January-February 2015

EMS Professionals

The Official Publication of the Wisconsin EMS Association – Your Voice For EMS

GETTING A LEAD ON STEMI:

The EMS role in STEMI

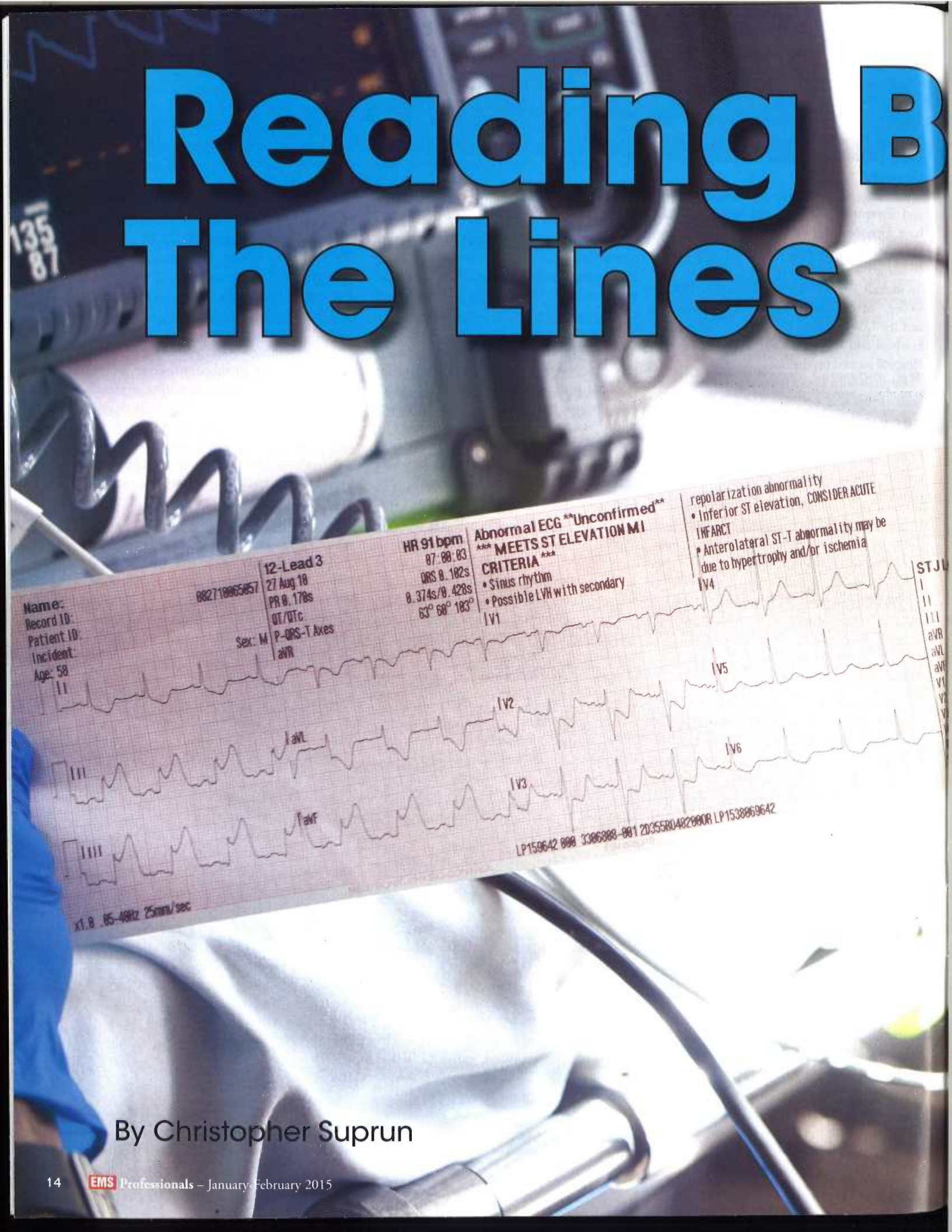
Mission Lifeline working to impact survival rates

A survivor's story

Working Together 2015

Ten Tips to help you get the most from the expo hall

Reading B The Lines



By Christopher Suprun

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Your patient is a 50-year-old male. His co-workers called 911 because he had chest pressure that started 90 minutes ago. His pressure is an eight on a 10-scale and feels like an elephant is sitting on his chest. The pain radiates from his anterior chest to his left arm. He complains of nausea and has obvious diaphoresis.

Your patient claims to be healthy, yet has both a pack of cigarettes and a half eaten supersized, double-bacon burger on his desk. He denies allergies, or any other health problems, but does take Seroquel and Levitra.

You are a few miles away from your local community hospital but 45 minutes away from an emergency facility with an interventional catheterization capability. What do you do and where do you go from here?

STATISTICS

STEMI, or ST elevation MI, accounts for 170,000-250,000 discharge diagnoses per year or 25-40 percent of all acute coronary syndrome (ACS) patients seen. This number, while large, is significantly lower than it had been even a decade ago. Multiple theories exist about this, but overall a higher focus on healthy lifestyles, including obesity prevention and smoking cessation programs, appears to have some causal relationship with the lower number of STEMI diagnoses.

Independent predictors of early death from STEMI include age, time to reperfusion, cardiac arrest, tachycardia, hypotension, anterior infarct location, prior infarction, diabetes mellitus, smoking status, renal function, and biomarker findings. However, untreated, ACS accounts for 10 percent of all deaths, and EMS works one-third of all Sudden Cardiac Arrest events in the United States.

SYMPTOMS/ PATHOPHYSIOLOGY

ST elevation MI, or STEMI, is a clinical syndrome defined by characteristic symptoms of myocardial ischemia in association with persistent electrocardiographic (ECG) ST elevation in anatomically contiguous leads. These changes should be ≥ 1 mm (0.1mV). These ECG changes occur from regional myocardial necrosis, typically endocardium-based, secondary to occlusion of an epicardial artery.

In some cases, concentric sub-endocardial necrosis may result from global injury. Areas of myocardial infarction may be sub-epicardial if there is occlusion of smaller vessels by thromboemboli originating from coronary thrombi. In the majority of patients, there is obstructive coronary disease on angiography.

This pathophysiology can exhibit in a number of ways, but we typically think

of shortness of breath, chest pressur changes in heart rate, light-headednes and diaphoresis.

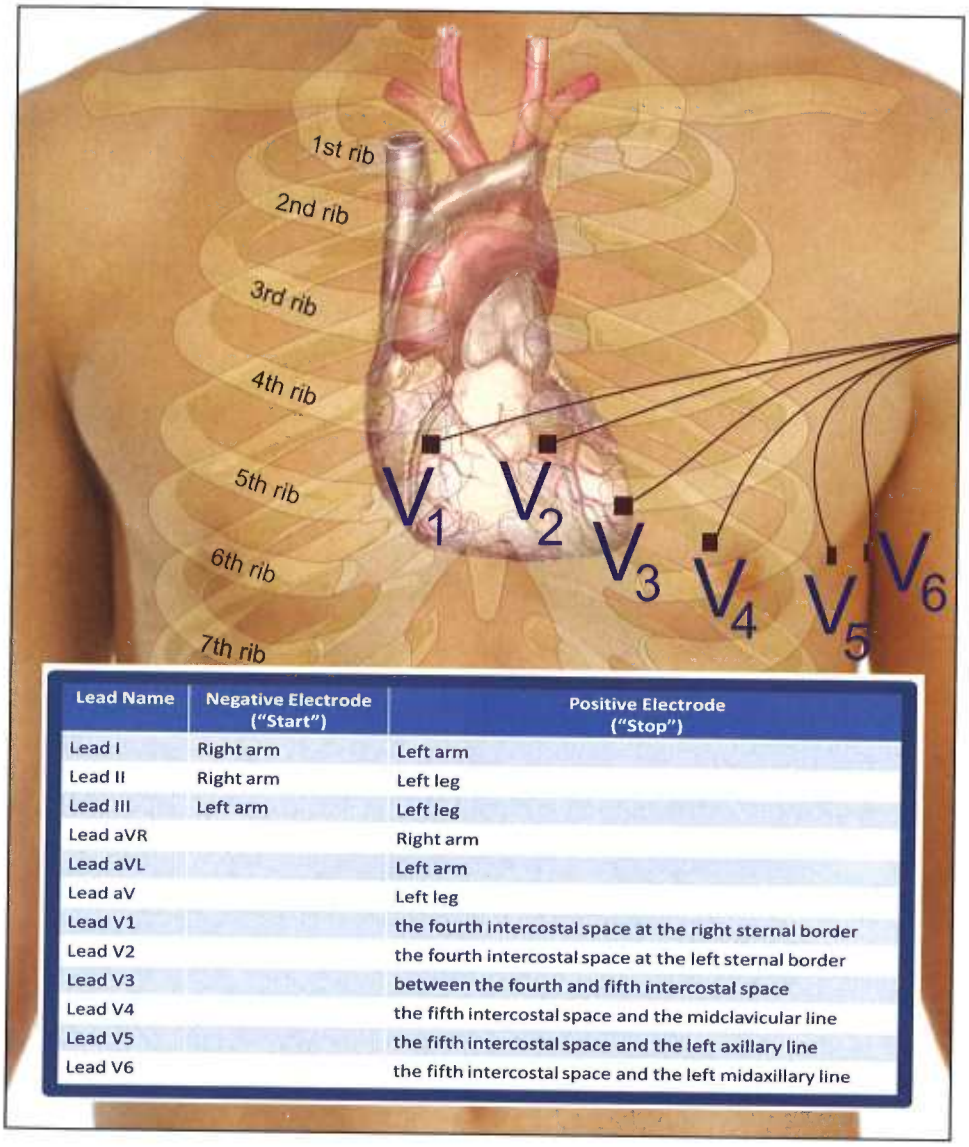
The variable symptomology lends itsel to three important roles for EMS: patien education, EMS transport, and use o 12-leads for patient assessment.

ROLE OF EMS

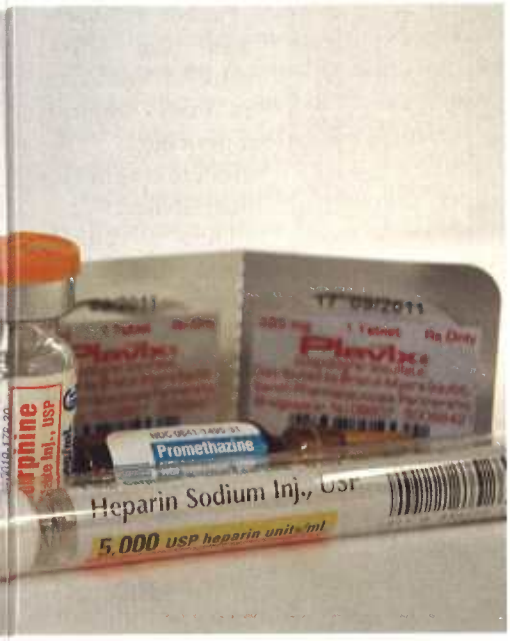
First, EMS has an important role to pla in community health education. Thi education is important because over th last decade there was still a long interva between when ACS symptoms began an patients sought medical attention. Thi time frame continues to be between 9 minutes and two hours.

Community education should include that heart attack, myocardial infarction and AMI does not only always occu with chest pain. Multiple symptoms may exist and may be different depending on gender or racial background. Some studies note that one-third of STEMI cases do not present with chest pain at all. It is important for patients to activate 911 as early as possible.

A vital component of community educa tion is that EMS is by far the best way to transport patients to the ER when the possibility of a STEMI exists. First, one in every 300 STEMI patients will suffer cardiac arrest en route to a hospital with a friend or family member. Second, beyond the safety factor for the patient and other drivers, there is the issue of the level of treatment available. Patients trans ported by EMS consistently have lower reperfusion times then those who drive



Lead Name	Negative Electrode ("Start")	Positive Electrode ("Stop")
Lead I	Right arm	Left arm
Lead II	Right arm	Left leg
Lead III	Left arm	Left leg
Lead aVR		Right arm
Lead aVL		Left arm
Lead aV		Left leg
Lead V1		the fourth intercostal space at the right sternal border
Lead V2		the fourth intercostal space at the left sternal border
Lead V3		between the fourth and fifth intercostal space
Lead V4		the fifth intercostal space and the midclavicular line
Lead V5		the fifth intercostal space and the left axillary line
Lead V6		the fifth intercostal space and the left midaxillary line



themselves to the emergency room.

Perhaps the best role for EMS is the use of 12-lead technology to evaluate our patients with a medical history. Some EMS providers use a 12-lead device on every medical patient who has a problem from their pons to their pelvis because of its usefulness beyond typical cardiac function. For the purpose of this article though, we should examine where the 12-lead can be most valuable.

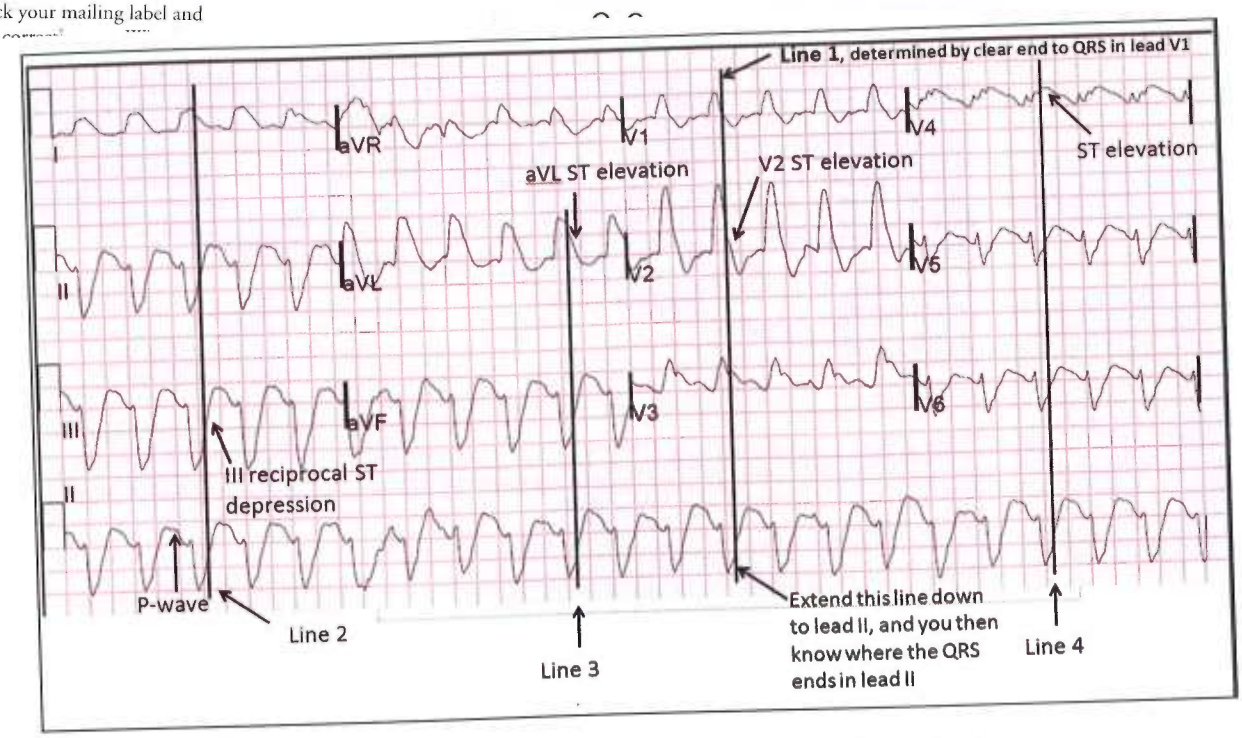
THE 12-LEAD

The 12-lead electrocardiogram, or ECG, records electrical activity of the heart through a diagnostic process that combined with the device's internal algorithms helps provide data on the patient. However, the basic function of an ECG is to detect electrical current flow through the patient's myocardium. A standard 12-lead is composed of six limb leads and six chest leads. These leads are called leads I, II, III, aVR, AVL, aVF, and V1-V6. (See chart on left)

Limb leads are exactly that – leads that should be attached to the patient's limbs. It is common to see electrodes for leads I, II, and III connected to the patient's body, but this is incorrect practice. The limb leads are bipolar leads which require a positive, negative, and ground pole.

The chest leads, or V leads, are unipolar leads where the electrode is placed at a specific location on the chest and the heart itself is the negative electrode.

Interpretation of a 12-lead ECG



requires attention to detail to acquire an accurate tracing in which the ECG is free of distortion. It is important that electrodes be properly placed not only in their correct position but on flat skin to provide an accurate reading. In nearly all cases, hair should be removed using either disposable razor or electric clippers and skin should be prepped using alcohol swabs or a dry rubbing system since alcohol can dry out the skin tissue.

Additionally, the 12-lead correlates with specific anatomic regions of the heart and therefore it is vital that electrodes be placed properly.

Limb leads should be placed on the inside of the patient's right wrist with the right arm electrode, on the inside of the patient's left wrist with the left arm electrode, and in equidistant positions on both thighs for the left leg and right leg electrodes. Some medical directors suggest that the placement of the leg electrodes should be on the ankles.

Chest lead placement requires palpation to ascertain correct location for 12-lead electrodes. Multiple methods exist and any can be used as long as leads are appropriately placed, usually starting with V1.

One method is to find the patient's right clavicle and follow down the patient's sternum on the right side until you find the fourth intercostal space. This is the correct location of V1. To the patient's left sternal border goes V2. From the V2 you should palpate down one intercostal space and follow to the mid-clavicular line along the fifth intercostal space. This location is specific for the lead V4. V3 is placed between V2 and V4. V5 is placed along the fifth intercostal space at the anterior axillary line and V6 is placed along the fifth intercostal space at the mid-axillary line.

> **"The focus of treatment in STEMI is to quickly salvage any heart cells that are in jeopardy by restoring blood flow through the occluded coronary artery."**

Once you have all electrodes properly positioned, the cables can be attached and you can record a tracing. It is important to limit patient movement, including heavy breathing, as well as check your equipment to look for loose or cracked cables to ensure a clean 12-lead with a static baseline and without artifact.

Patient movement can affect your 12-lead, but so can vehicle movement or electromagnetic interference.

The 12-lead itself will normally appear in a systematic way that is familiar to hospital-based practitioners with leads I, II, and III in the first column; aVR, aVL, aVF in the next; V1-V3 in the third; and V4-V6 in the fourth column. These columns and the accompanying technical information on PR intervals, QRS width, and vector analysis will help form a treatment plan.

TREATMENT

The focus of treatment in STEMI is to quickly salvage any heart cells that are in jeopardy by restoring blood flow through the occluded coronary artery. Therapy decisions must be made within minutes of a patient's initial evaluation based on the history, vital signs and the ECG findings, often well before blood markers would be available to focus treatment.

Management of the STEMI patient starts with the idea that we will limit myocardial damage and minimize further complications. Our treatment therapy must start with rest. The patient should not be

expected to walk to the EMS stretcher or otherwise exert themselves and should have oxygen therapy initiated as soon as possible. Oxygen therapy can occur from either a nasal cannula or a face mask if there is any degree of hypoxemia.

Since the coronary occlusion likely started with a coronary thrombus, antiplatelet therapy starting with aspirin is the immediate EMS step. As soon as the patient presents with ACS symptoms and without a history of allergic reaction to aspirin, the patient should receive two to four baby aspirin at a total dose of 162 to 324 mg. by mouth. Baby aspirin inhibits the aggregation of thromboxane A2, which limits the body's clotting cascade of further aggregate a clot in the coronary vessel already involved. It will not break up a clot, but serves as preventive for further damage only.

Nitroglycerin or other nitrate therapy can occur by oral spray, paste, tablet, or intravenous and is an important part of initial EMS treatment of the STEMI patient. Nitrates can help control ischemic pain and also serve as a vasodilator in patients with heart failure. Nitroglycerin's primary action of reducing preload reduces the amount of work the heart must do with the blood in its chambers. However it is important to utilize a 12-lead prior to administering nitroglycerin to ensure an absence of right ventricular infarction ECG signs as these can cause severe hypotension and death in cases where Right Ventricular Infarction (RVI) and nitrates are mixed without a fluid bolus first.

Depending on local protocols, many EMS systems will use morphine or fentanyl to reduce chest pain and anxiety for the patient which should further reduce myocardial oxygen needs.

In most EMS systems, this patient would be transported to the cath lab directly. There is significant data that says primary interventional cardiac catheterization facilities are the best choice for these patients. Primary cath lab intervention is best used early as well. Although we haven't necessarily practiced it, the message that "time is muscle" has been out there for years.

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In some systems, some steps are unnecessarily repeated, resulting in the delay of care. EMS, transport EMS (particularly medevacs), and hospital-based care all seem to be re-doing steps someone else has done while not moving that patient toward the definitive care of PCI or fibrinolysis.

Another option that may occur in EMS systems is the idea of

using fibrinolytics in the prehospital arena.

In-hospital-based care has focused on either breaking the clot up by using thrombolytics or fibrinolytics, which chew through the clot, or by percutaneous coronary interventions such as stent placement and angioplasty to physically open the arteries and remove athlerosclerotic build up of plaque.

Part of the issue with treating patients with fibrinolytics is that they do chew through clots. These clots may be in the coronary arteries where we want them broken up, or could be in other places such as the stomach, including ulcers, or other parts of the body, including from recent trauma or from insignificant surgeries such as hair plugs.

Another factor in the use of fibrinolytics is time, and we have typically used a timeframe of six hours for fibrinolytic use. However, some studies suggest that to use fibrolytics effectively, they need to be used much earlier than previously thought. In fact, the timing may be within 70-120 minutes. This may indicate that fibrinolytics have been underused by not having an earlier field initiation of certain fibrinolytic drug therapies.

In one study, patients had a 50 percent reduction in mortality from early fibrinolytic administration. The study followed up at five years and noted that fewer patients had died in the out-of-hospital group than the in hospital-treatment group, by a rate of 25-36 percent.

CASE STUDY

In this initial case presentation, our patient followed what is considered typical procedure for many patients and thereby delayed his own care. It is important to assess this patient with a set of vital signs and a 12-lead very early on.

If the patient has not taken any baby aspirin, it would be appropriate to administer two to four baby aspirin and instruct him to chew them. Oxygen can be initiated by nasal cannula assuming no hypoxia below 92 percent. If an ALS crew is available, initiate intravenous access.

Prior to administering nitroglycerin, a 12-lead would need to be assessed for the possibility of a right ventricular infarction. To prevent hypotensive episodes, you will also need to first ask the patient about his use of erectile dysfunction medications to ensure it has not been taken in the past 24 to 48 hours.

Many providers, especially those who are not trained to read EKGs as part of their scope, may rely exclusively on the monitor interpretation. Because of the

possibility of error, the 12-lead should be transmitted early to the receiving or medical control hospital. If you believe you have a STEMI, sending the 12-lead to the hospital will help confirm your interpretation and saves the patient valuable time at the hospital in getting the vessel open.

This patient should be transported to a hospital with interventional cardiac catheterization facilities. The EMS crew should alert both the cath lab and the ER of their findings after assessing vitals, the 12-lead, and continuing their patient history and physical assessment.

Christopher Suprun, NRP, FP-C, is a flight paramedic/firefighter and director of education for Never Forget Foundation, a 501(c)(3) aimed at preparing young people to face adversity and challenge using lessons from disaster response.

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