe under the nose. The patient should be able to identify the odor.
II	Optic	Sense of sight	Evaluate visual acuity using a Snellen visual acuity chart or Rosenbaum card. Ask the patient to cover one eye and tell you how many fingers you are holding up. Then evaluate the opposite eye.
III	Oculomotor	Size, symmetry, and shape of pupils Eye movement	Test the pupil response to light for equality, reactivity, and roundness. Pupils should briskly constrict with light and dilate in darkness.
IV	Trochlear	Downward gaze	Hold the patient's chin to prevent movement. Ask the patient to follow a penlight or object in an "H" pattern to track the six visual fields.

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Nerve No.	Name	Function	Assessment
V	Trigeminal	Cheek Jaw motion Chewing Facial sensation	Ask the patient to clench the teeth to determine the strength of the jaw and the ability to close the mouth without difficulty. The patient should feel a slight touch bilaterally.
VI	Abducens	Lateral eye movement	Same as for cranial nerve IV.
VII	Facial	Strength of facial muscles Taste Saliva secretion	Assess for weakness or asymmetry by inspecting the face at rest and when speaking. Ask the patient to raise the eyebrows, frown, show his or her upper and lower teeth, smile, and puff out both cheeks.
VIII	Acoustic	Sense of hearing Balance	Occlude each ear independently to test for hearing and balance.
IX	Glossopharyngeal	Tongue and pharynx sensation Taste Muscles of swallowing	Ask the patient to say "ahhh," and observe the uvula and soft palate response. The soft palate should move up, and the uvula should remain midline.
X	Vagus	Sensation of throat and trachea Taste Muscles for voice production Heart rate	Same as cranial nerve IX.
XI	Spinal accessory	Shoulder movement Ability to turn head	Ask the patient to raise and lower shoulders against the resistance of your hand on their shoulder.
XII	Hypoglossal	Speech articulation Tongue movement	Ask the patient to stick out the tongue and move it in several directions with symmetry.

weakness), which can be caused by stroke, meningitis, brain tumors, or seizure activity. Bilateral upper or lower extremity weakness should raise concern for a spinal cord lesion.

Cerebellar function can be evaluated by how a patient stands and walks. Ataxia (unsteady gait) may indicate damage from toxicity or chronic neurologic dysfunction. A shuffling gait may indicate neurologic damage caused by Huntington disease or Parkinson disease. Tremors, muscle rigidity, and repetitive motion may indicate degeneration of the nervous system attributable to Alzheimer disease or Parkinson disease.

Patients with a variety of psychological or behavioral disorders may take antipsychotic medications having spasmodic muscle movement as a side effect. These medications may also induce muscle dystonia, expressed as contortion of the extremities or facial tics.

Reflexes are tested to evaluate symmetry and strength of response. Reflexes are involuntary motor responses to specific sensory stimuli, such as a tap on the knee or stroking the eyelash. Testing may include deep tendon reflexes and superficial reflexes, including superficial abdominal reflexes. Inappropriate responses may indicate damage to neuronal pathways at corresponding spinal segmental levels. All responses should be thoroughly documented.

Deep tendon reflexes are stretch reflexes, requiring the muscles being tested to be relaxed and the tendons gently stretched (**Table 1-8**). Using a reflex hammer and keeping the wrist relaxed, gently swing the hammer to tap the tendon. Support the joint or extremity being tested with your nondominant hand (**Figure 1-22**). Upper motor neuron lesions, such as in the brain or spinal cord, typically lead to hyperreflexia, whereas peripheral nerve lesions, such as with Guillain-Barré syndrome, cause hyporeflexia.

The arm drift (**Figure 1-23**) is used to evaluate motor and sensory function in a suspected stroke patient. Patients are asked to close their eyes and extend their arms with palms up. Note any downward drift or drop or any inward rotation of either arm.

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Table 1-8 Superficial and Deep Tendon Reflexes

Reflex	Spinal Level Evaluated
Superficial	
Upper abdominal	T7, T8, and T9
Lower abdominal	T10 and T11
Cremasteric	T12, L1, and L2
Plantar	L4, L5, S1, and S2
Deep Tendon	
Biceps	C5 and C6
Brachioradial	C5 and C6
Triceps	C6, C7, and C8
Patellar	L2, L3, and L4
Achilles	S1 and S2
Scoring Deep Tendon Reflexes	
Grade	**Deep Tendon Reflex Response**
0	No response
1+	Sluggish or diminished
2+	Active or expected response
3+	More brisk than expected, slightly hyperactive
4+	Brisk, hyperactive, with intermittent or transient clonus

Rudy EB: *Advanced Neurological and Neurosurgical Nursing*, St. Louis, 1984, Mosby.



A **B**

Figure 1-22 Techniques to evaluate the deep tendon reflexes include, **(A)** using a reflex hammer and **(B)** supporting the joint or extremity being tested.

The Babinski test may be used to check for neurologic function in conscious patients and in patients with altered mental status. To perform this exam, take a pen or similar dull object and run it along the lateral length of the sole of the foot. Normal reaction to this stimulation is for the toes to move downward, a response known as plantar flexion. This movement indicates a negative test result. A positive Babinski test is indicated by abnormal extension of the great toe and fanning of the remaining toes, a response called dorsiflexion. This movement suggests neurologic dysfunction (**Figure 1-24**). Periodic reevaluation of the patient's response to questions about pain, discomfort, and difficulty breathing is important in gauging the effectiveness of interventions.

The patient's physical exam should also be reevaluated, as appropriate, for diminished pain and discomfort, bleeding, and edema. Capillary refill time; distal pulses; and skin color, temperature, and moisture should also be reevaluated. Central nervous system function should be reassessed for improvement in GCS scores and motor,

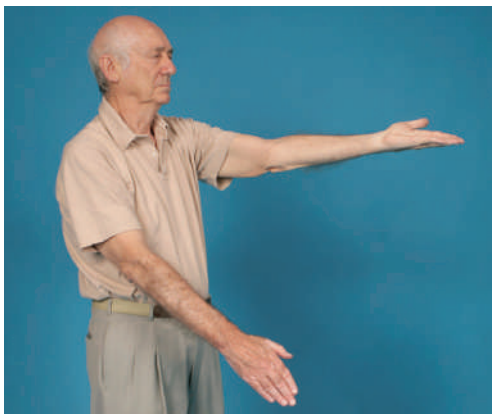


Figure 1-23 Arm drift test (National Institutes of Health Stroke Scale).

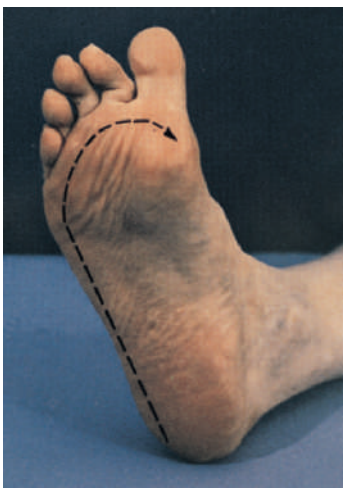


Figure 1-24 Check to determine the presence or absence of the Babinski sign.

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sensory, and pupil response. Take the following steps to examine the nervous system:

1. Assess the patient's mental status by using the AVPU mnemonic.
2. Note the patient's posture.
3. Evaluate cranial nerve function.
4. Evaluate the patient's neuromuscular status by checking muscle strength against resistance.
5. Evaluate the patient's coordination by performing the finger-to-nose test using alternating hands.
6. If appropriate, check the patient's gait and balance by having the patient walk heel to toe or perform the heel to shin stance.
7. Perform the arm drift test. There should be no difference in movement on either side.
8. Evaluate the patient's sensory function by checking the responses to both gross and light touch.
9. If appropriate, check for deep tendon reflexes.

Trauma Patients

Any trauma patient who is unresponsive or has altered mentation should be considered a high-risk, priority patient and requires immediate transport to a trauma center. An unresponsive patient may have a traumatic brain injury, stroke, hypoglycemia, or alcohol or drug intoxication. All are serious and potentially lethal events.

Recall you will perform the rapid exam on trauma patients to obtain a quick 60- to 90-second impression of a patient's injuries. Although there may not always be time for further physical examinations of trauma patients, when time and patient condition do allow for it, they should be performed. The most visible injury you may be looking at (for example, a scalp laceration) or the most painful injury the patient reports (such as a fractured ankle) may not be nearly as serious as the most lethal injury the patient has (for example, a ruptured spleen).

Quickly reassess the patient's current mental status, comparing it with the baseline that was established when you first encountered the patient. Last, revisit your transport decision. If you decide the patient needs immediate transport, perform the rapid exam and do not delay transport in order to perform more thorough examinations.

If additional physical examinations are performed beyond the rapid exam, remember to check your gloves for blood after each area of the body is assessed. This will enable you to note any areas having active bleeding. If you do not check your gloves frequently, you may be unsure which part of the body the blood came from and will have to redo the entire process.

Mentally piece together all you know about your patient, including the chief complaint, the history of the present event, the medical history, and any information about the patient's current health status. Combine that knowledge with the other information and insights you have gained from your various assessments, along the information obtained from your diagnostics, and you should have enough information to make appropriate clinical choices for your patient. Keep in mind a trauma patient may have also experienced a medical event and a medical patient may also have a traumatic injury. The provider must prioritize the most urgent complaint and condition for treatment. Some cases may involve both medical and trauma considerations.

Diagnostics

Whereas the history taking and secondary survey process are the best methods for determining a differential diagnosis in the patient, the use of certain diagnostic and monitoring devices in addition to performing laboratory tests aids in the assessment process. These devices are designed to assist the provider with diagnostic assessment and monitoring of patients. Keep in mind that while these devices are helpful, they cannot replace a good history and secondary survey. Patient history, physical exam, and diagnostic tools can be targeted to a specific body system. Each body system presents a set of unique assessment options to rule in or rule out differential diagnoses. Using clinical reasoning, the provider can integrate new information pertinent to the current patient with previous assessment and treatment knowledge.

Diagnostic tools can help identify a broad range of medical conditions. Prehospital diagnostic tools can provide valuable information and prompt early, lifesaving intervention.

Laboratory Studies

There are a variety of elements found in the blood aiding you in determining a differential diagnosis. Laboratory studies to obtain values for serum bilirubin, serum albumin, hemoglobin, hematocrit, serum urea nitrogen, and creatinine can be done. Measuring the blood glucose level of every patient who has altered mentation is a must in EMS. Laboratory results are evaluated for blood loss, metabolic acidosis, renal or hepatic disease, dehydration, and malabsorption syndromes. Laboratory and radiographic tests are ordered to identify the presence of kidney stones; ulcers; and obstructions to the gastrointestinal, genitourinary, and reproductive systems. Point-of-care laboratory testing is becoming more prevalent in today's EMS systems. Providers should strive to be knowledgeable in their interpretation.

Stroke Scales

Research indicates using a stroke scale can help determine whether a patient has had a stroke. Although other assessment data and physical exam findings are needed to establish such a diagnosis, several consensus guidelines advocate

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using such a scale to make the rapid determination that a stroke is likely to have occurred. This early identification will prioritize the patient's treatment and transport. Common scales utilized are the Los Angeles Prehospital Stroke Screen and the Cincinnati Prehospital Stroke Scale. Many protocols also specify notification of a designated stroke team early in the assessment process (Table 1-9 and Table 1-10).

Current controversy exists regarding stroke scales that can identify large vessel occlusions. This is in evolution as the text is published and there is currently no consensus as to which scales or scoring systems are best for this purpose. Please continue your lifelong learning processes and monitor the research and implementation of these ancillary tools.

Pulse Oximetry

A pulse oximeter takes advantage of hemoglobin's propensity to absorb light, which results in an indirect measurement of oxygen saturation when a pulse oximetry probe is placed on a finger or toe (without nail polish) or

Table 1-9 Los Angeles Prehospital Stroke Screen

Criteria	Yes	Unknown	No
1. Age > 45 years	❑	❑	❑
2. History of seizures or epilepsy absent	❑	❑	❑
3. Symptoms < 24 hours	❑	❑	❑
4. At baseline, patient is not wheelchair bound or bedridden	❑	❑	❑
5. Blood glucose level between 60 and 400 mg/dL	❑	❑	❑
6. Obvious asymmetry (right vs. left) in any of the following three exam categories (must be unilateral):	❑	❑	❑
	Equal	**Right Weak**	**Left Weak**
Facial smile/grimace	❑	Droop ❑	Droop ❑
Grip	❑	Weak grip ❑ No grip ❑	Weak grip ❑ No grip ❑
Arm strength	❑	Drifts down ❑ Falls rapidly ❑	Drifts down ❑ Falls rapidly ❑

Interpretation: If criteria 1–6 are marked yes, specificity of a stroke is 97%.

Table 1-10 Cincinnati Prehospital Stroke Scale

Assessment	Normal	Abnormal
Facial Droop		
Ask patient to smile and show his or her teeth.	Both sides of the face move equally.	One side of the face does not move as well as the other side.
Arm Drift		
Ask patient to close eyes and hold arms out for 10 seconds.	Both arms move the same or neither arm moves.	One arm does not move or one arm drifts down compared with the other.
Abnormal Speech		
Ask patient to repeat the phrase "You can't teach an old dog new tricks."	Uses correct words, no slurring.	Slurs words, uses inappropriate words, or is unable to speak.

Interpretation: If any of these is abnormal, probability of a stroke is 72%.

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earlobe. Oxygen saturation is an indication of how many hemoglobin-binding sites in the blood are occupied by (saturated with) oxygen molecules relative to the number available. This measurement is expressed as a percentage. Healthy people have an oxygen saturation of 97% to 99%. In a patient with a normal hemoglobin level, a saturation of 90% is minimally acceptable, but oxygen should be administered to patients with breathlessness, signs of heart failure, shock, or an oxygen saturation less than 94%.

The tool is of minimal value in patients with poor perfusion attributable to autoimmune disease, endocrine emergencies, drug toxicity, or blood loss. In addition, pulse oximetry readings may be unreliable in patients with carbon monoxide poisoning, in smokers, and in diabetics with advanced peripheral vascular disease.

A patient whose oxygen saturation is less than 94% should be administered supplemental oxygen by a nasal cannula or nonrebreathing mask (**Figure 1-25**). The percentage of supplemental oxygen administered will depend on assessment findings. Oxygen saturation findings are helpful to measure if assessed before and after application of supplemental oxygen.

Peak Flow Meter

Peak flow meters measure peak expiratory flow rate, or the rate at which a patient can breathe out. The rate is expressed in liters per minute (L/min). In patients with reactive airway disease, the rate diminishes because of increased resistance during exhalation. To participate in this test, the patient must be able to follow instructions to take deep breaths in and out (maximum inhalation and exhalation; see Figure 1-13A).

Capnography

Capnography is used to monitor carbon dioxide levels in exhaled gases, or end-tidal carbon dioxide ($ETCO_2$). This diagnostic assessment can give you a better understanding of the patient's ventilatory status. Capnography is projected as a waveform and a numeric value. The normal value of $ETCO_2$ in the blood is between 32 and 43 mm Hg.

Digital capnography can measure on a waveform tracing the exact amount of exhaled carbon dioxide. In addition, it can record air movement during inhalation and exhalation. This device allows continual monitoring of tracings. Abnormalities in inhalation or exhalation will alter the pattern of the waveforms.

Capnometry is the quantitative measurement of CO_2 without the waveform. A colorimetric capnometer provides semiquantitative information. This is a device with litmus paper that changes color in response to pH. The device can be placed between the airway and ventilating device. Exhaled air with no carbon dioxide will not change the paper color. Initially there is a dark purple color, and it turns to yellow/gold when there are near-normal levels of CO_2. If the litmus paper is exposed to stomach contents, it will also turn yellow/gold owing to acidity. The color should go from purple to yellow to purple with each ventilation to indicate the capnometer is accurately detecting CO_2.

Hypoventilation causes retention of CO_2, leading to respiratory acidosis. Increasing the percentage of supplemental oxygen, checking proper tracheal tube placement, and assisting ventilation with a bag-mask device are essential (**Table 1-11**).



Figure 1-25 A pulse oximeter.

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Electrocardiography

An ECG records the electrical activity of the atrial and ventricular cells of the heart and represents this activity as specific waveforms and complexes. The ECG continuously detects and measures electrical flow on the patient's skin. Electrocardiographic testing is used to detect acute myocardial ischemia and to monitor a patient's heart rate, evaluate the effects of disease or injury on heart function, analyze pacemaker function, and assess response to medications. The ECG does not provide information about the heart's contractile (mechanical) function.

Whether using a 3-lead, 12-lead, 15-lead, or 18-lead ECG, reviewing various views of the frontal surface, horizontal axis, and left ventricle of the heart provides key information about ischemia and infarction. The standard 12-lead ECG visualizes the heart in the frontal and horizontal planes and views the surfaces of the left ventricle from 12 different angles. Having multiple views of the heart makes possible the recognition of bundle branch blocks; the identification of ST-segment changes such as ischemia, injury, or infarct; and the analysis of ECG changes associated with medications. Extended lead placement, as in the 15- and 18-lead devices, allows additional anterior and posterior views.

ECG monitoring is typically performed in patients who are having difficulty breathing or who have chest or abdominal discomfort or pain, particularly if the patient has both complaints. ST-segment elevation MI (STEMI) points toward an acute, evolving myocardial necrosis. Non–ST-segment elevation MI (NSTEMI) may show up

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Table 1-11 Capnography-Related Terms

Term	Description
Capnography	Continuous analysis and recording of CO_2 concentrations in respiratory gases Output is displayed as a waveform Graphic display of the CO_2 concentration versus time during a respiratory cycle CO_2 concentration may also be plotted versus expiratory volume.
Capnometer	Device used to measure the concentration of CO_2 at the end of exhalation
Capnometry	A numeric reading of exhaled CO_2 concentrations without a continuous written record or waveform Output is a numeric value. Numeric display of CO_2 on a monitor
Capnograph	A device that provides a numeric reading of exhaled CO_2 concentrations and a waveform (tracing)
Exhaled CO_2 detector	A capnometer that provides a noninvasive estimate of alveolar ventilation, the concentration of exhaled CO_2 from the lungs, and arterial CO_2 content; also called an end-tidal CO_2 detector
Colorimetric $ETCO_2$ detector	A device that provides CO_2 readings by chemical reaction on pH-sensitive litmus paper housed in the detector The presence of CO_2 (evidenced by a color change on the colorimetric device) suggests tracheal placement.
Qualitative $ETCO_2$ monitor	A device that uses a light to indicate the presence of $ETCO_2$

$ETCO_2$, End-tidal carbon dioxide

Modified from Aehlert BJ: *Paramedic practice today: Above and beyond*, St. Louis, MO, 2010, MosbyJems.

on an ECG as ST-segment depression and T-wave inversion. When reviewing 12-lead ECGs, several patterns may mimic ST elevation, including left bundle branch block (LBBB) and pericarditis.

Additional tools such as ultrasonography, mechanical ventilators (**Figure 1-26**), and compensatory reserve monitors are becoming more commonly used in prehospital care. These devices provide valuable feedback and allow for rapid interventions of patient care. As they become more prevalent in day-to-day usage, we will be able to provide additional detail in this text. For now, those interested in these areas should seek additional knowledge as part of their lifelong learning process.

Refine the Differential Diagnosis

Throughout the assessment process, the provider will be distinguishing one disease from another based on accumulated data and clinical reasoning. The clues obtained from the patient's symptoms, history, physical examination, and diagnostic testing help narrow the possible diagnoses. Refining the differential diagnosis, which is the process of the elimination of potential diagnoses, eventually leads to one diagnosis.

The patient's differential diagnosis also helps you decide whether the patient's condition is life threatening, critical, or nonemergent. At any moment your patient's condition may decline from being critical to life threatening, and appropriate management and transport must begin without delay.

Ongoing Management

After the primary survey, reassessment is the single most important process you will perform. When performing reassessment, you must evaluate the patient's airway, breathing, and circulation/perfusion (ABCs), make certain you have adequately addressed the chief complaint, obtain another set of vital signs, and close any other patient care loops, such as dressing small wounds and placing ice packs. Reassessment represents a continuous, yet cyclical, process you perform throughout transport, right up to the time you turn patient care over to the receiving facility. For patients in stable condition, you should do a reassessment every 15 minutes. For patients in unstable condition, you need to make a concerted effort to repeat the reassessment every 5 minutes.

Reassess the Patient

Reassessment combines repetition of the primary survey, reassessment of vital signs and breath sounds, and repetition of the secondary survey. During the reassessment, you continue to evaluate and reevaluate the patient's status and any treatments already administered. Trends in the patient's current condition may give clues about the effectiveness of treatments. Compare vital signs. Have interventions improved the patient's condition?

First, compare the patient's LOC with your baseline assessment. Is the LOC changing? Second, review the

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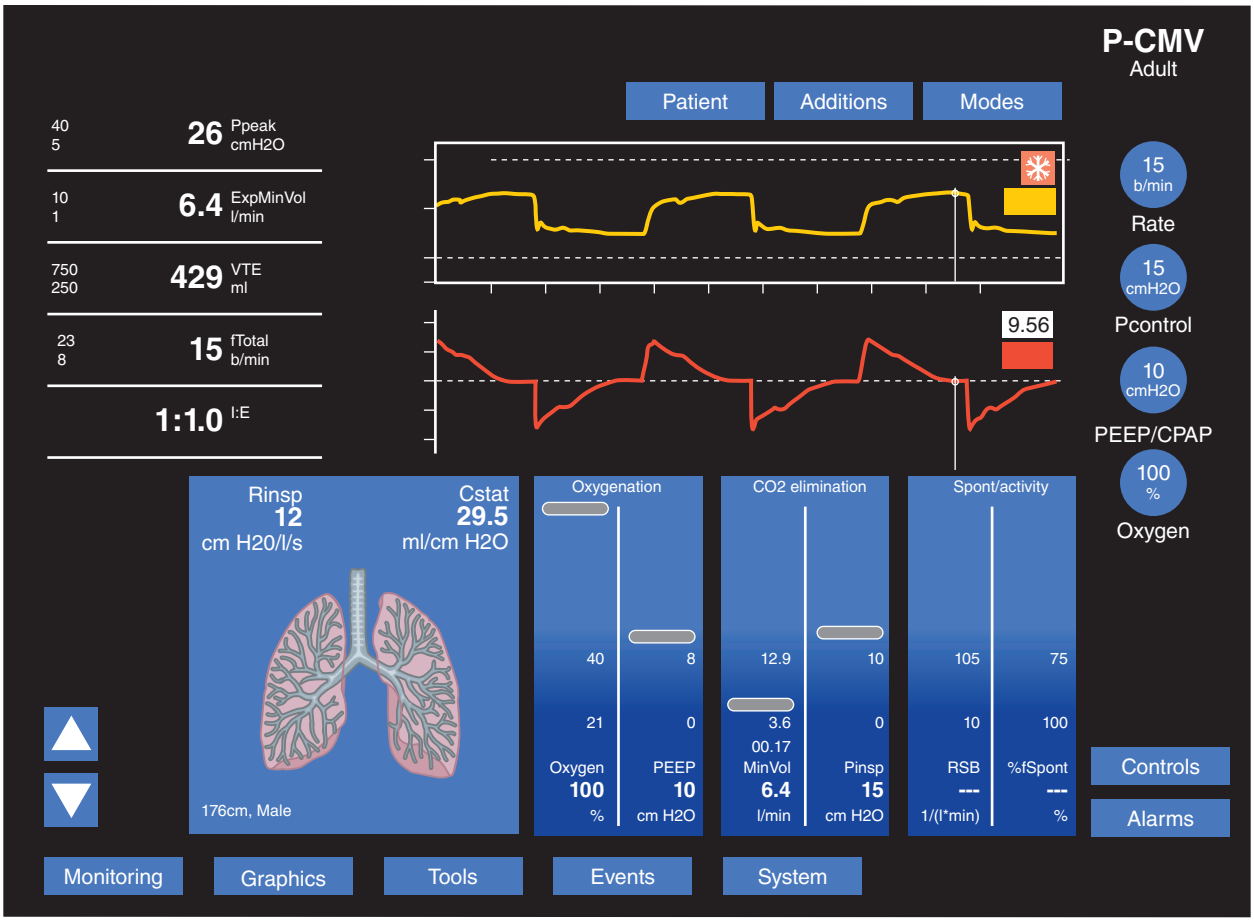


Figure 1-26 The control screen of a mechanical ventilator.

patient's airway. Is it patent? Always be prepared to suction, and do not delay if you hear gurgling in the upper airway. Third, reassess breathing. Is the patient breathing adequately? If not, figure out why and correct the problem. Finally, reassess the patient's circulation and perfusion. Assess overall skin color as an initial measure of cardiovascular function and hemodynamic status. Make certain all bleeding is identified and controlled.

Refine the Differential Diagnosis

As you perform your reassessment, you will continually be able to rule in or rule out certain conditions from your differential diagnosis. Keep an open mind as you gather patient information and modify your differential diagnosis based on new findings.

Modify Treatment

After reassessing the patient, think about your present care plan. Have you addressed all life threats? On the basis of what you know now, do you need to revise your priority list? If so, make the change and continue with patient care. In contrast, if your plan is working well and you have addressed most or all of the patient's complaints, there is no need to revise the care plan.

While you are reevaluating your patient care priorities, you should reassess the transport plan as well. Should routine transport be stepped up to priority? Is the patient's condition worsening to the point you need to consider diverting to a closer facility? Do you need to set up a rendezvous with an air ambulance and fly the patient to the healthcare facility? If your patient's condition has improved and stabilized, you should step down from priority and transport the patient as a routine case—the clearly safer choice.

Monitor the Therapeutic Response

Continue to monitor the patient's condition. Obtain another complete set of vital signs, and compare them with the expected outcomes from your therapies. For example, if you administered a 500-mL bolus of normal saline to a patient with gastrointestinal bleeding, you usually would expect a rise in blood pressure and a decrease in pulse rate. With any priority patient, you should have a minimum of three sets of vital signs. With most priority patients, you will have four or five sets of vital signs. With several sets of vital signs, you can look for trends in your patient's condition.

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Last, revisit your patient's complaints, as you recorded during history taking. Have any complaints improved or resolved? Which situations remain unresolved? Situations that are worsening are especially concerning because they could mean an unseen problem or ineffective interventions. If you have not reached the receiving facility, repeat the reassessment process again. Document all of your findings with each reassessment so your medical record is accurate and complete for handoff at the destination.

Special Populations

Older Adult Patients

The American Geriatrics Society has estimated more than one-third of all EMS calls are in response to an older adult patient. Many older adults lead healthy, active lives, but others have chronic health problems. Assessment of the geriatric patient is more challenging than a younger adult for a variety of reasons.

Geriatric patients lack appropriate compensatory mechanisms and therefore may not show signs of deterioration as their conditions become unstable. In addition, many of these patients have underlying diseases or take medications masking the true assessment findings. Orthostatic hypotension attributable to diminished baroreceptor function can be a concern during the physical exam. Take care to have older patients move slowly to better accommodate blood volume changes.

Medications

Most older adults take three to five prescription medications, which is referred to as polypharmacy. **Pharmacokinetics**—the absorption, distribution, metabolism, and excretion of medications—differs in older adults compared to younger patients. As a result, older adults tend to have adverse drug reactions more often, especially when they are also taking OTC medications or dietary supplements such as herbal preparations or nutritional drinks. The most common adverse reactions to medications are confusion, sedation, loss of balance, nausea, and electrolyte abnormalities.

Communication

Communication may be difficult if the patient has a hearing or speech–language impairment. However, many older adults are able to hear normally. If a patient does have hearing aids, make sure they are set at the proper volume.

Patience is vital when taking a history. Older adults sometimes cannot recall the names of medications or the conditions for which they have been prescribed. In addition, they may process questions slowly and feel obligated to share information they believe is important before answering the question directly. Such extra information may prove helpful when trying to work through the differential diagnosis.

Pulmonary System Changes

The pulmonary system undergoes changes in the older adult. The kyphosis (curvature) of the thoracic spine that often occurs with advancing age can make expanding the lungs more difficult. The respiratory muscles weaken, causing respiratory fatigue and failure earlier than in younger adults. This decrement is perhaps attributable to lifelong exposure to environmental pollutants or to repeated lung infections over the years. In addition, the elasticity of the lungs and chest wall decreases with age, diminishing tidal volume. Because of these changes, the respiratory rate normally increases to compensate and maintain an adequate minute volume.

If a patient shows signs or symptoms of hypoxia, oxygen must be given in an effort to attain an oxygen saturation of 94% or greater. When you are transporting a patient who has shortness of breath, the patient may ask to sit upright. Follow the patient's lead because patients are usually better able to determine for themselves which position makes breathing easier.

Cardiovascular System Changes

Many changes occur in the cardiovascular system of an older adult patient. Large arteries become less elastic, creating more pressure in the arteriole system during systole. This raises systolic blood pressure, leading in turn to a widened pulse pressure (the difference between systolic and diastolic blood pressure). Peripheral vascular resistance (PVR) may increase, and diastolic blood pressure and mean arterial pressure may rise, resulting in hypertension. Common cardiac problems among older adults include MI, heart failure, dysrhythmias, aneurysms, and hypertension.

When obtaining a history from the older adult patient complaining of chest pain or discomfort, try to ascertain his or her level of cardiovascular fitness. Older people who regularly engage in physical activity are able to maintain more efficient cardiac function.

Assessment of the older adult for cognitive changes can be difficult without family members or friends to whom you can direct questions about the patient's history. If possible, determine the patient's baseline mental status, and then assess for any changes in behavior, thought processes, and mood. Ask family or friends about any recent changes in the patient's hygiene and food preparation habits.

Terminally Ill Patients

Hospice services include supportive social, emotional, and spiritual care for patients and their families at the end of life. Patients who are terminally ill, such as those

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with advanced cancer or acquired immunodeficiency syndrome (AIDS), often receive palliative care (comfort care). Medical needs vary depending on the disease but typically center on pain management.

The terminally ill patient may have medical and legal documents such as advance directives or do-not-resuscitate (DNR) orders. Some states have specific DNR paperwork, so healthcare providers should be familiar with specific policies, procedures, and regulations in their part of the country. In many states, a provider's scope of practice governs whether a prehospital healthcare provider may honor legal DNR advance directives or living wills.

Bariatric Patients

Obesity is an excessive amount of weight relative to height. Being overweight is defined as a body mass index (BMI) of 25 to 29.9 kg/m^2. The CDC defines obesity in terms of body mass index, a height/weight ratio calculated as follows:

$$\text{BMI} = [\text{Weight (lb)} \div \text{Height}^2 \text{ (in.)}] \times 703$$

For example, a person who is 5 feet 5 inches tall and weighs 135 lb has a BMI of 22.5, which falls in the normal range for a person of that height and weight. A person of the same height who weighs 180 lb has a BMI of 30 and is thus, by definition, obese. BMI is calculated more precisely for children and teens, factoring in their precise height and weight as well as their age and sex. A BMI of 39 or greater, or being 100 lb or more over recommended weight for height, constitutes morbid obesity, which carries more serious health risks.

Obesity is a chronic disease and is the second leading cause of preventable death in the United States (behind tobacco use). Obese (bariatric) patients are at increased risk of diabetes, hypertension, coronary heart disease, dyslipidemia, stroke, liver disease, gallbladder disease, sleep apnea, respiratory disorders, osteoarthritis, and certain types of cancer; obese women are also at increased risk of infertility. Morbidly obese persons may develop pulmonary hypertension and right-sided heart failure, known as cor pulmonale.

Moving an Obese Patient

Healthcare personnel must have policies for moving and lifting obese patients because of the additional risk they pose to providers and the extra demands they place on staff and resources. Scene and situational assessment is especially important because a specially equipped bariatric ambulance and additional providers may be necessary (**Figure 1-27**). Ask the patient's weight, and call for lift assistance if necessary.

Both provider and patient are at particularly high risk as the patient is being moved. Providers are subject to heavy-lifting injuries. Patients can be dropped or may roll off surfaces not designed to accommodate them, such as standard-sized backboards. High-capacity carrying sheets made of plastic with built-in side handles may be a good alternative to moving the patient on a stretcher.



Figure 1-27 Some EMS systems have specialized equipment and vehicles to care for bariatric patients.

Providing Specialized Medical Devices and Supplies

All EMS agencies and healthcare institutions must have the proper equipment and supplies needed to care for obese patients, such as extra-large blood pressure cuffs; long-length needles for intramuscular injections or needle decompression; large cervical collars; extra-long straps and taping supplies; and large gowns, sheets, and blankets.

Obstetric Patients

Pregnancy-related emergencies include spontaneous abortion, ectopic pregnancy, premature labor, hemorrhage, blood clots, preeclampsia, infection, stroke, amniotic fluid embolism, diabetes, and heart disease. Begin by assessing the patient's skin color, temperature, and moisture. Maternal physiology changes as early as the first trimester of pregnancy. Heart rate quickens by 10 to 15 beats/min. Respiratory rate also increases as the enlarging uterus pushes up on the diaphragm, causing breathing to become more rapid and shallow. Assess the patient's vital signs for evidence of dehydration and shock.

In the early stages of pregnancy, usually the fifth to tenth weeks, abdominal pain, vaginal bleeding, and signs of shock can indicate ectopic pregnancy. Pregnant patients in the fifth to tenth weeks should be assessed for pregnancy-induced hypertension and gestational diabetes.

In later stages of pregnancy, patients who complain of tearing abdominal pain and vaginal bleeding with

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dark-colored blood may be experiencing an abruption, or separation of the placenta from the uterine wall. Painless vaginal bleeding in the last trimester can indicate a placenta previa, where the placenta is bleeding. Both conditions are life-threatening medical emergencies and require rapid transport.

Postpartum pathology may include hemorrhage, infection, and pulmonary embolism. Fever and severe abdominal pain are symptoms of endometritis (infection of the uterus), which can be very serious. A medical history related to the pregnancy must be obtained, including delivery by cesarean section.

Special Transport Considerations

Air Transport

Depending on the proximity to the hospital and its specialization, some patients will be transported by air. Transfer from one facility to another, such as from a community hospital to a burn center, may also occur by air. Helicopters and fixed-wing aircraft (airplanes; **Figure 1-28**) have been used for patient transport by both civilian and military medical systems almost since the dawn of aviation.

Patients who are critically ill and medically unstable may be considered for helicopter transport, especially when definitive care on the ground will be delayed. Examples of medical conditions that might be considered for air transport are as follows:

- Bleeding or imminent rupture of a dissecting aortic aneurysm
- Intracranial bleeding
- Acute (time-dependent for treatment) ischemic stroke
- Severe hypothermia and hyperthermia
- Cardiac dysfunction requiring immediate intervention
- Status asthmaticus
- Status epilepticus

Each EMS provider should be familiar with the ground and air transport options in his or her geographic area. The decision to transport a patient by air has some advantages and some drawbacks (**Table 1-12**). Air transport allows the patient to be rescued in a remote area if necessary, transported quickly, and transferred rapidly to a specialty unit. In addition, specialized personnel or supplies (e.g., antivenin, blood products) can be delivered in minutes or hours rather than days. However, flying is often restricted in bad weather, and all aircraft have load restrictions limiting the number and weight of patients who can be transported at once or at all. It is not just total passenger weight counts, but the number of passengers,



A



B

Figure 1-28 **A.** Air medical fixed-wing aircraft. **B.** Air medical rotary-wing asset.

A. © ChameleonsEye/Shutterstock; **B.** Courtesy of Travis County STARFlight.

as the weight in an aircraft must be properly distributed. Each aircraft is different; one may be able to accommodate a tail-heavy load, whereas the same distribution pattern would be unsafe in another aircraft.

In addition, patients with certain conditions cannot easily tolerate high altitude, vibration, and rapid changes in barometric pressure. The altitude at which an aircraft flies depends on the type of aircraft, weather conditions, noise abatement procedures pilots must follow to reduce engine noise in certain areas, geography of the terrain below (for obvious reasons, aircraft fly higher over mountainous terrain and forested areas), altitude restrictions in heavily trafficked urban air corridors, and other factors.

Helicopter transport (**Figure 1-29**) requires observance of proper safety procedures, such as finding a landing zone of adequate size (at least 100 × 100 feet) and a location (downwind of the patient care area) that is relatively level, firm, and free of dangerous obstructions such as power

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Table 1-12 Advantages and Disadvantages of Air Medical Transport

Advantages
■ Rapid transportation ■ Access to remote areas ■ Access to specialty units such as neonatal intensive care units and burn centers ■ Access to personnel with specialized skills ■ Access to specialized equipment and supplies
Disadvantages
■ Weather and environmental restrictions to flight ■ Limitations on patient weight ■ Limitations on number of patients who can be transported ■ Altitude limitations ■ Airspeed limitations ■ High cost ■ Difficulties delivering patient care because of limited access and cabin size ■ Limitations of the amounts of equipment and supplies that can be carried

Modified from Aehlert BJ: *Paramedic practice today: above and beyond*, St. Louis, MO, 2009, Mosby.



Figure 1-29 Helicopters can provide rapid transport for critical patients.

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Table 1-13 Landing Zone and Scene Operations

Landing Zone
■ Ensure the landing zone is a minimum of 100 × 100 feet. ■ Identify and mark any obstructions in the immediate area. ■ Identify the landing zone by GPS coordinates or a major nearby intersection. ■ Inform the flight crew of the landing surface and slope. ■ Mark the corners of the landing zone with cones or other easily visible objects in the daytime. Place a fifth marker on the upwind side of the landing zone. Make sure markers are secured or heavy enough that they will not blow away. ■ For night operations, mark the corners of the landing zone with ground strobes, secured flares, or vehicles with their lights on. Place a fifth lighted marker on the upwind side of the landing zone.
Scene Operations
■ Keep spectators at least 200 feet away. ■ Ensure personal equipment is secured. ■ Do not approach the helicopter until you are signaled by one of the crew members. ■ Always approach from the front of the helicopter, never from the tail. ■ Never bend over when approaching the helicopter. The rotors are 10 feet above the ground, and you are more likely to trip and fall if you are looking down. ■ Do not hold anything above your head. ■ Do not wear a hat.

GPS, Global positioning system.

Modified from Aehlert BJ: *Paramedic practice today: above and beyond*, St. Louis, MO, 2009, Mosby.

lines, trees, poles, buildings, and rocks (Table 1-13). Each EMS provider should be updated annually on local helicopter safety requirements and communication procedures.

Flight Physiology

The healthcare provider—in many instances the paramedic—must select the most suitable mode of transportation for patients based on their condition; the specialty care offered at the receiving facility; and the safest, most efficient means available by which to move them. Likewise, in-hospital providers use similar criteria to determine whether to transfer a patient by air or ground.

If air medical transport is thought to be in the best clinical interest of the patient, you must prepare the patient for transport. Although the transport crew is responsible for the patient's safety during the flight, proper preflight preparation is the responsibility of the prehospital or in-hospital provider, who must be aware of factors that affect the patient during flight. For example, you should understand how factors such as vertigo (dizziness), changes in temperature and barometric pressure, gravity, and spatial disorientation might affect the patient.

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Barometric Pressure

Patients with underlying pulmonary disease such as COPD, asthma, or pulmonary edema are at high risk of hypoxia when barometric pressure drops. Diminished barometric pressure during flight can reduce the partial pressure of oxygen (PaO_2) in the alveoli, in turn reducing blood oxygen saturation. During flight, the patient may need supplemental oxygen or tracheal intubation to maintain adequate oxygen saturation.

Patients who have sinus infections may experience severe sinus pressure or pain during flight, or epistaxis (nosebleed) can occur during ascent as gases trapped in the sinus cavity expand. In such patients, nasal vasoconstrictors can be administered prophylactically before the flight.

Helicopters rarely fly above 1,000 feet, so changes in barometric pressure are not clinically significant. However, with fixed-wing transport, this must be taken into consideration.

Humidity

As altitude increases, the amount of moisture in the aircraft decreases as fresh air from the outside is drawn into the cabin. Therefore, supplemental oxygen should be administered with humidification to prevent dehydration of the patient's mucous membranes and nasal passages.

Temperature

The patient should be adequately protected from wind and cold to ensure he or she remains normothermic. The transport team should be notified of the patient's hydration status and of any medications, such as sedatives, that have been administered. Alterations in cabin temperature with descent and ascent can disrupt a poorly hydrated and sedated patient's ability to maintain core body temperature.

Other Considerations

Anxiety is an emotional factor to consider when a patient is being transported by air. If conscious, the patient should be briefed on the types of aircraft vibrations and sounds experienced during flight and on how long the flight is expected to take. Ill or injured patients can have physiologic signs and symptoms attributable to air turbulence or engine vibrations. The patient may have motion sickness or abdominal pain or trouble staying warm.

Patients with a history or risk of seizures should be visually protected from the flashing lights they might see during the aircraft's ascent and descent.

Take basic safety precautions when you are around fixed-wing or rotary aircraft. Navigate carefully around rotating helicopter and propeller blades. Always approach a helicopter from the front or side, in view of the pilot. Whether you are a prehospital or in-hospital provider, you must heed the flight crew's instructions when you are loading or unloading a patient.

Special Environmental Considerations

Wilderness Conditions

EMS providers are often confronted with austere conditions complicating the assessment process. Care delivery in such conditions is often called wilderness medicine. Loosely defined, wilderness medicine is medical management in situations in which care is limited by environmental considerations, prolonged extrication, or limited resource availability. You may encounter such situations in remote areas like national parks, or in cities or suburbs, such as when caring for a patient who is suffering from hypothermia or has been struck by lightning. Unfamiliar situations occurring in a familiar environment, such as an earthquake in your city, may call upon your wilderness medicine skills. Chapter 9, *Environmental-Related Disorders*, discusses medical conditions you may encounter in patients as a result of environmental exposure.

Wilderness EMS is a subset of EMS operations requiring specialized training. Personnel need training in technical rope rescue, prevention of hypothermia, and the safety precautions to follow when working in an unpredictable, unsafe outdoor environment that poses threats ranging from ravines to rattlesnakes. The National Association of Emergency Medical Technicians (NAEMT) has compiled a list of variables affecting wilderness EMS activities, which include the following:

- Access to the scene
- Weather
- Daylight
- Terrain
- Special transport and handling times
- Access and transport times
- Available personnel
- Communications
- Medical rescue equipment available
- Hazards present

The wilderness EMS scope of practice is often expanded to include administration of medications (e.g., steroids, antibiotics), and additional interventions such as shoulder reductions and sutures. According to the Academy of Wilderness Medicine, many programs in this specialty have been developed, and fellowship and residency programs are available within emergency medicine and paramedic programs. Programs have been established in the field and are offered by the U.S. National Park Service, the National Ski Patrol, the Mountain Rescue Association, the Divers Alert Network, and many other organizations.

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Putting It All Together

A systematic, thorough, efficient patient assessment process is the backbone of effectively managing patients with medical or traumatic emergencies. The AMLS assessment pathway is built on the assumption providers already have a broad understanding of human anatomy, physiology, pathophysiology, and epidemiology to complement the assessment and management processes. Clinical reasoning, therapeutic communication, and clinical decision-making skills all affect your ability to integrate historical information, physical exam findings, and the results of diagnostic assessments to arrive at a working diagnosis. Implementation of appropriate treatment modalities hinges on the accuracy of this assessment information.

Initial patient presentations are often subtle; the dependability of your judgment is the key to timely, effective intervention. Most of the assessment information, especially in patients with emergent presentations, is obtained during history taking. When patients are poor historians, you must use your senses and let your experience guide your decisions.

Initial observations begin with the dispatch information or a prehospital radio report. A scene or situation assessment gives you a preview of the patient's condition even before any direct interaction takes place. All scenes or situations, whether prehospital or in-hospital, should be evaluated for safety. Home environments should be assessed for medical devices, environmental issues, and indications of chronic disease processes. Once the area is deemed safe, providers should note the patient's affect and body position, breath sounds and respiratory pattern, coloring, odor, and other physical characteristics. Any life threats must be addressed immediately. Proceed to the primary survey to identify and manage life threats relevant to airway, breathing, circulation, or perfusion. This assessment, while finished in a matter of seconds, should be systematic and thorough to identify any emergent conditions for which urgent intervention is needed. Determine an initial impression, including how sick the patient is and whether the patient is likely to deteriorate. If deterioration seems imminent, determine which body systems might be affected.

History taking is then performed. Historical information is obtained by soliciting information about the present illness (OPQRST) and past medical history (SAMPLER). During the secondary survey, the provider applies clinical reasoning to the patient's initial presentation. Diagnostic information is obtained and interpreted from pulse oximetry devices, blood glucose meters, laboratory tests, 3-lead or 12-lead ECG monitoring, and $ETCO_2$ devices to eliminate or confirm diagnoses. Vital signs, pain assessment, and a physical exam help rule in or rule out differential diagnoses to determine a working diagnosis.

Associated symptoms are investigated to determine the acuity of the working diagnoses and to identify underlying conditions needing to be managed. A focused physical exam should be performed on patients with nonemergent presentations. A full-body (head-to-toe) physical exam is performed on patients with minimal LOC if on-scene and transport time allow.

Communication, assessment, and management barriers can be encountered in patients with special challenges, such as bariatric patients, older adults, and obstetric patients. Transport decisions take into consideration the patient's condition but must also yield to exogenous factors such as weather, maximum aircraft load capacity, capabilities of the receiving hospital, and distance of the most appropriate facility.

Healthcare providers at all levels and scopes of practice can work as a team to apply the AMLS pathway to provide comprehensive assessment and management of patients experiencing medical emergencies. The AMLS pathway is a dynamic and ongoing assessment process in which conclusions are continually revised as more information about the patient's history and current status becomes available. The process promotes teamwork for efficient and accurate patient assessment and care from dispatch to delivery at the receiving facility.

Is the AMLS Pathway Also a Checklist?

This chapter closes with reflection upon a safety device in use every day in emergency medical services and public safety: the humble checklist. Whether the checklist contains the steps of a readiness check for a vehicle or the contents of a medical response kit, the goal of using checklists for each of these purposes is the same—that is, to ensure whatever the task, all required actions have been performed. Dr. Atul Gawande, an internationally famous surgeon, writer, and public health leader, pioneered the use of checklists in the operating room. In his well-known volume, *The Checklist Manifesto*, Dr. Gawande describes his quest for the acceptance of the use of checklists in the operating room. As he describes checklist design and function, the reader is introduced to two types of checklists: DO-CONFIRM and READ-DO.

In emergency medical services we are most accustomed to the READ-DO checklist. Whether one is performing vehicle maintenance or inventorying medical equipment or response gear, the user performs a series of tasks as they are checked-off in sequential order. This chapter has detailed how the AMLS pathway provides an organized recursive framework for assessing a patient, formulating differential and final diagnoses, providing initial and ongoing treatment, and reassessing a patient. But, the AMLS pathway also provides us with a schematic

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with which to review our actions and ensure essential actions have not been overlooked. Thus, the AMLS pathway also serves as a DO-CONFIRM checklist, handy for use after initial care steps have been accomplished. The very same framework can assuredly lead us through organized, sequential steps of care also provides a coherent framework, as a checklist to ensure that our care has been complete.

SCENARIO SOLUTION

- Several communication barriers may inhibit an efficient assessment. There may be hearing deficits and a short attention span due to fatigue and feelings of frustration. This requires the providers to use closed-ended questions and actively listen to what the patient and daughter state. Assistive devices may indicate inability to care for self or multiple complaints causing perfusion deficit. This patient may not be an accurate historian, so an efficient and thorough history and physical assessment are necessary to determine if this patient's presentation is life threatening. At this time, the patient's condition appears to be a potential life threat.
- The providers should investigate for congestive heart failure, bowel impaction, stroke, dehydration and nutrition concerns, head injury or bruising from falls or abuse, and STEMI or cardiac rhythm changes.
- Assessment should include a thorough OPQRST and SAMPLER exam to note current status and any changes since last week's complaints, as well as a neurologic exam to include motor/sensory and pupil status. A focused physical exam should evaluate pulmonary or systemic edema. Auscultation of breath, heart, and bowel sounds should be performed. Diagnostic evaluation of blood glucose, pulse oximetry, ECG, and waveform capnography should be performed.
- Reassessment en route to the receiving facility is essential to determine if the patient's condition is stable or deteriorating, despite interventions.
- The providers should be concerned about the patient's condition rapidly deteriorating; therefore, an organized, systematic approach to assessment and management is essential. Multiple underlying diagnoses in this patient are a concern attributed to the decrease in efficiency of all body systems in the elderly. Changes in metabolic rates, reduction in blood vessel elasticity, osteoarthritis, slowed reflexes, and diminished neurotransmitter activity all contribute to diminished efficiency of body systems in the elderly. Respiratory, cardiovascular, and neurologic assessments are key to determining differential diagnoses and ultimately a working diagnosis. The AMLS assessment pathway, while dynamic and flexible, can provide a tool for systematic and comprehensive assessments in patients with challenging medical presentations.

SUMMARY

- The AMLS assessment pathway is a dependable framework allowing for early recognition and management of a variety of medical emergencies, with a goal of improved patient outcome.
- The patient's history, physical exam, risk factors, chief complaint, and cardinal presentation help suggest possible differential diagnoses.
- Therapeutic communication skills, keen clinical reasoning abilities, and expert clinical decision making are the foundation for the AMLS assessment.
- Patient assessment and management can be hindered by social, language, behavioral, or psychological barriers.
- Effective clinical reasoning requires gathering and organizing relevant historical and diagnostic information, filtering out irrelevant or extraneous information, and reflecting on similar experiences to efficiently determine working diagnoses and management priorities.
- Clinical reasoning is a bridge between historical information and diagnostic test results, allowing the provider to draw inferences about underlying etiologies to formulate differential diagnoses.
- Barriers for efficient assessment and management of patient presentations involve the level of medical knowledge and experience and scope of practice of the healthcare provider.

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SUMMARY (CONTINUED)

- Clinical decision making is the ability to integrate diagnostic data and assessment findings with experience and evidence-based recommendations to improve patient outcomes.
- The primary survey consists of identifying and managing life-threatening medical emergencies related to the patient's level of consciousness, as well as his or her airway, breathing, circulatory, and perfusion status.
- An emergent or critical patient is one who is hemodynamically unstable and "sick," with a decreased level of consciousness, signs and symptoms of shock, severe pain, and difficulty breathing.
- The provider's senses can contribute and enhance information obtained from observation of the scene and the initial presentation of the patient.
- The physical exam can be a focused exam related to the chief complaint or initial presentation or a full-body head-to-toe exam.
- All healthcare providers should be familiar with the benefits and risks in transportation options for patients.
- Wilderness medicine is medical management in situations where care is limited by environmental considerations, prolonged extrication, or limited resources.

Key Terms

Advanced Medical Life Support (AMLS) assessment pathway A dependable framework to support the reduction of morbidity and mortality by using an assessment-based approach to determine a differential diagnosis and effectively manage a broad range of medical emergencies.

assessment-based patient management Utilizing the patient's cardinal presentation; historical, diagnostic, and physical exam findings; and one's own critical thinking skills as a healthcare professional to diagnose and treat a patient.

blood pressure The tension exerted by blood on the arterial walls. Blood pressure is calculated using the following equation: Blood pressure = Flow × Resistance.

clinical decision making The ability to integrate assessment findings and test data with experience and evidence-based recommendations to make decisions regarding the most appropriate treatment.

clinical reasoning The second conceptual component underpinning the AMLS assessment pathway, which combines good judgment with clinical experience to make accurate diagnoses and initiate proper treatment. This process assumes the provider has a strong foundation of clinical knowledge.

differential diagnosis The possible causes of the patient's cardinal presentation.

initial patient presentation The patient's primary presenting sign or symptom; often this is the accompanied by the patient's chief complaint, but it may be an objective finding such as unconsciousness or choking.

pattern recognition A process of recognizing and classifying data based on past knowledge and experience.

pharmacokinetics The absorption, distribution, metabolism, and excretion of medications.

primary survey The process of initially assessing the airway, breathing, circulation, and perfusion status to identify and manage life-threatening conditions and establish priorities for further assessment, treatment, and transport.

pulse pressure The difference between the systolic and diastolic blood pressures; normal pulse pressure is 30 to 40 mm Hg.

secondary survey An in-depth systematic evaluation of the patient's history, physical exam, vital signs, and diagnostic information used to identify additional emergent and nonemergent conditions and modify differential diagnoses and management strategies.

signs Objective evidence that a healthcare professional observes, feels, sees, hears, touches, or smells.

symptoms The S in SAMPLER; subjective perceptions by patients indicating what they feel, such as nausea,

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or have experienced, such as a sensation of seeing flashing lights.

therapeutic communication A communication process in which the healthcare provider uses effective communication skills to obtain information about the patient and his or her condition, including the use of the four *E*s: engagement, empathy, education, and enlistment.

working diagnosis The presumed cause of the patient's condition, arrived at by evaluating all assessment information thus far obtained while conducting further diagnostic testing to definitively diagnose the illness.

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Chapter Review Questions

1. Your sincere identification with the patient's feelings and compassion for what the patient is going through is known as:
   - **a.** engagement.
   - **b.** empathy.
   - **c.** enlistment.

2. A working hypothesis of the nature of the problem based on the chief complaint, history, and assessment is the:
   - **a.** differential diagnosis.
   - **b.** working diagnosis.
   - **c.** clinical reasoning.
   - **d.** scope of practice.

3. The tendency to perceptually lock on to parts of the patient's presentation early in the diagnostic process, which can lead to an incorrect working diagnosis, is called:
   - **a.** confirmation bias.
   - **b.** premature closure.
   - **c.** anchoring.
   - **d.** rapid recall.

4. Which of the following levels of personal protective equipment offers no eye protection?
   - **a.** Class A
   - **b.** Class B
   - **c.** Class C
   - **d.** Class D

5. You are caring for a patient who was found unresponsive. Upon your assessment, the patient moans, withdraws, and opens her eyes to painful stimuli. Her Glasgow Coma Scale score is:
   - **a.** 7.
   - **b.** 8.
   - **c.** 9.
   - **d.** 10.

6. Recent surgeries, travel, medical conditions, age, race, gender, and obesity are all examples of:
   - **a.** past medical history.
   - **b.** events preceding the current illness.
   - **c.** signs and symptoms.
   - **d.** risk factors.

7. Vesicular lung sounds can be auscultated:
   - **a.** over the main bronchi on either side of the sternum.
   - **b.** over the anterior and posterior part of the lower chest.
   - **c.** over the trachea near the sternal notch.
   - **d.** just above the belly button, over the stomach.

8. When performing an assessment of the pupillary dilation and constriction, which cranial nerve is being assessed?
   - **a.** I
   - **b.** II
   - **c.** III
   - **d.** IV

9. A positive Babinski test results in:
   - **a.** one pupil being larger than the other.
   - **b.** one arm unable to be raised while the other can be.
   - **c.** extension of the great toe and fanning of the remaining toes.
   - **d.** abdominal pain that radiates to the left shoulder.

10. Which of the following is a natural physiologic response to aging?
    - **a.** Respiratory muscles strengthen.
    - **b.** Tidal volume increases.
    - **c.** Arteries and veins become more elastic.
    - **d.** Peripheral vascular resistance increases.

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