AACN PRACTICE ALERT

ST SEGMENT MONITORING

Expected Practice:

- ☑ If 12 lead ECG is available continuous ST segment monitoring should be performed using all 12 leads.
- ☑ If 12 lead ECG is unavailable use the most appropriate leads for ST segment monitoring based on the patient's needs and risk for ischemia and/or dysrhythmia.
  - o For patients with Acute Coronary Syndromes (ACS) and a known "ST fingerprint", obtained during ST Segment Elevation Myocardial Infarction (STEMI) or Percutaneous Coronary Intervention (PCI), use the lead(s) that best displays the patient's "ST fingerprint" when monitoring.
  - o If the "ST fingerprint" is not known in ACS use Leads III and V_3.
  - o For patients without definitive ACS, but are suspected of having or being ruled out for ACS, leads III and V_5 should be monitored.
  - o In non-cardiac patients undergoing surgical procedures or admitted to the ICU, lead V_5 is valuable for identifying demand-related ischemia, which appears to be more common in this group of patients.
- ☑ Properly prepare the patient's skin before attaching the ECG skin electrodes.
- ☑ Once proper lead placement has been determined, mark skin electrode placement with indelible ink. Do not alter the location of the skin electrodes during monitoring as this can create false positive ST segment changes.
- ☑ Evaluate ST segment with the patient in the supine position, set the ST alarm parameter 1-2 mm above and below the patient's baseline ST segment and measure ST segment changes 60ms beyond the J point of the ECG complex (Figure 1).
- ☑ ST depression or elevation of 1-2 mm that lasts for at least 1 minute can be clinically significant and warrants further patient assessment.

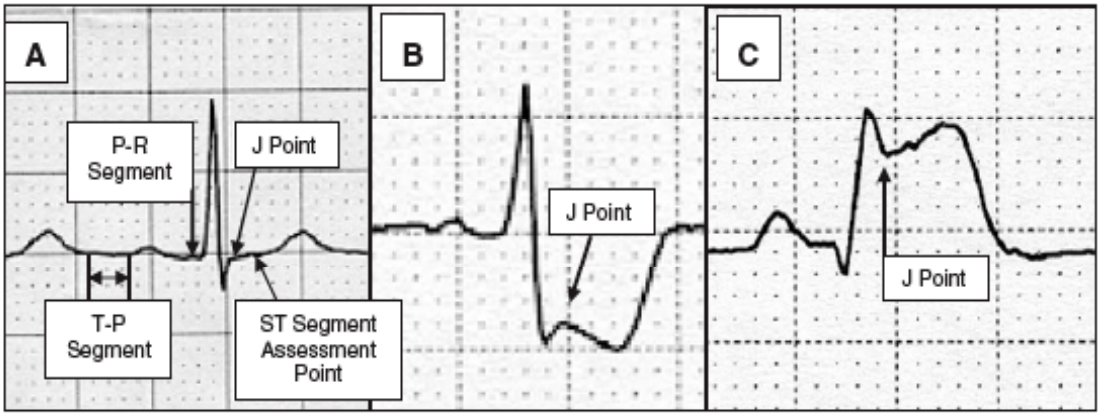

Fig. 1. (A) A normal ECG complex shows T-P segment and P-R segment, which may be used as reference points to the isoelectric line. The ST-segment is measured at 0.06 seconds after the J point. This ST-segment is isoelectric. (B) ECG complex show ST-segment depression of almost 5 mm. (C) ST-segment elevation of approximately 4 mm is depicted.

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Pediatric Specific

In neonates and infants it is better to consider the TP segment as the isoelectric line. For neonates and infants ST changes of 1 mm or greater above the isoelectric line are considered clinically significant.

Scope and Impact of the Problem:

- ST segment monitoring can detect silent ischemia, that which occurs in the absence of symptoms. Although the impact of ST segment monitoring on patient outcomes is not known, when ST segment monitoring is used it is imperative that accurate data are obtained.

Supporting Evidence:

- ST segment monitoring is useful for detecting silent ischemia.[2-4] ST segment monitoring is more sensitive than patients self-reporting of symptoms because 70-90% of episodes of myocardial ischemia detected with ECG are clinically silent. [2,4-8] It is important to point out that no randomized controlled trials have been conducted to determine whether the addition of ST segment monitoring improves patient outcomes.[9] (Level V)
- Several studies have demonstrated silent myocardial ischemia, as detected by continuous ST segment monitoring, may occur during the process of weaning from mechanical ventilation.[10-15] The presence of ST segment deviation prior to the initiation of the weaning process has been shown to increase the likelihood of weaning failure.[12-15] However the effect of ST segment monitoring on weaning outcomes is not known. The clinical utility of continuous ST segment monitoring during weaning has not been studied. (Level IV)
- Research demonstrates that monitoring for ST segment changes in multiple leads, preferably 12 leads, substantially improves the chance of identifying ischemic events.[4,16,17] (Level V)
- If all 12 leads are not available in the bedside monitor, use the patient's "ST fingerprint" to select the best ECG lead(s), which show maximal ST segment deviation. An ST fingerprint is defined as the pattern of ST-segment elevation and/or depression unique to a particular patient based on the anatomic site of coronary occlusion. A fingerprint can be obtained during known ischemia (STEMI or during PCI).[4,9,18-22] (Level V)
- If only 2 leads are available for ST segment monitoring, and an ST fingerprint is not available, leads III and V_3 are recommended for patients with acute coronary syndromes or suspected ACS.[4,9,19,23] (Level IV)
- In noncardiac patients undergoing surgical procedures[24] or admitted to the ICU[26], lead V_5 is valuable for identifying demand-related ischemia, which appears to be more common in this group of patients. (Level IV)
- Failure to properly prep the skin before placing the electrodes may cause the monitoring alarms to sound erroneously. Preparation may include carefully clipping hair areas where electrodes are to be placed and/or cleaning the skin with alcohol to remove skin oils.[4,9,27,28] (Level IV)
- Variability of electrode placement may occur during routine ECG. Expert consensus recommends marking the locations of the electrodes with indelible ink to assure that if electrodes are removed for any reason (leads V_2 and V_3 are typically removed during recording of echocardiograms) they can be replaced in their original locations. ECG information obtained from electrodes located close to the heart (precordial leads) is especially prone to waveform changes when the electrodes are relocated as little as 1 cm away from the original locations.[9,29] (Level II)
- Because a change in body position (right-, left-side lying) can alter the ST segment mimicking ischemia[30] when an ST alarm sounds and the patient is found in a side-lying position, the patient should be returned to the supine position. If the ST segment deviation persists in the supine state, it should be considered indicative of myocardial ischemia. [3,4,19] If possible, obtain "positional 12 lead ECG's" with the patient assuming right and left side lying positions at the initiation of ST monitoring. These positional ECG's can be used to identify false ST segment changes. (Level IV)
- Set the ST segment alarm parameter at 1 mm above and below the baseline ST segment in patients at high risk for ischemia and at 2 mm in more stable patients.[9] (Level II)
- Measure ST segment changes 60 ms beyond the J point of the ECG complex.[9] (Level II)
- ST depression or elevation of 1-2 mm that lasts for at least 1 minute can be clinically significant and warrants further patient assessment.[4,26,27] (Level II)
- Because most patients with coronary artery disease do not have perfectly isoelectric ST segments[31], it is important to set alarm parameters to 1 to 2 mm around the patient's baseline ST level. (Level IV)
- The goal of monitoring must be considered for each patient. For instance, in patients presenting for STEMI the goal of ST monitoring is to observe rapid ST segment recovery (back to isoelectric) within the one hour of treatment. Whereas, in patients presenting with ACS, the goal is to detect transient or recurrent ST segment changes[9]. (Level II)
- ST segment elevations greater than 1 mm above the isoelectric line are uncommon in the newborn. In neonates and infants it is better to consider as the isoelectric line the TP segment instead of the PR segment. T waves are normally quite variable in the first week of life. After one week, the T wave is negative in lead V1 and positive in V5-V6. [32] (Level II)

AACN Grading Level of Evidence

Level I: Manufacturer's recommendations only
Level II: Theory based, no research data to support recommendations: Recommendations from expert consensus group may exist
Level III: Laboratory data, no clinical data to support recommendations
Level IV: Limited clinical studies to support recommendations
Level V: Clinical studies in more than one or two patient populations and situations to support recommendations

Level VI: Clinical studies in a variety of patient populations and situations to support recommendations

Actions for Nursing Practice:

- When replacing current ECG monitoring equipment, consider equipment that has ST segment monitoring capabilities.
- Review organization policies and procedures related to cardiac monitoring to assure same standard of care across settings.
- Develop proficiency standards for all staff involved in the monitoring process to ensure patient safety and effective monitoring.
- Provide appropriate ECG education for staff.
    - Include didactic content and "hands-on" practice with return demonstration of lead placement
- Conduct audits, at least annually, on determining appropriate leads to use for ST segment monitoring and appropriately setting ST alarm parameters.

Need More Information or Help?

- Talk with a clinical practice specialist for additional information/assistance (www.aacn.org) then select PRN.

References:

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