

Acute Myocardial Infarction

Case #6

Myocardial infarction (heart attack) is the leading cause of death in the United States. It is estimated that one in every five deaths in the US is due to a heart attack. Approximately one million patients are admitted to hospitals each year due to heart attacks. 200,000 to 300,000 individuals die from heart attacks before ever receiving medical care. In Case #2 we'll join 48-year-old Jason Dixon as he experiences a life-threatening heart attack.

Case Objectives

- 1) Review Chapters 20 and 21 in Text. *Tortora, Grabowski, Principles of Anatomy and Physiology*, on the cardiovascular system. Also review the following links:
 - a. [The Heart](#)
 - b. [MedicineNet.com](#)
 - c. [NOVA](#)

Use the text and the internet sites to help you define the objectives listed under #2 below.

- 2) Describe the essential components of heart anatomy and physiology to include:
 - a. Path of blood flow
 - b. The role of arteries, veins, and capillaries
- 3) Define the following terms:
 - a. Ischemia
 - b. Arteriosclerosis
 - c. Cholesterol & relationship to plaque formation
 - d. Angina
 - e. Hypertension
 - f. Infarction
- 4) Outline and define the physiologic/pathophysiologic sequence of events that lead to an acute myocardial infarction (AMI).
- 5) List the critical parameters of assessment and treatment emergency responders (a paramedic or EMT) must perform when first attending to a patient with an acute myocardial infarction.
- 6) List common symptoms in an acute myocardial infarction (AMI).

- 7) Describe the information each of the following tests provide an ER (critical care) physician or cardiac specialist when presented with a patient with a suspected AMI.
 - a. Electrocardiogram
 - b. Echocardiogram
 - c. Creatine kinase (CPK-MB, LDH isoenzymes, troponin-I)

- 8) Define the following as to their prevention or treatment of an AMI:
 - a. Angiogram
 - b. Angioplasty
 - c. Coronary bypass surgery
 - d. Beta blockers
 - e. Thrombolytics, such as heparin & streptokinase
 - f. Aspirin
 - g. Streptokinase

- 9) Describe the key roles the following health professionals provide in the care of a patient with an acute heart attack:
 - a. EMT/Paramedics
 - b. Clinical laboratory personnel
 - c. Critical care (ER) physicians
 - d. Critical care and coronary care nurses
 - e. Radiologic technologist & cardiovascular technologists
 - f. Follow-up by a family physician

- 10) Briefly define procedures and medications that may be used to reduce the mortality from an AMI. Define factors that influence treatment decision making processes.

- 11) List the contributing factors in the patient's lifestyle that led to his first heart attack. List reasonable changes that need to be made in the future to reduce further episodes.

48 year old Jason Dixon had not been feeling well all day and around 10:00 p.m he went to bed. At around 4:00 a.m. his wife awakened to see him slump to the floor, breathing with difficulty and drenched in perspiration. Alarmed when he told her of the pain in his chest, neck and arm, she called 911. Within 12 minutes, emergency response team personnel (EMTs) were on the scene. During this critical period, EMT personnel performed the [standard emergency treatment](#) protocol for a patient with symptoms of a myocardial infarction, commonly referred to as a heart attack.

- 1) *What symptoms did Jason exhibit?*
- 2) *If you were an emergency medical technician treating a suspected myocardial infarction (heart attack), what would you do for initial assessment of the patient?*
- 3) *What initial treatment would you give the patient?*

The patient carried several risk factors related to both lifestyle and family history. He was 80 lbs. over his ideal weight and worked long hours in a high stress environment as an advertising agency manager. He was also a moderate cigarette smoker. According to his wife, he exercised very little and paid virtually no attention to diet, often eating fast food, as well as eating late at night. His father died at age 56 from heart disease.

4) *Summarize the lifestyle risks of the patient.*

Instructor's Note: Before we progress further into this relatively complex case, please visit the following sites and review heart biology for better understanding of the physiological basis of an acute myocardial infarction.

- 1) [The Heart](#). Good review of basic heart anatomy and physiology. Links to related subjects such as the composition of blood. Don't get overwhelmed with this site! Have fun with it. You will only be responsible for the material covered in the objectives. Look for the following sites (the answer key gives you directions on how to find these sites if you're lost):
- 5) *Find and view the slide show on the structure of a preserved heart. This is interesting to view but in depth. You will not be tested on this!*
- 6) *Study the structure of the heart. Learn about the roles of blood vessels including arteries, veins, and capillaries.*
- 7) *Describe the pulmonary, coronary and systemic circulatory systems.*
- 8) *What prescription is given for a healthy heart?*
- 9) *How can the heart's health be monitored by a physician?*
- 10) *Define echocardiograph.*
- 11) *Define electrocardiography.*
- 12) *List invasive heart procedures*

Did you watch the open heart surgery video? You must download [quick time](#) to view. (Click on "structure" from home page. From here click on "heart surgery." Click on "open heart surgery.")

- 2) [MedicineNet.com](#) Power points on myocardial infarctions. You may need your medical dictionary, but the intent is to gain an overview of this life-threatening disease. This is a good overall review site for this case prior to taking the case post test.

After studying this website the student should be able to:

Define:

- a. Ischemia
- b. Angina
- c. cardiac enzymes
- d. angiogram
- e. arterioscleroses
- f. cholesterol and relationship to plaque formation
- g. Infarction and hypertension (See objective 3).

Outline and define the physiologic/pathophysiologic sequence of events that lead to an acute myocardial infarction (AMI). (See objective 4).

List common symptoms in an acute myocardial infarction (AMI) (See objective 5).

List common risk factors associated with an AMI (See objective 6).

Define the following as to their relevance to an AMI: angiogram, angioplasty, coronary bypass surgery, beta blockers, thrombolytics, such as heparin and streptokinase (See objective 8).

These questions/objectives are not referred to in the "answers to case questions" section. All of the answers can be found in the above web site. Make sure to check out the medical dictionary. Please review site in detail!

- 3) [NOVA](#) (from the television series). Excellent graphical representation of the "troubled heart" with pictures of normal and abnormal arteries. Good animation of cardiac blood flow.

Review treating heart problems that contain sections on risk factors and treatment.

Review "troubled hearts" that contains pictures of normal and abnormal hearts and arteries.

Review "Map of heart" that includes an excellent animation depicting cardiac blood flow.

- 4) [Echocardiography](#). There are many sites that address these important tools for assessing cardiac function. This site is a decent primer.

13) *Describe how an echocardiogram works.*

14) *List information about the heart that can be gained from an echocardiogram.*

15) *What information cannot be learned from an echocardiogram?*

16) *Which health professional would be responsible for performing an echocardiogram?*

Case continued: Enroute to the ER, the patient's acute symptoms had been relieved by the prompt action of the emergency care personnel. Vital signs had stabilized, his chest pain was relieved by nitroglycerin, and breathing was made easier by the increased oxygen flow.

Arriving at the hospital emergency room, the patient was immediately surrounded by medical professionals including critical care nurses, ER physicians and others. Blood was drawn and sent to the laboratory (along with the initial blood drawn by the EMTs,) for STAT (immediate!) analysis of cardiac serum markers, a CBC and electrolytes. A chest radiograph (x-ray) and echocardiogram were also performed. The patient's [EKG findings](#) were carefully reviewed by the ER physician and the on-call cardiologist was summoned.

17) *What is an electrocardiogram?*

Instructor's Note: This is a critical decision point for the cardiologist. There are several algorithms (flow chart protocols) for treating patients with chest pain suggestive of an acute heart attack. They include the patient's symptoms and history; the interpretation of the 12-lead EKG; the results of cardiac enzyme markers

and cardiac-specific proteins, the echocardiogram results and others. Based on available evidence, the cardiologist implemented the following treatments:

1. Intravenous [beta blockers](#) for decreasing oxygen demand to the heart, as well as other symptoms.
2. Intravenous [streptokinase](#) to dissolve clots and promote vascular healing.
3. Admission to the coronary care unit (CCU) for careful observation and additional testing.
4. Continued [aspirin therapy](#) (300 mg twice a day)

Treatment of heart attack patients depend on several factors: The cardiologist's assessment, results of diagnostic testing and the patient's overall response to initial therapy. More aggressive options may be needed. There are several websites listed under "additional links of interest" that will give the interested student an overview of heart attack treatments such as angioplasty and coronary bypass surgery.

18) Describe how beta blockers, streptokinase, and aspirin therapy are effective heart attack treatments.

[Initial Diagnostic Results](#)

- 19) How does measuring the level of cardiac enzymes help detect a myocardial infarction (MI)?
- 20) Why are Mr. Dixon's cardiac enzyme levels normal or only slightly elevated, even though it appears he has just experienced an acute MI?
- 21) What health care professional is responsible for determining cardiac enzyme levels?

Mr. Dixon was admitted to the hospital's coronary care unit (CCU) and carefully monitored by specially-trained coronary care nursing personnel. In patients with an AMI, the risk of sudden death is usually within the first 24 hours of the initial attack.

Early on the second day, the patient was scheduled for an [angiogram](#) to help assess the patient's coronary blood flow.

- 22) What is an angiogram?
- 23) Why is this test done?
- 24) What health care professional assisted the physician in performing the angiogram?

An expanded blood chemistry work-up was ordered to include a second measurement of cardiac enzymes.

[Cardiac Markers after 24 hours of admission](#) [Additional Blood Tests Relating Risk Factors of Heart Disease](#)

After 2 full days in the CCU, Mr. Dixon continued to improve and was transferred to the regular medical floor of the hospital for continued observation of vital signs, monitoring of serum cardiac markers and other key parameters. After 6 days, he was discharged from the hospital with specific orders for post-AMI recovery.

Instructor's Note: Mr. Dixon was lucky to have survived this heart attack, as they are the nation's number 1 killer of adult males with over 800,000 deaths/year. The keys to his survival were the quick action by his wife by calling 911 and the EMTs, who administered life-saving, on-scene assessment and treatments that

contributed greatly to his survival. Prompt emergency room care by physicians and critical personnel, coupled with proper treatments and care gave this patient a second chance. In the long run, and to help reduce further cardiac problems, Mr. Dixon will have to make several lifestyle changes: These will include controlling weight and making dietary changes, reducing work-related stress, stopping smoking and implementing a plan for moderate exercise.

Case Summary

- 1) A patient presented with classic symptoms of a heart attack. A blood clot had formed in a coronary artery narrowed by atherosclerotic plaque formation, usually related to high blood lipoproteins such as triglycerides, cholesterol and lipids. This in turn cut off the blood supply to an area of heart muscle, medically called ischemia.
- 2) Symptoms include acute chest pain, often radiating down the arm, sweating, vomiting and shortness of breath.
- 3) His wife called 911 and within minutes emergency response personnel were administering life-saving care, including medication, breathing assistance and other measures. Transported to the emergency room, diagnostic tests such as the electrocardiogram, echocardiogram, MRI and serum cardiac markers helped confirm an acute myocardial infarction commonly called a heart attack.
- 4) This critically ill patient was admitted to the hospital's coronary care unit where he received around-the-clock care. Cardiologists, critical care nurses and monitoring of cardiac damage by blood tests and procedures such as the angiogram are critical to helping a patient recovering from a heart attack. Mr. Dixon received aspirin, anticoagulants (Streptokinase) to prevent further clots, a beta blocker medication to reduce cardiac demand and continued monitoring of essential serum cardiac markers.
- 5) After hospitalization for several days, the patient was released to further recover at home. He will have to make several lifestyle changes to include smoking cessation, exercise, diet and stress reduction. Medications are available to reduce cholesterol levels, regulate blood pressure and other abnormalities that contribute to coronary heart disease risk.
- 6) Myocardial infarction (heart attack) is the number one cause of death in the United States. It is fatal if not treated. Although heart damage always occurs in a heart attack, patient's who are treated may continue to live for many years.
- 7) Emergency medical technicians gave initial care to the patient. They were relieved at the hospital by an emergency room team consisting of emergency room doctors and nurses. Clinical laboratory scientists performed blood testing to determine cardiac enzyme levels. After admittance to the CCU, a specialized team of nurses and a cardiologist monitored Mr. Dixon. The cardiovascular team were responsible for the electrocardiogram (EKG technologist), and the angiogram (cardiovascular technologist and cardiologist).

Answers to Case Questions

Question 1

Jason was slumped over, had difficulty breathing, and was perspiring excessively. He also had pain in his chest, neck, and arm.

Question 2

Initial Assessment: Take vitals, perform EKG, check O2 level (O2 Saturation), start I.V., take brief history, and draw blood for cardiac markers, serum electrolytes, and coagulation studies.

Question 3

Treatment: Give oxygen, aspirin, nitroglycerin, and morphine if needed.

Question 4

Lifestyle risks: overweight, stress, smoker, poor diet, little exercise.

The following "answers" provide help finding the links within the web site. From here, the answers should be self-explanatory.

"The Heart" Web Site

Question 5

Link on development on the first page. Then find the link titled "View the structure of a preserved heart."

Question 6

Link on "structure" on the first page. From here link on "blood vessels." From this page you can link on "artery," "vein," or "capillary" and explore and learn.

Question 7

Link on "body systems" on the first page. From here link on "circulatory" and from here you can go to "pulmonary," "coronary," and "systemic

Question 8

Link on "healthy heart" from the first page.

- a) Get plenty of exercise.
- b) Follow a good diet.
- c) Keep your heart clean and drug-free.

Question 9

Links can be found from first page, "monitor"

- a) Check by feel and sound.
- b) Check vital statistics (blood pressure and pulse).
- c) X-ray
- d) Echocardiograph

Question 10

(Link on monitor, echocardiography) Echocardiography is the process of mapping the heart through echoes. The pulses are sent into the chest and the high-frequency sound waves bounce off of the heart's walls and valves. The returning echoes are electronically plotted to produce a picture of the heart called an echocardiogram.

Question 11

(Link on monitor, electrocardiography) Every time the heart beats, tiny electrical impulses are discharged. Using a process called electrocardiography, those electrical discharges can be recorded and used to measure the heart's condition. Several thin wires are attached to the body. The wires conduct the electrical charges into a machine that measures them and produces a readout.

Question 12

Link on monitor, exploratory, open heart surgery.

Question 13

An echocardiogram is also known as ultrasound examination or sound wave picture of the heart. It uses the same technology that's used to take pictures of the fetus in pregnant women. The pictures are taken by a highly trained technician who places a hand-held plastic ultrasound probe against the patient's chest. The probe is connected to a large computer with a video screen. The probe emits sound waves that pass through the chest to the heart. The heart then reflects those sound waves back to the probe. The probe transmits those reflected signals to the computer which reconstructs them into a picture of the heart. This picture is displayed on the screen and recorded on videotape or on a digital storage medium.

Question 14

An echocardiogram shows:

- a) The sizes of the 4 chambers of the heart.
- b) The strength of the heart muscle.
- c) The presence of fluid around the heart.
- d) Problems with the valves of the heart.
- e) Congenital heart disease. Babies born with holes in their hearts or abnormal connections between the cardiac chambers can be accurately diagnosed with an echocardiogram. It can even be done on the unborn fetus to make a diagnosis so the doctors are ready when the baby is born.
- f) Information about the pressures within the chambers of the heart.
- g) Information about why a person may have an erratic heartbeat.

Question 15

Echocardiograms do not give a picture of the arteries of the heart.

Question 16

A radiology technologist with a specialty in echocardiography.

Question 17

An electrocardiogram measures the heart rhythms and electrical impulses.

Question 18

Beta blockers slow the heart rate decreasing the strain on the heart and it's need for oxygen.
Streptokinase helps dissolve blood clots.
Aspirin decreases further blood clot formation.

Question 19

Cardiac enzymes are elevated following a myocardial infarction.

Question 20

Most cardiac enzymes do not peak until several hours following a M.I. (See link for cardiac enzymes).

Question 21

Clinical Laboratory Scientist

Question 22

An angiogram is an x-ray picture of dye moving through coronary arteries. The dye is inserted into a catheter which is placed inside the heart.

Question 23

An angiogram is done:

- a) To make a definitive diagnosis of blocked arteries when other clinical information and tests are equivocal.
- b) To determine if the blockages in the arteries are severe enough to be responsible for any symptoms the patient may be having.
- c) To determine if a patient's blockages would be best treated by procedures such as an angioplasty or bypass surgery.
- d) To assess the risk of future heart attacks in patients who have already had a heart attack or damage to their heart muscle.

Question 24

Cardiovascular technologist.

Health Professionals Introduced in this Case

[Emergency Medical Technician](#)

[Cardiovascular Technical Personnel](#)

[Critical Care/ Emergency Nurse](#)

[Cardiologist](#)

[Physician/Surgeon](#)

[Clinical Laboratory Scientist](#)

Health Professionals Previously Introduced

[Nursing](#)

[Radiology technician](#)

[Radiology](#)