 CLINICAL PRACTICE GUIDELINE	Practice Guideline: Cardiac Monitoring (Adults): Setup, Lead Placement, ST-Segment Monitoring and Alarm Management	
	Approval Date: Feb 12, 2021	Pages: 1 of 6
	Approval By: Professional Advisory Committee Standards Committee	Supersedes: Feb 27, 2019

1.0 PURPOSE:

- 1.1 To standardize the correct placement of electrocardiogram (ECG) electrodes for cardiac monitoring.
- 1.2 To provide guidance on the selection of appropriate monitoring leads based on patient needs so that suitable treatment may be provided.
- 1.3 To provide guidance on detecting recurrent and transient myocardial ischemia through continuous ST-segment monitoring when clinically indicated
- 1.4 To provide guidance on appropriate cardiac monitoring alarm management. This clinical practice guideline does not address hemodynamic, SpO₂ or other clinical monitoring parameters.

2.0 DEFINITIONS:

- 2.1 Continuous Cardiac Monitoring – Refers to the monitoring of the heart’s electrical activity generally by electrocardiography. The type and duration of continuous cardiac monitoring is ultimately a physician’s decision and is dependent upon available existing equipment and human resources. Options may include bedside continuous cardiac monitoring, telemetry monitoring, or 12 lead electrocardiography performed at the bedside by appropriately trained personnel.
- 2.2 Telemetry: A telemetry unit records the electrical activity (ECG) of the heart. The telemetry unit sends the data to a local monitoring system. The local monitoring system may be on the unit and/or located elsewhere (example coronary care or intensive care). The purpose of telemetry monitoring is to detect significant and life-threatening variations in a patient’s cardiac rhythm to facilitate early therapeutic intervention(s).
- 2.3 Arrhythmia - An arrhythmia is broadly defined as an abnormality of the heart rhythm.
- 2.4 ST-Segment – It represents the period between depolarization and repolarization of the ventricles in the heart. and is the flat line between the QRS complex and T wave of the ECG waveform.
- 2.5 Nurse - Refers to Registered Nurses (RN) and Licensed Practical Nurses (LPN). Nurses will follow the policies/procedures outlined by their employer regarding scope of practice.

3.0 GUIDELINE:

- 3.1 The following practice guideline requires nurses with advanced knowledge and skill.
- 3.2 Patient monitoring ECG electrodes are to be changed every 72 hours and as needed (PRN).

3.3 Alarm management guidelines will be program or site specific.

4.0 EQUIPMENT:

- 4.1 Soap, water, and washcloth
- 4.2 Clippers
- 4.3 Package of disposable ECG electrodes
- 4.4 ECG cable and lead wires
- 4.5 Cardiac monitor

5.0 PROCEDURE:

5.1 SKIN PREPARATION FOR ELECTRODE PLACEMENT

- 5.1.1 Perform hand hygiene before direct patient contact and subsequently as indicated.
- 5.1.2 Select sites with intact skin, without impairment of any kind.
NOTE: Electrodes should not be placed over scar tissue, bony prominences, implanted devices, medication patches, lesions, skin folds, burns or erythema.
- 5.1.3 Clip hair from sites as necessary. **NOTE:** Shaving application sites can irritate the skin.
- 5.1.4 Wash sites thoroughly with soap and water, leaving no soap residue.
- 5.1.5 Dry skin thoroughly. **NOTE:** Moist skin is not conducive to electrode adherence. Wiping the electrode area with a washcloth or gauze dries and roughens the skin to enhance conduction.

5.2 CONNECTING ECG LEADS

- 5.2.1 Date each electrode.
- 5.2.2 Attach the ECG leads to the electrodes. **NOTE:** If using ECG leads with clips, attach before or after applying electrodes to patient's skin. If using ECG leads with snaps, attach before applying electrodes to patient's skin to maintain integrity of electrode gel.
- 5.2.3 Apply electrodes to the skin. **NOTE:** If conventional electrode placement cannot be used, refer to CPG ECG Electrode Placement - Staple Method.

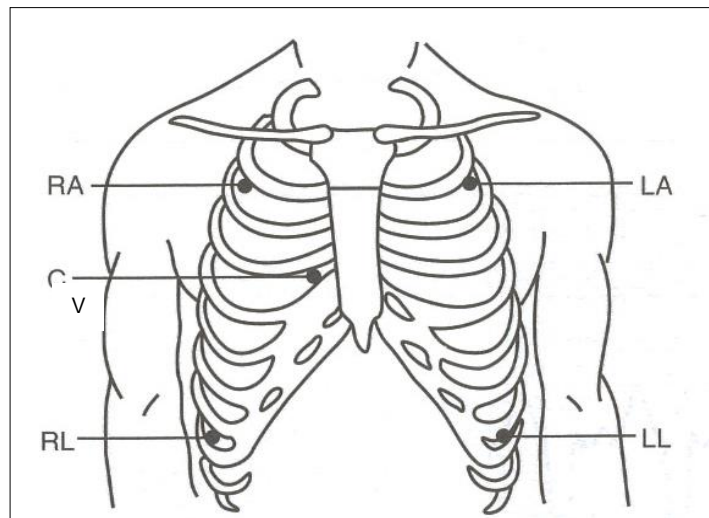
5 Lead System:

RA – below right clavicle, at the second intercostal space (ICS), midclavicular line (MCL).

LA – below left clavicle, at the second ICS, MCL.

RL – below the ribcage, right anterior axillary line.

LL – below the ribcage, left anterior axillary line.



Source: Huff, J. (2017)

NOTE: Electrodes are positioned to minimize artifact.

Only one precordial lead can be displayed. Electrode placement of precordial lead will identify the lead used.

Precordial lead (V Lead) –
select appropriate location (see below):

V₁ – 4th ICS, right sternal border.

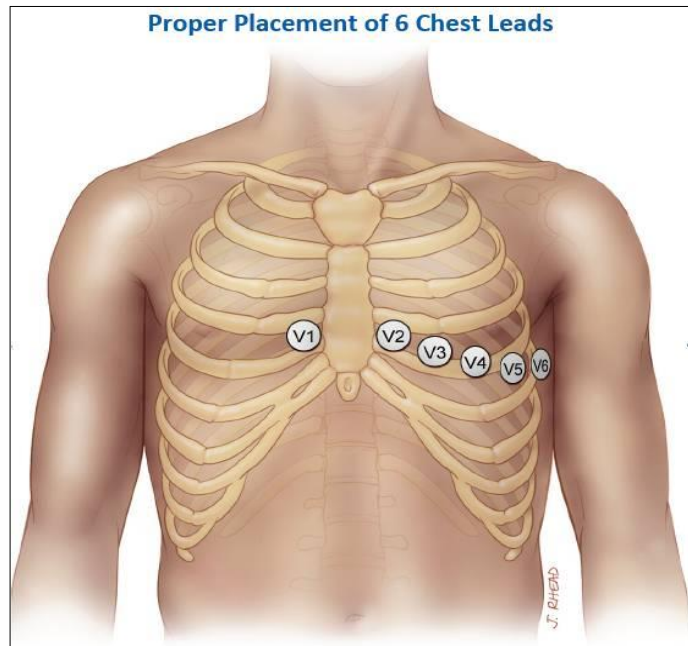
V₂ – 4th ICS, left sternal border.

V₃ – between V₂ and V₄.

V₄ – 5th ICS, left MCL.

V₅ – between V₄ and V₆, left anterior axillary line.

V₆ – left midaxillary line at the same horizontal level as V₄.



Source: <http://viyoutube.com/video/IUbWKy0weAc>

NOTE: Recommended monitoring leads are:

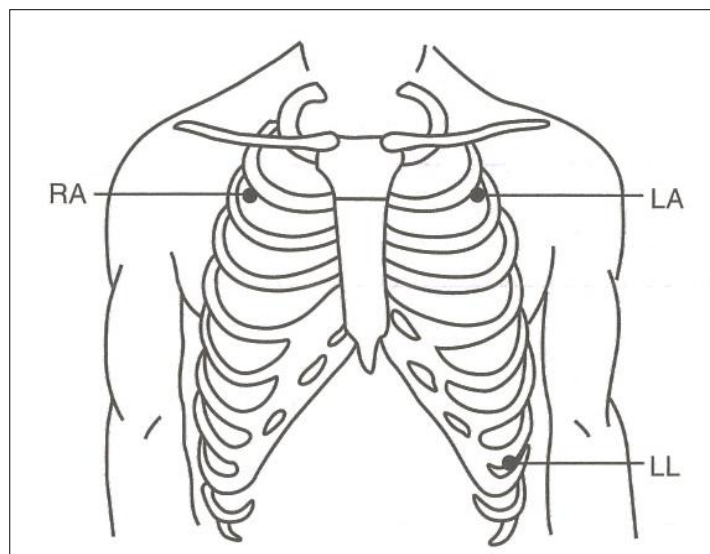
- Arrhythmias: Leads II, V₁
- Acute Coronary Syndrome (ACS): Leads III, V₃
- Demand Ischemia (ICU patients): Lead V₅ or as directed by clinical pathway documents for specific areas.

3 Lead System:

RA – close to the right shoulder near the junction of the right arm and torso.

LA – close to the left shoulder near the junction of the left arm and torso.

LL – just below the ribcage, midclavicular line



Source: Huff, J. (2017)

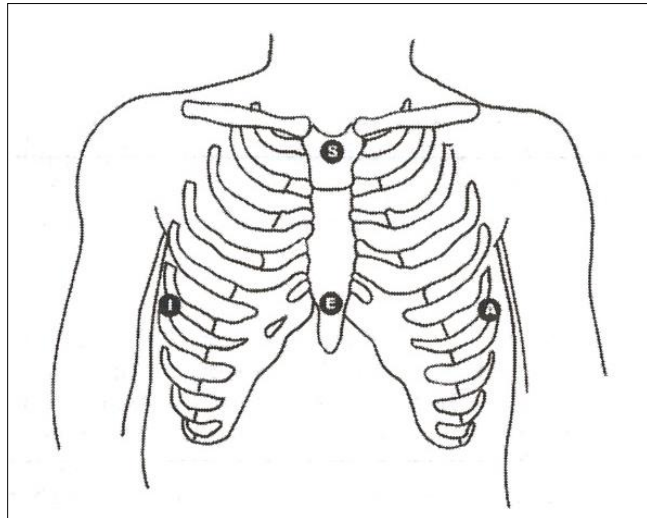
EASI Lead System:

E – lower part of the sternum at the level of the fifth intercostal space (brown).

A – left midaxillary line at the level of the fifth intercostal space (red).

S – upper part of the sternum (black).

I – right midaxillary line at the level of the fifth intercostal space (white).



Source: Zègre-Hemsey, J.K., Garvey, J.L., Carey, M.G. (2016)

A fifth ground electrode can be placed anywhere on the patient's chest, usually below the 6th rib on the right hip (green).

NOTE: A reduced lead set ECG is not identical to the standard ECG and is not to be compared with a previously recorded standard ECG for diagnoses that require serial ECG assessment.

- 5.2.4 Plug ECG cable into the ECG module. **NOTE:** An ECG waveform and value will appear on the monitor display. If the patient has a pacemaker, ensure monitor is set appropriately to recognize pacing.
- 5.2.5 In the setup ECG menu, select appropriate lead(s) if monitoring additional leads or leads other than monitor defaults. **NOTE:** Select primary and secondary lead if available on the monitor. The monitoring lead choices are to be based on the clinical situation and monitoring goals.
- 5.2.6 Set ECG alarm limits based on patient condition and ensure they are enabled at all times.

5.3 **ST-SEGMENT MONITORING**

- 5.3.1 Place patient in supine position with head of bed elevated less than (< 45) degrees for ST-segment analysis and to ensure artifact free ECG is obtained.
- 5.3.2 Ensure ST-segment monitoring is enabled if clinically indicated. Use the most appropriate leads for ST-segment monitoring. **NOTE:** Lead selection is based on the patient's needs and risk for ischemia and/or arrhythmias. Monitor as directed by Physician, or per unit/program protocols/guidelines. Examples of possible lead selection are as follows:
 - 5.3.2.1 For ACS patients, the leads that best display the patient's identified area of ischemia are:
 - Inferior wall – II or III
 - Septal wall – V₁ or V₂
 - Anterior wall – V₃ or V₄
 - Lateral wall – I, V₅ or V₆
 - 5.3.2.2 For ACS patients with unknown area of ischemia or suspected ACS, use leads III, V₃.

- 5.3.2.3 For non-cardiac patients, V_5 is valuable for identifying demand-related ischemia that can be caused by critical illness.
- 5.3.3 ST-segments cannot accurately be measured using the 3 Lead System.
- 5.3.4 It may be difficult to achieve reliable ST-segment monitoring if:
- There is artifact - something not "heart-made.". These include (but are not limited to) electrical interference by outside sources, electrical noise from elsewhere in the body, poor contact, and machine malfunction.
 - Arrhythmias are present such as atrial fibrillation/flutter (irregular baseline).
 - There is continuous ventricular pacing.
 - The patient has a left bundle branch block.
 - Tachycardia is present.
- 5.3.5 Set the ST alarm parameter to 1 to 2 mm above and below the patient's baseline ST-segment. Ensure alarms are always enabled.
NOTE: ST-segment depression or elevation of 1 to 2 mm that lasts for at least 1 minute can be clinically significant and warrants further patient assessment.
NOTE: Using the patient's baseline ST-segment level is preferred as the patient's baseline is rarely isoelectric.

5.4 Alarm Management

- 5.4.1 Activate monitor alarms at the beginning of each shift, when establishing cardiac monitoring or with any significant changes in patient condition. Alarms are never to be turned off. Exception: end of life care when cardiac monitoring is likely discontinued.
- 5.4.2 Adjust alarm parameters according to patient presentation, sound clinical judgement and guided by institution policies, procedures, or standard work. Setting alarm limits lower than clinically relevant for a patient may result in reduced awareness of patient critical conditions.
- 5.4.3 Do not turn alarm volumes to off or inaudible. Exception: end of life care.
- 5.4.4 Communicate all significant alarms that are clinically relevant to the physician. Significant alarms may vary according to patient's clinical status.

6.0 DOCUMENTATION

6.1 ECG Rhythm Strip Record Sheet or Unit Specific ECG Mounting Tool

- 6.1.1 An ECG rhythm strip is to be analyzed and mounted on admission, at the beginning of every shift and as needed with significant rhythm changes or with arrhythmias.
- 6.1.2 On each rhythm strip, document date/time, rhythm regularity, atrial and ventricular rates, PR interval, QRS complex, QT interval and lead, AV conduction, impression, symptoms and action.

6.2 Intensive Care Flowsheet or Unit Specific Nursing Documentation Tool:

- 6.2.1 Cardiac rhythm and heart rate as per order set, clinical pathway and PRN.
- 6.2.2 Frequency and type of ectopic beat(s) as per order set, clinical pathway and PRN.

- 6.2.3 ST-segments on admission and PRN. If continuous monitoring is required as per clinical condition or per unit/program protocols or guidelines, document q4h and PRN. **NOTE:** Refer to ST-Segment Learning Package – Clinical Conditions for ST-Segment Monitoring.
- 6.2.4 Any alarms communicated to the physician and subsequent actions.

7.0 REFERENCES:

- 7.1 American Association of Critical Care Nurses Practice Alert: Dysrhythmia Monitoring in Adults (2016). Retrieved from: <https://www.aacn.org/clinical-resources/practice-alerts#page/1> Doi <http://dx.doi.org/10.4037/ccn2016767>
- 7.2 American Association of Critical Care Nurses Practice Alert: Ensuring Accurate ST Segment Monitoring (2016). Retrieved from: <https://www.aacn.org/clinical-resources/practice-alerts#page/1> Doi: <http://dx.doi.org/10.4037/ccn2016935>
- 7.3 American Association of Critical Care Nurses Practice Alert: Alarm Management (2016). Retrieved from: <https://www.aacn.org/clinical-resources/practice-alerts#page/1>
- 7.4 Covidien (2008). *Product information: Electrode selection and wear time*. Point-Claire: Author.
- 7.5 Elsevier Mosby nursing Skills Online Resource. *Cardiac monitor setup and lead placement*. Retrieved from: http://lms.elsevierperformancemanager.com/ContentArea/NursingSkills/GetNursingSkillsDetails?skillid=CC_054&skillkeyid=66&searchTerm=cardiac%20monitor&searchContext=nursingskills
- 7.6 Elsevier Mosby nursing Skills Online Resource. *Continuous ST segment monitoring*. Retrieved from: http://lms.elsevierperformancemanager.com/ContentArea/NursingSkills/GetNursingSkillsDetails?skillid=CC_056&skillkeyid=68&searchTerm=ST%20monitoring&searchContext=nursingskills
- 7.7 Harris, P. R. E. (2016). The normal electrocardiogram: Resting 12 lead and electrocardiogram monitoring in the hospital. *Critical Care Nursing Clinics of North America*, 28(2016), 281-296. Retrieved from: <http://dx.doi.org/10.1016/j.cnc.2016.04.002>
- 7.8 Huff, J. (2017). *ECG Workout: Exercises in arrhythmia interpretation* (7th ed.). Philadelphia: Wolters Kluwer.
- 7.9 GE Medical Systems. (2014). *Carescape Central Station User's Manual: Software version 1, Hardware series MP100*. 85-104. USA: General Electric Company.
- 7.10 Jevon, P. & Ewens, B. & Pooni, J. S. (2013). Monitoring cardiovascular function1: ECG monitoring. *Monitoring the Critically Ill Patient*, 91-114. Wiley-Blackwell. Retrieved from: <http://onlinelibrary.wiley.com/book/10.1002/9781118702932>. Doi: 10.1002/9781118702932
- 7.11 Lough, M. E. & Thompson, C. (2014), In Urden, L.D., Stacy, K. M., & Lough, M. E. (Eds.). *Critical care nursing: Diagnosis and Management* (7th ed.), 237-337. St. Louis: Mosby.
- 7.12 McKinley, M. G. (2011). Electrocardiographic leads and cardiac monitoring. In Weigland, D. L. (Ed.), *AACN Procedure Manual for Critical Care*, 490-500. Philadelphia: Elsevier Saunders.
- 7.13 Philips (2006). *ST Segment Monitoring*. Retrieved from: <http://www.mc.vanderbilt.edu/documents/7north/files/STSegmentMonitoring%204522%20962%2020161.pdf>
- 7.14 Philips (2007). *Intellivue patient monitor manual: Patient monitoring*. Germany: Philips.

- 7.15 Sandau, K. E., Funk, M., Auergach, A., Barsness, G. W., Blum, K., Cvach, M., ... Wang, P. J. (2017). Update to practice standards for electrocardiographic monitoring in hospital settings: A scientific statement from the American heart association. *Circulation* 136(19), e273-e344. <https://doi:10.1161/CIR.0000000000000527>.
- 7.16 Zegre-Hemsey, J. K., & Garvey, J. L., & Carey, M. G. (2016). Cardiac Monitoring in the Emergency Department. *Critical Care Nursing Clinics of North America*, 28(2016), 331-345. Retrieved from: <http://dx.doi.org/10.1016/j.cnc.2016.04.009>