TRAINING CURRICULUM and LESSON PLANS

EMT-B Monitoring Endorsement

Curriculum Objectives and Sample Lesson Plans
for the EMT-Basic Monitoring Endorsement

Montana Department of Labor and Industry
Board of Medical Examiners

The purpose of the Monitoring Endorsement for EMT-B is to provide the EMT-B with the knowledge and skills to collect diagnostic values and initiate corrective actions.

Patient care should always be based on patient presentation and Montana Prehospital Treatment Protocols.

PULSE OXIMETRY

COGNITIVE OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

PO1-1.1 State the principles of pulse oximetry
PO1-1.2 State the normal values for pulse oximetry
PO1-1.3 Identify conditions which can adversely affect a patient's oxygen saturation level
PO1-1.4 Identify conditions which can produce erroneous readings in pulse oximetry

AFFECTIVE OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

PO1-1.5 Explain the rationale for obtaining a patient's oxygen saturation level (A-3)

PSYCHOMOTOR OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

PO1-1.6 Demonstrate the correct application of a pulse oximetry-monitoring device.
PO1-1.7 Demonstrate obtaining a pulse oximetry reading.
PO1-1.8 Demonstrate ability to correctly troubleshoot and correct simple problems.

LESSON PLAN:

RECOMMENDED TIME TO COMPLETE:
One hour, which combines, part Lecture overview and part Skills Practice.

EQUIPMENT:
Pulse oximetry monitoring unit
Patient transducer and cable
Fingernail polish remover pad

OVERVIEW:
Emphasize to the EMT- Basic: Treat the patient, not the device! If the saturation level is 90% or better, maintain this oxygen saturation level with high

concentration oxygen administration if there is great potential for development of a shock status!
If the saturation level falls below 90%, more aggressive oxygenation is in order.

I. Describe the basic concept of Pulse Oximetry monitoring.
   B. Objectively determines the oxygenation status of a patient when applied correctly.
   C. The pulse oximeter functions by measuring, via red and infrared light, through the skin to the arterial bed. It measures the hemoglobin saturation in the bloodstream.
   D. The reading will be expressed by percent of oxygen in patients.
   E. Provide any patient whose saturation level is below 90% with aggressive oxygenation.
II. Possible invalid readings
   A. A patient with low blood flow states (i.e., shock states, hypothermic, hypovolemia) may show an inaccurate low oxygenation percent.
   C. A patient who has experience carbon monoxide poisoning may show a false high percent reading. In this case, the oximeter is picking up the carbon monoxide that is attached to the hemoglobin and inaccurately assuming it to be hemoglobin and oxygen.
   D. Patients with certain anemias and oxygen capacity carrying diseases (i.e., sickle cell) may also show a false high reading. The monitor is measuring that each hemoglobin molecule is saturated but is not able to accurately note that the hemoglobin count itself is diminished.
   E. As with all monitors - in cases with these type patients one must monitor the patient and act accordingly.
   F. A patient with fingernail polish, excessive grease and dirt, nail-tips, or gel nails may also present with a false low reading. The infrared and red light is not able to penetrate the polish or nail endings.
III. Placement of the transducer
   A. Most commonly accepted place is the distal end of a finger or toe.
   B. Pediatric pulse oximetry transducers tape around the great toe or around the heel.
   C. The ear lobe is also an acceptable area.
   D. The pediatric transducer may also be taped across the bridge of the nose of an adult patient. This is especially useful in patients with bad circulation to distal extremities.
   E. Prior to placing the transducer onto a nail bed, remove excessive dirt, grease, or nail polish. If possible remove any nail tips.
IV. Obtaining a reading.
   A. Once the transducer is placed and the monitor turned on, the monitor will start sensing a pulse reading. Once the pulse the monitor senses the pulse, the oxygen saturation will be expressed in a percent fashion.
   B. The patient must have a palpable pulse before using the monitor and the palpated pulse rate must approximate the heart rate on the monitor to obtain an accurate reading.
V. Trouble shooting for simple errors.
   A. Not detecting a pulse

    1. Patient does not have a pulse
    2. Transducer not applied to patient
    3. Transducer not able to read through nail polish, etc.
    4. Patient cable not connected to monitor
    2. Monitor not turned on
    3. Low battery
  B. Continuous alarm sounds
    1. Alarm limits set too low
    2. Alarm limits set too high

SKILL SEQUENCE:

1. Remove excessive grime or polish from finger (if that is the applicable sensing area)
2. Apply the transducer correctly.
3. Connect patient transducer cable to monitor.
4. Turn monitor on.
5. Obtain reading.
6. Troubleshoot any simple errors.

GLUCOMETRY

COGNITIVE OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

G1-1.1 State the principles of blood glucose testing
G1-1.2 State the normal values for blood glucose levels
G1-1.3 Identify conditions which can adversely affect a patient's glucose level
G1-1.4 Identify conditions which can produce erroneous readings in blood glucose

AFFECTIVE OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

G1-1.5 Explain the rationale for obtaining a patient's blood glucose level

PSYCHOMOTOR OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

G1-1.6. Appropriately obtain a blood specimen for testing purposesG1-1.7 the student shall obtain a blood glucose level reading.
G1-1.8 Dispose of all sharps while adhering to Body Substance Isolation (BSI) procedures.
G1-1.9 Correctly troubleshoot and correct simple problems.
G1-1.10 Follow manufacturer and later developed service specific preventive maintenance procedures related to the monitoring device.

LESSON PLANS:

RECOMMENDED TIME TO COMPLETE:
One hour, which includes, part Lecture and part Skills practice time.

EQUIPMENT:
Blood glucose monitoring unit (glucometer)
Alcohol pad
Dry sterile dressing bandage (Band-Aid)
Universal precautions
Lancet (or other piercing device)
Test strips

OVERVIEW:

I. Describe the basic concept of glucose monitoring.
   A. Patient assessment
      1. Patient exhibits altered level of consciousness of suspected diabetic/hypoglycemic origin or unknown cause.
         a. Disorientation to time, location, events, or people or
         b. Responsive to persistent verbal or painful stimuli with inappropriate words/sounds or
         c. Unresponsive (coma) or
         d. Seizures/tremors.
         e. Rule out possibility of head trauma or cerebrovascular accident
   B. The goal of obtaining a specimen is to get an accurate blood glucose concentration.
   C. The blood concentration is read in milligrams of glucose per deciliter (mg/dL) of whole blood.

III. Obtaining a specimen.
   A. Assemble needed equipment
      1. Blood glucose monitoring unit
      2. Alcohol prep
      3. Dry sterile dressing
      4. Bandage
      5. Lancet (or other piercing device)
      6. Test strip
      4. Universal precautions
   B. Turn on machine and perform any initial start up or calibration procedures as directed by the manufacturer (especially if after cleaning the meter, if the meter has been dropped, or if the results do not reflect how the patient feels or when results are suspected to be inaccurate). For example:
      1. Check Strip Tests
      2. High/Low Calibration Tests
   C. If available, wash the patient's hands with soap and water and dry thoroughly. Warm water stimulates the blood flow to the fingers making it easier to obtain a sample.
   D. Select and prepare the site. The distal tip of any finger may be used. However, the preferable ones are the third or middle finger (next to the forefinger) and forth or ring finger (next to the "pinky") fingers. **NOTE***: Scar tissue may be present if the patient continually pricks the same finger for personal monitoring. Also, someone who has very calloused fingertips may present difficulty in obtaining a good blood sample. If unsuccessful on first try, it may be best not to waste time on attempting to get a sample, but **concentrate on other interventions and transporting the patient to the hospital! "TREAT THE PATIENT, NOT THE DEVICE"!**
      1. Have the patient hang their arm down to the side for 10 - 15 seconds before the stick.
      2. If using alcohol prep, make sure fingertip is allowed to dry completely before performing the finger stick.

E. Hold the lancet or other needle device firmly on the side ("off-center" in the fleshier part, not the bony side) of the patient's fingertip. The greater the pressure of the needle device against the finger, the deeper the puncture.
   1. If the needle device has a trigger mechanism - press release.
   2. If using a "lancet" type needle only, hold the device close to the fingertip area and quickly jab into the finger.
   3. Gently squeeze the finger to obtain a large, hanging drop of blood.

      Note* A more accurate sample is usually obtained if the first drop is wiped away with a clean 2X2 gauze square or similar dry wipe, and use the second drop of blood for analysis.

F. Apply the drop of blood from the patient's finger directly to the Test Spot of the Test Strip, or pick up the drop of blood with a capillary tube. Always use a new Test Strip for each blood specimen - never reuse a Test Strip.
   1. If the capillary tube is open at both ends
      a. First slide a bulb over one end
      b. Hold the capillary tube horizontally and touch the open end to the drop of blood
      c. The blood will flow into the tube by capillary action
      d. With the end of the tube containing the blood positioned over the Test Spot, squeeze the bulb gently to expel a shiny drop of blood with no air bubbles
   2. If the capillary tube is plastic and closed at one end
      a. Squeeze the tube or bulb, and hold the tube horizontally while touching the open end to the drop of blood
      b. Gently release pressure on the tube or bulb to draw up the blood
      c. With the end of the tube containing the blood positioned over the Test Spot, squeeze the bulb gently to expel a round shiny drop of blood with no air bubbles. Dispose of the sharp in an appropriate container.

H. Apply the sterile dressing to the tip of the finger. Once bleeding has stopped, apply a bandage (Band-Aid) to the tip of the finger.

I. The glucometer will then display the glucose concentration. Follow manufacturer's guidelines for test results.

III. Trouble shooting

A. Most often, each manufacturer will list in the operator's book, a key to error messages that the machine may display. Follow the manufacturer's guidelines to correct.

B. Some common errors:
   1. Insufficient blood specimen to cover Test Spot
   2. perform stick from beginning again with a new Test Strip
   3. Using Test Strips not coded for that particular machine
   4. follow manufacturer's guidelines for changing code in
   5. machine, then perform stick from beginning with new Test
   6. Test Strip is not inserted correctly
   7. perform stick from beginning again with a new Test Strip
   8. Expired or otherwise defective Test Strips (it is not recommended to use a bottle of Test Strips that was opened for the first time more than 4 months)
      a. Obtain new bottle of Test Strips

1. Air bubbles in the specimen on the Test Spot
    a. Perform stick from beginning again with a new Test Strip
2. The Test Strip moved out of the correct position during the test
    a. Remove Test Strip and perform stick from beginning again with new Test Strip
3. The glucometer is set in the neonatal mode with non-neonatal blood being tested and vice versa
    a. Reset the glucometer to match the blood sample

II. General Precautions and Limitations
   A. Do NOT use plasma or serum sample, as results will be inaccurate. If using venous blood collected in a tube, make sure that the red cells are thoroughly mixed and adequately reoxygenated prior to testing. Plasma/serum results are 10% higher than corresponding whole blood tests. Do NOT use specimens collected using fluoride as a preservative (gray topped tubes).
   B. Venous blood samples must be adequately oxygenated (pO2 greater than 45 mm Hg) to ensure accurate results.
   C. Shock administration of vasoactive agents, and other factors that decrease peripheral circulation may cause capillary blood glucose results to differ from venous or arterial results. Therefore, venous or arterial samples may be preferred.
   D. Non-neonatal samples with hematocrits below 25% or above 60% may result in inaccurate blood glucose readings.
   E. Store Test Strips in a cool, dry place below 86F (30C). Use caution when interpreting neonatal blood glucose results less than 50 mg/dL. Results may be inaccurate if neonatal sample hematocrits are less than 25% or more than 76%. All neonates exhibiting hypoglycemic symptoms should have their glucose concentrations confirmed by lab methods regardless of monitor results.
   F. If patient's symptoms are inconsistent with monitoring results and procedural errors are ruled out, follow your protocol for treating the symptoms. Blood glucose concentrations measure with a glucometer may be significantly lower than the true level if significant water loss and dehydration has occurred. This results because severe dehydration can cause increased blood viscosity and interfere with the penetration of the sample into the Test Spot and lead to inaccurately low results. Because severe dehydration is also associated with development of the hyperglycemic-hyperosmolar state (with or without ketosis), a potentially life threatening acute complication of diabetes, factors which cause it must be considered. For example:
      1. Sustained uncontrolled diabetes
      2. Vomiting or diarrhea
      3. Prescription drugs such as diuretics
      4. Shock (severe hypotension)

III. Normal lab values:
   A. Adult 70 - 110 mg/dL
   B. Neonatal 30 - 60 mg/dL *(***All neonates exhibiting hypoglycemic symptoms, regardless of blood glucose screen results, should have glucose levels confirmed by a laboratory test.)*

SKILL SEQUENCE:

1. Patient assessment
2. Assemble equipment
3. Prepare glucometer
4. Select and prepare site
5. Perform finger stick (**EMT-B should have BSI precautions in place prior to actually sticking finger)
6. Place adequate drop of blood on Test Strip
7. Obtain blood glucose concentration measurement
8. Dispose of sharps
9. Place dressing and bandage (“Band Aid”) on finger stick site

Manual Defibrillation

COGNITIVE OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

GK1.1 Describe the anatomical location of the heart in relation to the sternum and diaphragm

GK1.2 Given a diagram, identify the anatomical location of the heart in relation to the sternum and diaphragm

GK1.3 Given a diagram, trace the flow of blood through the heart and identify each chamber, valve and vessel

GK1.4 Given a diagram of the heart's electrical conduction system, trace the pathway of a normal impulse and identify each major structure

GK1.5 Define the following terms

- apex
- circulatory system
- myocardium
- ischemia
- myocardial infarction
- electrical cells
- automaticity
- pacemaker cells
- mechanical cells
- P wave
- QRS complex
- T wave
- depolarization
- repolarization
- lead
- artifact
- calibration
- standardization
- defibrillation
- hypothermia
- cardioversion
- joules

GK1.6 List three differences between automatic and manual technology for monitor defibrillators

GK1.7 List three types of electrode systems used with defibrillators

GK1.8 List five common causes of artifacts that result in poor ECG signals

GK1.9 Describe the response of heart muscle cells to defibrillation

GK1.10 State the most critical factor in increasing survival from ventricular Fibrillation

GK1.11 List and discuss the treatment guidelines (protocols) for pulseless ventricular fibrillation pulseless ventricular tachycardia asystole

GK1.12 State the two types of documentation

GK1.13 Given a simulated field situation, describe the information to be included in the recorded documentation

GK1.14 Given a simulated field situation, identify the information to be included in the written documentation

GK1.15 Describe the function and purpose of preventive maintenance and preventive maintenance checklists on manual and automatic defibrillators

PSYCHOMOTOR OBJECTIVES

At the completion of this lesson, the EMT-Basic monitoring endorsement student will be able to:

GD1.16 Demonstrate proper safety techniques

GS1.17 List three situations which may result in a shock to the operator of the defibrillator

GS1.18 The student must demonstrate control of the emergency scene and direct the resuscitation efforts

GS1.19 Demonstrate appropriate voice documentation of events on the scene

GS1.20 Demonstrate appropriate written documentation of events on the scene

GS1.21 Demonstrate appropriate assessment and care of the patient before, during, and after defibrillation

GS1.22 Demonstrate the completion of a preventive maintenance checklist on manual and automatic defibrillators

MK2.1 Given a normal ECG tracing, identify the following:
P wave
QRS complex
T wave

MK2.2 On ECG graph paper, label the following time measurements:
0.04
3 seconds

MK2.3 Identify examples of artifacts

MK2.4 List the sequence of steps necessary for manual monitoring

MD2.5 Demonstrate with a manual defibrillator, how to turn on the power, attach the device to the resuscitation manikin with the adhesive defibrillatory pads, determine rhythm, and deliver a shock

MD2.6 Demonstrate different treatment sequences with a manual defibrillator: Multiple shocks for persistent ventricular fibrillation, shocks with conversion to normal sinus rhythm, shocks with return of a rhythm and then re-fibrillation

MS2.7 Properly place electrodes in Lead II and MCL1 position for manual monitoring

MS2.8 Place the paddles in appropriate position on chest for manual defibrillation

MS2.9 Demonstrate correct adherence to the protocol in a simulated cardiac arrest while correctly defibrillating a manikin, with a manual defibrillator, within 90 seconds of arrival at the manikins side

MS2.10 Demonstrate SAFE use of a manual defibrillator; answer questions about the controls, disposable supplies, and maintenance; and demonstrate troubleshooting techniques

LESSON PLAN

RECOMMENDED TIME TO COMPLETE:
4 hours, which combines, part Lecture overview and part Skills Practice.

EQUIPMENT:
Monitoring Equipment (with strip capability)
Full Size Manikin Capable of Presenting a Rhythm and Being Ventilated (800ml min)
Oxygen Delivery Equipment (including ventilation devices)
Defibrillator (manual)

GENERAL KNOWLEDGE: Circulatory System

Body Cells
The human body is composed of billions of cells. In order to survive, each cell must have oxygen and nutrients delivered to it and carbon dioxide and other wastes transported from it.

Blood
The circulatory system brings oxygen and nutrients in the blood to the cells and transports carbon dioxide and other wastes products from them. The heart serves as the pump and keeps the blood moving through a closed system of blood vessels.

Heart

Location
The heart is located in the chest, behind and slightly to the left of the sternum. The apex (lower portion of the heart) rests on the diaphragm.

Myocardium
The heart muscle itself is called the myocardium and receives its blood supply from the coronary arteries. It is disease in these coronary arteries that is the number one cause of death in American adults. In vessels with coronary artery disease, blood cannot pass through the diseased and narrowed arteries to reach heart muscle cells. Without oxygen, these cells are injured or actually die.

Ischemia is the term used to describe inadequate flow of blood, and with it, oxygen to the tissues. The medical term used to describe death of heart tissue is MYOCARDIAL INFARCTION, which is commonly referred to by the lay public as a "heart attack".

Circulation of Blood Through the Chambers and Valves

The heart is actually a double pump. If open, the heart will be seen to be hollow, with four chambers. The RIGHT heart is separated from the LEFT heart by a thin wall called the septum.

Blood flows from the right atrium across a one-way valve (tricuspid) into the right ventricle, where it is ejected across another valve (pulmonary) into the pulmonary artery, entering the many vessels throughout the lungs.

In the lungs, a trade occurs. The blood receives oxygen and gives off carbon dioxide. The pulmonary veins collect this oxygen-rich blood and

return it to the left atrium. From the left atrium, the blood passes across another one-way valve (mitral) into the left ventricle. When the left ventricle contracts, the blood is ejected across yet another valve (aortic) into the aorta and out to the body to deliver oxygen and nutrients to the cells.

The venous system returns the blood that contains carbon dioxide and other waste products to the right atrium.

The two pumps, right and left, operate at the same time. Both atria contract first, then both ventricles. This coordinated pumping action is the result of a well-organized conduction system.

Electrical Conduction System

Electrical Cells

Two distinct types of cells are found throughout the heart muscle. Some electrical cells in the heart are unique in that they have a property called automaticity. Automaticity means that these cells can discharge an impulse without an outside stimulus. Cells possessing this property are known as pacemaker cells

Mechanical Cells

The second types of cells are mechanical cells (muscle cells), which normally respond to the electrical impulses and contract to pump blood. However, an electrical impulse will not always result in muscular contraction.

Spread of Conduction

Although any pacemaker cell in the heart can initiate an impulse, it normally begins in the sinus, or sinoatrial node (SA). The SA node is a cluster of specialized cells near the top of the right atrium. The electrical impulse begins here and spreads in all directions through both atria. This causes the atria to contract and empty blood into the ventricles.

To allow the ventricles time to fill with blood, the impulse is delayed for a short time at the atrioventricular node (AV), which is located in an area called the AV junction. After this short delay, the impulse travels through the Bundle of His, passes rapidly down the right and left bundle branches, and spreads through a network of conductive branches in the ventricular muscle called the Purkinje fibers. These fibers convey the impulse to the muscle and cause the ventricles to contract.

This normal conduction pathway synchronizes the chambers to contract and relax with a coordinated rhythm so that the heart chambers can fill and empty efficiently.

The Electrocardiogram

The electrocardiogram is a graphic display of the hearts electrical impulses as they travel through the conduction system. This electrical activity within the heart can be picked up from the skin surface by applying electrodes to the chest or extremities and connecting them by cables to a monitor that displays the electrical activity on graph paper.

Depolarization
Depolarization is the process by which the heart muscle is stimulated to contract.

Repolarization
Repolarization is the period after contraction during which time the cardiac muscle recharges in preparation for the next contraction.

Components of the ECG complex

The electrical activity forms a series of waves and complexes separated by regularly occurring intervals. These waves and complexes have been arbitrarily labeled as the P wave, the QRS complex, and the T wave.

The P Wave is formed as the electrical impulse spreads across the atria (depolarization) and causes both atria to contract

The QRS Complex is the deflection that is formed as the electrical impulse spreads from the Purkinje fibers to the ventricles (depolarization), causing both ventricles to contract.
The T Wave is the wave formed after ventricles contract, which represents the ventricular resting period (repolarization). During the resting period the chambers fill with blood for the next contraction.

Graph Paper

The graph paper moves through an ECG machine at a standard speed. This allows each vertical line to represent time.

Each Small Box = 0.04 seconds and the Large Box = 0.20 seconds.

Three-second time intervals are marked at the top of the ECG paper for your convience.

The graph paper is usually started and stopped by a control button placed on the top or front of the monitor.

Origin of Impulse Formation

Supraventricular Rhythms
The impulse begins within the atria or AV junction (above the ventricles) and continues down normal conduction pathway.

Supraventricular rhythms usually produce adequate cardiac output.

Ventricular Rhythms
The impulse begins below AV junction and does not follow normal conduction pathway.

Ventricular rhythms usually produce INADEQUATE cardiac output.

Three Step Method of Analysis

Calculate Rate

SHOW A SECTION OF STRIP TO EACH STUDENT

Note the three second intervals marked at the top of the ECG paper, two of which make a 6 second interval. In the provided tracing, nine QRS complexes appear in the 6-second interval. Since there are ten 6-second intervals every minute, you simply multiply the number of QRS complexes (9) by ten, which equals 90 QRS complexes every minute. You recall that each QRS complex represents depolarization of the ventricles, so this means that this patient's heart depolarizes 90 times each minute. If the patient’s heart is functioning normally, each depolarization will result in a palpable heartbeat.

Determine Regularity
To determine the regularity, measure the distance from one QRS complex to the next. If the rhythm is regular, the distance between each QRS complex will remain the same.

Measure Width of QRS
The QRS complex is formed as the electrical impulse travels throughout the ventricles. You can determine how long it takes the impulse to travel through the ventricles by counting the number of small blocks on the ECG paper from the beginning to the end of the complex. Each small block is 0.04 seconds; therefore, if you count two small blocks from the beginning to the end of the QRS complex, you have 2 times 0.04 seconds, which equal 0.08 seconds.

Normal conduction through the ventricles takes 0.12 seconds or less.

Abnormal conduction occurs when a blockage is present in the ventricular conduction system, which causes the impulse to travel around the blocked area. The impulse may travel slower on this alternate pathway, making the QRS wider than 0.12 seconds.

For the purposes of this training, if the QRS complex is greater than 0.12 seconds and there is no P wave, assume it has originated within the ventricles.

Dysrhythmia

The normal ECG consists of the P, QRS and T waves, all within a normal standard for size and shape and occurring at regular intervals at a rate of 60 to 100 per minute. When the rate, rhythm, size or shape of the individual waves does not meet normal standards, the disorder is called a dysrhythmia. The term arrythmia may also be used to describe this disorder.

Supraventricular Rhythms

The impulse originates above the ventricles (from the SA node, the atria, or AV junction).

Three Step Method
Heart rate = 60-100 minute
Regularity = regular or irregular
Width of QRS = 0.12 seconds or less

Patient Condition
Supraventricular rhythms usually pump blood more efficiently than ventricular rhythms. However, the only way to determine the effectiveness of the rhythm is to assess:

- airway
- breathing
- circulation
- level of consciousness
- blood pressure

Treatment
Treat the patient's condition based on assessment findings. Measures such as oxygen therapy, placing the patient in a position of comfort, emotional support and continued observation may be indicated.

Ventricular Rhythms

With ventricular rhythms the impulses that originate within the ventricles.

Premature Ventricular Contractions occur when a site within the ventricles discharges early, producing a complex that interrupts the regular rhythm.

The three step method
Heart Rate - depends on the underlying rhythm
Regularity - irregular due to early occurrences of PVC's
With of QRS - wide, slurred, greater than 0.12 seconds

Patient condition
PVC's may not alter the patients condition. However, frequent PVC's (more than 6 to 8 per minute) may decrease the amount of blood being circulated. Decreased blood circulation may result in:

- decreased LOC
- decreased blood pressure
- cool, clammy skin
- dyspnea

Treatment
Continually assess:

- Airway
- Breathing
- Circulation (carotid pulse)
- LOC
- Blood Pressure

Measures such as oxygen therapy, placing the patient in a position of comfort and emotional support may be indicated.

Ventricular Tachycardia is a series of 4 or more PVC's in a row. Ventricular tachycardia may develop without warning and is likely to degenerate into ventricular fibrillation.

The three step method
Heart rate = 140 - 220 beats per minute or faster
Regularity = usually regular, but may be irregular
Width of QRS = wide, slurred complexes greater than 0.12 seconds

Patient condition
The patient initially may be conscious and alert with an adequate blood pressure. Prolonged VT may result in; inadequate blood flow and ventricular fibrillation.

Treatment
Continually determine the effectiveness of the rhythm by assessing:

- airway
- breathing

circulation
LOC
blood Pressure

If there is no palpable pulse
Defibrillate immediately
Perform CPR until a defibrillator is available

Ventricular Fibrillation is electrical activity in the heart that is chaotic and produces a quivering motion with no orderly, effective contractions. The heart is not able to pump blood and circulation stops. The brain and other tissues no longer receive the vital oxygen they need to survive.

<u>The three-step method</u>
Heart rate = unable to determine
Regularity = totally irregular
QRS = unable to measure

The electrical pattern seen on an ECG is chaotic. The size of the waves may vary. The irregular waves may be quite large.

<u>Patient condition</u>
The patient is unconscious, with no respirations, pulse or blood pressure.

<u>Treatment</u>
Defibrillate immediately
Perform CPR until a defibrillator is available

Asystole is the absence of electrical activity; the ECG will record a straight-line pattern.

<u>The three step method</u>
Heart rate= none
Regularity = no electrical activity
Width of QRS = absent

<u>Patient condition</u>
The patient is unconscious with no respirations, pulse or blood pressure.

<u>Treatment</u>
CPR immediately

Pulseless Electrical Activity (PEA) is electrical activity without a palpable pulse.

The three step method
Heart rate = Variable-
Rhythm = regular or irregular
Width of QRS = Variable

Patient condition
The patient is unconscious with no respirations, pulse or blood pressure.

Treatment
CPR immediately

Pacemaker Rhythms
An artificial pacemaker is a battery-operated device. Pacemakers are designed to electrically stimulate the heart muscle to contract when the heart's normal pacemaker sites are not functioning properly. A pacemaker consists of two components, a battery source and a wire electrode. Usually, the wire electrode is placed in or on the right ventricle.

Numerous types of pacemakers are available. Pacemaker ECG tracing will vary considerably. Since the impulse travels backwards from the ventriculus through the conductive system. Because the impulse travels more slowly on the backward pathway, the QRS will be wider than 0.12 seconds.

The three second method
Heart rate = Artificial pacemakers are programmed to fire at a set rate, usually 70-80 times per minute. If the patient is alert he/she should know the set rate of the pacemaker. A rate below the pre-set rate indicates that the artificial pacemaker is not functioning properly.
Regularity = regular
Width of QRS = wide and greater than 0.12 seconds proceeded by a pacemaker spike.

Patient condition
If the pacemaker is functioning normally, the heart's contractions will provide adequate output.

Treatment
Treatment should be based on your assessment findings. Depending on the underlying disease process, the patient may require supportive measure (ie: oxygen, emotional support, position of comfort). Again, the key is to treat the patient, not the rhythm.

Defibrillation

Defibrillation is the delivery of an external electrical current through the heart muscle. Just as the cardiac cells normally respond to internal electrical impulses from the SA node, they will also respond to external electrical impulses.

Time element - Time from collapse to defibrillation is the most critical factor in increasing survival rates. The sooner a patient in ventricular fibrillation receives a counter shock, the better the chances for survival. CPR helps maintain circulation to the brain but only defibrillation will convert a fibrillating heart into a beating heart.

Implanted defibrillators and pacemakers do not change treatment with a manual defibrillator except that the paddles or pads should not be placed directly over the device.

Defibrillation of Children (over one year of age)

While uncommon, cardiac arrest can occur with children. Cardiac arrest is usually a result of electrocution or drowning.

Adult paddles (8 to 10 cm in diameter) are recommended for children weighing over 10 kg (over one year of age).

Standard paddle placement is with one paddle placed over the right side of the upper chest and the other over the apex of the heart (to the left of the left nipple).

Energy levels should be:

initial dose of 2 joules per Kg

with successive shocks at 4 joules per Kg.

Use of electrode paste, saline soaked gauze pads or self-adhesive monitoring-defibrillation pads

The use of BARE paddles without a coupling material between the electrodes and the patient results in very high transthoracic impedance (resistance). High transthoracic impedance decreases the effectiveness of defibrillation. The use of a conductive medium between the patient and defibrillation paddles MUST be used during defibrillation.

Conductive gel or paste is necessary between the chest and the paddles. Dry, unprepared skin acts as a resistor to the passage of electrical current and may result in burns to the skin and an ineffective energy delivery to the heart. Use enough gel to cover the surface of the paddles, but not so

much as that it spreads over the sides and onto your hands. Too much gel and sloppy technique can pose a safety hazard for you and your patient.

Defibrillation During Transport

If a patient develops ventricular fibrillation during ground transport, measures must be taken to assure the safety of the patient and others aboard the ambulance. The vehicle must come to a complete stop to thoroughly evaluate the rhythm. Due to the confined space of the ambulance, special caution should be taken to be sure that everyone is clear of the patient and cot before defibrillation.

During air transport in a non-pressurized aircraft, the equipment may not be reliable at certain altitudes or pressures. Consult your operation manual and or manufacturer for specifications. Electrical interference from radio equipment could also present a problem. If this occurs, repositioning the distance and or angle of the automatic defibrillator may reduce the interference.

Hypothermia

Hypothermia, a condition in which the body temperature is below normal, is probably the most significant factor in long term survival of near drowning victims rescued from cold water.

A combination of hypothermia and a phenomenon known as the "diving reflex" accounts for the body's response to cold-water immersion. The body decreases its use of oxygen by slowing the heart rate and shunting blood away from the extremities and less vital organs.

Blood flow to the heart and brain is maintained where it is needed to sustain life. Drowning victims may recover completely after extended periods of submersion, sometimes much longer than the 4 to 6 minutes commonly considered the upper limit for brain survival of cardiac arrest victims.

Therefore, CPR and defibrillation (when necessary) should be initiated and continued when the patient is a cold water-drowning victim. If you have the capability to measure core temperature, limit defibrillation to three shocks unless the core temperature is above 86F. REMEMBER! The patient must be removed from the water and dried. The potential for the accidental shocking of rescuers is greatly increased when dealing with drowning victims.

Safety

Safety procedures must be observed at all times. If defibrillation equipment is used improperly, the operator or bystanders may be accidentally shocked. Although such a shock may only stun the individual with general muscle contraction, accidental counter shock has the potential to cause ventricular fibrillation. Danger of receiving a shock exists if an individual is touching the patient or any conductive material in contact with the patient (ie a metal stretcher).

To keep risk at a minimum, be certain that everyone is clear of the patient and anything the patient is touching before pressing the discharge buttons.

DOCUMENTATION

Documentation of a resuscitative event is important in helping to evaluate patient care, as well as in providing legal protection. Documentation is both recorded and written.

Written Documentation

When preparing written documentation include the following information:

1). The patients age and sex

2). A brief history of the events before the cardiac arrest including witnessed or unwitnessed, arrest time and by whom CPR was started.

3). Significant medical history and a list of current medications

4). A description of the resuscitation. To be sure that information is not left out, it is helpful to use a consistent format. As in voice recording, the important information is:

what is observed
what is done
how the patient responds

MANUAL DEFIBRILLATOR OPERATIONS

Manual Technology

Overview - ECG monitor receives electrical impulses from the heart and transfers them onto graph paper in the form of deflections.

Attachment of Electrodes

Cleaning the skin surface may require an alcohol sponge if skin is dirty, oily or diaphoretic: Shaving the area may be necessary if body hair prevents adhesion.

Inspect pads to be sure conduction gel has not dried.

Attach electrodes to cable snaps.

<u>Electrode placement</u>

The heart can be viewed from different angles by placing electrodes in various places on body. These views are called leads.

Lead II
MCL1

Artifact

Outside interference with the ECG signal sometimes produces deflections that resemble ventricular fibrillation.

Causes of artifact include:

Loose electrodes due to, Diaphoretic skin, Dirty skin, Oily skin, and or Body hair.

Dried gel

Muscle tremor or patient movement

Broken cable tips or wires

Sixty cycle interference due to electrical appliances.

The manual defibrillator is designed to deliver electrical energy through paddles placed on the chest wall. Rechargeable batteries provide power.

Controls

Most defibrillators have a limited number of controls:

power control (ON - OFF)
energy select control
charge control (charges the defibrillator to the desired energy level)
discharge button (usually on button on each paddle)

Paddles - "Quick Look"

Frequently monitor/defibrillator units are capable of ECG monitoring through electrodes within the defibrillation paddles. One paddle contains the negative electrode and is usually labeled STERNUM. The other paddle is labeled APEX and contains the positive electrode.

Paddle placement for defibrillation.

The gelled paddles are placed on the bare chest. One paddle is placed just to the right of the sternum and below the clavicle. The other paddle is placed just below and to the outer side of the left nipple.

Steps of operation

Determine that patient is pulseless and breathless

Turn on monitor

Attach the patient to the monitor with cables or "quick look paddles"

Determine if rhythm is shockable (VF or VT)

Check to be certain the synchronize mode is "OFF"

Lubricate the paddles

Turn on the power to the defibrillator

Charge the machine to the desired level of energy

Make sure all personnel are clear. Place the paddles firmly on the patients chest, with about 25 lbs of pressure. State "I'm clear, you're clear, everyone's clear" while looking to see that everyone is clear.

Press the discharge buttons for counter shock. During actual defibrillation, the patients skeletal muscles will respond to the counter shock by contracting, causing a sudden jerking of the body.

Repeat as necessary

Energy Requirements

The amount of energy necessary to depolarize the heart cells without causing damage to them has been a subject of considerable controversy in recent years. Current thinking is that the lowest dose causing depolarization is best; therefore The American Heart Association's Advanced Cardiac Life Support guidelines recommend that:

The first attempt at defibrillation should be in the range of 200-300 joules

The second attempt should also be in the range of 200-300 joules

Successive counter shocks should be at 360 joules

AUTOMATED EXTERNAL DEFIBRILLATOR OPERATIONS

Semi-Automatic Technology

Overview - Operator attaches electrodes and follows voice or visual instructions of the machine.

Electrode systems - AED is connected to the patient by two electrodes that conduct the heart's rhythm back to the AED for analysis.

Electrode placement -

CHEST TO CHEST (anterior/anterior)

- One pad is placed to the right of the sternum, just below the clavicle.
- The other pad is placed just below the apex of the heart.

CHEST TO BACK (anterior/posterior)

- Anterior pad is placed over the apex of the heart.
- Posterior pad is placed near the center of the back, one or two inches above the anterior pad.

Artifact

Outside interference with the ECG signal sometimes produces deflections that resemble ventricular fibrillation.

Causes

Loose electrodes due to:
- Diaphoretic skin
- Dirty skin
- Oily skin
- Body hair
- Dried gel

Muscle tremor or patient movement

Broken cable tips or wires

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