I. Introduction (Slide 1-2)
   a. Course development and philosophy
   b. Course agenda
      i. Lecture
         1. PPT with instructor notes
         2. Resource citations
         3. Credit to contributors and reviewers
      ii. Hands on practice
         1. Scenarios within the PPT for practice
      iii. Written test (70% passing score)
         1. Sample written test meets CECBEMS testing standards
      iv. Final practical test
         1. DOH approved skill sheet included

II. Purpose (Slide 3)
   a. To provide rationale and benefits of cardiac care systems.
   b. To train BLS providers to acquire and transmit 12 Lead ECG data.
      i. To improve identification of patients with STEMI in BLS systems.
      ii. To facilitate transport to the most appropriate facility.

INSTRUCTOR NOTES
(Also present on PPT slides)

This course was developed by members of the Washington State EMS Pre-hospital Education Workgroup. The materials are designed to provide the minimum recommended information for this skill, however with the exception of the DOH skill sheet, we encourage instructors to modify and tailor content to their specific area’s needs. The course agenda is competency based meaning that there is no specified time requirement for delivering course materials. Content should be delivered until students demonstrate competency by successfully passing the written and practical examinations.

Instructors should review the Cardiac and Stroke system website (links available in the PPT) and associated resources to review and be empowered to explain the benefits of the cardiac care system in Washington State.

In EMS systems, acquiring and transmitting 12-leads from the field to more highly trained clinicians in hospitals can substantially improve the timeliness of identification and intervention in patients suffering a particular form of heart attack, specifically ST segment-elevation myocardial infarction (STEMI).

The 12-lead can mean the difference between services transporting the patient to the most appropriate facility for optimal care vs. a facility that may not have the services necessary to provide the level of cardiac care a patient needs, thus resulting in an increased time to definitive care which can result in poorer patient outcomes.

The goal for BLS services in acquiring 12 leads is oriented to data acquisition as opposed to interpreting data.
III. Objectives (Slide 4-7)
   a. Describe the components of a cardiac system.
   b. List the benefits of a cardiac system.
   c. Review the anatomy and physiology of the cardiovascular system.
   d. List the components of the electrical conduction system of the heart.
   e. List some examples of acute coronary syndromes.
   f. Identify risk factors for coronary syndromes.
   g. List and describe three events that are responsible for initiating acute coronary syndromes.
   a. List and describe the stages of progression in the cascade of events during an acute coronary syndrome.
   b. Describe symptoms of classic chest pain.
   c. Describe symptoms of atypical chest pain and list the most common characteristics of patients affected by this type of chest pain.
   d. Describe the symptoms anginal equivalent chest pain.
   e. List some indications for the acquisition of a 12 Lead ECG.
   a. List the three main steps to acquiring a 12 Lead ECG.
   b. Describe the proper placement of the 10 ECG leads that must be applied to the patient for 12 lead acquisitions.
   c. List at least three tips for success related to acquiring a 12 lead ECG.
   d. List some common causes of ECG signal noise/artifact.
   e. Demonstrate successful 12 lead ECG acquisition in a training scenario.
   f. Successfully complete a written exam with a passing score equal or greater to 70%.

IV. Cardiac Systems - National Epidemiology (Slide 8)
   a. Acute AMI is the leading cause of death in the US
      i. 1.1 Million people
         1. 439,000 women
         2. 668,000 men
   b. Costs for Coronary Artery Disease in 2001 $298 billion

There are cognitive, affective and psychomotor objectives listed in the slides for the course.

The written exam includes at least one test question for each of the objectives in accordance with CECBEMS standards.

How big of a problem is ACS?
V. Cardiac Systems - Needs Assessment (Slide 9)
   a. Emergency Cardiac and Stroke Care Executive Summary for Washington State
      i. People aren’t getting proven treatments
      ii. <50% of heart attacks get PCI
      iii. <3% of ischemic strokes get tPA
      iv. Variation in care and outcomes across the state
      v. Population at greatest risk increasing rapidly
      vi. Time to treatment makes big difference in outcomes
      vii. Because we can do better

In 2006 the EMS and Trauma Care Steering Committee with help of the Washington State Department of Health formed an Emergency Cardiac and Stroke Work Group to assess whether people in Washington were getting the treatments proven to save lives. The findings of the work group were published in a report in 2008 and revealed that less than 50% of heart attacks were receiving percutaneous coronary intervention (PCI) and less than 3% of ischemic strokes were getting tPA to break up the blood clot (while 10-20% are eligible), despite these being the recommended treatments. The study also found that there was wide variation in care and outcomes across the state.

These findings are particularly alarming since the population at highest risk of cardiovascular emergencies is increasing rapidly.

Despite these challenges, we know that reducing time to evidence-based treatment makes a big difference in patient outcomes. Thus, the report also identified recommendations to make the needed improvements through a system approach.

VI. Cardiac Systems - Door to Balloon Time (Slide 10)

VII. Cardiac Systems - Proven Performance (Slide 11)
   a. National momentum
      i. American Heart
      ii. American College of Cardiology
      iii. Centers for Disease Control
      iv. Society for Chest Pain Centers
      v. CMS
   b. Examples
      i. North Carolina RACE
      ii. Los Angeles
      iii. Minnesota Cardiac Level 1

The benefits of early defibrillation and treatment for cardiac arrest are well known. Clearly minutes also matter when it comes to other cardiac emergencies, especially ST-segment elevation myocardial infarctions (STEMIs). This graph shows a dramatic increase in mortality for patients that had longer hospital door to balloon (or PCI) times. One of the well documented strategies for helping hospitals reduce door to balloon times is through early activation by EMS.

The published papers laid a foundation for nation-wide momentum to approach care from a more holistic viewpoint. The American Heart Association launched initiatives for STEMI systems and the American College of Cardiology worked with hospitals to reduce door to balloon times. The CDC provided funding to heart disease and prevention programs to create cardiac systems. The Society for Chest Pain Centers began certifying Chest Pain Centers and Center for Medicare Services is monitoring quality of cardiac and stroke care.

Many regions of the country have established systems that are working. North Carolina has a statewide system for STEMI care, Los Angeles and the surrounding areas determined which hospitals are STEMI receiving centers and which are referral centers and are using those designations for triage, and Minnesota established a cardiac system to quickly transfer patients for PCI. Meanwhile, Phoenix has established a matrix of stroke centers.
VIII. Cardiac Systems – Minimize Delay in the Chain of Survival (Slide 12)
   a. Goals of the Cardiac System
      i. To Deliver the right patient
      ii. to the right place
      iii. at the right time

IX. Cardiac System Components (Slide 13)

Just like Washington’s trauma system, the goals of the emergency cardiac system are to minimize delays in the chain of survival by standardizing care to follow evidence-based guidelines. Having a system that spans from patient to dispatch to EMS to treatment in an appropriate hospital will ensure that we deliver the right patient to the right place in the right amount of time.

Complete systems should include all of the following components working consistently and cooperatively:
- Patients and the public need to be educated to recognize the signs and symptoms and to quickly call 911
- Dispatch operators need to have quick procedures to recognize potential cardiac and stroke emergencies and dispatch appropriate personnel as quickly as possible
- Pre-hospital personnel should have standard assessment, treatment, and triage procedures to appropriate hospitals
- Emergency rooms should also have standard assessment, treatment, and triage procedures for walk-in patients
- Neurology or cardiology should find ways to reduce time to treatment by activating stroke or cardiac teams based on pre-hospital or ER notification, as well as other means.

X. Cardiac Systems - Washington’s Approach (Slide 14)
   a. Emergency Cardiac & Stroke Technical Advisory Committee provides direction on:
   b. Recommended dispatch guidelines
   c. Standardized EMS protocol guidelines
   d. Standardized EMS triage tools
   e. Voluntary hospital categorization
   f. Quality improvement & data collection
   g. Public education

The report and recommendations from the Emergency Cardiac & Stroke workgroup laid the foundation for a system approach in Washington and lead to the formation of a Technical Advisory Committee to work on implementation. The committee has taken many of their cues for system creation from Washington’s trauma system, as well as from national papers, and existing systems in Washington or around the country.

Although recommendations from the committee touch on public education, most of the work has been on pre-hospital and hospital aspects of emergency cardiac and stroke care. The committee has developed cardiac & stroke dispatch guidelines, standardized EMS protocol guidelines, standardized EMS triage tools, voluntary hospital categorization levels, and a set of recommendations for data collection.

The EMS protocol guidelines, EMS triage tools, and hospital categorization levels have been approved by the Governor’s Steering Committee from EMS and Trauma as
XI. Cardiac Systems - EMS Guidelines and Tools (Slide 15)
   a. Pre-hospital protocol guidelines
   b. Triage tool
   c. Hospital levels

EMS providers have an active role in Emergency Cardiac Care in Washington state. During this course we will review our pre-hospital protocol guidelines related to the care and transport of patients with ACS. We’ll also review the Washington State Cardiac Triage Tool and review the levels of cardiac care that hospitals in our area can provide. Emergency "Cardiac" means acute coronary syndrome, an umbrella term used to cover any group of clinical symptoms compatible with acute myocardial ischemia, which is chest discomfort or other symptoms due to insufficient blood supply to the heart muscle resulting from coronary artery disease. This includes both STEMIs (completely blocked arteries) and NSTEMIs (partially blocked arteries). Emergency "Cardiac" also includes out-of-hospital cardiac arrest, which is the cessation of mechanical heart activity as assessed by emergency medical services personnel, or other acute heart conditions.

We’ll review the protocol guidelines for treatment in the field, the standard triage tool, and briefly look at the hospital categorization levels.

XII. Cardiovascular Anatomy (Slide 16)
   a. Muscular pump consisting of four chamber
   b. Great vessels to & from the heart

A fist-sized organ that beats an average of 50 to 100 times per minute and, in that time span, pumps 5 or 6 quarts of oxygen-filled blood to the rest of the body.

XIII. Cardiovascular Physiology (Slide 17)
   a. Coronary circulation
      i. Heart is fed through two (2) Coronary Arteries
         1. Right Coronary Artery (RCA)
         2. Left Coronary Artery (LCA)
         3. Left Circumferential Artery
      ii. Originate from base of Aorta
      iii. The heart is fed during diastole (while heart is at rest)

Electrical impulses trigger the heartbeat; those impulses cause the walls of the heart’s chambers to contract, in turn forcing blood in and out of those chambers in a cycle.

XIV. Basic Electrophysiology (Slide 18)
   a. The heart has a electrical conduction system that sends electrical current throughout the heart.
   b. Electrical current causes contractions of the heart that produces pumping of blood.
   c. Pathophysiology that occurs within the heart may affect the electrophysiology and vice versa.

Electrical impulses trigger the heartbeat; those impulses cause the walls of the heart’s chambers to contract, in turn forcing blood in and out of those chambers in a cycle.

Pathophysiology is the normal function of a body system.

Pathophysiology can be defined as any abnormal function of a body system.
XV. Basic Electrophysiology - Components of the electrical conduction system (Slide 19)
   a. SA node
   b. Three intermodal pathways
   c. AV node
   d. Bundle of His
   e. Right and left bundle branches
   f. Electrical conduction system in action

XVI. Basic Electrophysiology – Electrical Conduction System in Action (Slide 20)

XVII. Basic electrophysiology and the ECG (Slide 21)
   a. The electrophysiology of the heart can be detected and analyzed with a 12 Lead ECG machine.
   b. ECG electrodes placed on the skin detect the electrical activity of the heart.
   c. The ECG machine converts the detected activity to wave forms.
   d. Lead placement is important for the most accurate results.

Any pathophysiology that may occur within the heart may affect the electrophysiology and vice versa.

We can detect specific types of pathophysiology through evaluating the electrophysiology of the heart by using ECG machines.

The heart contains a network of specialized tissue, called electrical conduction system that conducts electrical current throughout the heart.

The main function of the ECS is to create an electrical impulse & transmit it through the heart in an organized manner.

For reference, a Sinus Rhythm or SR is a rhythm in which the SA node acts as the pacemaker.

The impulse goes through the intermodal pathways & into the atrial cardiac muscle cells, resulting in atrial depolarization which should result in a contraction of the heart muscle. (See imbedded video)

The electrophysiology of the heart can be affected by acute coronary syndromes and acute coronary syndromes can cause electrical problems in the heart such as arrhythmias, like Ventricular Fibrillation.

Early detection of cardiac issues is a key to successful cardiac care.

The electrophysiology of the heart can be detected and analyzed with a 12 Lead ECG machine.

The ECG electrodes detect the electrical activity of the heart.

The ECG machine converts the detected activity to wave forms often referred to as ECG complexes. A group of waveforms on paper is often referred to as the ECG tracing. ECG complexes and waveforms will vary and can be greatly affected by how and where the lead is placed.
XVIII. Basic Electrophysiology - The ECG Complex (Slide 22)

a. One complex represents one contraction (beat) of the heart
b. The complex consists of several wave forms.
   i. P
   ii. Q
   iii. R
   iv. S
   v. T
c. Each waveform represents a different phase of coronary circulation and electrophysiological function.

XIX. Basic Electrophysiology - The ECG Complex (Slide 23)

a. A segment is a specific portion of the complex.
b. An interval is the distance, measured in time, occurring between two cardiac events.

An ECG complex is a group of wave forms representing one full cardiac cycle. Each waveform represents a phase of the cardiac cycle.

The P wave indicates an electrical impulse was initiated from the SA node.

The QRS wave typically indicates that the impulse was sent through the AV node and perkinje fibers to initiate a contraction of the heart muscle.

The T wave indicates that the electrical impulse is repolarizing and preparing for another cycle. Variations of the waveforms can be measured to detect acute coronary syndromes.

To measure variations of the waveforms you need to understand the normal parameters of the waveforms and some more terminology.

A segment is a specific portion of an ECG complex. For example, the ST Segment represents the period of time between the end of the QRS complex (depolarization of the electrical impulse stimulating contraction of the heart) and the beginning of the T wave (re-polarization of electrical impulse). An anomaly from the normal waveform presented here would indicate a problem in the heart.

An interval is the distance, measured in time between to cardiac events within one cycle. For example, the PR Interval represents the period of time it takes an electrical impulse to travel to and be distributed by the AV node. A variation in this time frame may indicate a problem in the heart.

ECG paper is designed mathematically to assist with the measurement of waveforms and complexes.
XX. Basic Electrophysiology – Principles of an ECG Tracing (Slide 24)  
a. An ECG is a recording of the heart’s electrical activity.  
b. Just because there is electrical activity doesn’t mean there is mechanical activity.  
c. Electrical current moving toward the positive electrode causes positive deflection of a waveform on an ECG tracing.  
d. Electrical current moving away from the positive electrode causes negative deflection of a waveform on an ECG tracing.  
e. The stronger the current, the stronger the deflection.  

XXI. Basic Electrophysiology - The Normal Sinus Rhythm (Slide 25)  
a. All the P waves should be the same  
b. A normal heart rate 60-100 beats/min.  

XXII. Acute Coronary Syndromes (Slide 26)  
a. ACS is a term used to describe a continuum of similar disease processes that include;  
   i. Angina  
   ii. Unstable Angina  
   iii. ST Elevation MI (STEMI)  
   iv. Non-ST Elevation MI (NSTEMI)  
b. It is often NOT possible for EMS to determine which event is occurring in the early minutes of a heart attack.  

XXIII. Tip for Success (Slide 27)  
a. IF a patient is having a STEMI, studies show these patients have the most to gain from rapid transport and heart catheterization.  

XXIV. Acute Coronary Syndromes - Risk Factors for ACS (Slide 28)  
a. Cigarette smoking (doubles the risk)  
b. Family history of heart attack  
c. Male over 35  
d. Women over 40  
e. Diabetes mellitus  
f. Hypertension  
g. Obesity  
h. Elevated blood cholesterol levels  
i. Sedentary life style-lack of sufficient exercise  
j. Stress
XXV. Acute Coronary Syndromes - Initiating Events
(Slide 29)
  a. Plaque rupture
  b. Thrombus formation
  c. Vasoconstriction

These three events are present, to one degree or another, in all of the acute coronary syndromes. Understanding these events not only explains why the three syndromes are grouped together, but it also provides a framework for understanding exactly how the treatments you provide will benefit the ACS patient.

XXVI. Acute Coronary Syndromes - Cascade of Events
(Slide 30)
  a. Ischemia
  b. Injury
  c. Infarct

Once the initiating events have taken place, tissue damage begins to occur in a progression beginning with ischemia. This is a result of lack of oxygen to the tissue and if not treated will progress to injury and eventually infarct, which is death of tissue. Infarcted tissue cannot be reperfused, but injured tissue can be reperfused.

The goal for EMS is to recognize the symptoms of ACS, apply oxygen, administer medications, acquire and transmit the ECG and transporting the patient to the most appropriate facility. These actions will optimize the amount of tissue that can be reperfused, minimize tissue death and greatly affect the patient’s outcome.

XXVII. Acute Coronary Syndromes (Slide 31)
  a. 50% of the population discover they have Coronary Artery Disease when they go into cardiac arrest!
  b. The other 50% present as one of the following chest pain stories;
     i. Classic
     ii. Atypical
     iii. Anginal equivalent

XXVIII. Acute Coronary Syndromes - Classic Chest Pain
(Slide 32)
  a. Central anterior chest
  b. Dull, fullness, pressure, tightness, crushing
  c. Radiates to arms, neck, back

XXIX. Acute Coronary Syndromes - Atypical Chest Pain
(Slide 33)
  a. Musculoskeletal, positional or pleuritic features
  b. Often unilateral
  c. May be described as sharp or stabbing
  d. Includes epigastric discomfort
  e. Often seen in female;
     i. Diabetics
     ii. Post menopausal
     iii. Elderly

PL Courson
XXX. Acute Coronary Syndromes - Anginal Equivalent (Slide 34)
   a. Dyspnea
   b. Palpitations
   c. Syncope or pre-syncope
   d. General weakness
   e. Diabetes

XXXI. Acute Coronary Syndromes - Treatment (Slide 35)
   a. Follow local protocols and AHA Guidelines
   b. Treatment and 12 lead should be provided concurrently
   c. Don’t delay treatment to acquire 12 lead
   d. Transport to the most appropriate facility

XXXII. Indications for BLS 12 Lead ECG (Slide 36)
   a. Chest Pain
      i. Classic
      ii. Atypical
      iii. Anginal Equivalent
   b. Discomfort
      i. Shortness of breath
      ii. Nausea
      iii. Lightheadedness
   c. Stroke
   d. Post-Resuscitation

XXXIII. Tip for Success (Slide 37)
   a. Even if a 12 lead is NORMAL – it doesn’t mean the patient isn’t having an MI!

XXXIV. Tip for Success (Slide 38)
   a. Know your Cardiac System. Use the Washington State Cardiac Triage Tool to determine the most appropriate facility for your patient

XXXV. Pre-hospital 12 Lead ECG Machines (Slide 39)
   a. Benefits
      i. Quick
      ii. Reliable
      iii. Early and accurate identification of acute ischemia and arrhythmias
   b. Variety of models
      i. Set of cables
      ii. Electrodes
      iii. Transmission capabilities

The benefits of prehospital 12 lead ECG machines include:
- Rapid set up and interpretation of data.
- Reliability
- Machines are accurate
- Allow for early identification of cardiac conditions requiring specialized cardiac care

There are a variety of models an agency must choose from. Typically, the most common characteristics of pre-hospital machines are the obvious, sources of durable portable and non-portable power supply, durable carrying case, set of cables, electrodes and the most important feature is the ability to transmit the data to the hospital.
XXXVI. Steps for Acquiring a 12 Lead ECG (Slide 40)
   a. Prepare the equipment
   b. Prepare the patient
   c. Perform the procedure

XXXVII. Steps for Acquiring a 12 Lead ECG - Prepare the Equipment (Slide 41)
   a. Assure there is sufficient paper in the monitor
   b. Assure the monitor is ready for transmission

XXXVIII. Steps for Acquiring a 12 Lead ECG - Prepare the Patient (Slide 42)
   a. Explain the procedure to the patient
   b. Expose the chest
   c. Prepare the skin for electrode
   d. Make sure skin is not broken or bleeding
   e. Clean skin with alcohol, towel or 4x4 by rubbing briskly
   f. Shave excessive hair at the electrode site.

XXXIX. Steps for Acquiring a 12 Lead ECG - Perform the Procedure (Slide 43)
   a. Turn the monitor ON
   b. Attach electrodes to the cables
   c. Confirm electrodes are not expired
   d. Attach electrodes to the ECG cables
   e. Grasp electrode tab and peel electrode from carrier
      i. Inspect electrode gel, replace electrode if gel is dried or otherwise inadequate
      ii. Attach the electrodes to the prepared skin
      iii. Avoid pressing in the center of the electrode

XL. Steps for Acquiring a 12 Lead ECG – Lead Placement (Slide 44)
   a. Four (4) limb leads
   b. Six (6) chest leads
   c. Limb leads should be placed on the LIMBS.
   d. Chest leads should be placed on the CHEST.
      i. Chest leads are also known as precordial leads

The term lead causes some confusion because it is used to refer to two different things. Typically, when an electrode is attached to a cable, it is often referred to as a lead. Using the term lead in this context, there are 10 leads that are attached to the body to acquire a 12 Lead ECG.

The term lead also refers to the tracing the voltage difference between two electrodes which is what is actually produced by the ECG machine. For example: Lead I is the voltage between the right arm electrode and the left arm electrode. Lead II is the voltage between the right arm electrode and foot electrodes. Keeping this concept in mind, know that the standard ECG is composed of twelve (12) separate leads which include limb leads (I, II, III, AVR, AVL, AVF) and Chest leads (V1, - V6).

There are three steps to acquiring a 12 Lead ECG. Use the Washington State ECG Acquisition Practical Skill Sheet to follow along the following slides.

Always ensure your equipment is in good working order. Be sure to check the equipment daily using the manufacturers recommended daily check list. Items to check include sources of power, performing the machines self diagnostic, ensure the machine and cables are in good working order, check electrodes for expiration and gel problems, and check for sufficient paper.

It is important to have direct skin contact when obtaining an ECG.

The most important step in acquiring a quality 12 lead ECG on your patient is proper preparation of the skin and electrode placement.
XLI. Steps for Acquiring a 12 Lead ECG - Limb Lead Placement (Slide 45)

a. “White on right, smoke over fire”
   b. White lead on shoulder or arm.
   c. Black lead on left shoulder or arm.
   d. Red lead on the left leg.
   e. Green lead on the right leg.

XLII. Steps for Acquiring a 12 Lead ECG - Precordial Lead Placement (Slide 46)

a. V1 & V2
   i. Each side of sternum
   ii. 4th intercostal space
b. V4
   i. midclavicular
   ii. 5th intercostal space
c. V3
   i. Between V2 and V4
d. V5
   i. Anterior axillary line
e. V6
   i. Midaxillary line
   ii. 5th intercostal space

If you get into the routine of placing the leads in the order listed on the slide, you’ll find your placement will become rapid, efficient and accurate over time.

The limb electrodes can be placed far down on the limbs or close to the hips/shoulders, but they must be at even height to each other.

Try not to place the lead directly over a bone or thick muscle.

- White lead on right shoulder or arm
- Black lead on the shoulder or arm
- Green lead on the right low abdomen or leg
- Red lead on the left low abdomen or leg

Locating the V1 position (4th intercostal space) is important because it is the reference point for locating the placement of the remaining V leads. To locate the V1 position;
   - Place your finger at the notch in the top of the sternum.
   - Move your finger slowly downward about 1.5 inches until you feel a slight horizontal ridge or elevation. This is the Angle of Louis where the manubrium joins the body of the sternum.
   - Locate the second intercostal space on the patient’s right side, lateral to and just below the Angle of Louis.
   - Move your finger down two more intercostal spaces to the fourth intercostal space which is the V1 position.

Position the V1 & V2 leads on each side of the sternum at the 4th intercostal space.

V4 is placed at the 5th intercostal space in the midclavicular line.

V3 is placed between V2 & V4.

V5 is placed in the anterior axillary line, & V6 in the midaxillary line at the 5th intercostal space.

Never use nipples as reference points for locating the electrodes for men or women patients, because nipple locations may vary widely.

XLIII. Tip for Success (Slide 47)

a. Place the electrodes on the patient in the position they will be in during acquisition.

XLIV. Tip for Success (Slide 48)

a. On female patients, always place leads V3 – V6 under the breast rather than on the breast.
XLV. Steps for Acquiring a 12 Lead ECG - Perform the Procedure (Continued) (Slide 49)
   a. Make sure all connections are made
      i. Cable to monitor
      ii. Leads to patient
   b. Enter the patient’s name into the machine.
   c. Encourage patient to remain still and breathe normally
   d. Acquire ECG tracing following specific machines acquisition procedure

XLVI. Steps for Acquiring a 12 Lead ECG – Perform the Procedure (Continued) (Slide 50)
   a. If configured, the LP 12 will automatically print the 12 Lead ECG Tracing.
   b. Check the ECG for artifact
   c. Address artifact
   d. Re-run the ECG if necessary
   e. Document the procedure

XLVII. Tip for Success (Slide 51)
   a. There is no need to interpret the ECG. All you have to do is acquire and transmit.

XLVIII. Troubleshooting Common Errors (Slide 52)
   a. If the monitor detects signal noise, the 12 lead acquisitions will be interrupted until the noise is removed.
   b. Use the trouble shooting tips on the next slide to address common signal noise issues.
   c. Take action to eliminate signal noise, or press 12 Lead again to override.

XLIX. Troubleshooting Common Errors – ECG Signal Noise (Slide 53)
   a. Artifact
   b. Causes
      i. Poorly placed leads
      ii. Loose electrodes
      iii. Broken cables or wires
      iv. Muscle tremors
      v. Breathing difficulties
      vi. Patient movement

L. Troubleshooting Common Errors (Slide 54)
   a. Refer to your machines manufacture guide for trouble shooting specific to your machine.
   b. Check your electrodes to make sure they are secured on the skin and have adequate conductive gel.
   c. Reduce excessive body hair where electrodes are placed.

Check to make sure these steps match the steps for your particular machine.
If using the LIFEPAK, if you do not enter a patient’s age after pushing the 12 Lead button, 40 years will automatically be selected.

Recall we mentioned artifact, which is a type of interference that can occur when trying to acquire an ECG. Artifact often presents as unorganized, erratic lines on the ECG tracing and is considered a complication to adequate interpretation of the ECG.
Artifact occurs when the signal between the skin and the ECG machine is inadequate and can occur for a variety of reasons.
Artifact is a type of interference that can occur when trying to acquire an ECG. Artifact often presents as unorganized, erratic lines on the ECG tracing and is considered a complication to adequate interpretation of the ECG.
It is important to minimize artifact or the potential for artifact as much as possible to allow the machine or properly trained ALS provider to interpret the ECG properly.

Recall we mentioned artifact, which is a type of interference that can occur when trying to acquire an ECG. Artifact often presents as unorganized, erratic lines on the ECG tracing and is considered a complication to adequate interpretation of the ECG.
Artifact occurs when the signal between the skin and the ECG machine is inadequate and can occur for a variety of reasons.
d. Dry the skin to minimize wetness from diaphoresis or other fluids.
e. Check to ensure your leads are placed in the most appropriate and correct location.
f. Check to ensure your cables are connected to the machine.
g. Check the cables for broken, loose, exposed wires, or pinch points where damage may have occurred.
h. Check for missing electrodes.
i. Check and try to manage patient
j. Movement
k. Tremors
l. Breathing patterns

II. Transmitting the 12 Lead ECG (Slide 55)
   a. Review the manufacturer’s instructions for the ECG machine you are using.

III. Transmitting the 12 Lead ECG – LIFEPAK (Slide 56)
   a. LIFEPAK will transmit the data to a pre-prescribed ER or receiving station.
   b. Press Transmit

IV. Transmitting the 12 Lead ECG – LIFEPAK (Slide 57)
   a. Select Data
   b. If the REPORT, SITE, and PREFIX settings are correct, select SEND to transmit.

V. Transmitting the 12 Lead ECG – LIFEPAK (Slide 58)
   a. If the REPORT, SITE, and PREFIX settings are not correct;
   b. Turn dial to adjust each item and push to select the correct options.

VI. Transmitting the 12 Lead ECG – LIFEPAK (Slide 59)
   a. Turn dial to adjust each item and push to select the correct options.
   b. Watch bar across bottom of screen to see transmission status.

VII. Transmitting the 12 Lead ECG – LIFEPAK (Slide 60)
    a. Verify transmission report indicates it was “completed”

VIII. Transmitting the 12 Lead ECG – LIFEPAK (Slide 61)
     a. Prepare the equipment
     b. Prepare the patient
     c. Perform the procedure

Instructors should review and update slides to reflect the instructions from the manufacturer’s guide of the machine they are using.
<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVIII.</td>
<td>Case Presentation 1 – (Slide 62-64)</td>
</tr>
<tr>
<td>LIX.</td>
<td>Case Presentation 2 – (Slide 65-67)</td>
</tr>
<tr>
<td>LX.</td>
<td>Resources and Tools</td>
</tr>
<tr>
<td>LXI.</td>
<td>References</td>
</tr>
<tr>
<td>LXII.</td>
<td>Contributors and Reviewers</td>
</tr>
</tbody>
</table>