Continuing Education Material:

Understanding Myocardial Infarction

ABP, Inc.

ABP CONTINUING EDUCATION MATERIAL

UNDERSTANDING MYOCARDIAL INFARCTION

OBJECTIVES

1. Identify the 3's of myocardial infarction.
2. Outline the evolution of a myocardial infarction.
3. Identifying the MI damaged area of the heart.

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This continuing education material, **Understanding Myocardial Infarction**, will earn the participant 1.0 contact hours. If you have any questions regarding this information or would like further information on other continuing education opportunities, please contact:

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UNDERSTANDING MYOCARDIAL INFARCTION

INTRODUCTION

Myocardial infarction occurs when there is an interruption to the blood flow that supplies the myocardium or heart wall. When there is an injury to the inner lining of the coronary arteries, the platelets, WBCs, clotting factors and lipids rush to the injured site form a clot or thrombus. A fatty streak forms as the some of the cells gather under the damaged lining and absorb oxidized cholesterol. This fatty streak causes the lumen or opening in the arteries to narrow. This narrowing is a gradual process Collateral or parallel circulation develops to try to maintain the blood supply to the heart wall distal to the obstruction. When the myocardial demand for oxygen from the blood supply is more than the collateral circulation can supply, myocardial metabolism shifts from aerobic to anaerobic producing lactic acid. Lacking oxygen the cells in the myocardium die. When myocardial cells are not able to function, there is decreased contractility in the heart wall resulting in less blood being pumped to the rest of the body.

ECG CHANGES

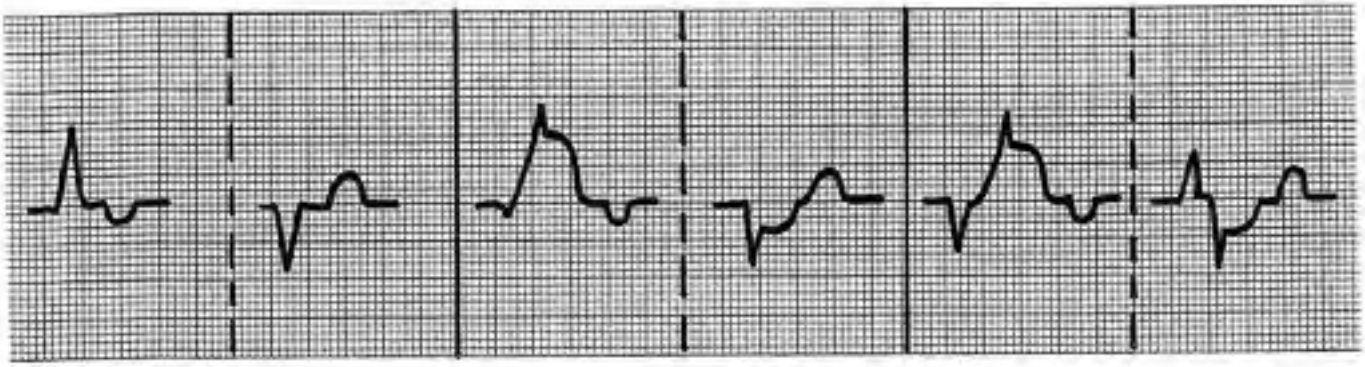
The ECG reflects decreases in the oxygen supply to the myocardium. There are three "I's" associated with myocardial infarction: ischemia, injury and infarction.

Ischemia is localized deficiency of blood caused by a constriction or obstruction. Ischemia is characterized on an ECG by a symmetrically inverted, sharply pointed T wave in two or more contiguous (adjacent) leads that face the compromised area. The ischemia delays repolarization (electrical recovery) and results in the larger, inverted T wave. This is usually a reversible, transient event that is corrected when the blood and oxygen supply to the myocardium is restored. If this event is prolonged, injury can occur. In adults an inverted T wave may be normal in any of the limb leads, but any T wave inversion in leads V2-V6 is considered to be significant. ST segment depression of 1 mm or more in two or more contiguous leads is also an indicator of ischemia. T wave changes and ST segment changes are visible only while the patient is experiencing pain. Continued ischemia can result in damage to the myocardium and an injury pattern on the ECG.

Injury indicates the acuteness of the obstruction and is characterized on the ECG by ST segment elevation of 1 mm or more in two or more contiguous leads. ST segment elevation indicates impaired blood flow through the coronary artery and probably thrombus (clot) development. If the injury occurs on the inner surface of the heart wall (endocardium), the ST segment will be depressed and reflects non-transmural injury, that is an injury that does not involve the entire thickness of the heart wall. If the injury occurs on the inner surface of the heart wall (epicardium), the ST segment will be elevated and reflects transmural injury or injury that involves the whole heart wall in that area. The more leads involved with ST segment elevation is an indicator of more myocardial involvement. Injury is reversible if the patient receives rapid treatment. If patients do not receive immediate treatment to reestablish blood flow to the myocardium, infarction or tissue death may occur.

Infarction indicates tissue death and is characterized on the ECG by a significant or pathologic Q wave The presence of a Q wave confirms the diagnosis of MI (myocardial infarction). A pathologic Q wave has the following characteristics: width greater that 0.04 seconds (1 small square), depth of 2 mm or greater and height or amplitude is ¼ to ⅓ the height of the R wave. The Q wave may decrease in size over time following an MI, but it will never disappear. Once a patient has had an MI, the Q wave will always be present on an ECG.

ISCHEMIA	INJURY	INFARCTION
Leads Facing Injury Reciprocal Changes	Leads Facing Injury Reciprocal Changes	Leads Facing Injury Reciprocal Changes



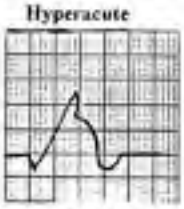
PHASES OF A MYOCARDIAL INFARCTION

There are four phases of a myocardial infarction: hyperacute, acute or fully evolved, resolution or recent, and stabilized chronic or old MI.

1. Hyper acute Phase
   - occurs immediately or with the first hour
   - extreme ST segment elevation which obscures the R wave
   - tall upright T waves hidden in ST segment
   - may be missed if medical attention delayed
   - benefits most from thrombolytic treatment (tpa)

Hyperacute

2. Acute or Fully Evolved Phase
   - occurs anywhere from hours up to 5 days after the MI
   - ST segment resolution, i.e. back to the baseline
   - deep T wave inversion
   - pathologic Q wave in leads facing the infarcted area



Fully Evolved

3. Resolution or Recent Phase
   - occurs weeks to months after the MI
   - ST segment resolution
   - T wave resolution, i.e. return to upright
   - pathologic Q wave in leads facing the infarcted area

Resolution

4. Stabilized Chronic or old MI Phase
   - occurs 6 months or more after the MI
   - pathologic Q waves persist
   - check for loss of R wave progression

Stabilized Chronic

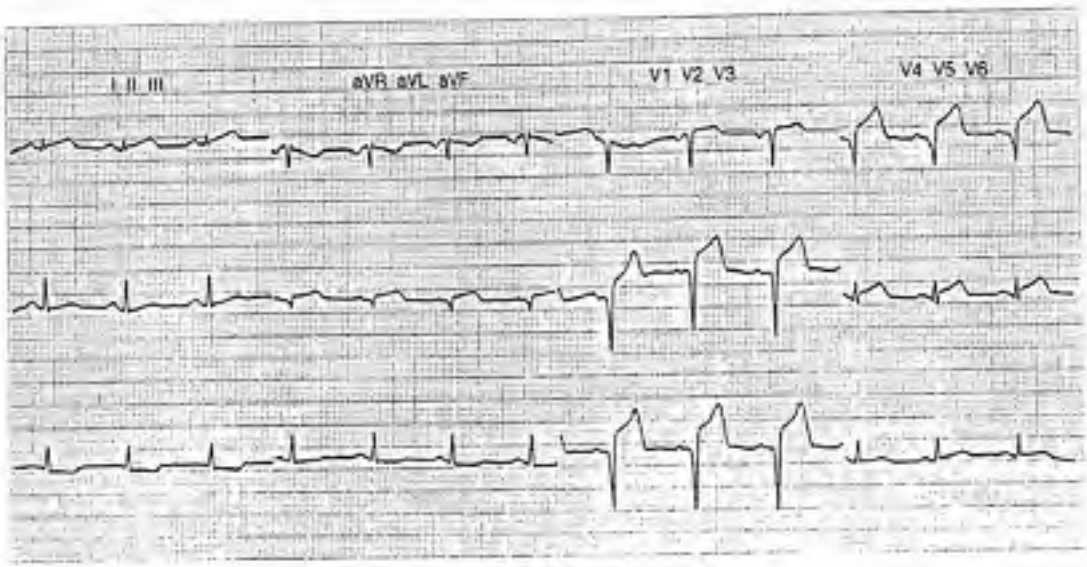
Remember that reciprocal or opposite changes have occurred in the leads opposite the infarcted area. Therefore, look for tall, wide T waves and ST segment depression.

IDENTIFYING MI DAMAGED AREA

Diagnosis of an MI is made when there are changes seen in two or more contiguous leads.

- Inferior Wall MI: may result from occlusion or the right coronary artery or the circumflex artery.
  - ECG changes in II, III, AVF
  - Reciprocal changes in I, AVL
- Anterior Wall MI: usually results from occlusion of the proximal left anterior descending artery.
  - ECG changes in V1 to V4 (septal involves V1, V2; anterior involves V1-V4)
  - Reciprocal changes in II, III, AVF
- Lateral Wall MI: usually results from an occlusion of the circumflex artery.
  (hi Lateral involves I, AVL; lateral involves V4-V5 or V6)
  - ECG changes in I, AVL and/or V5, V6
- Posterior Wall MI
  - Identified from reciprocal changes in V1, V2
    See tall R, depressed ST, tall T, R/S ratio >1
- Right Ventricular MI
  40% of all inferior wall MI's also involve the right ventricle.
  - Identified by elevated ST of $\geq$ 1 mm in
    V3R, V4R or both

EXAMPLE



Anterior wall MI: ST segment elevation V1-V5 and reciprocal changes in III and aVF

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2. **ECGs MADE EASY,** Aehlert, B., 1995; Mosby Year Book, St. Louis, MO.
3. **NURSING2000,** "Cardiac Pain: Discover the unexpected", McAvoy, RN, CCRN, MSN, Julia A.; Vol. 30, No. 3, pp. 34-40, March 2000.
4. **ELECTROCARDIOGRAPHY: A Training and Review Manual**, Mullins, C., January 2001, ABP, Inc., Granger, IN.

ABP CONTINUING EDUCATION SELF-ASSESSMENT QUIZ

Understanding Myocardial Infarction

Please answer all questions on the Continuing Education Form.

1. Cells in the myocardium die due to a lack of:

   a. Lactic acid
   b. Clotting factors
   c. Oxygen
   d. Platelets

2. Localized deficiency of blood to the myocardium cause by an obstruction or constriction is called?

   a. Infarction
   b. Ischemia
   c. Injury
   d. Inversion

3. The ECG change that indicates the acuteness of the obstruction in the leads facing the injury is:

   a. Inverted T wave
   b. Tall pointed T wave
   c. Elevated ST segment
   d. Wide, deep Q wave

4. A diagnosis of MI is confirmed by the presence of changes in two or more contiguous leads and/or the presence of:

   a. Inverted T wave
   b. Tall pointed T wave
   c. Elevated ST segment
   d. Wide, deep Q wave

5. An injury that occurs on the inner surface of the myocardium (endocardium) and does not involve the entire thickness of the heart wall shows which of the following ECG changes in the leads facing the injured part?

   a. Inverted T wave
   b. Wide, deep Q wave
   c. Depressed ST segment
   d. Elevated ST segment

6. Once a patient has had an MI, which of the following will always be present on an ECG?

   a. Inverted T wave
   b. Wide, deep Q wave
   c. Depressed ST segment
   d. Elevated ST segment

7. All of the following would be present in an acute or fully evolved phase of an MI, **except:**

   a. Extreme ST segment elevation
   b. T wave inversion
   c. ST segment begins to return to baseline
   d. Wide, deep Q wave in leads facing injury

8. What type of MI is diagnosed from reciprocal changes in V1 and V2?

   a. Inferior wall MI
   b. Anterior wall MI
   c. Lateral wall MI
   d. Posterior wall MI

9. The reciprocal change seen in leads opposite the are of ischemia would be?

   a. Inverted T wave
   b. Tall, upright T wave
   c. Elevated ST segment
   d. Depressed ST segment

10. The following 12 lead ECG represents a patient with:

a. Inferior wall MI
b. Anterior wall MI
c. Lateral wall MI
d. Posterior wall MI