Performance Standard	7401
Effective: **April 1, 2018**	Expires: **March 31, 2019**
Category II Skill – High Frequency/High Risk: **12-Lead Electrocardiogram**	Approval: Medical Director **Reza Vaezazizi, MD** — Signed
Applies To: **EMT, AEMT, PM, MICN, BHP, EMS System**	Approval: REMSA Director **Bruce Barton** — Signed

Purpose

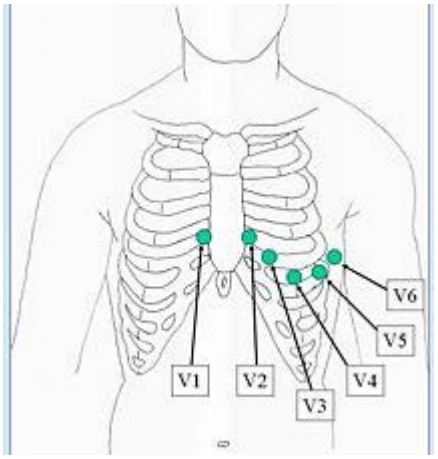
To identify guidelines for the acquisition and transmission of a 12 Lead ECG in the prehospital setting.

12 Lead Inclusion Criteria

1. A 12 Lead ECG shall be performed when a patient presents with signs or symptoms suggestive of Acute Coronary Syndrome, including but not limited to:
    a. Chest pain, discomfort, pressure or tightness radiating to the jaw, shoulders, or arms
    b. New onset cardiac dysrhythmias (including adult cardiac arrest, if return of spontaneous circulation)
    c. Palpitations
    d. Unexplained diaphoresis
    e. Dyspnea
    f. Syncope, near syncope, or dizziness
    g. Known history of Acute Coronary Syndrome (ACS)
    h. Epigastric pain
    i. General weakness
    j. Congenital heart problems
    k. Any patient the paramedic feels would benefit from a 12 Lead ECG assessment

Before performing a 12 Lead ECG on a patient, the EMT, AEMT, or paramedic must: [1] [2]

1. Explain the procedure to the patient.
2. Properly clean and prepare the patient's skin.
    a. Care must be taken in patients with sensitive skin.
3. Properly apply electrodes to the prepared skin of the patient.
    a. Attach the lead wire to each electrode *before* applying the electrode for patient comfort.
    b. Place electrodes on flat, fleshy parts of the arms and legs, avoiding bony areas and major muscles if possible to minimize muscle and motion-related artifact and maximize the ECG signal strength.
    c. Apply the electrode by pressing around the entire edge of the electrode. Avoid pressing directly on the electrode center since it spreads the gel out and may create air pockets that contribute to artifact.
        i. Note: If you are using multifunction electrode defibrillator pads, you may need to reposition ECG electrodes to allow for correct pad placement to facilitate pacing or defibrillation therapy.
    d. Precordial ECG leads shall be placed as indicated below:
        i. V1: right 4th intercostal space, immediately adjacent to right border of sternum
        ii. V2: left 4th intercostal space, immediately adjacent to left border of sternum
        iii. V4: left 5th intercostal space, mid-clavicular line
        iv. V3: halfway between V2 and V4
        v. V6: horizontal to V4, mid-axillary line
        vi. V5: horizontal to V4, anterior axillary line



[1] ECG Interpretation: How to obtain a good quality ECG, Lancashire and South Cumbria Cardiac Network
[2] Improving ECG Quality, Philips Healthcare

e. Limb leads should be placed as per manufacturer's directions.

When a 12 Lead ECG is indicated:

1. 12-lead ECG should be done early in the call and prior to transport. Post-ROSC cases require obtaining a 12-lead as soon as possible.[3]
    a. ECG should be obtained prior to administration of medications.
    b. Annotate on ECG and PCR if patient has received medications prior to ECG.
2. In order to record a good quality ECG the patient must be as relaxed and comfortable as possible.
    a. Ensure privacy for the patient.
    b. Cover the patient with a sheet or blanket once leads have been placed to reduce shivering and ensure privacy.
3. Instruct the patient to breathe normally and not speak during the acquisition of the ECG. Note patient's position on ECG recording strip.
4. Acquire ECG tracing as per manufacturer's directions.
5. If ECG tracing quality precludes accurate interpretation, re-check and correct any problems with connections/electrodes, then re-attempt 12-lead acquisition.

Transmit ECGs when:

1. The machine reads, **Acute MI Suspected** or equivalent
    a. "Infarct suspected, age indeterminate" usually indicates an MI in the patient's past, and is usually not considered to be an Acute MI.
2. The paramedic interprets the ECG as STEMI, even if the machine does not read **Acute MI Suspected** or equivalent
    a. STEMI is defined as 1 mm ST-elevation or greater in two or more contiguous leads with reciprocal depression.
3. Transmit any ECGs that the paramedic has questions or concerns about.
4. Transmit any ECGs requested by the Base Hospital.
5. STEMI Base Hospital contact is ***mandatory*** for all patients identified as possible STEMI patients.
    a. In addition to standard ALS reporting format, include:
        i. Interpretation of the 12 Lead ECG:
            1. Machine interpretation
                a. If the paramedic disagrees with machine interpretation, include that information in the report.
            2. Tell Base Hospital exactly what you are seeing on the ECG using the following format:
                a. Underlying rhythm (e.g. regular sinus rhythm, sinus tach)
                b. Noted abnormalities (e.g. ST changes, conduction errors/blocks, reciprocal changes)
                c. Anatomic location if applicable (e.g. "inferior leads" or "…in leads II, III and aVF")
                d. Machine interpretation
        ii. If a standard treatment, such as aspirin, oxygen, or nitroglycerine was withheld, include this information along with an explanation why it was withheld.
        iii. Family history of heart disease
        iv. Patient's local cardiologist/local PMD
        v. Any request for orders.
        vi. ETA to closest Paramedic Receiving Center and to closest STEMI Receiving Center.
    b. Once a patient is identified as a STEMI patient, the focus must be on rapid transport to the nearest STEMI Receiving Center, as directed by the STEMI Base Hospital, while still ensuring optimal patient care en route.

[3] Implementation and Integration of Prehospital ECGs into Systems of Care for Acute Coronary Syndrome, AHA Scientific Statement, August 13, 2008, Ting, HH; Krumholz, HM; Bradley, EH; Cone, DC; Curtis, JP; Drew, BJ; French, WJ; Gibler, WB; Goff, DC; Jacobs, AK; Nallmothu, BK; O'Connor, RE; Schuur, JD

c. Once the STEMI Receiving Center has assumed care of the patient, complete the first section of the Suspected ST Elevation MI (STEMI) Report form and hand it to the MICN or accepting nurse at the STEMI Receiving Center.
    i. The Suspected STEMI Report form shall be completed for all suspected STEMI patients, including those suspected STEMI patients sent to (by Base Hospital order) to a non-STEMI Center.

Once the hospital has assumed care of the patient, the paramedic must:

1. Give one copy of the PCR/ePCR to the MICN or accepting nurse.
2. Give all 12-Lead ECG printouts to the MICN or accepting nurse. Ensure that each printout is identified with the patient's name, and that the date/time stamps are correct.
    a. The paramedic must make copies of the 12 Lead ECG and attach to his/her copy of the PCR/ePCR.

Critical Success Targets for 12-Lead ECG

1. Appropriately identify patients meeting criteria for obtaining a 12-Lead ECG.
2. A diagnostic quality ECG will be obtained on above patients.
3. Results of ECG will be communicated to an appropriate hospital.

System Benchmark

% of appropriately identified patients having a diagnostic quality ECG performed and communicated to an appropriate hospital.

Applicable Protocols

The REMSA Treatment Protocol for the Universal Patient, Suspected Acute Coronary Syndrome (ACS), and any other policy authorizing a 12-Lead Electrocardiogram.

Core Competency Requirements to be covered during education/training [4]

1. Explain the placement and view of the heart provided by bipolar, unipolar (augmented) and precordial ECG leads.
2. Discuss QRS axis deviation and the effects of body position on the axis.
3. Explain the evolution and localization of acute myocardial infarction.
4. Discuss/define five STEMI "mimics" or imposters.
5. Explain prehospital 12-Lead ECG monitoring procedure.
6. Describe the importance of skin preparation prior to the application of the electrodes.
7. Describe the proper placement of precordial and limb leads for a 12-Lead ECG.
8. Discuss trouble shooting the ECG machine.
9. Describe methods to decrease artifact on the 12-Lead ECG.
10. Discuss the importance of providing privacy for the patient while performing a 12-Lead ECG.
11. Describe the criteria for interpreting a 12-Lead ECG as a STEMI.
12. Emphasize that not all ACS patients are manifested as a STEMI.
13. The importance of pre/post Treatment 12-Leads.

Adjunctive Performance Standards

Patient Assessment

Equipment Requirements

1. PPE
2. Single-use razor
3. Sharps container
4. 12-Lead ECG machine

[4] "Paramedic Care Principles & Practice", Volume 3, Third Edition, Bledsoe, Porter, Cherry

5. Means to provide 12 lead ECG examples
    a. Rhythm generator or ECG strips
6. Electrodes
7. Sheet or blanket

Instructor Resource Materials

1. Paramedic Care Principles & Practice, Volume 3, Third Edition, Bledsoe, Porter, Cherry
2. The 12-Lead ECG in Acute Coronary Syndromes, Second Edition, Tim Phalen, Barbara Aehlert
3. Rapid Interpretation of EKG's, 6th Edition, Dale Dubin, MD

12-Lead Electrocardiogram Validation

PERFORMANCE OBJECTIVE: A diagnostic quality ECG will be performed and communicated to an appropriate hospital.

PERFORMANCE CRITERIA: 100% accuracy required on all items marked with an *.

Before performing a 12-Lead Electrocardiogram, the EMT, AEMT, or paramedic must:

Pts	Score	Performance Steps	Additional Information
1		Take or verbalize body substance isolation.	Selection: gloves, goggles, mask, gown, booties, P100 PRN
1		Explain the procedure to the patient.	
1		Properly clean and prepare the patient's skin.	Care must be taken in patients with sensitive skin.
1		Properly apply electrodes to the prepared skin of the patient.	1. Attach the lead wire to each electrode *before* applying the electrode for patient comfort. 2. Place electrodes on flat, fleshy parts of the arms and legs, avoiding bony areas and major muscles if possible to minimize muscle and motion-related artifact and maximize the ECG signal strength. 3. Apply the electrode by pressing around the entire edge of the electrode. Avoid pressing directly on the electrode center since it spreads the gel out and may create air pockets that contribute to artifact. a. Note: If you are using multifunction electrode defibrillator pads, you may need to reposition ECG electrodes to allow for correct pad placement to facilitate pacing or defibrillation therapy.
1		Precordial ECG leads shall be placed as indicated: *	1. V1 right 4th intercostal space, immediately adjacent to sternum 2. V2 left 4th intercostal space, immediately adjacent to sternum 3. V4 left 5th intercostal space, mid-clavicular line 4. V3 halfway between V2 and V4 5. V6 horizontal to V4, mid-axillary line 6. V5 horizontal to V4, anterior axillary line Limb leads should be placed as per manufacturer's directions.

While performing a 12-Lead Electrocardiogram, the EMT, AEMT, or paramedic must:

Pts	Score	Performance Steps	Additional Information
1		Acquire ECG ***prior*** to beginning transport.	Early transport should be considered when a STEMI is identified. a. ECG should be obtained prior to administration of medications. b. Annotate on ECG and PCR if patient has received medications prior to ECG.
1		Acquire ECG tracing as per manufacturer's directions.	1. In order to record a good quality ECG the patient must be as relaxed and comfortable as possible. a. Ensure privacy for the patient. b. Cover the patient with a sheet or blanket once leads have been placed to reduce shivering and ensure privacy. 2. Instruct the patient to breathe normally and not speak during the acquisition of the ECG. Note patient's position on ECG recording strip.
1		If the ECG tracing quality precludes a good interpretation, the tracing should be repeated. *	

Critical Failure Criteria

____Failure to place precordial ECG leads as indicated.
____Failure to repeat tracing if the ECG tracing quality precludes a good interpretation.
____Any procedure that would have harmed the patient.

While performing a 12-Lead Electrocardiogram, paramedics must also:

Pts	Score	Performance Steps	Additional Information
1		Transmit ECG when the machine reads, **Acute MI Suspected** or equivalent. *	"Infarct suspected, age indeterminate" usually indicates an MI in the patient's past, and is usually not considered to be an Acute MI.
1		Transmit ECG when the paramedic interprets the ECG as STEMI, even if the machine does not read **Acute MI Suspected** or equivalent. *	***STEMI is defined as 1 mm ST-elevation or greater in two or more contiguous leads with reciprocal depression.***
1		Transmit ECG when the paramedic has questions or concerns. *	
1		Transmit ECG when requested by the Base Hospital. *	
1		Contact STEMI Base Hospital for all patients identified as possible STEMI patients: *	STEMI Base Hospital contact is ***mandatory*** for all patients identified as possible STEMI patients.

1		Report additional pertinent information to the STEMI Base Hospital.	In addition to standard ALS reporting format, include: 1. Interpretation of the 12 Lead ECG: a. Machine interpretation i. If the paramedic disagrees with machine interpretation, include that information in the report. b. Tell the STEMI Base Hospital exactly what you are seeing on the ECG. c. Include the underlying rhythm and width of the QRS complex in the report. 2. If a standard treatment, such as aspirin, oxygen, or nitroglycerine was withheld, include this information along with an explanation why it was withheld. 3. Family history of heart disease 4. Patient's local cardiologist/local PMD 5. Any request for orders. 6. ETA to closest Paramedic Receiving Center and to closest STEMI Receiving Center.
1		Provide rapid transport of all STEMI patients as directed: *	***Once a patient is identified as a STEMI patient, the focus must be on rapid transport to the nearest STEMI Receiving Center, as directed by the STEMI Base Hospital, while still ensuring optimal patient care en route.***
1		Provide treatment based upon reassessment findings.	
1		Accurately document all assessment findings, therapeutic treatments, and the patient's response to therapy.*	1. Once the STEMI Receiving Center has assumed care of the patient, complete the first section of the Suspected ST Elevation MI (STEMI) Report form and hand it to the MICN or accepting nurse at the STEMI Receiving Center. a. The Suspected STEMI Report form shall be completed for all patients transported to a STEMI Receiving Center with a suspected STEMI. 2. Give one copy of the PCR/ePCR to the MICN or accepting nurse. 3. Give all 12-Lead ECG printouts to the MICN or accepting nurse. Ensure that each printout is identified with the patient's name, and that the date/time stamps are correct. a. The paramedic should make copies of the 12 Lead ECG and attach to his/her copy of the PCR/ePCR.

Critical Failure Criteria

____Failure to transmit ECG when indicated.
____Failure to contact STEMI Base Hospital for all patients identified as possible STEMI patients.
____Failure to provide rapid transport of all STEMI patients as directed.
____Failure to accurately document all findings, treatments, and the patient's response.
____Any procedure that would have harmed the patient.