

Component III: Clinical

Module B: Specialty procedures

Topic 4: Electrocardiogram (EKG)

Statement of Purpose

To prepare the learner with basic knowledge and skills necessary to perform an electrocardiogram (EKG).

Student Learning Outcomes

Upon completion of this topic, the learner will be able to:

1. Spell and define key terms.
2. Identify the Medical Assistant's role in performing an EKG.
3. Identify the basic components of the heart.
4. Describe common cardiovascular disorders.
5. Demonstrate limb and precordial lead placements.
6. Identify the basic elements of an electrocardiograph (EKG).
7. Identify various forms of artifact and measures needed to correct them.
8. Patient education, EKGs.
9. Explain the purpose of a Holter monitor and cardiac event monitors
10. Patient education, Holter monitors and cardiac event monitors.
11. Explain the purpose of a cardiac stress test.

Terminology

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|---|--------------------------------|
| 1. Artifact | 17. Ischemia |
| 2. Arrhythmia | 18. Lead |
| 3. Atria | 19. Millivolt (mV) |
| 4. Atrioventricular node (AV node) | 20. Myocardial Infarction (MI) |
| 5. Bradycardia | 21. Pacemaker |
| 6. Calibration | 22. Polarity |
| 7. Cardiac event monitor | 23. Polarization |
| 8. Cardiomegaly | 24. Precordial |
| 9. Cardiomyopathy | 25. Purkinje fibers |
| 10. Coronary Artery Bypass Graft (CABG) | 26. Repolarization |
| 11. Defection | 27. Sinoatrial node (SA node) |
| 12. Depolarization | 28. Standardization |
| 13. Diastole | 29. Stylus |
| 14. Electrocardiogram (ECG, EKG) | 30. Systole |
| 15. Electrode | 31. Tachycardia |
| 16. Holter monitor | 32. Ventricles |

References

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Content Outline/Theory Objectives	Suggested Learning Activities
<p>Objective 1 Spell and define key terms.</p> <ul style="list-style-type: none"> A. Review the terms listed in the terminology section. B. Spell the terms listed accurately. C. Pronounce the terms correctly. D. Use the terms in their proper contexts. 	<ul style="list-style-type: none"> A. Games: word searches, crossword puzzles, Family Feud, Jeopardy, bingo, spelling bee, hangman, and concentration. B. Administer vocabulary pre-test and post-test. C. Discuss learning gaps and plan for applying vocabulary.
<p>Objective 2 Identify the Medical Assistant's role in performing the EKG test.</p> <ul style="list-style-type: none"> A. Obtaining the EKG using electrocardiograph equipment and correct electrode/lead placement. B. Recognizing problems that need immediate Physician attention <ul style="list-style-type: none"> 1. Medical Assistants do not interpret EKG test results. 2. Medical Assistants should be able to recognize basic elements of EKG patterns <ul style="list-style-type: none"> a. Heart rhythm and regularity. b. Equal time and distance between each corresponding P wave and R wave. c. Irregularities termed arrhythmias. d. Heart rate determined by counting the number of QRS complexes in a six second rhythm strip and multiplying by 100. 3. Medical Assistants should be able to recognize lethal arrhythmias <ul style="list-style-type: none"> a. Absence of normal EKG complexes, tachycardia (>100beats per minute) or bradycardia (<60 beats per minute) rates need immediate Physician attention. b. Heart conditions are indicated by variations from normal length and position in the intervals and segments of the cardiac cycle such as myocardial infarction (MI) or heart attack. 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Place actual EKG tracings with normal and abnormal rhythms and patterns on overhead projector or PowerPoint. D. Ask students to recognize abnormalities.
<p>Objective 3 Identify the basic components of the heart.</p> <ul style="list-style-type: none"> A. Cardiac anatomy <ul style="list-style-type: none"> 1. The heart is a double-sided muscular pump <ul style="list-style-type: none"> a. Right side receives deoxygenated blood from the body. b. Left side of the heart receives oxygenated blood from the pulmonary veins. 2. The heart has four chambers 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Use visuals or models of the heart for anatomy recognition. D. Students label the anatomical structures of the heart. E. Utilize online images from

<ul style="list-style-type: none"> a. The two upper atria are receiving chambers. b. The two lower ventricles are the pumping chambers. 3. One-way valves located between the atria and ventricles prevent regurgitation of blood. 4. Septum is the partition that divides the heart into right and left sides. 5. Cardiac physiology <ul style="list-style-type: none"> a. Contraction and ejection phase is called “systole”. The systolic phase pumps blood out of the heart. b. Relaxation and filling phase is called “diastole” this phase allows the ventricles to fill. c. The sequence of contraction and relaxation makes up the complete heartbeat and is known as the cardiac cycle which takes place on an average of once every 0.8 seconds. 6. Electrical conduction system <ul style="list-style-type: none"> a. Controlled by autonomic nervous system. b. Cardiac impulse originates in the sinoatrial (SA) node located in the right atrium. Also known as the pacemaker of the heart, it causes both atria to contract and sets the rhythm of the heart contractions. c. Second area of conduction tissue is located in the bottom of the right atrium near the septum and goes down into the ventricle. It is called the atrioventricular (AV) node. This is where the impulse is slowed to allow the atria to contract and the ventricles to fill. d. Bundle of His is a collection of fibers that is located in the septum between the ventricles. The electrical impulse continues with a slight delay. e. The Purkinje fibers conduct the impulse to the ventricles causing them to contract. f. The entire cardiac cycle consists of: <ul style="list-style-type: none"> 1) Depolarization, contraction. 2) Repolarization, recovery. 3) Polarization, resting. 	<p>www.innerbody.com</p> <p>1. Images are copyrighted but can be viewed online: © 1999-2007 Intellimed International Corporation.</p>
<p>Objective 4 Describe common cardiovascular disorders.</p> <ul style="list-style-type: none"> A. Arrhythmias (dysrhythmias), abnormal heart rhythm <ul style="list-style-type: none"> 1. Atrial Fibrillation. 2. Bradycardia. 3. Tachycardia. 4. Ventricular fibrillation. 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings

<ul style="list-style-type: none"> 5. Ventricular tachycardia. B. Disorders of the heart <ul style="list-style-type: none"> 1. Cardiomegaly. 2. Congenital heart disease. 3. Congestive heart failure. 4. Endocarditis. 5. Myocarditis. 6. Myocardial infarction (MI). 7. Pericarditis. 8. Valvular heart disease. C. Disorders of the blood vessels <ul style="list-style-type: none"> 1. Aneurysm. 2. Arteriosclerosis 3. Atherosclerosis 4. Hypertension 	
<p>Objective 5 Demonstrate limb and precordial lead placements.</p> <ul style="list-style-type: none"> A. Greet and identify the patient B. Preparing the patient <ul style="list-style-type: none"> 1. Reduce patient anxiety and apprehension. Make sure the room is comfortable and well-lit, explain procedure to patient and answer questions. 2. Prepare skin for contact. Lotions and oils may be remove with alcohol. Excessive hair may need to be shaved. Follow protocols for your office and standard precautions. C. Electrodes (sensors)/leads <ul style="list-style-type: none"> 1. These are attached to the patient's skin 2. There are several types <ul style="list-style-type: none"> a. Disposable (most commonly used), metal plates, and suction bulb. 3. Routine electrocardiography requires placement of 10 electrodes: right arm (RA), left arm (LA), right leg (RL), and left leg (LL) and 6 specific chest wall locations (V1,V2, V3, V4, V5, V6) 4. Leads show an image of electrical activity from different angles, moving in different directions, up, down, backward and forward, left and right 5. Limb leads are the 6 leads that directly monitor electrodes on the arms and legs <ul style="list-style-type: none"> a. Three standard leads (i, ii, and iii) monitor two limb electrodes. These are called "bipolar" leads. b. Three "augmented" leads (aVR, aVL, aVF) monitor one limb electrode and a point midway between two other limb electrodes. They directly monitor only one electrode ("unipolar" leads). c. Limb leads are placed on the patient prior to precordial lead placement 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Demonstration

<p>6. Precordial leads</p> <ul style="list-style-type: none"> a. Six “precordial” or “chest” leads b. Precordial leads monitor electrical changes and variations within the heart c. Designated V1 through V6 <ul style="list-style-type: none"> 1) V1: 4th intercostal space right sternal border 2) V2: 4th intercostal space left sternal border 3) V3: between V2 and V4 4) V4: 5th intercostal space mid-clavicular line 5) V5: 5th intercostal space anterior axillary line 6) V6: 5th intercostal space mid-axillary line 	
<ul style="list-style-type: none"> 2. Used to detect abnormalities associated with the heart’s conduction system <ul style="list-style-type: none"> a. Cardiac disease evaluation b. Ischemia c. Delays in impulse conduction d. Hypertrophy of the cardiac chambers e. Arrhythmias f. Evaluate effectiveness of cardiac medications g. Patient’s progress post MI/surgery 3. The wave forms indicate the electrical activity taking place in the myocardium of the heart <p>B. The cardiac cycle and electrocardiography</p> <ul style="list-style-type: none"> 1. The cardiac cycle refers to one heartbeat (systole and diastole) depolarization, repolarization and polarization 2. When the cardiac cycle is transferred to a machine that records the electrical activity it becomes an electrocardiogram (EKG/ECG) 3. The EKG is a series of waves or deflections above or below the baseline on specialized graph paper 4. Waves and deflections depict the electrical impulses of the heart <p>C. Electrocardiograph paper</p> <ul style="list-style-type: none"> 1. EKG paper is heat or pressure sensitive 2. Graph paper with internationally accepted increments 3. Horizontal small squares are lightly printed and measure 1 mm by 1 mm (represent 0.04 sec) 4. Large squares are darker and measure 5 mm by 5 mm (represent 0.2 sec) 5. The stylus is the device that marks the EKG paper by using heat or pressure 6. The paper is advanced so that the stylus 	<ul style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Show sample EKGs to students to identify waveforms. D. Equipment demonstration

intersects with a vertical line every 0.04 seconds or at 25 mm per second

D. Electrocardiograph controls

1. Each small vertical square represents 0.1mV
2. Each large vertical square represents 0.5mV
3. Standardization, 1 millivolt (mV) impulse to produce a standardization mark on the EKG paper (10 small squares or 10 mm or 1 cm) and stay there for 0.08 seconds
4. Most EKG machines have three sensitivity standards ½ standard (5mm), 1 standard (10mm) and 2 standard 20mm)
5. Speed selector set at 25 mm per second unless otherwise noted on the EKG strip
6. Sensitivity control adjusts the height of the standardization mark and the tracing
7. Lead selector is used to allow one specific lead to be run
8. Marker control used to mark codes on paper to identify the specific lead. Modern machines do this automatically.

E. ECG waveforms

1. P wave reflects depolarization of the atria
2. The QRS reflects depolarization of the ventricles
 - a. Q wave is the first deflection after the P wave
 - b. R wave is the first upward deflection after the Q wave
 - c. S wave is the downward deflection after the R wave
3. T wave is the upward deflection after the S wave. It reflects ventricular recovery (repolarization). After the T wave there is a period of heart rest (polarization) and there is a straight line (no electrical activity).
4. U wave occasionally seen following the T wave in patients with low serum potassium or other metabolic disturbances
5. Flat horizontal line without upward or downward deflections is the baseline

F. Intervals, complexes, and segments

1. PR interval reflects the time it takes from atrial contraction to the ventricular contraction (normal interval 0.12 to 0.20 seconds)
2. QRS complex reflects contraction of the ventricles (normally <0.12 seconds)
3. ST segment reflects the time interval between QRS and T wave

<p>Objective 7 Identify various forms of artifact and measures needed to correct them.</p> <p>A. Causes of artifacts</p> <ol style="list-style-type: none"> 1. Improper technique 2. Poor conduction 3. Patient movement 4. Electrical interference 5. Improper tracing handling 6. Mechanical problems with ECG machine <p>B. Possible mechanical problems</p> <ol style="list-style-type: none"> 1. Wandering baseline is a shift from the center. Caused by patient moving during the recording of the EKG. 2. Somatic tremor is caused by the patient's muscle movement and tensing of voluntary muscles. Some disease processes may cause involuntary movement (i.e., Parkinson's). 3. Alternating current (AC) interference, electrical current may be given off by other electrical equipment 4. Baseline interruption occurs when the electric current has been interrupted. Caused by dislodged electrode or a broken lead wire. 5. Flat line indicates a loose lead or wire. Or it could indicate cardiac arrest – check your patient! 	<p>A. Lecture/Discussion B. Assigned Readings</p>
<p>Objective 8 Patient education, Electrocardiograms(EKGs)</p> <ol style="list-style-type: none"> A. Greet and identify the patient B. Explain procedure in layman's terms C. Reduce patient anxiety and apprehension. Make sure the room is comfortable and well-lit. Explain procedure to patient and answer questions. D. Skin preparation for good contact may involve clipping or shaving hair; follow protocols for your office and follow standard precautions. E. Ask if patient has further questions F. Reassure patient about procedure 	<p>A. Lecture/Discussion B. Assigned Readings</p>
<p>Objective 9 Explain the purpose of a Holter monitor and cardiac event monitor</p> <ol style="list-style-type: none"> A. Holter Monitor is a small and portable monitor that records cardiac arrhythmias and dysfunctions for 24 hours <ol style="list-style-type: none"> 1. Does not interfere with daily activities, with the exception of bathing and showering 2. Set for continuous recording or patient triggered recording when they are symptomatic 3. Patient must keep a diary of daily activities B. Cardiac event monitor is a small portable recording 	<p>A. Lecture/Discussion B. Assigned Readings</p>

<p>device which may be worn up to 30 days to catch events that are difficult to record in 24 hours</p> <ol style="list-style-type: none"> 1. Patients trigger the recording if they feel any indication of a cardiac event 2. The monitor must be removed for bathing and the patient must learn how to reapply electrodes 3. Patient must keep a diary of daily activities 4. Change electrodes and batteries daily <p>C. Patient will be given instruction on transmitting recordings</p>	
<p>Objective 10 Patient education, Holter monitors and cardiac event monitors</p> <ol style="list-style-type: none"> A Explain the reason for the application of the monitor B Explain to the patients with Holter monitor that they must return in 24 hours C Patients with Holter monitor should not bathe D Patients with the cardiac event monitor must be shown how to change electrodes and batteries E Patients should be instructed to change the location of the electrodes to avoid skin irritation F Patients with the cardiac event monitor must be shown how to transmit data G Both types of monitors require patients to keep a diary to record activities and when events occur H Ask if the patient has further questions 	<ol style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings C. Equipment demonstration
<p>Objective 11 Explain the purpose of a cardiac stress test</p> <ol style="list-style-type: none"> A. A cardiac stress test is performed to observe and record the patient's response to measured exercise challenges <ol style="list-style-type: none"> 1. To determine if there is adequate blood flow to your heart during increasing levels of activity 2. To evaluate the effectiveness of heart medications to control angina and ischemia 3. To determine the likelihood of having coronary heart disease and the need for further evaluation 4. To check the effectiveness of procedures done to improve blood flow within the heart vessels in people with coronary heart disease 5. To identify abnormal heart rhythms 6. Help develop a safe exercise program B. Performed with a patient walking on a treadmill or riding an exercise bike C. The test is performed according to physician's orders and is monitored by a physician D. Emergency equipment should be available in case of cardiac or respiratory difficulties 	<ol style="list-style-type: none"> A. Lecture/Discussion B. Assigned Readings