Bedside Cardiac Monitoring

Carol Jacobson, RN, MN, CCRN

Q What is the best lead to use for continuous bedside monitoring to detect arrhythmia?

The choice of monitoring lead should be based on the patient’s clinical situation and dictated by the arrhythmias most likely to occur and be clinically significant for that patient:

- Premature atrial complexes, abnormal sinus rhythms, and most heart blocks, can be recognized in any lead that displays clear P waves and QRS complexes.

- Atrial fibrillation can be recognized in most leads by the irregular R-R intervals and chaotic atrial activity that characterize this rhythm.

- When the QRS becomes wide, as it does in bundle branch block, ventricular rhythms, and antegrade conduction over an accessory pathway, it is very important to choose a lead that best displays the electrocardiographic criteria used to differentiate wide QRS rhythms.

Research consistently shows that leads V1 and V6 (or their bipolar equivalents MCL1 and MCL6) are the best leads for differentiating wide QRS rhythms. The QRS morphologies displayed in these leads are invaluable in differentiating ventricular tachycardia from supraventricular tachycardia with aberrant conduction. Other criteria used in the differential diagnosis, such as the presence of AV dissociation, QRS width, QRS axis, and the presence of fusion or capture beats, can be observed in other leads as well. Multiple-lead monitoring is better than single-lead monitoring, and a 12-lead ECG should be done during the arrhythmia whenever possible.

Q: How do I get lead V1 and V6 on my bedside monitor?

Most newer bedside monitors allow monitoring of 2 leads simultaneously but only allow monitoring of one precordial (V) lead at a time. Leads V1 or V6 can be obtained by using a 5-lead bedside monitoring cable with limb electrodes placed as shown in Figure 1:

- Arm electrodes should be placed on the shoulders as close as possible to where the arms join the torso. Although the arm electrodes

Figure 1 Electrode placement for a 5-lead system

C, chest; LA, left arm; LL, left leg; RA, right arm; RL, right leg.

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are commonly placed on the anterior shoulder area, placement on the top or posterior area of the shoulder is also acceptable.

- Leg electrodes should be placed at the level of the lowest ribs on the thorax or on the hips.
- To monitor in lead V1, place the chest electrode in the fourth intercostal space at the right sternal border and select “V” on the bedside monitor. To obtain V6, place the chest electrode in the fifth intercostal space at the left midaxillary line and select “V” on the bedside monitor.

Another option available with a 5-lead system is to monitor lead V1 and the bipolar lead MCL6 simultaneously by placing the electrodes as shown in Figure 2. The arm electrodes are placed on the shoulders, the right leg electrode is placed low on the right thorax or right hip, and the left leg electrode is placed in the V6 position (fifth intercostal space, left midaxillary line). With the electrodes in this position, select “V” on the first channel of the bedside monitor to display V1, and select lead III on the second channel to display MCL6. This combination of leads allows an accurate diagnosis of wide complex rhythms 90% of the time.8

Q: If our bedside monitors use a 3-lead cable, can we still monitor V1 or V6?

When using a 3-wire cable for monitoring it is not possible to obtain a true unipolar V1 or V6 lead. In this case, the bipolar equivalents MCL1 and MCL6 can be recorded by placing electrodes as shown in Figure 3. Place the right arm electrode on the left shoulder, the left arm electrode at the V1 position (in the fourth intercostal space at the right sternal border), and place the left leg electrode in the V6 position (fifth intercostal space at the left midaxillary line). With electrodes in this position, select lead I on the monitor to obtain MCL1 and switch to lead II on the monitor to record MCL6.

Q: Our bedside monitors use a 5-lead cable and give us a choice of monitoring either V or MCL. Does it matter which one we choose?

The bipolar leads MCL1 and MCL6 are valid substitutes for their true unipolar counterparts, V1 and V6, most of the time. However, Drew and Scheinman5 found that during ventricular tachycardia, QRS morphology recorded simultaneously in V1 and MCL1 was clearly different 38% of the time. Monitoring with an MCL lead is acceptable when using a 3-lead system, but is not recommended when it is possible to obtain a true V lead.7 Therefore, when using a 5-lead system it is best to select the true V lead.

Q: When should we use ST-segment monitoring?

ST-segment monitoring has become an important part of patient monitoring to detect ischemia and coronary artery reocclusion in patients who have received thrombolytic therapy or interventional cardiology procedures such as atherectomy, stents, or rotablation. It is also useful in detecting silent ischemia and in evaluating chest pain in patients presenting to the emergency department with atypical pain and nondiagnostic ECGs.

Q: What leads should be used when doing ST-segment monitoring?

Lead selection for ST-segment monitoring depends on the coronary artery involved in the acute infarction or interventional procedure being performed (see Table).
Most current bedside monitors display only 2 leads simultaneously and allow monitoring of only one V lead at a time. If lead V1 is used for arrhythmia detection, then a limb lead is the only choice for ST-segment monitoring. Lead selection for ST-segment monitoring can be facilitated by noting the patient’s “ischemic fingerprint.” The ischemic fingerprint is the unique pattern recorded during each patient’s acute ischemic event or when the balloon is inflated during percutaneous transluminal coronary angioplasty. Choose a lead with maximum ST elevation or depression recorded during ischemia. If no ischemic fingerprint is available or if maximum ST-segment deviation occurs in a V lead, continuous 12-lead ST-segment monitoring provides a global view of the heart and is the best choice if it is available. 12-lead monitoring allows the use of all limb leads and all V leads simultaneously, eliminating the need to rely on limb leads alone for ST-segment monitoring and avoiding the need to choose the “best” leads for the patient’s clinical situation. Monitoring using all V leads provides the 2 best arrhythmia detection leads (V1 and V6) and allows ST-segment monitoring in V2 and V3 for patients with anterior myocardial infarction or interventions in the left anterior descending artery.

In summary, the best arrhythmia monitoring lead is V1 (or MCL1); the next best is V6 (or MCL6). Leads III or aVF are the best limb leads for ST-segment monitoring in the absence of an ischemic fingerprint to guide lead selection, or in patient’s whose maximum ST deviation occurs in a V lead. Continuous 12-lead monitoring is the ideal when available. 9

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References

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