Acute Coronary Syndrome (ACS)
Course Objectives

After completion of this course, you should be able to:

• Understand the meaning & cause of ACS
• Understand ACS treatment types & prevention
• Be familiar with heart disease risk factors
• Be able to recognize chest pain symptoms
Introduction

In the United States, acute coronary syndrome (ACS) is the cause of over 1.5 million hospitalizations and approximately 30% of all deaths each year. Worldwide this number rises to many millions more.

When the only treatment for angina was nitroglycerin and a limitation of activity, patients with newly diagnosed angina had a 40% incidence of a heart attach and a 17% mortality rate within 3 months. With the advances in diagnostic equipment and treatment from 1987-2000, 30 day death rates due to ACS decreased 47% in newly diagnosed patients. This decrease in the death rate is attributed to aspirin, medications which dissolve blood clots, and medical procedures which restore blood flow to the heart muscle. In spite of these medical advances, tens of thousands of lives are lost each year due to delays in diagnosis and failure to provide some of these newer treatments.
What is Acute Coronary Syndrome?

- **Acute Coronary Syndrome (ACS)** - a term used for any condition brought on by a sudden blockage in an artery of the heart (coronary artery), leading to a greatly reduced or completely cut off blood supply to an area of the heart muscle (myocardium). If the supply is greatly reduced or cut off for more than a few minutes, heart muscle dies.

- **Heart attack** - also termed myocardial infarction (MI) - is death of heart tissue from ischemia.

- The most frequent cause of this decrease in blood flow is a buildup of fatty substances (plaque) that collects in the walls of the heart’s artery(s). This plaque, which can vary in its make up, becomes unstable and tears or ruptures, exposing a surface that is favorable for blood clots to form. The combination of this ruptured plaque and blood clot causes a reduction in coronary blood flow. This can result in a heart attack (MI) and ultimately permanent damage of heart muscle in the area beyond the site of the artery disease.
ACS

• Uncommonly, a heart attack results when a coronary artery spasm occurs. This spasm stops the blood flow to the heart muscle. Spasms may be caused by drugs such as cocaine. Sometimes the cause is unknown.

• ACS covers a group of clinical conditions, ranging from unstable angina to heart attacks that vary in severity.
Unstable Angina

- **Unstable angina** occurs when a heart artery is severely narrowed by plaque and possibly a clot, causing the heart muscle not to receive a sufficient blood flow.

- **Unstable angina** is a change in the pattern of stable angina where the symptoms are reproduced by exercise, eating and/or stress and subsequently relieved with rest.

- Symptoms of unstable angina occur in a random, unpredictable fashion without any apparent trigger.

- Symptoms usually last less than 30 minutes and often wax and wane. Unstable angina can present as rest angina, new-onset severe angina, or increasing severity and frequency of angina.
Heart Attack

- Heart attacks occur when the heart muscle’s demand for oxygen is greater than that supplied due to a non-occlusive or complete occlusion in an artery of the heart.

- The symptoms of unstable angina lasting more than 30 minutes will typically be present.

- The severity of the heart attack can vary depending on the amount of muscle deprived of oxygen and the resulting damage. With some heart attacks, only the inner most layer of the heart muscle is damaged – this type is less severe. This type of heart attack is called a non ST elevation myocardial infarction (NSTEMI).

- Heart attacks that involve damage of all the layers of the heart muscle tissue are severe. This heart attack is named ST elevation myocardial infarction (STEMI).

- These two types of heart attacks are diagnosed according to the appearance of the ECG. Based on the changes identified on the ECG the heart attack will be classified and appropriate treatment can then be provided.
Signs and Symptoms of ACS

• Symptoms of the acute coronary syndromes are similar, and it is usually impossible to distinguish the syndromes based on the symptoms alone. The severity of the symptoms of ACS does not correlate with the amount of heart muscle damage.

• Men and women, as well as the elderly and diabetics may experience varying symptoms. The cause of these symptoms is a decrease blood flow to the heart muscle caused by plaque and a blood clot. These symptoms are called angina.
Signs and Symptoms of ACS

• **TYPICAL SIGNS OF ANGINA:**
  – Pressure, squeezing or burning in the chest area that may radiate to the shoulders, arms, back, neck, or jaw
  – Sweating
  – Nausea or vomiting
  – Shortness of breath with exertion that resolves with rest
  – Decreased exercise tolerance

• **ATYPICAL SIGNS OF ANGINA:**
  – Weakness,
  – Unusual or unexplained fatigue
  – Abdominal pain
  – Heartburn
  – Nausea
  – Shortness of breath
  – Lightheadedness/fainting
Signs and Symptoms of ACS

- Women, the elderly and people with diabetes are more likely to experience atypical angina symptoms. They may have only subtle symptoms or even a complete absence of symptoms and yet still have a heart attack (Silent Heart Attack).
Risk Factors for ACS

- Since the cause of ACS is rupture of the fatty plaque buildup in the artery wall, the factors that contribute to this plaque formation are the risk factors for ACS.

- These risk factors are those that can be changed with lifestyle changes or treatment, such as medication. The non-modifiable risk factors are those that cannot be changed.
Risk Factor for ACS

• **Modifiable Risk Factors**
  – Tobacco use
  – High blood pressure
  – High blood cholesterol/lipids
  – Obesity – especially abdominal
  – Physical inactivity
  – Diabetes mellitus

• **Non-Modifiable Risk Factors**
  – Increasing age
  – Male gender
  – Menopause
  – Family history of heart disease or stroke
  – Prior stroke – these patients make up 7.5% of patients with ACS and have high-risk features
Diagnosing ACS

• It is very important to perform diagnostic tests early when the signs and symptoms of unstable angina occur. It is possible that other medical conditions or heart problems can cause symptoms of unstable angina, so these need to be ruled out.

• Early risk stratification should focus on angina symptoms, physical findings, ECG findings and biomarkers of cardiac injury.

• Diagnostic tests:
  – ECG
  – Blood Tests
  – Nuclear Scan
  – Coronary Angiogram (Cardiac Catheterization)
  – Chest Xray
  – Echocardiogram
ECG

- A 12 lead ECG should be the first test done to diagnose a heart attack. This test records the electrical activity of the heart via electrodes attached to the skin.

- Because injured heart muscle does not conduct electrical impulses normally, the ECG may show that a heart attack has occurred or is in progress.

- Impulses are recorded as “waves” displayed on a monitor or printed on paper.

- The ECG gives valuable information about the type of heart attack based on the structure of these “waves” (STEMI or NSTEMI can be diagnosed with an ECG).
Blood Tests
(Serum Markers)

- Certain heart enzymes slowly leak into the blood when the heart muscle has been damaged by a heart attack. Therefore, blood tests to evaluate the heart enzymes should be measured in all patients who present with unstable angina.

- The blood tests that are used to diagnose cardiac injury are troponin I, myoglobin, and CKMB.
  - Troponin I
    - Cardiac specific; not elevated by acute or chronic skeletal muscle injury
    - Appears 4-6 hours after muscle damage
    - May be present for several days after a heart attack
  - Myoglobin
    - Not specific in cardiac muscle; useful in detection of a heart attack in the absence of skeletal muscle trauma
    - Appears in blood in abnormal levels as early as 1-3 hrs after onset of heart muscle damage
  - CKMB
    - Not specific to the heart muscle, therefore noncardiac patients may have measurable CKMB from skeletal muscle release
    - Not normally elevated until 6-8 hrs after the onset of a heart attack
Nuclear Scan

• This test helps identify blood flow problems to the heart.

• Small amounts of radioactive material, such as thallium, are injected into the bloodstream. Special cameras are used to detect the radioactive material as it flows through the heart and lungs.

• Areas of reduced blood flow to the heart muscle through which less of the radioactive material flows appear as dark spots on the scan.
Coronary Angiogram (Cardiac Cath)

- This test can show if the heart’s arteries are narrowed or blocked.

- A liquid dye is injected in the arteries of the heart through a long, thin tube (catheter) that’s fed through an artery, usually in the leg, to the arteries of the heart.

- As the dye fills the arteries, they become visible on x-ray, revealing areas of blockage.
Chest X-ray & Echocardiogram

• Chest X-ray
  – An x-ray image of the chest provides a picture of the size and shape of the heart and its blood vessels.

• Echocardiogram
  – After a heart attack has been ruled out, an echocardiogram may be done to evaluate the muscle function of the heart and if it is pumping normally.
  – This test uses sound waves to produce an image of the heart. These sound waves are directed at the heart from a transducer held on the chest. The sound waves bounce off the heart and are reflected back through the chest wall and processed electronically to provide images of the heart.
Treatment of ACS

• Treatment of ACS depends on if heart muscle damage has occurred, the amount and location of muscle damage (STEMI vs NSTEMI), and how much time has elapsed from when the symptoms started until emergency medical care was sought.

• Today, there are treatments that can abort the heart attack or reduce the amount of heart muscle damage, but only if emergency treatment is started early. A delay in treatment may lead to a greater amount of muscle injury, a greater chance of subsequent complications and even death.

• Medications and invasive procedures are the treatments available today to treat patients that have been diagnosed with ACS.
Medications

• Medications are now available that can relieve chest pain and improve blood flow through the heart.

  – **Aspirin**
    • This decreases blood clotting, helping to keep blood flowing through the narrowed heart arteries.
    • One of the first medicines given in the emergency room for suspected ACS
    • Should be chewed as this will allow it to be absorbed into the blood stream more quickly
  
  – **Plavix**
    • Used to prevent blood clots from forming in the coronary arteries.
    • Given when the patient is allergic to aspirin.
    • May also be given along with aspirin when a patient has been diagnosed with NSTEMI

  – **Nitroglycerin**
    • Medication for treating angina
    • Temporarily widens narrowed blood vessels, improving blood flow to and from the heart.
Medications

• Medications, cont…

  – **Beta Blockers**
    • These drugs help relax the heart muscle, slow the heart rate, and decrease the blood pressure which decreases the demand on the heart.
    • Also able to increase blood flow through the heart, thereby decreasing chest pain, and the potential for damage to the heart during a heart attack.

  – **Thrombolytics**
    • Also called “clot busters”, these help dissolve a blood clot that is blocking blood flow to the heart.
    • The sooner a thrombolytic rug is given after a heart attack, the greater survival chance and the less chance for muscle damage.

  – **Angiotensin-Converting Enzyme (ACE) Inhibitors and Angiotensin Receptor Blockers (ARBS)**
    • Allow blood to flow from the heart more easily.
    • ACE inhibitors and ARBS are prescribed following a moderate to severe heart attack that has reduced the heart’s pumping capacity.
    • These drugs also lower blood pressure and may prevent a second heart attack.
Invasive Procedures

• While medications can dissolve clots and improve blood flow through heart, artery plaque may still be limiting adequate blood circulation to the heart muscle.

• Invasive procedures may be recommended when these conditions are present.
  – **Coronary Angioplasty and Stenting (PCI)**
    • In this procedure, a thin tube (catheter) is inserted into the blocked or narred part of the artery.
    • A wire with a deflated balloon is passed through the catheter to the narrowed area.
    • The balloon is then inflated, compressing the plaque against the artery wall.
    • A mesh tube (stent) is frequently left in the artery to help hold the plaque against the artery wall, thus keeping it open
  – **Coronary Bypass Surgery (CABG)**
    • This surgery creates an alternative route for blood to go around a blocked heart artery.
    • An artery, from the chest wall or a vein form the leg or arm, is used to bypass around the artery with the blockage.

• The treatment selected will be dependent on the type of ACS
If the ECG confirms changes that suggest STEMI, the most common treatment would be thrombolytic (clot buster) therapy or a coronary angioplasty/stenting.

The time frame for thrombolytic administration should be within 30 minutes, whereas door to angioplasty/stent time should be within 90 minutes.
NSTEMI or Unstable Angina Treatment

- If the ECG does not show typical changes, the patient may still have suffered a NSTEMI. The management of a NSTEMI and unstable angina should be treatment with aspirin, heparin or lovenox, and plavix.

- Intravenous nitroglycerin and pain medication are also given as needed to relieve symptoms of angina.

- Blood tests are performed to evaluate the heart enzymes. If these are elevated (positive) for a heart attack, a coronary angioplasty/stenting is typically performed emergently as this is highly predictive of a heart attack.

- If the biomarkers are negative, a nuclear scan may be done to assess the blood flow to the heart.
Complications of ACS

- The complications of acute coronary syndromes depend on how much, how long, and where a coronary artery is blocked.

- If the blockage shuts off blood flow to the electrical system of the heart, the heart rhythm may be affected.

- Complications include:
  - Pumping problems
  - Rhythm problems
  - Other complications
Complications of ACS

• Pumping Problems
  – In a heart attack, part of the heart muscle dies. Dead tissue, and the scar tissue that eventually develops when the heart heals, does not contract. Consequently, there is less muscle to pump blood.
  – If a large heart attack occurs resulting in a large area of scar tissue, the heart’s pumping ability may be so reduced that the heart cannot meet the body’s need for blood and oxygen.
  – Heart failure, low blood pressure or both develop.
  – The damaged heart may enlarge to compensate for the decrease in its pumping ability. Enlargement of the heart makes abnormal heart rhythms (arrhythmias) more likely to occur.
Complications of ACS

- **Rhythm Problems**
  - Abnormal heart rhythms (arrhythmias) occur in more than 90% of people who have had a heart attack.
  
  - These abnormal rhythms may occur because the attack damages part of the heart’s electrical system
  
  - Sometimes there is a problem with the part of the heart that triggers the heartbeat, so heart rate may be too slow.
  
  - Other problems can cause the heart to beat rapidly or irregularly.
  
  - Sometimes the signal to beat is not conducted from one part of the heart to the other, causing the heartbeat to slow or stop.
  
  - In addition, areas of heart muscle that have poor blood flow but have not died can be irritable. This irritability can cause heart rhythm problems which greatly interfere with the heart’s ability to pump adequate amounts of blood to the body or may cause the heart to stop beating. Examples of such arrhythmias are ventricular, tachycardia, ventricular fibrillation, and cardiac arrest.
Complications of ACS

• Other Complications
  – Pericarditis – inflammation of the sac that surrounds the heart
    • May develop in the first day or two after a heart attack or about 10 days to 2 months later.
    • People seldom notice symptoms of early developing pericarditis, because their heart attack symptoms are more prominent.
    • Later developing pericarditis causes:
      – Fever
      – Pericardial effusion – extra fluid in the space between the two layers of the pericardium
      – Pleural Effusion – extra fluid in the space between the two layers of the pleura (membrane in the lungs).
      – Joint Pain
Prevention

• Acute Coronary Syndrome reflects the degree of disease in the arteries of the heart caused by plaque buildup and possible rupture with subsequent clotting. Therefore **Primary Prevention** of this plaque disease process is focused on controlling the modifiable risk factors.

  - Cessation of tobacco and avoiding second hand smoke
  - Assessment of blood lipid/cholesterol levels and an intensive lipid-lowering medication regimen provides greater protection against death or major cardiovascular events.
  - Consuming a low cholesterol, low fat, 2400mg sodium diet
  - Treatment of diabetes mellitus
  - Regular exercise
  - Weight loss as necessary to achieve ideal weight
  - Managing stress
  - Consume alcohol in moderation
  - Take medications as prescribed
• Please make an appointment to follow up with your primary physician if you have any questions regarding Acute Coronary Syndrome.

• Most importantly, please call 9-1-1 if you or a loved one begin experiencing any signs of a heart attack!!!

• Early Care MATTERS!!