SCIENTIFIC DECISION-MAKING

TEAM DIAGNOSIS OF THREE CASES

Baylor College of Medicine

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About the Project

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Activities described in this book are intended for middle or high school students under direct supervision of adults. The authors, Baylor College of Medicine and AHRQ cannot be held responsible for any accidents or injures that may result from conduct of the activities, from not specifically following directions, or from ignoring cautions contained in the text. The opinions, findings and conclusions expressed in this publication are solely those of the authors and do not necessarily reflect the views of BCM or the sponsoring agency.

BioEd^{SM}

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Team Diagnosis of Three Cases

Overview

Students work in teams and take on the role of medical personnel to analyze symptoms, order diagnostic tests, and determine the nature of the health crises being experienced by Arturo, Brian and Angela.

Health-related Careers

- Accountant
- Admitting Clerk
- Anesthesiologist
- Cardiologist
- Data and Systems Analyst
- Dietitian
- Electrocardiograph (EKG) Technician
- Emergency Medical Technician (EMT)
- Emergency Room Registered Nurse (ER-RN)
- Emergency Services Physician
- Licensed Practical Nurse
- Medical Laboratory Technician
- Nurse Anesthetist
- Pharmacist
- Pharmacy Technician
- Phlebotomist
- Scrub Nurse
- Surgeon
- Surgical Nurse
- Surgical Technologist

Physicians diagnose hearts attacks (acute myocardial infarctions, or MI) based on a patient's signs and symptoms, physical examination findings, electrocardiogram (EKG or ECG) results, and cardiac enzyme studies. Emergency personnel also assess the heart rate, blood pressure, breathing rate, and general appearance and alertness of the individual in crisis.

Typically, in cases where heart attack is suspected, emergency room personnel will attach wire electrodes or leads to the patient's chest and perform an EKG (a graphical record of the heart's electrical activity as it contracts and relaxes). Each heartbeat sends an electrical signal that travels from the top of the heart to the bottom, causing the heart to contract and pump blood. These electrical signals set the rhythm of the heartbeat, which produces the familiar jagged-line pattern on an EKG monitor. Emergency room professionals viewing the EKG printout can detect the rate of the heartbeat, abnormal heart rhythms, and the strength and timing of the electrical signals as they pass through each part of the heart. Students learned about this test in the activity, "Introduction to Personal Stories."

During a heart attack, damaged or destroyed heart muscle cells release chemicals, particularly proteins, called cardiac enzymes, into the bloodstream. Specific tests that measure the blood levels of these proteins can help determine whether a patient has had a heart attack. Normally, very low levels of cardiac enzymes are found in the blood, but the levels rise dramatically when heart muscle is injured or destroyed (as during a heart attack). Physicians usually order repeated blood tests of two cardiac proteins—creatine phosphokinase (CK) and troponin (T)—and compare their levels over time.

CK is an enzyme found in heart, brain, muscle and blood of healthy people. Blood levels of CK rise four to six hours after muscle damage, and peak about 18–24 hours after a heart attack. CK-MB is a form of the enzyme found mainly in heart muscle, so elevated blood levels suggest heart muscle damage. Troponin is released into the bloodstream more quickly (two to six hours after heart cell damage) than CK is, and blood levels of T peak in 12–26 hours. Because T is an "earlier" and somewhat more accurate indicator of cardiac muscle cell damage than CK is, it is the preferred marker for diagnosing heart attack. But both cardiac proteins typically are measured in patients suspected of having MI.

Materials

Teacher

- Interactive white board or video projector and computer
- Internet access
- Copy of "Teacher Key to Diagnostic Tests and Exam Results"
- Copies of "Diagnosis of a Heart Attack" (add to Reference Folders)
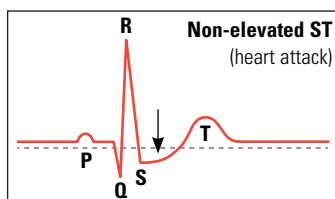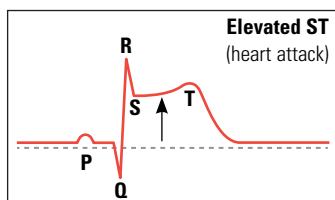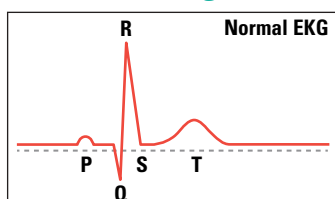- Copies of "Table of Diagnostic Tests" (add to Reference Folders)

Producing an EKG

With a typical EKG, a technician connects electrodes from a machine to a patient's chest, upper arms and legs. The machine records the heart's rhythm, producing the EKG printout.

Image courtesy of the NHLBI (http://www. nhlbi.nih.gov/health/health-topics/topics/hb/understanding.html).

EKG Readings

Normal EKG

R
P S T
Q

Elevated ST
(heart attack)

R
S T
P
Q

Non-elevated ST
(heart attack)

R
T
P S
Q

EKG readings provide information about the location and severity of arterial blockages in the heart. Usually, an EKG with an elevated ST segment indicates a more severe form of heart attack, with greater heart muscle damage.

- Diagnostic Test Cards (one set per student team), photocopied onto card stock, cut into sets and stored in zip-top bags
- Copies of the "Medical Team Instruction Sheet" (one per student team)
- Copies of "Patient Diagnosis" sheets for Arturo, Brain and Angela (one set per team)
- Copies of "Arturo: Part Two," "Brian: Part Two" and "Angela: Part Two" (one set per team)
- Copies of Expert Diagnostic team certificates (optional)

Per Student

- Set of Diagnostic Test Cards
- Copy of "Medical Team Instruction Sheet"
- Copy of "Patient Diagnosis" sheets for Arturo, Brain and Angela
- Personal story folders for each character
- Reference folder with a copy of the "Table of Diagnostic Tests" (added to folder previously, in the activity, "Introduction to Personal Stories") and "Diagnosis of a Heart Attack" (add to folder).
- Copy of "Arturo: Part Two," "Brian: Part Two" and "Angela: Part Two" (Do not add to the personal story files until after the activity is completed. Students will use this information at the end of the activity.)

Setup

Photocopy the Diagnostic Test Cards onto card stock and cut into sets. Make at least one copy per team of the "Table of Diagnostic Tests," "Diagnosis of a Heart Attack" and Part Two of the personal stories. Do not give students Part Two of the personal stories until they have completed their diagnostic teamwork on each patient. A "Diagnosis Answer Key" is provided to the left.

Have students work in teams of four.

Note. You may want to allow most of one class period to work through the first case, and follow with the other two cases during a second class period.

Procedure

1. Remind students that Arturo, Brian and Angela still are in the emergency room. Project the video, Scientific Decision-making, Part Two **(http://www.bioedonline.org/lessons-and-more/resource-collections/scientific-decision-making/)** to familiarize students with changes in the EKG and blood tests that are used to identify myocardial infarction (heart attack). Pause the video after the introduction. You will return to the video after student teams have finished diagnosing each patient. Depending on your students, you also may have them read the reference sheet, "Diagnosis of a Heart Attack," before beginning the activity or as homework the day before.
2. Tell students that they will work in teams, as medical personnel, to diagnose Arturo, Brian and Angela. Provide each team with the updated Reference folder, all three personal story folders (without Part Two for each character), a copy of the "Medical Team Instruction Sheet," and a set of Diagnostic Test Cards.
3. Read the "Medical Team Instruction Sheet" to the class, ensuring that students understand the diagnosis process. Answer any questions before proceeding.
4. Have students start with Arturo's case. Project or write the following questions on the board: *What do we know about the patient? What information do we need to diagnose his condition?* You may want to work through Arturo's case as a class, to be sure students understand the process.

Diagnosis Answer Key

CHARACTER: ARTURO

Diagnosis: Appendicitis; no heart attack; hypertension

Evidence: Abdominal tenderness, high white blood count, CT scan all indicated appendicitis. Normal EKGs and low levels of cardiac enzymes (in the normal range) suggested that a heart attack had not happened. Blood pressure was above 120/80, indicating hypertension.

CHARACTER: BRIAN

Diagnosis: Heart attack (myocardial infarction); hypertension

Evidence: Fast and irregular heart rhythm on EKGs, elevated levels of CK-MB and troponin, and a coronary angiogram provided evidence of heart attack. Blood pressure was above 120/80, indicating hypertension.

CHARACTER: ANGELA

Diagnosis: Pregnancy; slight anemia; hypertension

Evidence: Positive test confirmed pregnancy. Hemoglobin below 11 gm per dL is considered low (mild anemia) in females. Blood pressure was above 120/80, indicating hypertension.

Grand Rounds

Grand rounds are important teaching tools, used to help keep doctors and healthcare professionals up to date. Grand rounds presentations typically are lectures that focus on the medical problems and treatment of a particular patient, or on findings from new research on a variety of medical topics.

5. Students will select diagnostic tests or physical exam results to give them additional information about Arturo's condition—so that they can arrive at a diagnosis. The information on Arturo's "Patient Diagnosis" sheet will help them decide which diagnostic tests to order. Inform students that they also may request physical exam results (in the appropriate table on the "Diagnosis Sheet") to gain further insight into Arturo's medical condition. Each team may request three results at a time.

6. You will serve as monitor, using the "Teacher Key to Diagnostic Test Results" sheet to fill in the "Results" column for each test requested by student teams. You may want to appoint one or more students to serve as additional monitors.

    Note: Students may calculate the CK-MB% of total CK on their own, or request the calculation result (at an additional cost).

7. After all teams have submitted a diagnosis, determine a winner based on the completeness of the diagnosis and time submitted (see "Diagnosis Answer Key," left sidebar). In case of a tie, also consider the amount of funds expended. (If you wish to print certificates for members of winning teams, a template is included at the end of this activity.)

8. Have members of the winning team present the evidence they used to reach a diagnosis. The class may question the team's presentation, with you as moderator. Ask the team, *Could you have saved the patient any money by ordering fewer or different tests?* Have the team defend its test choices. Allow further classroom discussion as necessary.

    OR hold team presentations after all three patients have been diagnosed. Conduct "Grand Rounds" in class (see "Grand Rounds," left sidebar), during which time each team presents one of its diagnoses and evidence. Following each team's report, others in the class may contribute to, or challenge the presentation. If lab coats are available, students should wear them for their Grand Rounds presentations.

9. Have teams repeat steps 4–8 to develop and reach diagnoses for Brian and Angela. Assist the teams as before. Depending on the time required to complete Arturo's diagnosis, Brian's case can serve as the start of day two for this activity.

10. After all the teams have made their diagnoses and presented their outcomes, read or have students read Part Two of each personal story. You also may show the next section of the video narrative.

    Explain that the additional information includes the emergency room physician's explanation of tests ordered and the reasoning for them, along with a definitive diagnosis and follow-up for each character.

11. Conclude by having students discuss the cases as a whole. Ask, *Were you surprised by any of the diagnoses? At first, did you think all of the patients were having a heart attack? Was cost a factor in any of the diagnoses?*

12. You may want to have each team write and submit a report of the tests ordered, and conclusions reached for each patient.

EXTENSIONS OR HOMEWORK

Several kinds of careers are encountered in the personal stories of Arturo, Brian and Angela. Have students research and present different health-related careers to the class. Presentations should include a description of the career, educational requirements to obtain a position in this field, typical duties/responsibilities, and work settings for those who do this job. A partial list of professions involved in the cases is provided (see sidebar, p. 1). You can add to this list or allow students to choose a different health-related career, with your approval. ■

Teacher Key
To Diagnostic Tests and Exam Results

ARTURO: DIAGNOSTIC TESTS	ER: 7:50 PM	2:00 AM	8:00 AM	2:00 PM
Total CK series (IU/L)**	74	81	77	74
CK-MB (IU/L)**	2.2	2.3	2.2	2.2
CK-MB Fraction (% of total CK)	3.0%	2.8%	2.9%	3.0%
Troponin (ng/mL)**	0.06	0.07	0.06	0.06

PE-Abdomen Palpation* (physical exam)	Tenderness with guarding, lower right quadrant	CBC RBC*	4.7
PE-Ears, Eyes, Nose, Throat	Not remarkable	CBC WBC*	15,500
PE-Elbows and Knee Reflexes	Not remarkable	CBC Hemoglobin*	16
PE-Heart with Stethoscope	Not remarkable	CT Scan-Abdomen**	Inflamed appendix
PE-Lungs with Stethoscope	Not remarkable	CT Scan-Chest	Not remarkable
Potassium (mEq/L)*	155	CT Scan-Head	Not remarkable
Sodium (mEq/L)*	4.8	Pregnancy Test	NA

BRIAN: DIAGNOSTIC TESTS	ER: 1:45 PM	8:00 PM	2:00 AM	8:00 AM
Total CK series (IU/L)**	150	181	220	174
CK-MB (IU/L)**	6.4	19.9	47	15.7
CK-MB Fraction (% of total CK)	4.3%	11.0%	21.4%	9.0%
Troponin (ng/mL)**	0.15	1.88	0.97	0.75

PE-Abdomen Palpation* (physical exam)	Not remarkable	CBC RBC*	5.2
PE-Ears, Eyes, Nose, Throat	Not remarkable	CBC WBC*	7.1
PE-Elbows and Knee Reflexes	Not remarkable	CBC Hemoglobin*	16.3
PE-Heart with Stethoscope	Not remarkable	CT Scan-Abdomen**	Not remarkable
PE-Lungs with Stethoscope	Not remarkable	CT Scan-Chest	Not remarkable
Potassium (mEq/L)*	144	CT Scan-Head	Not remarkable
Sodium (mEq/L)*	4.2	Pregnancy Test	NA

ANGELA: DIAGNOSTIC TESTS	ER: 10:15 AM	4:00 PM	10:00 PM	4:00 AM
Total CK series (IU/L)**	74	80	75	55
CK-MB (IU/L)**	1.2	0.9	0.8	0.3
CK-MB Fraction (% of total CK)	1.6%	1.1%	1.1%	0.5%
Troponin (ng/mL)**	0.05	0.06	0.04	0.05

PE-Abdomen Palpation* (physical exam)	Tenderness in lower middle abdomen	CBC RBC*	3.0
PE-Ears, Eyes, Nose, Throat	Not remarkable	CBC WBC*	4.2
PE-Elbows and Knee Reflexes	Not remarkable	CBC Hemoglobin*	9.9
PE-Heart with Stethoscope	Not remarkable	CT Scan-Abdomen**	Should not be done
PE-Lungs with Stethoscope	Not remarkable	CT Scan-Chest	Not remarkable
Potassium (mEq/L)*	140	CT Scan-Head	Not remarkable
Sodium (mEq/L)*	4.5	Pregnancy Test	Positive

NA = Not applicable

  *   Valuable in preliminary or initial diagnosis.

**   Important for definitive diagnosis of Angela's medical condition

Medical Team Instructions

Emergency Room Case Studies

You are third-year medical students completing a rotation in the emergency room of a county hospital. Your team will use clinical evidence to decide on a diagnosis for Arturo, Brian, and Angela. Your diagnosis must indicate (1) if each patient had a cardiac event and (2) what other medical issues, if any, are involved in each patient's health condition.

INSTRUCTIONS

1. Complete your diagnosis of one patient before moving on to the next. Your teacher will tell you the order in which you should diagnose patients.

2. Use each patient's symptoms and vital signs, along with information in the Table of Diagnostic Tests. Read "Diagnosis of a Heart Attack" before you begin. This will give you some ideas about the types of information you need to make a diagnosis.

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3. Your team must decide which additional tests (from the Diagnostic Test Cards) are needed for each patient. You also may request physical exam results. You may request three test or exam results at a time. But be aware, each diagnostic test or physical exam request card has a cost (dollar value). Medical personnel must try to provide the best care possible without wasting money on unnecessary tests.

4. The first team to make the correct, complete diagnosis for each patient will be recognized as Diagnostic Experts! But remember, while looking for evidence of a heart attack, you also may find evidence that leads to an alternative or combined diagnosis. A complete diagnosis must (1) state if the patient had a cardiac event and (2) identify other medical issues, if any, that are involved in the patient's current health condition. In the event of a tie, the team that has spent the fewest dollars wins. All teams must be prepared to defend their findings.

5. After you have decided on the first three diagnostic test results to order, record your selections, along with the corresponding point values, in Step 3 of the patient table. Bring the patient diagnosis sheet to your teacher for approval to receive requested test results.

6. Return to your work area and review your test results to decide if you have enough information to make a complete diagnosis. If so, record your diagnosis in Step 4 and submit the patient diagnosis sheet to the teacher.

7. If you need more information, you may select up to three more tests. Request them on the patient sheet as before, and submit your request to the teacher. You may continue to request test results until you have enough information. Once you have a diagnosis, record it in Step 4 and submit the patient diagnosis sheet to the teacher.

Patient Diagnosis: Arturo

1. Vital signs for Arturo, taken at his home by EMS, and in the ER, are provided in the table to the right. They will help you to diagnose Arturo's condition.

2. What do you already know about Arturo? Record any symptoms or information from the emergency room that may help you to choose additional diagnostic tests.

Vital Signs and EKG Results

Vital Sign		EMTs: 7:15 PM	ER-RN: 7:45 PM
	Temperature	101.0 °F	102.0 °F
	Blood pressure (mm Hg)	145/100	142/95
	Pulse rate (beats per minute)	120 bpm	92 bpm
	Respiration rate (per minute)	28	20
	Oxygen saturation (pulse ox)	92%	95%
	Electrocardiogram (EKG)	Normal	Normal

3. List the diagnostic tests your team selects for Arturo, and identify the points spent for each test. Have your teacher approve the tests and record the results. You may choose three test results at a time.

Diagnostic Tests/Physical Exam Requests	Points Spent	Results

4. Diagnosis for Arturo:

Teacher Time Stamp: _____ Dollars Spent: _____

5. Prepare your team's defense on the back of this page.

Patient Diagnosis: Brian

1. Vital signs for Brian, taken at the school by EMS, and in the ER, are provided in the table to the right. They will help you to diagnose Brian's condition.

2. What do you already know about Brian? Record any symptoms or information from the emergency room that may help you to choose additional diagnostic tests.

Vital Signs and EKG Results

Vital Sign	EMTs: 12:55 PM	ER-RN: 1:15 PM
Temperature	98.6 °F	98.6 °F
Blood pressure (mm Hg)	155/100	165/105
Pulse rate (beats per minute)	122 bpm (regular)	120 bpm (regular)
Respiration rate (per minute)	38 (shallow)	32 (shallow)
Oxygen saturation (pulse ox)	85%	87%
Electrocardiogram (EKG)	—	Irregular pattern

3. List the diagnostic tests your team selects for Brian, and identify the points spent for each test. Have your teacher approve the tests and record the results. You may choose three test results at a time.

Diagnostic Tests/Physical Exam Requests	Points Spent	Results

4. Diagnosis for Brian:

Teacher Time Stamp: _____ Dollars Spent: _____

5. Prepare your team's defense on the back of this page.

Patient Diagnosis: Angela

1. Vital signs for Angela, taken at home by EMS, and in the ER, are provided in the table to the right. They will help you to diagnose Angela's condition.

2. What do you already know about Angela? Record any symptoms or information from the emergency room that may help you to choose additional diagnostic tests.

Vital Signs and EKG Results

Vital Sign		EMTs: 9:45 AM	ER-RN: 10:00 AM
98.6°F	Temperature	98.6 °F	98.6 °F
	Blood pressure (mm Hg)	166/110	160/105
	Pulse rate (beats per minute)	118 bpm	100 bpm
	Respiration rate (per minute)	28	18
	Oxygen saturation (pulse ox)	96%	97%
	Electrocardiogram (EKG)	–	Normal

3. List the diagnostic tests your team selects for Angela, and identify the points spent for each test. Have your teacher approve the tests and record the results. You may choose three test results at a time.

Diagnostic Tests/Physical Exam Requests	Points Spent	Results

4. Diagnosis for Angela:

Teacher Time Stamp: _____   Dollars Spent:_____

5. Prepare your team's defense on the back of this page.

Diagnostic Test Cards

|	
Total Creatine Phosphokinase (CK or CPK) Series — $450 Cardiac enzyme	**Electrolyte-Potassium [K]** — $35
Creatine Phosphokinase-MB CK–MB Series — $250 Cardiac enzyme	**Electrolyte-Sodium [Na]** — $35
CK-MB fraction (% of total CK) — $30 You must request Tests 1 and 2 to obtain this calculation.	**PE-Abdomen Palpation** — $50 Physician physical exam
Blood Count: Red Blood Cells (RBC) — $65	**PE-Ears, Eyes, Nose, Throat** — $80 Physician physical exam
Blood Count: White Blood Cells (WBC) — $65	**PE-Elbow and Knee Reflexes** — $30 Physician physical exam
Blood Count: Hemoglobin — $35	**PE-Heart with Stethoscope** — $50 Physician physical exam
CT Scan-Abdomen — $850 Computed tomography scan	**PE-Lungs with Stethoscope** — $50 Physician physical exam
CT Scan-Chest — $850 Computed tomography scan	**Pregnancy Test** — $45
CT Scan-Head — $850 Computed tomography scan	**Troponin (T) Series** — $450

Diagnosis of a Heart Attack

Reference

With a typical EKG, a technician connects electrodes from a machine to a patient's chest, upper arms and legs. The machine records the heart's rhythm, producing the EKG printout.

Image courtesy of the NHLBI (http://www.nhlbi.nih.gov/health/health-topics/topics/hb/understanding.html).
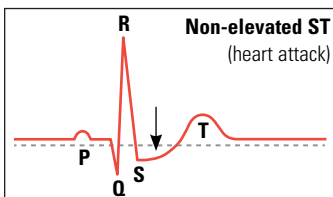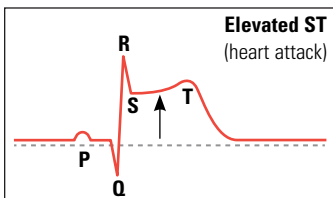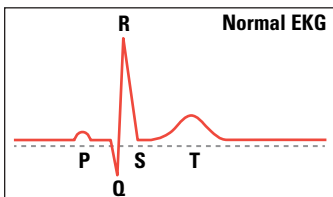
EKG Readings

EKG readings provide information about the location and severity of arterial blockages in the heart. Usually, an EKG with an elevated ST segment indicates a more severe form of heart attack, with greater heart muscle damage.

Hearts attacks (acute myocardial infarctions or MI) are diagnosed based on an individual's signs and symptoms, physical examination findings, electrocardiogram results, and cardiac enzyme studies. In the case of a possible heart attack, emergency personnel will assess the heart rate, blood pressure, breathing rate, and general appearance and alertness of the individual in crisis.

Electrocardiogram (EKG/ECG)

Emergency personnel will place wire electrodes (leads) on the chest and perform an EKG (which is a graphical record of the heart's electrical activity as it contracts and relaxes). Each heartbeat sends an electrical signal that spreads from the top of the heart to the bottom. As it travels, the signal causes the heart to contract and pump blood. These electrical signals set the rhythm of the heartbeat. During an EKG, a jagged-line image appears on a monitor and shows the rate of the heartbeat, abnormal heart rhythms, and the strength and timing of the electrical signals as they pass through each part of the heart.

Blood Tests (Cardiac Enzyme Studies)

During a heart attack, heart muscle cells are damaged or destroyed resulting in release of their contents to the bloodstream. Specific blood tests can measure the amount of certain proteins called cardiac enzymes. These proteins are normally found in the blood at low levels. When heart muscle is injured or destroyed during a heart attack, the cardiac protein levels rise dramatically. Cardiac proteins include creatine phosphokinase (CK or CPK) and troponin (T). Normally, physicians order repeated cardiac enzyme studies for comparison. Blood samples are drawn at admission to the hospital, then repeated every 6 to 8 hours for 1 to 2 days following a suspected heart attack. A significant rise and fall in the cardiac enzyme levels indicates a heart attack.

Creatine Phosphokinase (CK/CPK)

Total CK levels generally rise within 6 hours after a heart attack. CK reaches its peak level in 18 hours then returns to normal within 4 days. Total CK is not specific for heart damage and can rise following vigorous exercise, injuries to muscles, or muscle inflammation. However, there are three measurable isoenzymes or fractions that together make up total CK. One fraction is specific for muscle (CK-MM), one specific for brain (CK-BB), and one specific for heart muscle (CK-MB). CK-MB, which is released in large amounts from damaged or destroyed heart muscle cells, is a more specific way to detect heart damage. Normally, CK-MB makes up 0% to 6% of the total CK in the bloodstream. During a heart attack, CK-MB levels typically rise within 4 hours and peak within 18 hours showing an increase of two or more times baseline values. The CK-MB levels fall within 3 days and return to normal.

Troponin (T)

The protein troponin (specifically the TnT fraction) is normally so low it cannot be detected in the blood. Troponin is released to the blood-stream in great amounts when heart muscle is damaged or destroyed. It is thought that the more troponin in the blood, the greater the damage to the heart. Blood levels of troponin typically rise within 6 hours after a heart attack and reach their highest level within 18 hours then fall slowly to normal levels within 10 days. ■

Personal Story: Arturo
Part 2

Arturo's Vitals and Diagnostic Test Results

DIAGNOSTIC TESTS/VITALS	ER: 7:45 PM	2:00 AM	8:00 AM	2:00 PM
Total CK series (IU/L)	74	81	77	74
CK-MB (IU/L)	2.2	2.3	2.2	2.2
CK-MB fraction (% of Total)	3.0%	2.8%	2.9%	3.0%
Troponin (ng/mL)	0.06	0.07	0.06	0.06
EKG	Normal	Normal	Normal	Normal
CBC (RBC, WBC, Hemoglobin)	RBC: 4.7 | WBC: 15,000 Hemoglobin: 16	NA	NA	NA
Potassium (mEq/L)	4.8	NA	NA	NA
Sodium (mEq/L)	155	NA	NA	NA
PE-Abdomen Palpation (physical exam)	Tenderness with guarding, lower right abdomen	NA	NA	NA
CT Scan-Abdomen	Inflamed appendix	NA	NA	NA
Blood Pressure (mm Hg)	142/95	135/85	135/90	140/85
Oxygen Saturation (pulse ox)	95%	95%	96%	95%
Pulse Rate	92 bpm	90 bpm	92 bpm	85 bpm
Respiration Rate (per minute)	20	12	15	14
Temperature	102.0 °F	102.0 °F	100.8 °F	100.5 °F
Total Cholesterol (mg/dL)	NA	NA	320	247
HDL Cholesterol (mg/dL)	NA	NA	36	38
LDL Cholesterol (mg/dL)	NA	NA	245	190
Triglycerides (mg/dL)	NA	NA	195	95
BMI (Kg/m^2)	NA	NA	38.4	NA

Key: deciliter (dL), international unit (IU), liter (L), microliter (mcL), milliliter (mL), milliequivalent (mEq), nanogram (ng). NA = Not applicable.

Physician Summary for Arturo

Arturo, a 56-year-old male, presented in the ER with a head laceration (cut) caused by a fall that resulted in unconsciousness.

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He complained of stomachache and nausea that were not relieved by antacids. His wife called 911. EMTs noted that the patient was short of breath, disoriented and pale in appearance, with tenderness in the abdomen. Vitals signs taken at the scene and in the ER indicated fever, rapid heartbeat, low oxygen saturation (92% initially) and high blood pressure. Serial EKGs were normal. The cut did not require stitches. Hemoglobin levels and red blood cell (RBC) count were normal, indicating minimal loss of blood.

Upon physical examination, tenderness with guarding (tension in the muscles of the abdomen) was detected, especially in the lower right abdomen. Nothing else in the exam was remarkable. A cardiac enzyme series, sodium and potassium, and CBC were ordered. Results indicated high sodium, possibly from dehydration, and an elevated white blood cell count, indicating inflammation or infection. Initial diagnosis was appendicitis. A cardiac event could not be ruled out at this time. An abdominal CT-scan was ordered, revealing a swollen appendix. The patient was prepped for surgery and an appendectomy was performed without complications. The cardiac enzyme series indicated no apparent heart attack. ■

Personal Story: Brian

Part 2

Brian's Vitals and Diagnostic Test Results

DIAGNOSTIC TEST/VITALS	ER: 1:15 PM	8:00 PM	2:00 AM	8:00 AM
Total CK series (IU/L)	150	181	220	174
CK-MB (IU/L)	6.4	19.9	47	15.7
CK-MB fraction (% of Total CK)	4.3%	11.0%	21.4%	9.0%
Troponin (ng/mL)	0.15	1.88	0.97	0.75
EKG (12-lead)	Irregular pattern	Irregular pattern	Normal	Irregular pattern
Blood Pressure (mm Hg)	165/105	155/100	165/105	145/95
Oxygen Saturation (pulse ox)	87%	85%	87%	90%
Pulse Rate	120 bpm	110 bpm	95 bpm	90 bpm
Respiration Rate (breaths per minute)	32 shallow	22	15	14
Temperature	98.6 °F	98.6 °F	97.4 °F	98.6 °F
Fasting Glucose (mg/dL)	NA	NA	NA	75
Total Cholesterol (mg/dL)	NA	NA	NA	247
HDL Cholesterol (mg/dL)	NA	NA	NA	38
LDL Cholesterol (mg/dL)	NA	NA	NA	190
Triglycerides (mg/dL)	NA	NA	NA	95
BMI (Kg/m^2)	NA	NA	28.0	NA

Key: deciliter (dL), international unit (IU), liter (L), microliter (mcL), milliliter (mL), milliequivalent (mEq), nanogram (ng). NA = Not applicable.

Physician Summary for Brian

Brian is a 40-year-old male who presented in the ER with symptoms of heart palpitations (pounding heart) and chest pain. He is a one-pack-a-day smoker, weighs 195 pounds, and is 5'10" in height. He was hypertensive upon arrival and has a history of hypertension (high blood pressure). He was at school when his heart started racing. He became cold, pale, clammy and nauseous. He also experienced tightness in his chest and tingling in his fingers. He became disoriented and unresponsive to immediate caregivers. A bystander called 911. Brian was stabilized and transported to the hospital ER.

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Vital signs taken at the scene and initially in the ER indicated rapid heartbeat, low oxygen saturation (85%), and high blood pressure. Breathing was fast and shallow. Initial and follow-up EKGs indicated a fast and irregular heart rhythm. Body temperature was normal. A complete blood count (CBC), and cardiac enzymes, sodium, and potassium tests were ordered. Results indicated normal electrolytes and CBC. Physical examination was unremarkable.

Initial diagnosis, which could not be ruled out at this point, was myocardial infarction (heart attack). Cardiac enzymes also indicated a myocardial infarction because levels of CK-MB and troponin were elevated in the first 24 hours following the event. A coronary angiogram (allows a doctor to visualize blockages in coronary arteries) revealed two significant blockages. The blockages were opened by balloon angioplasty with stenting.

Stents

During balloon angioplasty, a specially designed tube, equipped with a tiny balloon at the tip, is guided through a blood vessel in the arm or leg, and all the way into the affected coronary artery. When the balloon reaches the blockage, it is inflated several times to compact the plaque and widen the opening in the artery. Afterward, a wire mesh tube, called a stent, is left behind to keep the artery open.

Personal Story: Angela
Part 2

Angela's Vitals and Diagnostic Test Results

DIAGNOSTIC TESTS/VITALS	ER: 9:45 AM	4:00 PM	10:00 PM	4:00 AM
Total CK series (IU/L)	74	80	75	55
CK-MB (IU/L)	1.2	0.9	0.8	0.3
CK-MB fraction (% of Total)	1.6%	1.1%	1.1%	0.5%
Troponin (ng/mL)	0.05	0.06	0.04	0.05
EKG	Normal	Normal	Normal	Normal
Potassium (mEq/L)	140	NA	NA	NA
Sodium (mEq/L)	4.5	NA	NA	NA
Abdomen Palpation (physical exam)	Tenderness lower middle abdomen	Same	Same	Same
Pregnancy Test	Positive	NA	NA	NA
Blood Pressure (mm Hg)	160/105	155/105	160/105	145/100
Oxygen Saturation (pulse ox)	97%	98%	97%	97%
Pulse Rate	100 bpm	85 bpm	80 bpm	82 bpm
Respiration Rate (per minute)	18	16	14	14
Temperature	98.6 °F	98.9 °F	99.1 °F	99.0 °F
Fasting Glucose	NA	NA	90	NA
Total Cholesterol (mg/dL)	NA	NA	NA	NA
HDL Cholesterol (mg/dL)	NA	NA	NA	NA
LDL Cholesterol (mg/dL)	NA	NA	NA	NA
Triglycerides (mg/dL)	NA	NA	NA	NA
BMI (Kg/m^2)	NA	NA	20.0	NA

Key: deciliter (dL), international unit (IU), liter (L), microliter (mcL), milliliter (mL), milliequivalent (mEq), nanogram (ng). NA = Not applicable.

Physician Summary for Angela

Angela, a 35-year-old female, is 120 pounds, and 5'5" in height. Non-smoker. She presented in the ER with dizziness

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and vomiting. During a morning run, she experienced severe pain in her right side, indigestion and shortness of breath. Later, she was lightheaded and had a headache. Her husband said she was pale, short of breath, agitated, dizzy and nauseated. Angela told the EMTs she had an ache in her lower jaw, and she vomited while prepping for the trip to the ER.

At the hospital, Angela still had a headache, and was vomiting and dizzy. Breathing was normal. Vital signs indicated rapid heart beat, but normal pulse ox, respiration rate, and temperature. EKG was normal, but she was hypertensive. Physical exam revealed tenderness in the lower middle abdomen. Initial diagnostic tests: complete blood count (CBC), sodium, cardiac enzymes, potassium and a standard pregnancy test. Results indicated normal electrolytes. Lower central abdominal tenderness is suspicious. A cardiac event seems unlikely. CBC revealed low RBCs and low hemoglobin. Review of blood slide revealed hypochromic (paler in color), microcytic (smaller) red blood cells, indicative of iron deficiency anemia. Pregnancy test was positive. ◼

CERTIFICATES

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SCIENTIFIC DECISION-MAKING PROJECT
BAYLOR COLLEGE OF MEDICINE

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