1 Electrocardiography for Healthcare Professionals

Chapter 4: Performing an ECG

2 Learning Outcomes

- 4.1 Prepare the patient, room, and equipment for an ECG.
- 4.2 Describe the communication needed during the ECG procedure, including the actions to take if a patient refuses to allow an ECG to be performed.
- 4.3 Identify the anatomical landmarks that are used to apply the ECG chest electrodes to the correct locations.

3 Learning Outcomes (Cont'd)

- 4.4 Demonstrate the procedure for applying the electrodes and lead wires for a 12-lead ECG and cardiac monitoring.
- 4.5 Identify at least three ways to prevent infection and provide for safety during the ECG procedure.
- 4.6 Describe the procedure for recording a 12-lead ECG.
- 4.7 Identify types of artifact and how to prevent or correct them.

4 Learning Outcomes (Cont'd)

- 4.8 Describe how to report the ECG results.
- 4.9 Identify the steps for cleaning and caring for the ECG equipment.
- 4.10 Explain variations for a pediatric ECG procedure.
- 4.11 Distinguish between a routine ECG and cardiac monitoring.

5 Learning Outcomes (Cont'd)

- 4.12 Summerize special patient circumstances when performing an ECG.
- 4.13 Recall the steps for handling an emergency during the ECG.

6 4.1 Preparation for the Procedure

- Select a room away from electrical equipment and x-rays
- Turn OFF non-essential electrical equipment in the room
- Place ECG machine away from electrical cords

7 4.1 Verification

- Verify physician order for ECG
 - □Patient name/date of birth
 - □Location/date/time of recording
 - □Patient age/sex/race/cardiac medications
 - □Height and weight

8 4.1 ECG Preparation Essentials

- **Billing information**
- Must be entered in the computer or handwritten

Patient information

Enter on LCD panel or write it on the completed ECG

9 4.1 Before You Begin

- Check paper supply and replace if red line is visible
- Read operator's manual before replacing paper
- If paper is replaced, run machine to check for proper functioning and alignment

10 4.1 Apply Your Knowledge

True or False: It is unnecessary to place the ECG requisition or physician order in the patient's chart.

11 4.1 Apply Your Knowledge

True or False: It is unnecessary to place the ECG requisition or physician order in the patient's chart.

ANSWER: False; all orders should be placed in the patient's chart.

12 4.2 Communication

- Identify the patient
- Check the patient name, identification number, and date of birth
- Introduce yourself and explain what you are going to do

13 4.2 Communication

■ Answer all questions

- If the patient refuses the ECG, determine the cause
- Notify your supervisor if you cannot resolve the problem

14 4.2 Preparing the Patient

- Patient removes clothing from the waist up
- Provide with drape, sheet, or hospital gown with opening in the front
- Patient removes jewelry that may interfere
- All electronic devices should be turned off and removed

15 4.2 Preparing the Patient (Cont'd)

- Position patient comfortably on back and provide pillow for head and knees, if preferred
- Work from patient's left side if possible
- Ensure privacy
- Ensure that arms and legs are supported

16 4.2 Preparing the Patient

(Cont'd)

- Provide sheet or blanket to prevent chills
- Make sure bed/exam table is not touching wall or electrical equipment
- Ensure that patient is not touching metal

17 4.2 Apply Your Knowledge

What should you do if a patient refuses the ECG procedure?

18 4.2 Apply Your Knowledge

What should you do if a patient refuses the ECG procedure?

ANSWER: Determine the reason for refusal. Then, if needed, report to your supervisor.

19 4.3 Anatomical Landmarks

20 4.3 Identifying Anatomical Landmarks

■ Midclavicular line

□Usually starts in the center of clavicle and passes through nipple line □Troubleshooting – in obese patients or female patients with large breasts, midclavicular line may not run through nipple

21 4.3 Identifying Anatomical Landmarks (Cont'd)

- Anterior axillary line
- Mid-axillary line
- Intercostal spaces (ICS)
- Suprasternal notch
- Angle of Louis

- 22 4.3 Identify Anatomical Landmarks
- 23 4.3 Identify Anatomical Landmarks (Cont'd)
- 24 4.3 Apply Your Knowledge
- 25 4.3 Apply Your Knowledge
- 26 4.4 Applying the Electrodes
 - Prep the skin with either an alcohol swab or electrolyte pad
 - Shave hair if necessary, or clip hair for continuous monitoring
- 27 4.4 Applying the Electrodes (Cont'd)
 - Apply V1 to the 4th intercostal space at the right sternal border
 - Place V2 at the 4th intercostal space on the left sternal border
 - Place V4 at the 5th intercostal space on the left midclavicular line

28 4.4 Applying the Electrodes (Cont'd)

- Place V3 midway between V2 and V4
- Place V5 at the 5th intercostal space, left anterior axillary line
- Place V6 directly in line with V5 on the midaxillary line

29 4.4 Electrode Placement

30 4.4 Applying the Electrodes (Cont'd)

- For females, lift left breast and place electrodes in closest position possible
- Limb electrodes
 - □Place on wrists or upper arms and inside of lower legs □Alternate site: shoulders (deltoid), upper legs

31 4.4 Applying the Electrodes (Cont'd)

- Non-standard location of electrodes must be documented on recording
- Troubleshooting
 - □For comparing ECGs, electrodes must be located as close to original sites as possible

32

- Cleanse skin with alcohol pads and pat dry
- Clip or shave hair from the site only if necessary

33 4.4 Applying the Leads

- Chest leads □Usually brown and labeled V1 - V6
 - Electrode tabs point toward feet
- Limb leads □Arm electrode tabs point toward feet □Leg electrode tabs point toward hands

34 4.4 Applying the Leads (Cont'd)

- Avoid looping wires outside of body
- Verify there is no tension on wires or electrodes

35 4.4 Apply Your Knowledge

Where on the body should the V1 electrode be placed?

36 4.4 Apply Your Knowledge

Where on the body should the V1 electrode be placed?

ANSWER: The 4th intercostal space; right of the sternal border

37 4.4 Apply Your Knowledge

Where is an acceptable alternate site for electrode placement on the upper extremity?

38 4.4 Apply Your Knowledge

Where is an acceptable alternate site for electrode placement on the upper extremity?

ANSWER: Shoulder (deltoid)

39 4.5 Safety and Infection Control

- Follow universal precautions
- Wash your hands
- Wear gloves when exposure to blood or bodily fluids is likely

40 4.5 General Safety

- Make sure the procedure is performed on the correct patient
- Raise bed rail if available
- Pull out extension for legs and feet if using an exam table
- Check grounding plug for security

41 4.5 ECG Safety

- Ensure that bed or table is not touching wall or electrical equipment
- Ensure that patient is not touching bed rail, exam table frame or safety rail
- Check insulation wires for cracks

42 4.5 Apply Your Knowledge

True or False: Universal precautions should be practiced on every patient when performing an ECG.

43 4.5 Apply Your Knowledge

True or False: Universal precautions should be practiced on every patient when performing an ECG.

ANSWER: True

44 44 4.6 Operating the ECG Machine

- Operating automatic machine □Press "Run" or "Auto"
- Operating manual machine □Make sure equipment is standardized and set to Lead 1 □Run a few complexes, insert standardization mark

45 45 4.6 Operating the ECG Machine (Cont'd)

Mark lead codes unless automatically done by machine Change lead code dial while machine is running □Run 8 - 10 inches of complexes for Leads I, II, III □Run five inches for remaining leads Deliver Mount tracing immediately upon completion

46 4.6 Apply Your Knowledge

For a manual ECG machine, to which lead should the equipment be standardized and set?

47 47 4.6 Apply Your Knowledge

For a manual ECG machine, to which lead should the equipment be standardized and set?

ANSWER: Lead I

48 4.7 Checking the ECG Tracing

Artifacts caused by: □Somatic tremor □Wandering baseline □AC interference □Interrupted baseline

49 4.7 Checking the ECG Tracing (Cont'd)

■ Somatic tremor – Large spikes caused by muscle movement

50 4.7 Checking the ECG Tracing (Cont'd)

Wandering baseline
AKA baseline shift
Usually caused by improper electrode application

51 4.7 Checking the ECG Tracing (Cont'd)

Alternating current (AC) interference
Small, uniform spikes caused by electricity radiated from other machines
Common sources include improper grounding, lead wires crossed, corroded or dirty electrodes

52 4.7 Checking the ECG Tracing (Cont'd)

Other sources of AC interference
High-tension wires
Diathermy machines
Electrocautery and x-ray machines
Electrical wires in walls, ceilings, and floors

53 4.7 Checking the ECG Tracing (Cont'd)

Interrupted baselines or flat lines on tracings are caused by:
□Loose or unplugged lead
□Switched wires
□Broken wires

54 4.7 Apply Your Knowledge

What is the cause of the following artifact?

55 4.7 Apply Your Knowledge

What is the cause of the following artifact?

ANSWER: Wandering baseline

56 4.8 Reporting Results

Follow your facility's policy

- Make copy, if required
- Fax tracing, if required
- If ordered stat, immediately give tracing to your supervisor

57 **4.8 Billing**

■ Complete designated information accurately

- Incomplete forms may adversely affect the facility's finances
- Enter patient diagnosis and diagnostic code (ICD-9 code)

58 4.8 Apply Your Knowledge

How should you report a stat ECG?

59 4.8 Apply Your Knowledge How should you report a stat ECG?

Answer: Give the results directly and immediately to your superior or the physician.

60 4.9 Equipment Maintenance

- Keep machine clean to prevent infection and present professional image
- For disposable electrodes, clean alligator clips and check for paste/gel
- Disinfect cables and reusable electrodes

61 4.9 Equipment Maintenance (Cont'd)

- Wash straps; replace cracked/broken straps
- Wash reusable electrodes to prevent gel/paste buildup
- Scour reusable electrodes once a week

62 4.9 Equipment Maintenance (Cont'd)

- Wipe patient cables and lead wires with damp cloth
- Replace cracked
- or broken wires
- Store neatly

63 4.9 Apply Your Knowledge

Give two reasons why the ECG machine should be kept clean.

64 🔳 4.9 Apply Your Knowledge

Give two reasons why the ECG machine should be kept clean.

ANSWER: To prevent infection and present a professional image

65 🔳 4.10 Pediatric ECG

- Keep directions simple
- Avoid technical words
- Identify child by name
- Infants may need to use a pacifier or fall asleep for accurate ECG

66 🔳 4.10 Pediatric ECG

- Use smaller electrodes
- Paper speed may need to be adjusted for faster heart rates
- Proper placement of electrodes is more important than in adults
- V3 may require placement on the right side (V₃R)

67 4.10 Apply Your Knowledge

True or False: In pediatric patients, it may be necessary to place the V5 electrode on the right side of the chest.

68 📕 4.10 Apply Your Knowledge

True or False: In pediatric patients, it may be necessary to place the V5 electrode on the right side of the chest.

ANSWER: False; the V3 electrode may be placed on the right side of the chest.

69 4.11 Cardiac Monitoring

Heart rhythm strip
Usually produced by Lead II
Run time approximately 10 seconds
Used to check for heart rhythm abnormalities

70 4.11 Cardiac Monitoring

■ Three electrodes are used □RA white cable/electrode □LA black cable/electrode □LL red cable/electrode

71 4.11 Apply Your Knowledge

When do patients require continuous cardiac monitoring?

72 4.11 Apply Your Knowledge

When do patients require continuous cardiac monitoring?

Answer: At an emergency scene, during or after surgery, when they have cardiac, pulmonary, or electrolyte problems.

73 4.12 Special Patient Considerations

Females

□V1 and V2 may be placed higher due to implants □Place electrode under breast, make note on chart □Mastectomy: make note on chart

■ Amputees – place leads on upper chest and lower abdomen versus arms and legs

74 4.12 Special Patient Considerations (Cont'd)

- Pregnant patients-Place lower limb leads on thighs, not abdomen
- Geriatric patients-Apply electrodes carefully to avoid damaging thin skin
- Note non-standard body positions on tracing-Place electrodes on back only if necessary

75 Special Patient Considerations (Cont'd)

Dextrocardia - heart on right side

Reverse leads from normal placement

- aVR tracing will produce positive deflection
- Indicate right-side on chart
- 76 4.12 Special Patient Considerations (Cont'd)
 - 15- or 18-lead ECG □Used for a right and/or posterior view of the heart □Used to aid in the detection of heart attacks

77 4.12 Special Patient Considerations (Cont'd)

Right electrode placement
V4R: midclavicular line, 5th ICS on right
V3R: between V1 and V4R
V5R: anterior axillary line
V6R: midaxillary line

78 4.12 Special Patient Considerations (Cont'd)

- Posterior electrode placement
 - □V7: left posterior axillary line
 - □V8: under left midscapular line
 - □V9: left paraspinal border

79 4.12 Apply Your Knowledge

A 15- or 18-lead ECG views which additional regions of the heart?

80 4.12 Apply Your Knowledge

A 15- or 18-lead ECG views which additional regions of the heart?

ANSWER: Right and posterior regions

81 4.13 Handling Emergencies

- Cardiac or respiratory arrest □Requires quick/efficient ECG □Pre-enter patient information
- Be prepared to run second ECG □Note "repeat ECG - same lead placement on tracing"

82 4.13 Seizure Emergency

- Stay with the patient
- Protect the patient from injury
- Call for help and report the seizure
- After the seizure, perform the ECG and note "Post Seizure"
- 83 📕 4.13 Apply Your Knowledge

If your patient has a seizure while an ECG is being performed, what should you do?

84 🔳 4.13 Apply Your Knowledge

If your patient has a seizure while an ECG is being performed, what should you do?

ANSWER: Protect the patient, call for help, and report the seizure.

85 Chapter Summary

- Patient, room, and equipment should be prepared for the ECG
- If patient refuses an ECG, identify the reason, document, and notify the supervisor if needed
- Locate anatomical landmarks for applying the ECG electrodes

86 Chapter Summary (Cont'd)

- Follow standard precautions when performing an ECG
- Maintain safety during an ECG procedure
- Be sure to identify your patient
- Watch for artifact when performing the ECG
- Provide the ECG promptly and in proper format

87 E Chapter Summary (Cont'd)

- For the pediatric ECG, V3 may require placement on the right side of the chest
- Special patient considerations may be needed during an ECG
- After completion, the ECG equipment must be cleaned and stored properly