



Seattle-King County EMS

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CBT434-EMT12- Cardiovascular Emergencies

Print Version

FOR A WEB-BASED TRAINING MODULE

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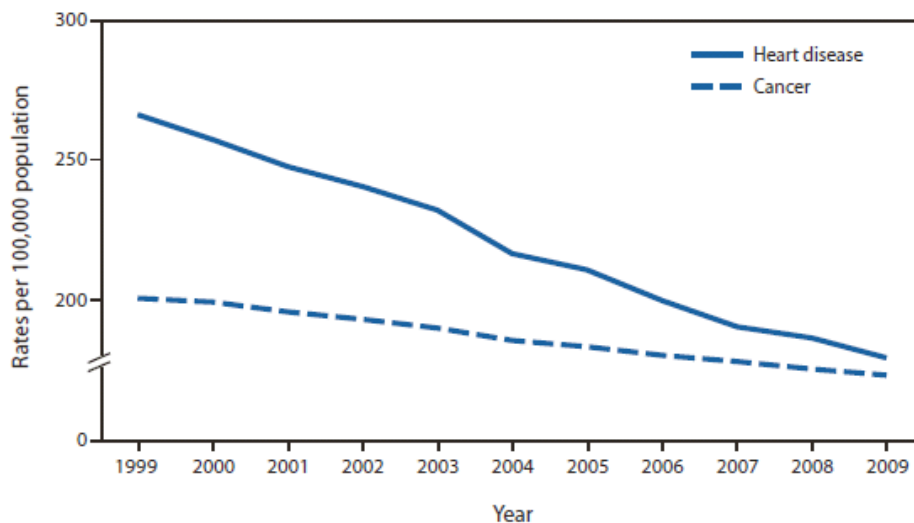
Introduction

Heart disease is the leading cause of death in the United States. In 2010, an estimated 785,000 Americans had a new coronary attack, and about 470,000 had a recurrent attack. About every 25 seconds, an American will have a coronary event, and about one every minute will die from one. An estimated nine out of 10 cardiac arrest victims die before they get to the hospital.

YOUR HANDS ARE THE PUMP – Dr. Kudenchuk explains Why
Video - **Kudenchuk_CV_HP_CPR.wmv** – access via course on EMS Online

Elaboration – Death rate from heart disease is declining – CDC comparison to Cancer

During 1999--2009, age-adjusted death rates for heart disease and cancer declined significantly by 32.5% and 13.5%, respectively. The mortality rate for heart disease decreased at a faster pace than the cancer death rate during that period. The risk for death from heart disease was 32.7% higher than from cancer in 1999, whereas it was 3.6% higher from heart disease than from cancer in 2009.



[Heart Disease Deaths](#) – Seattle and King County (external web site)

Elaboration - Before You Begin

This is a continuing education and recertification course for EMTs. It covers fundamental EMT-Basic concepts and terminology as well as advanced material. We highly recommend completing the case studies and practice exam before completing the exam.

We also recommend that you review an EMT textbook chapter covering cardiovascular emergencies as a refresher before taking the exam; for example: Chapter 14 in *Emergency Care and Transportation of the Sick and Injured*, 10th edition (AAOS) or Brady Emergency Care Chapter 17, 11th edition.

Elaboration – Course Objectives Practical Skills

To receive CBT or OTEP credit for this course a trained skills evaluator must evaluate your ability to perform the following hands-on practical skills.

- Perform a focused history using SAMPLE/OPQRST technique
- Assist a patient to taking prescribed nitroglycerin
- Perform the proper technique for auscultating the chest using a stethoscope
- Assist a patient with ventilations using a BVM
- Demonstrate the ability to care for acute coronary syndrome, CHF, aortic dissection, cardiogenic shock
- Demonstrate the proper use of AED during CPR

CBT434 is an online EMS continuing education module for EMS providers. After completing this course you will be able to:

- Recognize the structures of the thoracic cavity.
- Describe the structures of the cardiovascular system.
- Name the causes of myocardial ischemia.
- Identify the definition of acute coronary syndrome.
- Identify the five sources of chest pain.
- Distinguish between the five common cardiovascular emergencies.
- Give examples of atypical presentations of AMI.
- Demonstrate knowledge of medical history gathering techniques by identifying questions used in the OPQRST method.
- Determine how to treat a patient experiencing chest pain/discomfort.

Terms

Acute myocardial infarction (AMI) - Death of heart muscle caused by blockage in a coronary artery.

Acute coronary syndrome (ACS) - A term used to describe a range of symptoms and conditions from acute myocardial infarction to unstable angina.

Aneurysm - A bulge in the wall of an artery that can burst. If an aneurysm bursts in a vital organ (e.g., brain) or in a major vessel (e.g., aorta), the results can be catastrophic.

Angina - Chest pain (with squeezing or tightness in the chest) due to an inadequate blood supply to the heart muscle.

Aortic dissection — A tear in the lining of the aorta. An aortic dissection can extend to the point that it obstructs arterial blood supply to vital organs.

Asystole - Absence of electrical activity in the heart.

Atherosclerosis - A disease characterized by thickening and destruction of the arterial walls, caused by fatty deposits; arteries lose ability to dilate and carry oxygen-enriched blood.

Cardiogenic shock - Shock resulting from inadequate functioning of the heart.

Congestive heart failure (CHF) - A condition characterized by shortness of breath, fluid in the lungs and/or swelling of the body due to water retention usually in the lower legs. It is due to a damaged heart that cannot contract effectively.

Coronary artery disease - A disease that causes the arteries that supply blood to the heart muscle to become hardened and narrowed. Also called *coronary heart disease*.

Diaphoresis - Perspiration or sweating due to a medical condition and not caused by normal exertion.

Dyspnea - Deep, labored respirations.

Dysrhythmia - Abnormal heart rhythm. Also called *arrhythmia*.

Infarction - Death of tissue due to loss of blood flow.

Ischemia - Poor oxygen supply to tissue.

Myocardium - Another term for heart muscle.

Necrosis - Tissue death.

Pedal edema - Fluid collecting in the feet which can indicate underlying heart disease. Often seen in CHF.

Pulmonary edema - Abnormal accumulation of fluid in the tissues and air spaces of the lungs. Pulmonary edema is most commonly associated with acute myocardial infarction or uncontrolled CHF.

Sustained tachycardia - Persistent heart rate of 100 or greater caused by a clinical condition such as hypoxia or impending shock.

Thrombus - A clot formed in a blood vessel or in a chamber of the heart.

Vasospasm - A sudden constriction of a blood vessel.

Ventricular fibrillation (VF) - A dysrhythmia in which the heart muscle undergoes an ineffective, uncoordinated quivering.

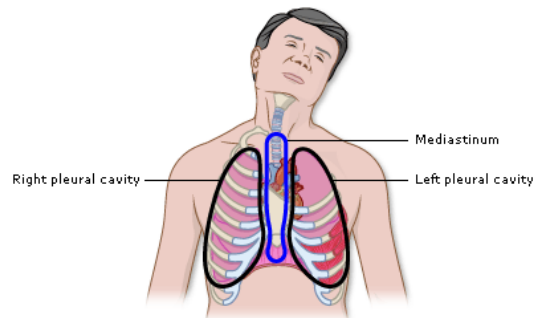
Anatomy

The Thoracic Cavity

The chest, also called the thorax, extends from the neck to the lower reaches of the ribs. The bones of the chest surround a space called the thoracic cavity. The thoracic cavity is divided into the **mediastinum** and the **pleural cavities**.

The mediastinum is the area that lies in the center of the thoracic cavity with the diaphragm at its base. It contains the trachea, esophagus, heart, aorta, vena cava and the pulmonary artery. The lungs are not part of the mediastinum.

The pleural cavities lie on each side of the mediastinum. Each pleural cavity contains one lung.



Elaboration – More on the Pleural Cavities

A thin double-walled tissue lines both pleural cavities. The *visceral pleura* lines the outside of the lungs. The *parietal pleura* lines the inside of the thoracic cavity. There is a potential space between the visceral and parietal pleura. A thin layer of fluid provides lubrication during chest wall expansion and contraction.

Structures of the Thoracic Cavity

There are twelve pairs of **ribs** surrounding the thoracic cavity. The ribs connect to the **sternum** through a bridge of cartilage. This creates a cage that supports and protects the **heart, lungs, trachea, aorta and pulmonary artery**.

The lower five ribs connect to the sternum through a long cartilage bridge called the **costal arch**. Between the ribs are the **intercostal muscles**. They work in conjunction with the **diaphragm** to produce breathing.

Flash diagram – drag the names of the structure to its proper location

Arteries and Veins

The purpose of the cardiovascular system is to provide the body's cells with oxygen and nutrients and remove waste. Its components are the **heart, arteries, arterioles, capillaries, veins and venules**.

Elaboration – More on Arteries, Arterioles and Capillaries

Arteries are vessels that carry blood away from the heart. They branch out and become smaller as they reach out into the body. Arteries have thicker walls than veins.

Arterioles are the small terminal branches of an artery that connect with a capillary.

Capillaries are vessels with many branches. Slow blood flow and thin walls make capillaries effective in exchanging water, food and wastes.

Elaboration – More on Veins and Venules

Veins are vessels that carry the blood to the heart. Large veins, such as those in the abdomen, contain smooth muscle that can contract to propel blood toward the heart. A small amount of cardiac muscle is present in the vena cava and pulmonary veins as they join the heart.

Small and medium sized veins have valves to prevent backflow. Veins with valves are prevalent in the extremities where contraction of skeletal muscle helps to propel the blood toward the heart.

Venules are small veins that connect capillaries to larger veins.

Flash diagram – drag the names of the structure to its proper location

Heart and Coronary Arteries

The heart is a hollow organ that pumps blood through the cardiovascular system. It is made of a specialized muscle tissue called *myocardium*. The myocardium requires a consistent flow of blood to work effectively. It is an involuntary muscle and under control of the autonomic nervous system.

There are two main arteries that nourish the heart with blood: the **right coronary artery** and the **left coronary artery**. Both descend directly from the aorta. Blockage in these arteries can lead to a reduced flow of blood to the heart. The anterior descending branch of the left coronary artery is a commonly blocked vessel.

The heart has four chambers that contract in coordination to pump blood. The two chambers on top are called the **atria**. The bottom chambers are called **ventricles**.

Flash diagram – drag the names of the structure to its proper location

[View Photos](#) of network of coronary arteries (external link)
PBS

[View video](#) – Coronary Artery Disease (external link)
NIH – MedlinePlus

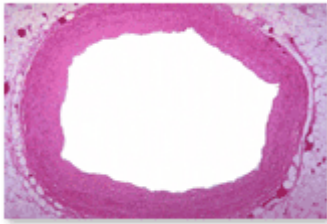
Knowledge Check

Myocardial Ischemia

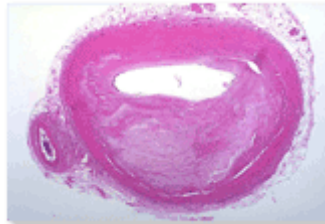
Ischemia (is-KE'me-ah) is an inadequate blood flow to a part of the body. It is caused by constriction or blockage of the blood vessels supplying it. The cells do not receive an adequate supply of oxygen.

Myocardial ischemia is the lack of blood flow and oxygen to the myocardium (heart muscle).

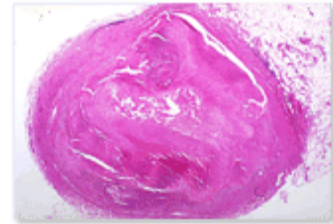
When arteries are narrowed by coronary artery disease, less blood and oxygen reach the heart muscle. This can lead to a range of conditions from angina to heart attack. Collectively these conditions are called **acute coronary syndrome**.



Coronary artery (Normal)



Coronary artery (75% occluded)



Coronary artery (occluded)

Causes of Myocardial Ischemia

The myocardium depends on a constant supply of oxygen in order to work properly. There are a number of situations in which the oxygen supply can be disrupted resulting in myocardial ischemia. These include:

Obstruction of an artery caused by:

- plaque (fat deposit)
- thrombus (clot)
- vasospasm

Reduced blood flow associated with conditions that cause:

- hypotension (e.g. blood loss)
- tachycardia
- bradycardia

Elaboration – Myocardial Ischemia

Myocardial ischemia is poor oxygen supply to the heart's muscle tissue. It can be caused by plaque or a clot inside an artery. Plaque is a deposit of fatty material on the inner lining of an arterial wall. An embolus is a fat particle or blood clot that travels from another location in the cardiovascular system. In either case, the substance narrows the inside of the artery and reduces the amount of blood that can pass.

In addition, myocardial ischemia can be caused by a vasospasm. Vasospasm is the narrowing of a blood vessel by tightening or spasm of the muscles within the vessel's wall. Cocaine or methamphetamine use can cause vasospasm.

Other causes of myocardial ischemia include symptomatic hypotension (e.g., blood loss), symptomatic tachycardia, or symptomatic bradycardia due a medical condition such as CHF. Severe anemia (lack of sufficient red blood cells) can be a cause, too.

Coronary Thrombosis

Recent scientific research has expanded our understanding of the process of arterial occlusion and myocardial ischemia. One process, called **coronary thrombosis**, occurs when arterial plaque ruptures and platelets adhere to the ulcerated surface. A blood clot or thrombus, forms and blocks the vessel.

Flash diagram – Process of Thrombus Formation

Elaboration – More on Coronary Thrombosis

1. Plaque forms on the inner wall of an artery

Arterial plaque forms on the wall of an artery due to stress on the internal lining of the artery from:

- high blood pressure
- high lipids in the blood
- diabetes
- smoking
- genetic factors

Plaque is a deposit of a fat-like substance that is hard on the outside and soft on the inside. If the cap of a plaque deposit ruptures, it exposes the blood to a lipid-rich layer inside.

2. The hard surface of the plaque tears, exposing the soft inside

Plaque is disrupted or the inner lining of the artery overlying the plaque is eroded away. The plaque can eventually burst or tear. This creates a "snag" where a clot forms.

3. Platelets arrive to form a blood clot. The clot restricts blood flow.

Platelets and other components (fibrin) in the blood immediately react to the newly exposed layer and a clot begins to form. Depending on the size of the rupture, blood flow can begin to diminish beyond the site. This reduces the oxygen delivery to the myocardium. At some point the oxygen supply is reduced enough to cause chest pain or other symptoms.

At the same time, the body begins trying to break up the clot with its own clot-busting agents. Clot dissolving (fibrinolytic) enzymes attempt to remove the clot and open the blood vessel. This is a dynamic and rapidly changing process. It explains why many patients can have short and recurring periods of symptoms.

If the thrombus completely blocks the artery, the area of oxygen-starved tissue dies. If the body is able to reduce the size of the thrombus to allow oxygen delivery beyond the site, the patient most likely will develop angina. When angina is unstable or increasing a patient is at severe risk for a complete myocardial infarction.

Elaboration – Myocardial Ischemia Due to Atherosclerosis

Atherosclerosis is another process that causes myocardial ischemia but does not involve actual disruption of an unstable plaque deposit. A stable plaque deposit can increase in size and diminish blood flow past its location.

In this case, the reduced oxygen delivery can meet the myocardial demand while the patient is at rest, but can fall short with exertion. The patient can then develop chest pain as with angina. This chest pain should resolve with either decreasing the workload, stopping exertion and resting, or by increasing the blood flow past the stable plaque by taking nitroglycerin, which causes the artery to dilate.

Elaboration – Myocardial Ischemia Due to Vasospasms

A less common cause of a heart attack is a severe spasm (tightening) of the coronary artery that cuts off blood flow to the myocardium. These spasms can occur in persons with or without coronary artery disease. Vasospasms can be caused by drugs such as cocaine and cigarette smoking.

In Prinzmetal's angina, atherosclerosis is not the underlying cause. Rather there is a spasm of the artery that acutely reduces or stops blood flow through the artery.

More Information

Animations

- [Coronary thrombosis](#) (external link)
MedicBD Video Library

Images

- [Atherosclerotic plaque](#) (external link: Internet Pathology Lab)
- [Thrombus in coronary artery](#) (external link: Internet Pathology Lab)
- [Atherosclerotic aorta](#) (external link: UTSW Medical Center)

Article

- [Coronary artery atherosclerosis](#) (external link)
Medscape REFERENCE

Sources of Chest Pain

Not all chest pain is cardiac related. Conditions causing chest pain range in severity from minor, for example a chest wall bruise, to catastrophic, such as a dissecting aortic aneurysm.

Chest pain takes on special significance for the EMS provider because it is very difficult to differentiate between the various clinical presentations. This is particularly true in the assessment of myocardial ischemia.

Besides the, chest pain can arise in the **chest wall**, the **lungs and pleura** and the **abdomen**. It can also be due to **psychogenic** (non-organic) sources.

Flash diagram – Click the name of the area in which the source of pain is located

Elaboration – More on Sources of Chest Pain

Chest pain can originate in the mediastinum, the chest wall, the lungs and pleura and the abdomen. It can also be due to psychogenic sources such as stress.

Chest Wall

- traumatic contusion
- muscle strain
- overuse syndromes such as rotator cuff tear with pain radiating from the shoulder
- breast cysts and infections
- shingles
- inflammation of rib cartilage

Lungs and Pleura

- pleurisy
- pneumonia
- pneumothorax
- pulmonary embolus
- asthma, bronchitis, upper-respiratory infection

Mediastinum

- angina
- unstable angina (pre-infarction angina)
- myocardial infarction
- esophagitis, esophageal spasm, heartburn, reflux (GERD)
- pericarditis
- mediastinal air from ruptured bronchus

Abdomen

- gallbladder (cholecystitis, gallstones)
- stomach (gastritis)
- pancreas (pancreatitis)

Psychogenic chest pain (non-organic, psychosomatic)

- stress
- hyperventilation
- panic attack

Knowledge Check

Conditions Angina

Angina pectoris is chest pain due to myocardial ischemia. Angina pectoris literally means "choking in the chest." It is caused when not enough oxygen reaches the myocardium. The characteristics of angina-related pain are described as follows:

- brought on by exercise, stress or cold weather
- possible radiation of pain to jaw, arm or upper back
- sudden onset
- usually relieved with rest within 3-5 minutes and/or nitroglycerin

Elaboration - Physiology of Angina

Angina occurs when a person with atherosclerosis exerts or is stressed. The heart muscle does not receive adequate blood flow and thus it becomes ischemic. Anaerobic metabolism begins and produces lactic acid and carbon dioxide.

The accumulation of lactic acid and carbon dioxide in the myocardium causes pain. This process generally does not occur when the patient is at rest. It often occurs when the workload of the heart increases due to exercise, exertion or stress.

Elaboration – Signs of Stable Angina

There is typically a regular pattern to stable angina. It can be triggered by physical exertion, stress or cold weather. The pain can radiate to the jaw or arm. The pain usually goes away in a few minutes with rest or nitroglycerin.

Acid reflux (heartburn), lung infection and lung inflammation can be confused with angina.

Onset sudden

Provocation physical exertion, stress, cold weather, relieved by rest

Quality pressure or squeezing pain

Radiation pain can radiate to jaw, arm or upper back

Severity mild to moderate

Time relieved with rest and/or nitro within 3-5 min

Acute Coronary Syndrome

Acute coronary syndrome (ACS) is a new term being used to describe the range of clinical conditions from unstable angina to acute myocardial infarction. The symptoms, which vary from patient to patient, are caused by acute myocardial ischemia.

The range of symptoms can include:

- shortness of breath
- discomfort
- chest pain
- pressure
- nausea
- weakness
- dysrhythmias
- syncope

Elaboration – Symptoms of ACS

In acute coronary syndrome, shortness of breath can be due to a weakened heart that causes fluid to backup into the lungs. Palpitations are caused by myocardial ischemia which makes the heart muscle irritable. Nausea and weakness can be due in part to stimulation of the vagus nerve. In addition, nausea can be caused by hypotension and direct abdominal stimulation.

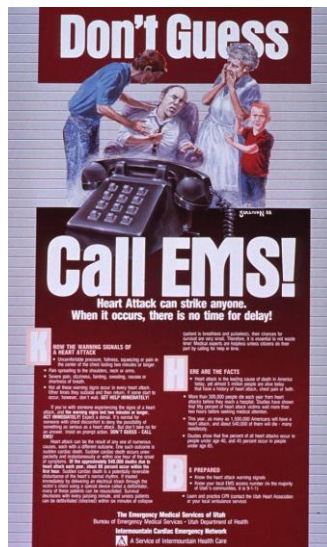
Elaboration – Difference between ACS and AMI...ACS=Chest Pain – Dr. Peter Kudenchuk

Access Video clip via course on EMS Online

[View more information](#) on ACS (external link)
MedscapeREFERENCE

Acute Myocardial Infarction

Acute myocardial infarction (AMI) occurs when oxygenated blood cannot reach the myocardium and muscle tissue dies. It is caused when a coronary artery is completely blocked or occluded.



AMI is caused by the same mechanism as angina except that AMI results in tissue death and is not reversible. Patients with AMI can experience:

- chest discomfort
- discomfort in other areas of the upper body
- shortness of breath
- diaphoresis, nausea or weakness

Elaboration - Physiology of AMI

AMI is a severe form of myocardial ischemia. The blood flow through a coronary artery with atherosclerosis is stopped by a blood clot or spasm. Next, the process of anaerobic metabolism begins that produces lactic acid and carbon dioxide. The accumulation of lactic acid and carbon dioxide causes pain. A sustained reduction in blood flow then causes tissue death.

Other conditions can reduce blood flow and cause myocardial ischemia leading to AMI. These include shock, dysrhythmias and pulmonary embolism. All prevent oxygen from reaching the heart muscle.

Elaboration - Symptoms of AMI

Chest discomfort is one possible symptom of AMI. The discomfort can occur in the center of the chest that lasts more than a few minutes. It can go away and come back. The discomfort can feel like fullness, pressure, squeezing or pain.

Another symptom can be discomfort in other areas of the upper body including pain or discomfort in one or both arms, the back, neck, jaw or stomach.

Shortness of breath is another possible symptom of AMI. Shortness of breath can occur with or without chest discomfort.

Other associated symptoms can include dyspnea, nausea, vomiting, diaphoresis, dizziness and a feeling of impending death.

Symptoms of AMI	
Onset	varies, can be sudden
Provocation	varies, can start at rest
Quality	pressure or squeezing pain
Radiation	pain can radiate to jaw or arm
Relief	none, not relieved with rest and/or nitro
Severity	very severe, intense, terrifying (10/10)
Time	can last hours

Elaboration – Typical vs. Atypical Presentation...Be Suspicious - Dr. Peter Kudenchuk

Access Video clip via course on EMS Online

More Information

Images

- [Heart with AMI](#) (external link: Internet Pathology Lab)
- [Dissected heart showing infarction](#) (external link: PBS.org)
- [Cross-section of heart showing AMI](#) (external link: UTSW Medical Center)

Aortic Dissection

An **aortic dissection** is a condition in which blood gets behind the inner layer of the aorta. Blood starts to fill the space between the layers of the arterial wall. The aorta widens and significantly disrupts blood flow. The patient can experience:

- sudden and severe chest or upper back pain
- anxiety
- diaphoresis
- nausea



[Photo](#) of aortic stenosis
Wikipedia (external link)

[Dissecting aortic aneurysm](#)
MedscapeREFERENCE (external Web site)

CHF

Congestive heart failure (CHF) is a condition that occurs when the heart is too weak to adequately circulate blood. In the case of left-sided heart failure, pulmonary edema occurs as blood backs up into the lungs. This increases the amount of fluid in the alveoli of the lung and results in shortness of breath. CHF can be brought on by an AMI.

Signs of left-sided CHF include:

- fatigue
- cough
- dyspnea
- pulmonary edema (a severe form of CHF)
- tachypnea
- agitation and confusion hypertension
- swollen feet or lower legs

Elaboration - How CHF Occurs (Left-sided Heart Failure)

Left-sided congestive heart failure occurs when a damaged left ventricle cannot keep up with the return flow of blood being pushed through the lungs. The lungs become congested with fluid. Below are the typical steps that occur in this process.

1. Acute myocardial infarction damages the left ventricle.
2. A weakened left ventricle is unable to pump blood effectively throughout the body.
3. The blood and fluid backs up into the pulmonary veins and lungs.
4. This fluid in the lungs reduces gaseous exchange in the alveoli (pulmonary edema).
5. Hypoxia results due to inadequate oxygenation of the blood.

Elaboration – Causes, Signs & Symptoms of CHF...Could it be Heart Failure? - Dr. Peter Kudenchuk

Access Video clip via course on EMS Online

[More information](#) on heart failure
MedscapeREFERENCE (external link)

Cardiogenic Shock

Cardiogenic shock occurs when the heart is seriously weakened and cannot pump enough blood to perfuse the body. This condition can be brought on when approximately 40% of the left ventricle is involved with an AMI.

Signs and symptoms of cardiogenic shock are similar to those of any other kind of shock. When you see shock in the absence of trauma, consider cardiac causes. The signs of cardiogenic shock include:

- altered LOC
- rapid, shallow breathing
- restlessness and anxiousness
- pale, cool skin
- tachycardia/dysrhythmias
- lowered blood pressure or hypotension

Elaboration — How AMI Results in Cardiogenic Shock

Cardiogenic shock is due to the impaired ability of the heart to pump. It can be caused by disorders of the heart muscle, the valves or the heart's electrical conduction system. Acute myocardial infarction is the most common cause.

Dead myocardium does not contract, therefore, a weakened heart cannot pump enough blood throughout the body. There is an adequate blood volume but failure to put the blood in circulation. Hypoxia results due to inadequate perfusion.

Thromboembolism

Thromboembolism means a blood clot travels from its source of origin to a vital organ such as the brain or lungs. Clots usually form in the deep veins of the legs or pelvic veins and may occur following surgery or prolonged sitting (such as a long airplane flight). The clot forms because of stasis (not moving enough in the vessel). Once the clot forms in the vein it may break off of the vessel wall and float through the circulation until it lodges in an organ. It may be particularly devastating if the clot lodges in the brain or lungs.

Elaboration – Blood Clot (Embolus) Formation
[Blood Clot \(Embolus\) Formation](#) - Medical Animation
Patient Education Reference Library

Hypertensive Emergencies

Hypertensive emergencies occur when very high blood pressure is associated with neurological or other symptoms. In general the BP is greater than 120 diastolic and 180 systolic. To qualify as an emergency there must be symptoms that occur with this high pressure. Symptoms can include any neurological finding such as severe headache, unilateral weakness or sensory change, visual problems. There may also be shortness of breath and chest pain. Because so many people with high blood pressure are under therapy, true hypertensive emergencies are becoming rare. If you encounter a patient with very high pressure and neurological symptoms you must have the patient transported to the hospital.

Elaboration – Uncontrolled Blood Pressure
[Hypertensive Emergencies](#) in Emergency Medicine
MedscapeREFERENCE

Knowledge Check

Patient Care Initial Assessment

The purpose of an initial assessment is to guide the initial path of treatment. You should be able to quickly assess a patient, generally within a minute, by evaluating a few key clinical indicators. At that point you can make a SICK or NOT SICK classification.

Elaboration – SICK vs. NOT SICK

A SICK patient is one who can die quickly unless you initiate aggressive BLS and ALS treatment and rapid transport. This patient appears physiologically unstable as indicated by key clinical signs.

A NOT SICK patient is one who can be ill or injured, but not severely enough to be life threatening. This patient appears physiologically stable and does not need immediate ALS measures at this time. BLS treatment can still be required!

The SICK/NOT SICK choice is a very important medical decision. In some cases, it is a life-saving choice. You should be able to decide within the first minute of contact whether or not the patient is critically ill. You do this by forming a clinical picture. Once the decision is made, responder actions should proceed in a manner appropriate to the patient's condition.

The key clinical indicators you need to make an initial assessment include:

- respirations (rate and character)
- pulse (rate and character)
- mental status
- skin signs and color
- body position

Your determination of SICK or NOT SICK will guide which initial treatment options you employ. For example, the SICK patient with moderate dyspnea would receive high flow oxygen and appropriate positioning. In addition, you would update the incoming ALS unit.

Make an initial assessment and start appropriate treatment.

OPQRST

As part of collecting a medical history for a patient with a suspected cardiac condition, you will focus on the character of his or her specific complaints such as pain or discomfort. OPQRST is an excellent tool for assuring a thorough medical history. It helps define the patient's complaint which will assist in assessment.

OPQRST		
Onset	What was patient doing when the pain started?	moving resting
Provocation	What makes it better or worse?	inspiration palpation movement walking working exercise eating swallowing position antacids nothing
Quality	Can you describe it? What does it feel like?	local tenderness sharp squeezing dull pressing pressure crampy burning
Radiation	Where do you feel it? Where does it go?	localized point discomfort chest pain radiates to arm, jaw or upper back all over
Severity	How bad is it on a scale of 1 to 10?	10 (ten being the worst) 0 (nothing hurts)
Time	When did the pain begin?	about 2 hours ago

Physical Exam

For a patient with a medical condition, you will obtain a complete set of vital signs and auscultate breath sounds. If your protocols allow, pulse oximetry and blood glucometry can be helpful. A complete physical exam may include:

- Auscultate breath sounds starting at the bases
- Blood pressure in both arms (note difference of 10 mm Hg or more)
- Skin color, moisture and temperature
- Pulse oximetry
- Blood glucometry
- Head, neck-to-toe exam

Elaboration – Lung Sounds – Audio Files **Access audio files via course on EMS Online**

Normal lung sounds – recorded over the left anterior upper chest of a 15 year old male adolescent.

Rales – These **crackles and bronchial breathing** were recorded posteriorly over the consolidated left lower lung of a 16 year old boy with tuberculosis .

Rales – These late inspiratory **fine crackles** were recorded over the right posterior lower lung of a 55 year old woman with rheumatoid lung disease.

Wheeze (a) – This expiratory **wheezing** was recorded over the right anterior upper chest of an 8 year old boy with asthma

Wheeze (b) –. These **wheezing and coarse crackles** were recorded over the right posterior lower lung of an 8 month old boy with viral bronchiolitis

Elaboration - Importance of Proper Auscultation Technique

EMS providers must be able to distinguish normal breath sounds from abnormal breath sounds. Although you do not need to positively identify every abnormal breath sound by name, it is helpful to practice listening and trying to distinguish the major differences. The proper technique for auscultating the chest using a stethoscope includes:

- Listen at six locations on the back and four locations on the front
- Start in the back at the base first in sitting patient
- Instruct patient to take a deep breath through the mouth then exhale
- Listen to one or two inspiration/expiration cycles per location
- Move to the other side and compare
- Try to avoid listening through clothing

Changing airflow patterns inside the lungs produce normal breath sounds. They make a "swishing" sound as air flows in or out. Absent breath sounds can indicate apnea, pneumothorax, hemothorax, or lung removal.

Once you have auscultated the lungs, record breath sounds as either normal or abnormal, which includes the presence of wheezing. Document the absence of breath sounds when none are heard.

Elaboration - Why Begin Auscultation at the Bottom?

When auscultating the chest, start in the back at the base first. This will allow the opportunity to hear subtle rales. Otherwise after several, deep breaths the fluid can redistribute throughout the base of the lungs. This will make the rales more difficult to detect.

Atypical Presentation

Myocardial ischemic pain caused by angina or myocardial infarction may be described as classic when it presents as an oppressive, substernal discomfort radiating to the arms and neck.

It can also present in atypical ways, especially in an elderly, diabetic or female patient. Atypical presentations can include shortness of breath, weakness, fatigue, indigestion or even a new onset of cardiac dysrhythmia.

Classic Symptoms

- pressure, fullness, heaviness, squeezing pain in center of chest that can radiate to neck, shoulder, jaw or back
- sweating
- nausea
- weakness
- shortness of breath

Atypical Symptoms

- unusual fatigue
- sudden onset of unusual shortness of breath during usual activities or at rest
- nausea, dizziness
- belching, burping, indigestion
- palpitations, new dysrhythmia, esp. atrial fibrillation
- pain experienced only in jaw, neck, back, arm or wrist

Atypical presentations are common in the elderly, diabetics and females.

Elaboration – Atypical Cardiac Presentations

[Diagnosing Heart Disease](#): Women are Different
Massachusetts General Hospital – Heart Center

Treating Patient with [Atypical Cardiac Presentations](#)
Journal of Emergency Medical Services

Principles of Management

The general steps for management of a cardiovascular emergency include: decision of SICK or NOT SICK, ensuring an adequate airway and respirations, administering oxygen, positioning the patient appropriately and assuring an ALS response.

Other steps that may be required include controlling airway secretions and assisting ventilations with a bag-valve mask. Consider preparing for cardiopulmonary arrest and application of an AED.

Nitroglycerin

Nitroglycerin is a medication used to treat angina. It relaxes vascular muscles and increases blood flow and oxygen to the myocardium. This helps relieve the pain.

These conditions must be met before you may assist with nitro:

- complaint similar to normally experienced angina or cardiac pain
- BP greater than 100 mmHg systolic
- no more than three doses total (5 minutes apart)
- must be patient's prescription
- patient must be sitting or lying down
- no Viagra or Levitra within past 24 hours or Cialis within past 48 hours



Nitrostat



Nitro Spray

EMS providers may assist a patient in taking prescribed nitroglycerin if:

1. The pain is the same type of pain for which nitroglycerin is normally taken (i.e. typical angina), AND
2. The patient's blood pressure is greater than 100 mmHg systolic.

Make sure the expiration date of the medication has not passed.

Elaboration – Assisting with Nitro

Assisting a patient with their nitro means you can locate the container, open it and offer a pill to the patient. Do not administer the drug by placing a pill in the patient's mouth. You may assist in the same way with nitroglycerin spray.

If you have any doubts about the circumstances, consult with the responding paramedic unit or with medical control before assisting with nitro.

Aspirin in the Field

Why give aspirin to someone with ACS?

The main effect of early aspirin administration is its anti-inflammatory properties. This helps protect inflamed heart muscle that may be in jeopardy from ischemia. Aspirin also reduces the body's production of prostaglandins. Prostaglandins can cause platelets in the blood to stick together. This can lead to blocked blood vessels and prevent delivery of oxygen-rich blood to the tissues. Reducing the prostaglandins may reduce the risk of dangerous blood clots, heart attacks and strokes. The anti-platelet effect takes an hour to "kick in."

When to Give Aspirin

You should give one, non-coated 325 mg aspirin to a patient who has any of the following signs or symptoms of ACS. They include:

- Uncomfortable **pressure, fullness, squeezing** or **pain** in the center of the chest that lasts more than a few minutes or goes away and comes back
- **Pain that spreads to the shoulders, neck or arms**
- Chest discomfort with **lightheadedness, fainting, sweating, nausea** or **shortness of breath**

You may also give an aspirin to a patient who exhibits any TWO of the following signs or symptoms when ACS is suspected:

- Atypical chest pain, stomach or abdominal pain. This may include discomfort that can be localized to a point, that is "sharp" in nature, that is reproducible by palpation or that is in the "wrong" location (such as the upper abdomen).
- Unexplained nausea (without vomiting) or lightheadedness (not vertigo) without chest pain
- Shortness of breath and difficulty breathing without chest pain
- Unexplained anxiety, weakness or fatigue
- Palpitations, cold sweats or paleness

How to Administer Aspirin

Follow these steps when administering aspirin:

1. Be sure the patient is **alert** and **responsive**.
2. Ask the patient to swallow **one, non-coated 325 mg aspirin** tablet (or four 81 mg tablets) with water.
3. If the patient has a prescription for nitroglycerin and meets the criteria for administration, do not delay in assisting with nitroglycerin.
4. **Request a paramedic** response if paramedics were not dispatched.
5. **Record your actions**, including the dosage and the time of administration

Knowledge Check

Resources

Skills Videos

[Video Case Study Cardiac Arrest – Atypical Presentation](#)

[Video Case Study Cardiac Arrest – Typical Presentation](#)

Web sites

Reports

[Heart Disease Deaths](#) – Seattle and King County

Animations

[View video link](#) –Coronary Artery Disease

[Coronary thrombosis](#) - video

[Blood Clot](#) (Embolus) Formation (Patient Education Reference Library)

Images

[Atherosclerotic plaque](#) (Internet Pathology Lab)

[Thrombus in coronary artery](#) (Internet Pathology Lab)

[Atherosclerotic aorta](#) (UTSW Medical Center)

[Heart with AMI](#) (Internet Pathology Lab)

[Dissected heart showing infarction](#) (PBS.org)

[Cross-section of heart showing AMI](#) (UTSW Medical Center)

Articles

[Coronary artery atherosclerosis](#) (Medscape REFERENCE)

[View more information on ACS](#) (Medscape REFERENCE)

[Dissecting aortic aneurysm](#) (Medscape REFERENCE)

[Heart Failure](#) (Medscape REFERENCE)

[Uncontrolled Blood Pressure](#) (Medscape REFERENCE)

[Diagnosing Heart Disease](#): Women are Different – Massachusetts General Hospital – Heart Center

[Treating Patient with Atypical Cardiac Presentations](#) – Journal of Emergency Medical Services

Assessments Quality Improvement Audits

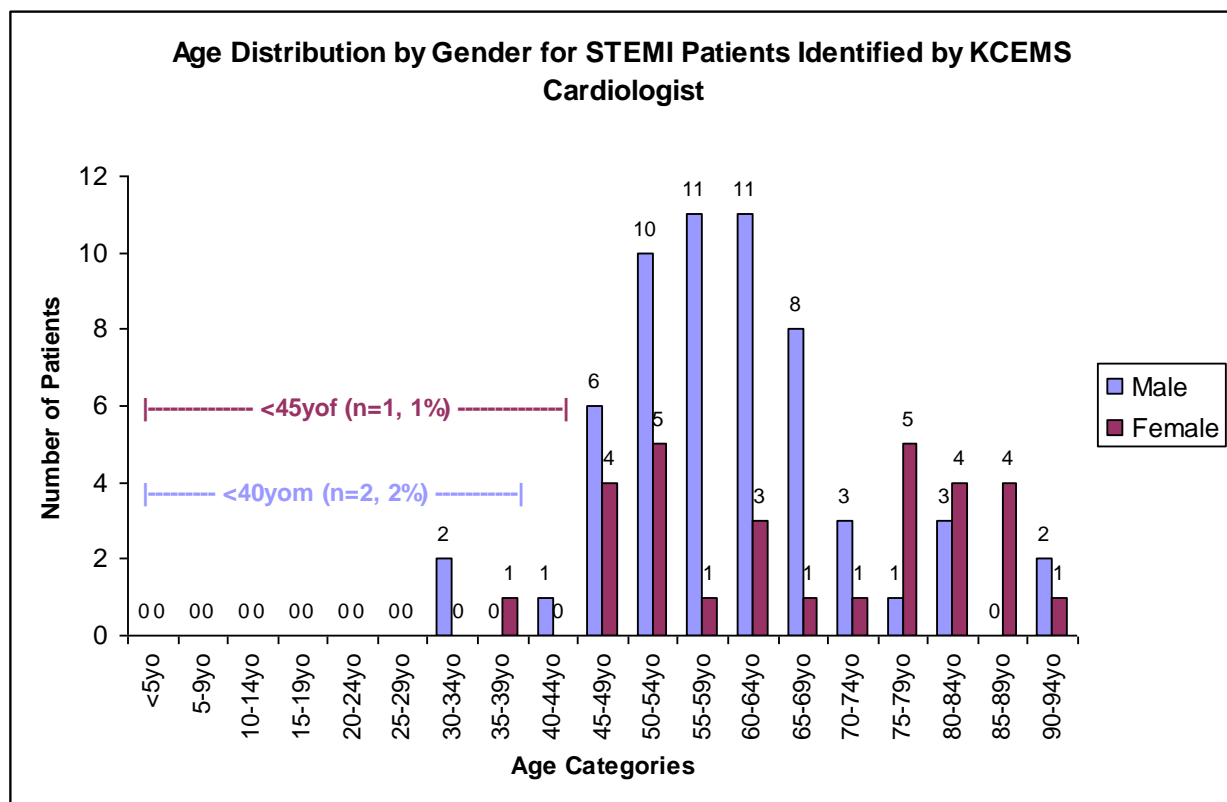
In 2011, the Medical Quality Improvement (QI) section of King County EMS initiated a series of focused EMT QI audits to assess EMT response to various critical conditions. These reviews are conducive in pointing to strengths, as well as areas needing improvement, in patient care. Below is an audit on "Characterizing STEMI Cases in King County" conducted in September of 2011.

Background:

We evaluated patients with prehospital ST-elevation MIs (STEMIs) who were seen by KCEMS EMTs and paramedics from January 1, 2011 to June 30, 2011. Prehospital STEMI diagnoses were based on KCEMS cardiologist's review of available 12-leads. (Hospital records were not reviewed to confirm these diagnoses.) We were particularly interested in evaluating the age and gender distributions of patients, the adherence to dispatch criteria for patients with chest pain, and the presenting symptoms of these patients.

Age and Gender Distribution Summary:

Of the 475 suspected MI cases reported in this time period, 88 (19%) were identified as STEMIs after KCEMS cardiologist's review of available 12-leads. We conducted a review of the age and gender of these prehospital STEMI cases (as shown below). The overall median age was 60 years – 59 years for males and 69 years for females – and 66% of the cases were males.



Dispatch Criteria Evaluation:

We also used these 88 cases to evaluate current dispatch criteria for 9-1-1 calls reporting chest pain/discomfort. Current dispatch criteria require a medic response for chest pain in males 40 years or older and in females 45 years or older. This age criterion does not apply if the patient reports chest pain associated with another significant symptom, such as shortness of breath or signs of shock. As shown in the graph above, two males <40yo and one female <45yo with chest pain received STEMI diagnoses based on pre-hospital 12-leads. In one of

these cases, BLS and ALS units were dispatched simultaneously and ALS arrived on scene 3.1 mins after BLS units. In two instances, an ALS unit was dispatched after BLS units arrived on scene, leading to an approximate delay of 15 mins in ALS assessment. Both of these patients reported atypical STEMI symptoms without chest pain.

Chief Complaint Summary:

We reviewed the same 88 cardiologist-confirmed prehospital STEMI cases for the patients' chief complaints. Chest pain was reported in 83% of instances. Additional chief complaints noted, some in association with chest pain, were shortness of breath, pain radiating to arms, diaphoresis, nausea/vomiting, syncope, decreased level of consciousness, fatigue, loss of consciousness, and blurred vision. (See table below.) All patients were evaluated and transported to a hospital by ALS units.

Chest pain	73 (83%)
Shortness of breath	28 (32%)
Radiating pain to arms	24 (27%)
Diaphoresis	19 (22%)
Nausea/vomiting	12 (14%)
Syncope	8 (9%)
Decreased level of consciousness	5 (6%)
Fatigue	4 (5%)
Loss of consciousness	2 (2%)
Blurred vision	2 (2%)
Internal defibrillatory shock	1 (1%)

Conclusion: It may be helpful to keep the following points in mind when evaluating possible STEMI patients:

1. Until the approximate age of 75, a greater number of men have prehospital STEMI than women.
2. Current dispatch criteria for BLS versus initial ALS response seem appropriate for calls with complaints of chest pain.
3. The primary presentation of a STEMI is chest pain in most patients, though other associated symptoms may also be present.

Summary

The following key points were covered in this module:

The thoracic cavity is divided into the mediastinum and the pleural cavities. The structures within the thoracic cavity include the intercostal muscles, ribs, sternum, costal arch, diaphragm, heart, lungs, trachea, aorta and pulmonary arteries.

Myocardial ischemia is the lack of blood flow and oxygen to the heart muscle.

Acute coronary syndrome (ACS) is the new term being used to describe clinical conditions ranging from unstable angina to acute myocardial infarction.

Sources of chest pain include the mediastinum, chest wall, lungs/pleura and abdomen. It can also be due to psychogenic sources.

Five common cardiovascular emergencies are angina, AMI, aortic dissection, CHF and cardiogenic shock.

OPQRST is a mnemonic that helps you assess the character of a specific complaint--it stands for Onset, Provocation, Quality, Radiation, Severity and Time.

Principles of care for a cardiovascular emergency include: decision of SICK or NOT SICK, ensure an adequate airway and respirations, administer oxygen, position the patient appropriately and assure an ALS response.