THE MOST IMPORTANT TEST

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RECENT ENHANCEMENTS MADE TO PHILIPS DXL ECG ALGORITHM EXPEDITE DETECTION OF ACUTE ISCHEMIA, AMI & STEMI

STEMI patients are ideal candidates for time-critical interventions, and they are now often identified in the field.

The clinical presentation of acute myocardial infarction (AMI) varies greatly among individuals and requires consideration of clinical findings, electrocardiographic (ECG) features and the presence of myocardial cell death.[1] Of these, the ECG is most important, because it can quickly identify ST elevation myocardial infarction (STEMI, a subset of AMI). This is especially important since STEMI patients are ideal candidates for time-critical interventions, such as coronary artery catheterization or fibrinolytic therapy.

Over the past several years, numerous EMS systems have enhanced their prehospital diagnostic and treatment considerations for AMI through the use of ECG technology. The field ECG's ability to aid in the quick diagnosis of STEMI has also led to the development of dedicated systems of care, including transport to specialized STEMI receiving centers (STEMI-RC).[2] Once acquired, the 12-lead ECG can be interpreted by physician, paramedic or STEMI-RC, depending on the technology and sophistication of the EMS system.[2]

Recently, the American Heart Association (AHA), in conjunction with the American College of Cardiology (ACC) and the Heart Rhythm Society (HRS), published a series of scientific statements on the standardization and interpretation of the ECG. The last of these focused on recommendations for improved detection of acute ischemia and AMI.[3] These enhancements have been incorporated into the Philips DXL ECG algorithm and the HeartStart MRx monitor/defibrillator.

The following sections highlight the enhanced functionality of the Philips DXL algorthim that should be valuable to EMS providers.

The STEMI Algorithm

Until recently, the ECG standards for ST-segment elevation required J-point elevation greater than 0.2 mV (2 mm with standard calibration) in leads V1–V3 and greater than 0.1 mV (1 mm) in all other leads. These criteria were established to reduce the false detection of ST elevation associated with early repolarization in young males. As a result, the sensitivity of computerized ECG interpretation has been found to be lower for anterior STEMI than for inferior STEMI.[4]

The new AHA/ACC/HRS statements recommend that the threshold value for J-point elevation now be adjusted for age and gender to improve detection of anterior AMI.[3] Specifically, the new criteria recommend a J-point threshold in V2 and V3 of 0.2 mV in men 40 years of age and older, 0.25 mV for men younger than 40 and 0.15 mV for women of all ages. In all other leads, the J-point elevation threshold is 0.1 mV for all ages regardless of gender. The DXL algorithm incorporates these new criteria to improve STEMI detection in women and reduce false alarms with young men.

Because right-ventricular AMIs often go unrecognized in the presence of an inferior or posterior AMI, the DXL algorithm has also been programmed per the new recommendations to suggest consideration of right-sided chest leads (V3R, V4R) in the appropriate setting (see Figure 1, p. 5).

The potential value of a right-sided chest lead recommendation is illustrated by a recent case within our EMS system. Crews responded to a 73-year-old male complaining of nausea and chest pain. He was pale and diaphoretic with an absent radial pulse and a heart rate of 58. His 12-lead ECG showed ST elevation in lead II and aVF, along with ST depression in leads I, aVL and V1–V3. The crew established an IV, placed the patient in the Trendelenburg position, gave him aspirin and a dopamine infusion and rapidly transported him to a STEMI-RC. Had the computerized interpretation recommended a right-sided ECG, the diagnosis of right-ventricular AMI may have prompted the crews to consider a fluid bolus before turning to dopamine.

STEMI-Culprit Artery Identification

Another AHA/ACC/HRS recommendation is that algorithms identify the occluded artery and the site of

occlusion within that artery, if possible.[3] The DXL algorithm meets this objective by offering STEMI-Culprit Artery identification. Culprit arteries identified by the algorithm include the left anterior descending (LAD) artery, the right coronary artery (RCA), the left circumflex (LCx) and the left main or multi-vessel disease (LM/MVD).

Identification of the culprit artery helps direct therapy in the presence of multi-vessel disease and can also help in the interpretation of clinical features. For example, occlusion of the RCA can be associated with heart blocks, because both the SA and AV nodes are often supplied by this artery.

Similarly, a large anterior infarction associated with an occluded LAD and hypotension indicates cardiogenic shock. Such patients don't benefit from thrombolytic therapy and must be transported rapidly to a STEMI-RC. Fluid therapy in these instances should also be limited in favor of earlier inotropic support to avoid pulmonary edema.

Critical Value Statements

The Philips DXL ECG algorithm has incorporated four critical value statements designed to alert providers to ECG features that require immediate attention: Acute MI, Acute Ischemia, Extreme Tachycardia and Complete Heart Block.

The Acute MI statements were introduced to allow for more rapid detection of STEMI as well as to reduce false-positive STEMI alerts. The AMI statement was triggered primarily by the presence of ST segment elevation combined with reciprocal ST depression (see Figure 1).

Acute global myocardial ischemia is defined as a non-ST elevation myocardial infarction (NSTEMI), which presents with ST depression in multiple leads along with ST elevation in aVR. It's frequently associated with severe left main (LM) coronary artery occlusion or high grade multi-vessel disease (MVD).[5]

Early identification of LM/MVD is important because patients have a high risk of complications, such as cardiac arrest and pump failure. These patients are also more likely to require coronary artery bypass grafting (CABG).[5] The Acute Ischemia statement, combined with the LM/MVD STEMI-Culprit Artery identification, now allows for early detection of this condition.

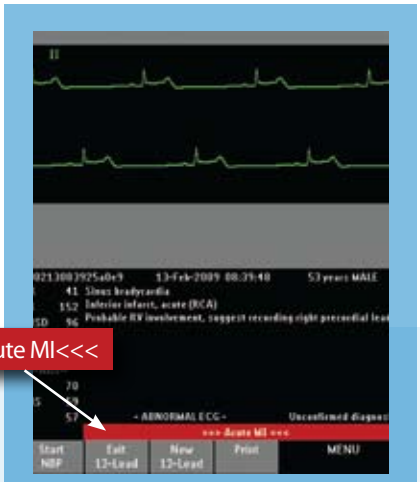

Figure 1: The DXL ECG algorithm has been programmed per the new recommendations to show right-sided chest leads (V3R, V4R), culprit artery identification and the Acute MI statement. These enhancements expedite detection of acute ischemia, AMI and STEMI.

Other Enhancements

The DXL ECG algorithm also includes several other enhancements, such as more sensitive and specific detection of atrial fibrillation and more sensitive detection of pacemakers (atrial, ventricular and dual).

Summary

The 12-lead ECG remains the most important initial test for the diagnosis of AMI. Enhancements in the Philips DXL ECG algorithm have improved its ability to detect STEMI rapidly; however, the ECG cannot be interpreted in isolation. Many other conditions can still mimic STEMI due to deviation of ST segments, including acute pericarditis, early repolarization, hyperkalemia, left ventricular hypertrophy and bundle branch blocks.[6] The ECG should always be interpreted in conjunction with clinical findings and, where available, prior tracings.

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