

Value of Monitoring a Second Precordial Lead for Patients in a Telemetry Unit

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Case report

Mr. M., a 62-year-old with a history of stable angina pectoris, is admitted to a telemetry unit because of recent episodes of acute shortness of breath and near syncope. Mr. M.'s cardiologist thinks the symptoms may be due to an arrhythmia or episodes of acute myocardial ischemia. The cardiologist explains that Mr. M. had a cardiac catheterization two weeks before which showed stenotic lesions in the left anterior descending (LAD) coronary artery which were too diffused to treat with coronary angioplasty or stenting. The patient was offered coronary artery bypass surgery and was considering this option when his symptoms developed.

Nursing implications

The goal of monitoring Mr. M. is to document any arrhythmias or acute myocardial ischemia episodes he might have and to correlate these ECG changes with his symptoms ¹. The best ECG lead for monitoring arrhythmias is lead V1 because if Mr. M.'s symptoms are due to the development of a wide QRS complex tachycardia, there are criteria in the QRS configuration in lead V1 that can be used to distinguish ventricular tachycardia from supraventricular tachycardia with aberrant conduction ^{2, 3}.

The best ECG lead for monitoring for acute ischemia related to the LAD coronary artery is lead V3 ^{4, 5, 6}.

Therefore, to detect both arrhythmias and acute ischemia, the ideal lead combination for Mr. M. would be V1 and V3. Unfortunately, the telemetry system in Mr. M.'s unit allows for monitoring only one precordial lead because there is only one chest lead (Figure 1).

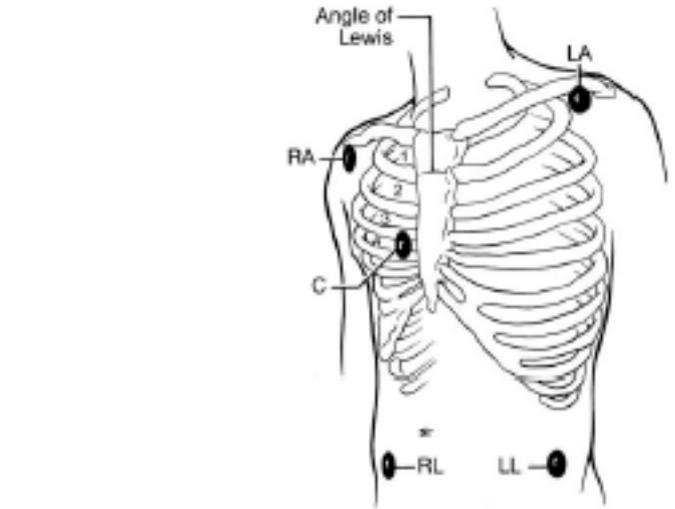


Figure 1. Current cardiac monitors typically have patient cables with five lead wires which allow for monitoring any of the six limb leads (I, II, III, aVR, aVL, aVF), but only one precordial lead. While the chest (C) electrode can be placed in any of the six precordial sites for monitoring (V1 is illustrated here), it is impossible to monitor two precordial leads at the same time.

Therefore, the nurse must choose between two bad options: (a) monitoring for arrhythmias while ignoring ischemia (V1), or (b) monitoring for ischemia while ignoring arrhythmias (V3). The nurse selects lead V1.

At 6:00 a.m., Mr. M. has an 11-beat burst of wide QRS complex tachycardia (Figure 2) which is diagnosed as supraventricular tachycardia (SVT) with an aberrant ventricular conduction because of the QRS configuration in lead V1 (Figure 3). Mr. M. is unaware of any symptoms at this time and, therefore, the arrhythmia is not considered the cause of his symptoms. Moreover, nonsustained SVT is not life threatening and doesn't warrant immediate treatment.

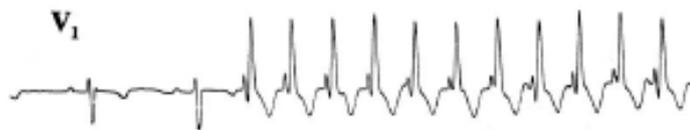


Figure 2. Onset of wide QRS complex tachycardia recorded in lead V1 shows a triphasic rsR' pattern, which favors the diagnosis of supraventricular tachycardia with aberrant ventricular conduction.

Configuration V1 Favors

	Configuration V1:	Favors
Taller left peak		VT
Biphasic RB or OR		VT
Triphasic rsR or rR		SVT

Figure 3. During a wide QRS complex tachycardia, an upright complex in V1 is likely to be ventricular in origin if the configuration is a taller left peak or biphasic RS or QR pattern. A triphasic pattern is likely to be supraventricular tachycardia with right bundle branch block or aberrant ventricular conduction.

At 7:15 a.m., Mr. M.'s monitor alarm sounds and the rhythm strip shows a sustained wide QRS complex tachycardia at a rate of 188 beats per minute (Figure 4). Mr. M. is sitting in the bedside chair complaining of shortness of breath and "a feeling that I'm going to pass out." His blood pressure is palpable at 80 systolic. While Mr. M. does not lose consciousness, it is clear that the arrhythmia is ventricular tachycardia (VT) because of the QRS configuration in lead V1. Moreover, it is imperative to immediately terminate the VT before it degenerates into ventricular fibrillation, causing a cardiac arrest. Mr. M. is assisted back to bed and a bolus of Lidocaine is successful in terminating the tachycardia.



Figure 4. Wide QRS complex tachycardia shows an upright QRS complex with a "taller left peak" pattern in lead V1, which indicates a diagnosis of VT.

Nursing implications

Monitoring lead V1 proves valuable in this patient because it provides ECG criteria to make the important distinction between SVT and VT. Without these criteria, the nurse may have thought the sustained tachycardia (Figure 4) was SVT because the patient did not lose consciousness. A drug commonly used to terminate SVT is verapamil, a calcium channel blocker which is not efficacious in treating VT. Moreover, verapamil is contraindicated for patients with VT because it has negative inotropic effects and can cause sudden hemodynamic deterioration and cardiac arrest in patients with VT 7.

An ECG technician hands the nurse two standard 12-lead ECGs that were recorded at 7:03 a.m. and 7:08 a.m., just prior to the sustained VT (Figures 5 and 6). The reason two ECGs were recorded was that the technician was training a new employee so the first ECG was demonstrated by the technician and the second ECG was recorded by the new employee.

The second ECG shows an ischemic event with striking ST segment elevation in leads V3 – V5 (Figure 6). Of interest, the ST segment in lead V1 does not change during this time, which explains why the ST monitor alarm was not triggered during this ischemic episode. Moreover, the patient did not experience chest pain or other symptoms during this time, so his nurse was unaware of this ischemic event.

Mr. M.'s cardiologist is grateful for the inadvertent 12-lead ECG documentation of an ischemic event prior to the development of VT because it indicates that the trigger for malignant ventricular arrhythmias in Mr. M. is acute ischemia. Thus, the need for coronary bypass surgery is a high priority and surgery is scheduled for the next day. In addition, intravenous (IV) nitroglycerine is initiated with an order to "titrate up if further ischemic episodes occur."

Baseline 7:03 a.m.



Figure 5. Standard 12-lead ECG showing Mr. M.'s normal ST segments recorded prior to an ischemic event.

Ischemic Event 7:08 a.m.

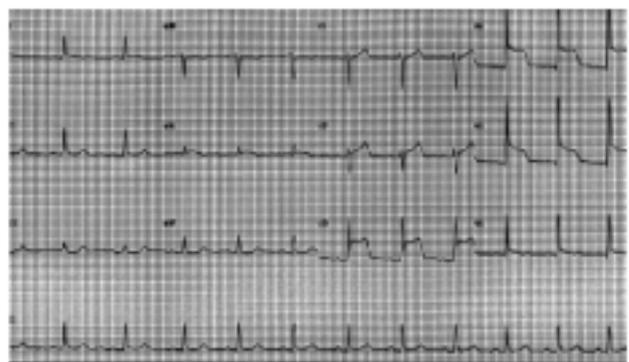


Figure 6. Standard 12-lead ECG recorded minutes later showing ST segment elevation, which is best visualized in leads V3 – V5. Mr. M.'s cardiac monitoring lead V1 fails to detect this ischemic event. Another routinely used monitoring lead (lead II) also fails to detect acute ischemia in this patient

Nursing implications

The nurse realizes that the ECG documentation of this ischemic episode was a lucky accident. It would have been missed with routine cardiac monitoring of leads V1 or II. The dilemma the nurse faces now is how best to monitor Mr. M. for both arrhythmias and ischemia over the next 24 hours prior to surgery. Because Mr. M. has silent ischemia, the nurse cannot rely on chest pain symptoms to detect acute ischemic episodes. Moreover, without chest pain symptoms, the nurse will not be cued as to when to record a “stat” 12-lead ECG with an ECG cart to document further ischemic episodes. If monitoring is continued with lead V1, the titration of IV nitroglycerine will be based on guesswork rather than valid ECG data. However, if the monitoring lead is changed to lead V3, future episodes of wide QRS complex tachycardia will not contain the valuable QRS criteria to make the important distinction between VT and SVT. What is needed is a telemetry system that provides for monitoring of two precordial leads (e.g., V1 and V3) so that both goals of monitoring (arrhythmias and ischemia) can be achieved in this patient.

Recommended leads for cardiac monitoring

Arrhythmia monitoring

- For diagnoses of bundle branch blocks, right versus left ventricular pacing rhythms, ventricular versus supraventricular tachycardia with aberrancy – lead V1
- For diagnosis of atrial flutter – lead II, III, or aVF

Ischemia monitoring ⁸

- Acute anterior Myocardial Infarction (MI) or left anterior descending artery interventions – lead V2 or V3 (ST elevation)
- Acute inferior MI or right coronary artery interventions – lead II, III, or aVF (ST elevation)
- Posterior infarction or left circumflex artery interventions – lead V2 or V3 (reciprocal ST depression)
- Ischemia related to increased myocardial O₂ demand (e.g., early post-operative period, angina related to increased heart rate or development of a tachycardia): lead V5 (ST depression)

About the author —

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Dr. Barbara Drew is a Professor at the University of California, San Francisco, where she teaches cardiovascular and critical care nursing in the Master of Science and Doctoral programs and conducts research related to cardiac electrocardiology and cardiac monitoring. The primary goal of Dr. Drew's research is to improve cardiac monitoring techniques and practices for more accurate diagnosis of arrhythmias and myocardial ischemia. She brings to the research enterprise the knowledge and skills gleaned over 20 years of clinical experience in coronary intensive care units. Currently, she is principal investigator of a three year study funded by the National Institutes of Health to determine the value of 12-lead ST segment monitoring in patients with acute coronary syndromes. Dr. Drew is a fellow of the American Academy of Nursing, the American Heart Association's Council of Cardiovascular Nursing, is active in the American Association of Critical-Care Nurses, and is an editorial board member and manuscript reviewer for many cardiovascular and critical care journals. She has published over 100 articles and research abstracts. She is the recipient of numerous awards, including a Distinction in Teaching Award at UCSF, the Hewlett-Packard AACN Critical Care Nursing Research Award, the 1995 Sigma Theta Tau International Research Utilization Award, and the 1997 Martha Hill New Investigator Award from the American Heart Association.

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