American Heart Association Mission Lifeline: Developing a STEMI Regional Care System

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Objectives:
1. To describe the need for a change in current management of patients with STEMI.
2. Discuss the objectives of Mission Lifeline.
3. Review the Mission Lifeline plan for implementation of STEMI systems.

Optimizing STEMI care

ST-segment elevation myocardial infarction (STEMI) remains a major health care problem and serves as a target for quality improvement. The American College of Cardiology/American Heart Association (ACC/AHA) guidelines recommend that reperfusion with fibrinolytic therapy should occur within 30 minutes of arrival in the emergency department (ED) or that primary percutaneous coronary intervention (PCI) be performed within 90 minutes of presentation.1 Multiple studies support the use of primary PCI as the superior method of reperfusion strategy, with the caveat that the incremental delay of performing primary PCI be no more than 60 minutes.1-4 Despite the existence of well established guidelines, care registry data show that the majority of sites in the United States are not achieving these desired target times to treatment.5,6 There are multiple practical issues which may impact timely reperfusion. Geophysical, financial, organizational, and operational issues within a healthcare system all can influence reperfusion strategies and time to treatment. Leaders within the cardiovascular field have presented the option of regionalization of STEMI care, a process similar to current strategies for the treatment of major trauma and stroke patients, as a means of improving time to reperfusion.

In May of 2004 an Advisory Working Group largely comprised of members from the AHA and ACC was recruited to explore methods for increasing the number of patients receiving timely PCI. The compilation of work from this group resulted in a publication in Circulation which discussed the need for an improved method for the management of these patients.1 With the continued support of the AHA and ACC, in April 2006 a stakeholder summit was convened which included 25 organizations to discuss and develop a system of care for STEMI patients. This resulted in multiple publications from writing groups comprised largely of cardiologists but including representation from emergency medicine, emergency medical services, and hospital administrators. As these working groups were finalizing their manuscripts, the AHA began to establish a cross-functional team to serve as the leadership of Mission: Lifeline. On May 30, 2007, the eleven manuscripts prepared as a result of these STEMI working groups were published in Circulation.7-17 At the same time the Mission: Lifeline program was launched. The initial Mission: Lifeline program had four key objectives:

1. EMS system assessment and improvement
2. Evaluate existing models
3. Establish local initiatives
4. Explore the possibility of national STEMI certification

Over the last two years this program has focused on these initial goals and has strived to establish registered systems of care across the United States with the aim of improving time to reperfusion in all patients with STEMI. Integral to this concept are three key venues of emergency care: Emergency medical services (EMS), hospitals that receive STEMI patients but can not perform PCI (STEMI referring hospital), and STEMI receiving hospitals that are PCI capable. This review will discuss each of these three key components as identified by Mission: Lifeline and the implications of new performance measures recently proposed by Cardiology.18,19

Regionalization: key components

Mission: Lifeline suggests that a region is based on an integrated health care network, the “spoke and hub” concept, where outlying hospitals serve as the “spokes,” and a central hospital—a PCI capable center—serves as the “hub.” Proximity around such a hub center could define this integrated health care network. This is similar to the model used in the reperfusion of Acute Myocardial Infarction in North Carolina Emergency Department (RACE) project which organized treatment plans based on resources within a region, each individual hospital, and coordination among EMS systems to reallocate patients as needed.20 The RACE project showed that the process of regionalization addressed existing barriers to timely reperfusion with PCI and fibrinolitics in regions where patient transfer could not readily occur.
Emergency Medical Services

Emergency medical services are an integral component of a coordinated system of care. Appropriately, Mission: Lifeline has established parameters for EMS systems. A key component of the EMS role in a STEMI system is the standardization of the evaluation and treatment of patients with symptoms suggestive of myocardial ischemia which includes the acquisition of a pre-hospital electrocardiogram (ECG). This allows coordinated transport to the appropriate locations.

Multiple studies have shown that pre-hospital ECG acquisition results in improved time to reperfusion in patients with STEMI. How the information from the ECG is incorporated into clinical care is also important. The Mission: Lifeline program acknowledges that ECG data acquisition and transmission occur by varying methods such as direct communication and interpretation by paramedics, computerized interpretation and transmittal, and wireless transmission with physician interpretation.

As Mission: Lifeline identifies PCI as the preferred reperfusion strategy, each EMS system should have a STEMI care pathway which designates transport to a PCI center by direct or inter-hospital transfer. The program acknowledges that fibrinolytic therapy should be given when PCI can’t be performed within 90 minutes of first medical contact.

Central to the development of any system is the ability to track and assess performance. In the realm of EMS, Mission: Lifeline recommends the evaluation of multiple facets of EMS care including:

1. Time from symptom onset to 911 call
2. Time the 911 call is first received by primary public safety answering point to vehicle arrival at hospital door
3. Time from first medical contact-to-balloon inflation (first device used).
4. Time from pre-hospital ECG-to-balloon inflation (first device used).
5. Proportion of patients with non-traumatic chest pain > 35 years treated by EMS for whom 12-lead ECGs were obtained
6. Proportion of patients with STEMI treated by EMS for whom 12-lead ECGs were obtained
7. Proportion of patients with field diagnosis of STEMI and activation of the cardiac catheterization laboratory for intended primary PCI that:
   a. do not undergo acute catheterization because of misdiagnosis
   b. undergo acute catheterization and found to have no elevation in cardiac biomarkers and no revascularization in the first 24 hours

Continuous quality improvement and assessment of practice requires communication between the STEMI referring hospitals. Mission: Lifeline recommends the following data points be routinely evaluated:

1. Door-to-first ECG time (goal <10 minutes)
2. Proportion of STEMI-eligible patients receiving any reperfusion (PCI or fibrinolysis) therapy.

8. Proportion of patients with EMS treated ventricular fibrillation (VF) who are taken to the cardiac catheterization laboratory
9. Survival to hospital discharge of all STEMI patients and of patients with VF (EMS and STEMI-Receiving Center to monitor jointly)

This depth of data collection and assessment has not traditionally been tracked by EMS providers and represents a change in philosophy as actions and interpretations by EMS significantly impact in-hospital outcomes for patients with STEMI.

STEMI Referral Center

In the development of a STEMI system, the establishment of patient transfer relationships between those hospitals that are PCI capable and those that are not is essential. Timely reperfusion strategies which require transfer of patients is difficult to obtain when established transfer pathways are not available. As shown by the RACE initiative, even in the best of systems it is difficult to obtain timely PCI in transferred patients.

As identification of patients with STEMI is the initial step to a system of care, Mission: Lifeline suggests appropriate protocols and standing orders should be in place for the identification of STEMI. In addition, each emergency department (ED) should have reperfusion pathways which designate primary PCI as the standard of care and a fibrinolysis pathway if PCI is not possible within a guideline recommended time frame. As already mentioned, transferring patients to another institution is often a timely process and each hospital should have a mechanism to initiate rapid transfer selecting the optimal transport method based on meeting existing door-to-balloon guidelines. It is important to realize that the door-to-balloon time in those patients transferred begins at the arrival of the patient at the STEMI referring hospital. Minimizing time to transfer requires the presence of an integrated system with seamless transition from the referring hospital to the receiving hospital, including the transport vehicle. On a practical note this may require the elimination of existing barriers to transferring patients as the Emergency Medicine physician cannot use valuable time contacting multiple different cardiologists to accept the patient in transfer.

Continuous quality improvement and assessment of practice requires communication between the STEMI referring hospitals. Mission: Lifeline recommends the following data points be routinely evaluated:

1. Door-to-first ECG time (goal <10 minutes)
2. Proportion of STEMI-eligible patients receiving any reperfusion (PCI or fibrinolysis) therapy.
3. STEMI Referral Center ED door-to-balloon (first device used) time for patients transferred to PCI center:
   a. STEMI Referral Center ED door to ED discharge
   b. STEMI Referral Center ED door-to-balloon (first device used) time within 90 minutes, including transport time to receiving PCI hospital

STEMI Receiving Center

The STEMI receiving center is the “hub” of a system of care. This center should play a major role in coordinating the system of care for STEMI patients, ensure communication with referring hospitals, and have a clear process to accept patients with STEMI within their coverage area. In addition, the receiving center must be able to perform timely PCI on a 7 day a week, 24 hour each day basis. It is also reasonable to assume that the interventional cardiologists at the receiving center are in compliance with AHA guidelines regarding procedural volume.

Despite these key principles there is limited literature regarding the success of such STEMI receiving centers when evaluated as part of a system. A recent study looked at a single regional system of care that included EMS diversion. In this study, a door-to-balloon time of 90 minutes or less was achieved for 651 (89%) patients, and 459 (62.5%) had EMS-patient contact-to-balloon times ≤ 90 minutes. Transport to a STEMI receiving center resulted in ambulance diversion from a closer ED for 31% of patients and a median increase in transport time of 3.8 minutes. A recent trial evaluating time to reperfusion in elderly patients transferred for PCI reports a longer time to reperfusion, but no change in clinical outcomes. Other systems that have looked at time to reperfusion, however, have shown suboptimal compliance with the door-to-balloon recommendation of < 90 minutes.

Since the goal of the STEMI receiving center is to meet the door-to-balloon time of < 90 minutes from time of first medical contact, Mission: Lifeline recommends that care protocols should be established to ensure meeting this goal. This includes a plan for 24 hour capability for performing PCI, close proximity of the cardiac catheterization laboratory to the hospital, and a comprehensive quality improvement team which is multidisciplinary and communicates with EMS and the referring hospitals. Several key data points are suggested as important parameters to be measured and including:

1. Door-to-balloon (first device used) time, non-transfer within 90 minutes
2. STEMI Referral Hospital ED door-to-balloon (first device used) time, transfer within 90 minutes
3. First Medical contact-to-balloon inflation (first device used) non-transfer within 90 minutes

4. First Medical contact-to-balloon inflation (first device used) transfer
5. Proportion of eligible patients receiving reperfusion therapy
6. Proportion of eligible patients administered guideline-based Class I therapies
7. Proportion of patients with field diagnosis of STEMI and activation of the cardiac catheterization laboratory for intended primary PCI that:
   a. do not undergo acute catheterization because of misdiagnosis
   b. undergo acute catheterization

STEMI System

Three components comprise the STEMI system advocated by Mission: Lifeline: the Emergency Medical System, the STEMI referring hospital and the STEMI receiving hospital. To have a successful system, coordination must be accomplished between all three components. It is important for the EMS providers to have a clear understanding of destination protocols. Mission: Lifeline advocates the identification of a physician champion for a system to maximize the likelihood of success. All participating hospitals should be able to meet the criteria discussed above and evaluate their operational practices. Through the process of registration in Mission: Lifeline, STEMI systems can receive feedback regarding their process of care.

A New Challenge

An essential component of understanding the implication of STEMI systems of care is the review of process of care measurements. The majority of current process of care measurements for STEMI patients involves treatment outside of the purview of emergency medicine. The recommendations for data collection from Mission: Lifeline require detailed data abstraction from EMS and ED processes of care. The need for the collection of performance measurements which span the care of STEMI patients from the STEMI referring hospital to the receiving hospital is emphasized. The reporting of such performance measures may drive changes in how care for these patients organized. It is becoming clear that emergency medicine physicians will be held accountable on some level for the time a STEMI patient spends in the ED, even if the patient is transferred. This may require more involvement of the ED personnel in the collection of data which drives these processes and require additional resources be allocated to collect process of care measurements.

In conclusion, through Mission: Lifeline, the AHA has created recommendations for the management of patients with a
STEMI which spans a patient’s entire medical encounter from EMS contact to time of reperfusion. This program provides multi-disciplinary guidance on mechanisms to improve time to reperfusion for STEMI patients. The framework established by Mission: Lifeline can serve as a tool to begin the integration of care for these patients and the creation of collaborative efforts between the emergency medical services and hospitals which care for patients with STEMI.

References


