

Investigation 3.5

3.5A: Emergencies

3.5B: Chest Pain

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We have pushed you into the role of a medical doctor taking care of patients who come to you for treatment of their symptoms. You have probably felt some anxiety and tension in filling that role. In this section we want to step back and allow you to play yourself, but give you an opportunity to think about medical emergencies that may actually take place in your life. Can we take some of the things you have learned and apply them in that context?

One of the authors of this workbook has grandchildren, two boys, in the early years of elementary school. They were playing by themselves in the basement of their home after getting home from school. A large portion of the basement has been set aside for their play that often seems to center on space travel. They have spaceship models and fictional space character figures based on movies. On this particular afternoon play got vigorous and one of the boys injured himself sufficiently to disrupt the play. His brother raced to the bottom of the stairs and yelled up to his parents, “Medic! Medic!” Perhaps they have seen too many war movies, because the usual cry for help has become, “Medic.”

The boys in this story were fine, but all of us have the potential of being involved in a real emergency situation, and almost everyone has a feeling of inadequacy when such an event comes along. This workbook was never intended by itself to turn you into a healthcare provider, and even the ability to handle common household emergencies may require considerable training and experience. We can still, however, plant a few concepts into your mind here to make you more competent in the face of an actual emergency.

You may find this subject compelling enough to want to actually take a course and earn a certification in **Basic Life Support**. The **American Heart Association** has found that individuals as young as 9 years of age can learn and effectively administer life-saving skills. The **Red Cross** has a certification in emergency skills for young adults who specifically wish to do baby-sitting.

The first basic concept important in every **emergency** we actually demonstrated earlier in our introduction. **Get help**. No matter how much knowledge or skill you have you still need help to deal with a real emergency. Help brings manpower, equipment, medications, and usually transportation to a medical facility if the emergency warrants. The most effective route to getting help usually lies in telephoning **911** or recruiting someone to make that call.

Individuals who have no emergency training frequently feel they can help by getting the victim up, either sitting or on their feet. Fight that impulse. Only move someone injured or stricken if staying put would create more injury, for example, if they have fallen in a room on fire.

The letters ABC were originally used in Basic Life Support to focus attention on creating an open **Airway**, getting air to move into the lungs by **Breathing**, and moving oxygen throughout the body via the **Circulation** of blood. That makes good sense if you are thinking that getting oxygen to the brain and heart constitutes the primary objective of **Basic Life Support**. More recent research has changed that thinking to **CAB**. The first objective lies in maintaining circulation of the blood. You will easily remember that when you understand why.

The cells in our body need oxygen to release energy from food to stay alive, but in the absence of oxygen they can release energy by an alternative chemical reaction for a while. The alternative chemical reaction produces **lactic acid** that can become **toxic** to the cell if it builds up. If the circulation of blood continues the lactic acid will become **diluted** in the blood and delay that toxicity usually long enough to get help. So if the victim lacks a **pulse**, Basic Life Support procedures now call for vigorous **chest compressions** without stopping to keep the blood moving. The chest compressions take priority over all other steps until help arrives, and help open up additional options for treatment.

Emergency victims who are **bleeding** need prompt attention to stop the loss of blood. Commonly bleeding can be slowed or stopped with **pressure** applied directly to the site of bleeding or to the vessels close to the bleeding.

Healthcare providers once thought we should give fluids to people who were bleeding or elevate arms or legs to raise the blood pressure while moving the patient to a hospital where the bleeding could be stopped. We now know that trying to keep the blood pressure close to normal in patients who are still bleeding actually makes the situation worse. The current recommended strategy lies in applying direct pressure to the wound or vessels as best one can, but getting the patient to the hospital as quickly as possible without trying to raise the patient's blood pressure before transporting. At the hospital the **surgeons** will rush to stop the bleeding and then the **transfusion** of blood from the **Blood Bank** can begin to restore the blood pressure. Some have called this strategy of getting injured patients to the hospital as quickly as possible without trying to treat them at the scene of injury by the phrase "**Scoop and Run.**"

Basic Life Support courses cover what to do in the case of a **heart attack** (chest pain or sudden loss of pulse), a **stroke** (sudden development of weakness, loss of vision, or impaired speech), **choking** (something blocking the passage of air to the lungs), **loss of breathing** (no effective **respiration** or chest movement), and severe **bleeding**. We once had little we could do for a stroke, but now a number of **therapies** can reverse or minimize the effects of stroke if the victim gets to a stroke center quickly. The original time limit for stroke treatment was less than three hours; now some centers allow a longer window, but getting to treatment sooner produces better results.

An emergency that can occur when we don't chew our food adequately, take enormous bites, or just swallow wrong, we call **choking**. Choking can also occur when small children place household objects in their mouths. Choking is an emergency because it physically blocks oxygen from making its way into our **trachea** and traveling to our lungs. Without oxygen in our lungs our vital organs, especially our brain, go into panic mode. Within four minutes of blocking our airway with food or other objects our brain can suffer irreversible damage.

You can tell when someone is choking because they flail about, usually placing their hands to their throat, but not voicing any sounds. They cannot speak because no air can escape from their trachea; we only voice sounds when we exhale air across our vocal chords. Choking victims cannot **exhale**.

So what should you do if you encounter a friend, a family member, even a stranger who demonstrates the signs of choking? First, ask if they are choking. They will not answer, but will probably shake their head up and down. If they answer with a normal voice, they are not choking. When you are convinced they indeed are choking, you can help them using the **Heimlich Maneuver**. Dr. Heimlich proposed this method to expel a blockage of the main stem bronchus (the wind pipe) by squeezing the victim's abdomen. The American Heart Association denounced his method for more than a decade before quietly adding it to their teachings as the scientific evidence grew of its benefits. You can learn this maneuver as part of a basic life support class or perhaps look at <http://www.wikihow.com/Perform-the-Heimlich-Maneuver> and become an expert.

You can learn basic life support skills and potentially save the life of a family member or friend by knowing how to respond to an emergency before help arrives. You can look up a course on the Internet and perhaps talk a family member into taking one of these courses with you. It is reassuring to know that someone else in the family can help you should the need arise.

The Red Cross and the American Heart Association are two organizations active in most communities that teach emergency response skills.

An extra tip:

We have all heard about heart attacks and know they are quite serious. Our hearts are made of muscle and that muscle works throughout our life pumping blood through our arteries and veins. It never gets a holiday. The term "heart attack" lacks specificity so doctors normally use another term on written records. If arteries that take blood to a region of heart muscle become blocked, those muscle cells with blood circulation will not have the oxygen and nutrients they need to keep working. If that situation persists those muscle cells will die and physicians call that situation a **myocardial infarction** or an MI.

Usually an MI results from a clot forming in an artery in the heart that blocks the blood flow. Nerve endings in the heart can sense a lack of oxygen. These nerve endings we call **ischemia receptors**, ischemia meaning inadequate oxygen. These receptors cause the sensation we perceive as chest pain, often described as "crushing" in nature. The pain often seems to go into the left arm or up into the neck and jaw. In addition to pain, the receptors increase the rate of heart beats and increase blood pressure by causing the release of hormones that direct arteries to squeeze down (pinch), cutting off blood flow going to **non-vital** organs. When the heart beats faster and has to push the blood through pinched arteries, the heart actually must work harder than before. So when a patient has chest pain the body actually makes the situation worse by its response to the ischemic receptors making the effected straining muscle not getting enough oxygen work even harder. Emergency physicians give patients with ischemic heart pain medicines that will undo the bad effects caused by these receptors.

You might ask yourself, why would we have a nerve receptor in our body that essentially tries to kill us during a heart attack? If our body evolved traits that made us smarter and stronger over thousands of years, how did this bad trait get there? A number of theories have been proposed. Perhaps the tribe would see an advantage to killing off its older members. That seems very harsh. Another theory suggests that ischemic receptors actually do the right things if the ischemia comes from blood loss rather than a blocked artery. Perhaps we evolved these receptors for instances where tigers attacked and bit cavemen. Consider yet another possibility. The cheetah chases the antelope for less than 30 seconds and then stops before that high-speed chase does damage to the cheetah's heart. Zoologists believe the signal for the cheetah to stop the chase comes from its cardiac ischemic receptors. Perhaps humans got those receptors in the process of evolution before they actually became humans, sort of leftover genes. In any case, it is interesting to think about how our physiology evolved and why.

Also included in that non-specific category of "heart attacks" you will find **ventricular fibrillation**. Ventricular fibrillation, or V-Fib, occurs when the heart muscle's cells become disorganized and no longer beat in the normal sequence that makes the heart an effective blood pump. V-Fib can come from insufficient heart blood flow, but also from other causes (for example, an accident in which electrical current passes through the body). If the heart muscle cells in V-Fib just beat individually any time they want to beat, the heart squirms about but does not actually pump. V-Fib causes **sudden cardiac death**, meaning the patient may have no warning from chest pain, but simply falls down with no pulse. These patients do benefit from chest compression and prompt application of an electrical **defibrillator**, a device currently available in many public buildings and carried about by community emergency response teams. The defibrillator can restore the **coordinated** beat of the muscle cells of the heart when it arrives promptly. This device has saved many lives. The defibrillators in public buildings have a **voice track** that instructs people trying to help how to correctly shock the victim back to life.