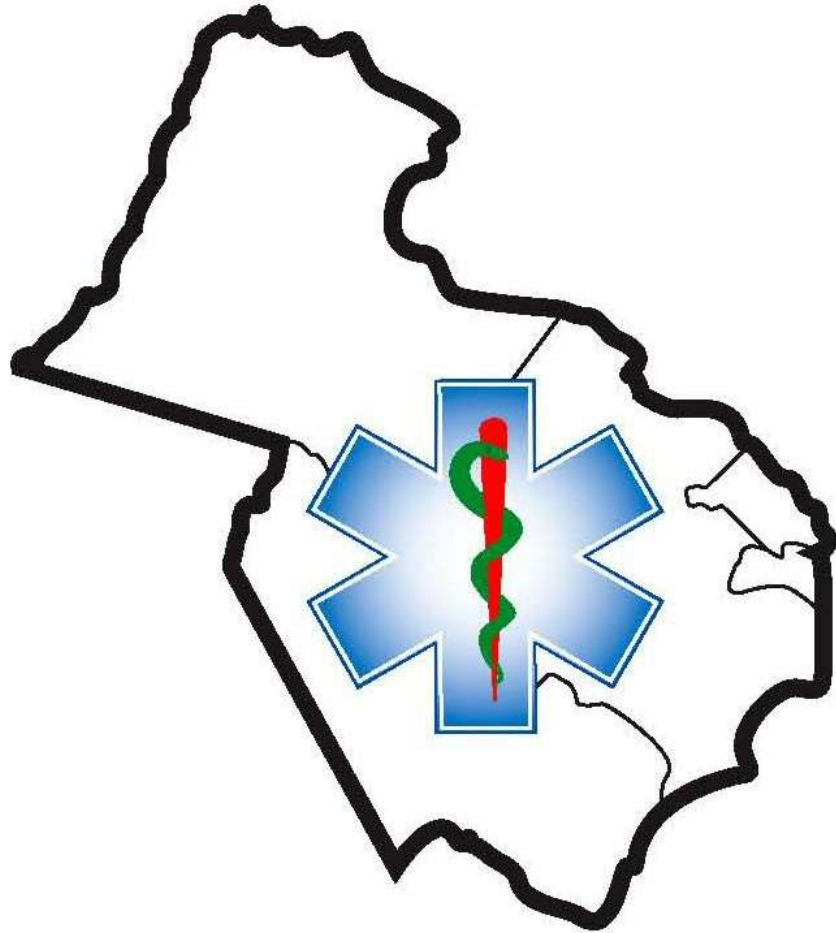# Northern Virginia
Prehospital and Interfacility
Regional STEMI Plan

Northern Virginia Emergency Medical Services Council
7250 Heritage Village Plaza, Suite 102
Gainesville, VA 20155
877-261-3550
northern@vaems.org

Reviewed and Approved by NVEMSC Board of Directors June 15, 2023

Table of Contents

Executive Summary

Scope: The acute care of patients experiencing acute ST-segment elevation myocardial infarction (STEMI) requires an organized and integrated systematic approach to patient care, starting with the patient's initial contact with the pre-hospital care system (activation of the 911 system) through the arrival of EMS responders, recognition of STEMI using 12-lead electrocardiography, through initial patient care, contact with on-line medical control as required, and the decision-making process for transport and choice of destination facility.

Purpose: This is a document for all entities involved with STEMI patient care – prehospital providers, EMS agencies, hospitals, private ambulance companies, medevac, cardiologists, emergency physicians and nurses, hospital labs, 911 call centers, etc.

Mission Statement: *"To increase the accuracy and efficiency of STEMI patient identification and treatment."*

State Activities: In late 2007, the Virginia Healthy Pathways Coalition was approached by the Virginia Department of Health's Heart Disease and Stroke Prevention Project regarding their willingness to become involved with the development and implementation of a new state plan addressing heart disease and stroke. The Coalition agreed to lead the initiative and, over the next year, worked to identify the plan's priorities, goals, and objectives. In early 2009, the final version of the state plan was published, and the Coalition was reorganized into the [Virginia Heart Disease and Stroke Alliance](#) (VHDSA).

Regional Approach: Concurrently during this same time period, a Northern Virginia Regional STEMI Committee was developed and included representatives from public safety answering points (PSAP), prehospital emergency response agencies, inter-facility transport agencies, emergency departments, as well as cardiology and hospital administrative leaders from both cardiac and non-cardiac specialty centers. The participants sought to collaboratively develop guidelines and recommendations for the development of systems and strategies to improve the care of STEMI patients and populations. Where available published evidence was utilized in the development of these recommendations and guidelines; where evidence was limited, published recommendations of national and international consensus panels were utilized; in the absence of both, the regional consensus of participants in conjunction with the Northern Virginia Heart Attack Coalition formed the basis for recommendations.

> *Note: The American Heart Association - Mission: Lifeline™ information (in black text boxes) is included for reference only.*

Goal: All participating entities share the common goal and responsibility for the effective and efficient care of STEMI patients.

Regional Objectives

✱ Have a system where the patient is able to identify the symptoms of an acute cardiac syndrome and will call 911 without delay

✱ Have a system where the actions for public safety answering point (PSAP) personnel are clearly defined to include appropriate call triage for acute cardiac syndromes patients, the ability to send the right EMS resources and provide pre-arrival instructions to the 911 caller.

✱ Have a system where the prehospital actions for identified acute cardiac syndromes patients are clearly defined to include the appropriate assessment, treatment modalities, transmission of ECG findings, and transport to the closest appropriate facility.

✱ Have a system where the hospital actions for identified STEMI patients are clearly defined for both non-PCI capable facilities and PCI centers.

✱ Have a system where all entities strive to meet American Heart Association Guidelines for the care of STEMI patients.

✱ Maintain an updated list of key contact individuals for organizations involved in STEMI patient care to support the continuous performance improvement efforts by sharing data.

✱ Provide a deliberate method of continuous inter-disciplinary performance evaluation, improvement, and communication to monitor the effectiveness and define areas for improvement.

Assumptions

✱ A widespread educational campaign is underway to increase the knowledge of citizens on healthy heart living.

✱ A widespread educational campaign is underway to increase the knowledge and willingness of citizens to access 911 to rapidly enter the health care system when they are experiencing potential cardiac-related events.

✱ The systems and strategies described herein represent guidelines and consensus recommendations. Sound and rational arguments may support different approaches. Successful improvements and innovations shared regionally provide the opportunity for modeling solutions with opportunities for refinement based on agency/entity-specific features or limitations.

✱ It is recognized that evidence-evaluating systems and strategies of care in the domain of STEMI continue to evolve; the recommendations and guidelines published herein require re-evaluation as new evidence emerges.

A Regional STEMI System

Public Education

Public education is very important in a total approach to STEMI care. It is incumbent upon the region to educate our citizens on how to:
- Identify potential patients
- Access 911

We must also strive to identify the current methods for public education, including resources beyond EMS and hospitals, and identify who are the public education stakeholders.

Two educational links are: AHA Patient Information and HeartHub For Patients Portal

Initial Contact

Prompt initial contact with the EMS system – usually through contact with a Public Safety Answer Point (PSAP) using the 911 system is the first step in activating EMS resources. Fire and EMS dispatchers must be alert to acute cardiac signs and symptoms of acute cardiac syndromes (ACS) and trained to dispatch appropriate resources to respond. The involvement of medical direction in the development of dispatch protocols is an important part of this system. Education of the public, stressing the need for prompt activation of the EMS system once the signs and symptoms of ACS are identified, is also a key component of this phase of the continuum of care.

Recommendations and Guidelines for 911-Call Centers

- Utilization of a formal Emergency Medical Dispatch (EMD) program

- Recommendation for patient self-administration of aspirin for those believed to be experiencing chest pain due to coronary occlusive disease

- Recommendation for patient self-administration of sublingual nitroglycerin for those prescribed sublingual nitroglycerin for chest pain

- Adequate and appropriate response – Send the correct resources

- QI program for EMD compliance and integration of data into the prehospital QI program

Prehospital Care

Recognition

Recognition of STEMI in the prehospital environment depends upon the initial team of responding providers quickly recognizing signs and symptoms of STEMI, both objectively and subjectively, and obtaining a 12-lead ECG. Training and continuing education of providers are essential to maintaining a high level of suspicion for ACS, particularly in atypical situations, and to maintaining proficiency in promptly and accurately obtaining 12-lead ECG.

An EMS agency needs to provide a mechanism for 12-lead acquisition at the earliest appropriate juncture. Transmission of field ECG's to a hospital receiving station for review and confirmation by a physician providing online medical command should be integrated in the regional EMS STEMI systems but is not necessary to activate resources at the receiving hospital.

Providers who are not trained and experienced in the interpretation of ECG's can communicate the monitor's software interpretation of the electrocardiogram to online medical command, and other alternative methods of communication (e.g., transmission of cell-phone pictures of the ECG) may also be utilized.

There are three typical ways to identify STEMI patients:
1. Transmission of 12-lead ECG
2. Device interpretation of 12-lead ECG findings
3. Provider interpretation of 12-lead ECG findings

Some strategies to consider:
- Prehospital 12-lead capability needs to be an available resource at the earliest appropriate time.
- Does the patient have a recognized Do Not Resuscitate (DNR) order?
- There needs to be good communication between pre-hospital and the ED for subsequent patient care
- It is recommended to have a STEMI screening checklist, such as a prehospital fibrinolytic checklist. (See Appendix A)

Prehospital Patient Care Decision Making

Decisions involving patient destination require pre-planning between EMS agencies and the receiving hospitals, both PCI and non-PCI hospitals. Transport guidelines for STEMI patients need to consider both the time/distance to the nearest hospital and the time/distance to the most appropriate hospital. Typically, this is the hospital that can provide comprehensive cardiac care, including emergent PCI for STEMI patients. These guidelines need to address situations in which it is in the patient's best interest to bypass the closest hospital in favor of transport to a facility with PCI services.

Optimally, when there are multiple PCI facilities in relatively close proximity, hospital protocols should consider planning for situations in which the primary PCI facility might be unable to accept the patient initially, requiring real-time communication with the next closest PCI facility. The next closest PCI facility may also require communication with those facilities that may be positioned outside of the regional area proper or outside of a facility's home network.

Quality Improvement

Our EMS system participates in a regular quality improvement program designed to examine all facets of the ACS patient's care, from initial contact with the EMS system through initial care, destination decision-making, and initial care at the receiving hospital. Particular attention should be given to critical decision-making and transition or "hand-off" points in the continuum of care. Every effort should be made to facilitate sharing of pertinent patient information between components of the system, including data from the initial phases of the patient's hospital care, such as "door-to-balloon" time, with appropriate safeguards for patient privacy and confidentiality

Community-based research to help identify effective interventions for improving universal utilization of EMS for STEMI and eliminate associated regional variation should be promoted

Prehospital 12-lead ECG systems and the reliability of data transfer should be evaluated.

Recommendations and Guidelines for Prehospital EMS Agencies

To prove the best care possible, a 12-Lead ECG Program for EMS should encompass the following. These recommendations do not limit any agency's individual actions to exceed the guidelines mentioned below:

- An EMS agency needs to provide a mechanism for 12-lead acquisition at the earliest appropriate juncture.

- Acquire a 12-Lead ECG, if possible, within 5 minutes of patient contact with patients exhibiting symptoms consistent with a STEMI.

- Communicate early with online Medical Control because early notification increases coordination with specialty care resources.

- Relay the 12-Lead ECG findings to a predetermined medical control facility and/or receiving hospital, as well as print their 12-Lead ECG rhythm upon arrival at the receiving facility.

- The prehospital fibrinolytic checklist should be designed to determine the presence or absence of co-morbid conditions and underlying conditions in which fibrinolytic therapy may be hazardous. The prehospital fibrinolytic checklist should also facilitate the detection of patients with suspected STEMI who are at especially high risk, including those with severe heart failure or cardiogenic shock, for whom primary PCI is generally the preferred reperfusion strategy. Do Not Resuscitate (DNR) status may be another consideration.

- Written protocol that guides EMS system personnel in determining the most appropriate receiving facility and method of transport to that facility for their suspected or confirmed STEMI patient.

- EMS should continue to be encouraged to follow the American Heart Association (AHA) guidelines regarding STEMI care to include, but not limited to, the administration of Oxygen (via NRB), Aspirin (162-325 mg chewed), Nitroglycerin, Fentanyl, and Morphine Sulfate.

- In addition to the appropriate tools and treatment, the agencies should ensure that adequate training and update is provided to these frontline providers.

- Thorough documentation regarding patient information and related destination determinations is essential. This will include the utilization of any patient transfer methods (i.e. medevac) to ensure the patient arrives at the most appropriate receiving facility.

American Heart Association - Mission: Lifeline™
Recommendations for EMS

1. Each EMS system should maintain a standardized algorithm for evaluating and treating patients with symptoms suggestive of myocardial ischemia that should include acquisition of a 12-lead ECG and appropriate communication of the ECG findings (via direct paramedic interpretation/voice communication, automated computer algorithm interpretation, wireless transmission and physician interpretation, or any combination of these three strategies) to the receiving hospital.

2. Each EMS system should maintain a standardized reperfusion STEMI care pathway that designates primary PCI as the preferred reperfusion strategy if initiated within 90 minutes of first medical contact or fibrinolytic therapy in eligible patients when primary PCI within 90 minutes is not possible.

3. Prearranged EMS destination protocols for STEMI patients should include:
   a. Bypassing non-PCI hospitals/STEMI Referral Centers and going directly to primary PCI hospitals/STEMI-Receiving Centers for patients with anticipated short transport interval (e.g. <30 minutes in urban/suburban settings, so as to achieve primary PCI within 90 minutes)
   b. Emergency transfer by EMS or other agencies to a STEMI-Receiving Center of patients with STEMI who transport themselves to a STEMI Referral Center.
   c. Air transport if possible (or default to ground transport) to STEMI-Receiving Center or stabilization in STEMI Referral Center for patients with anticipated long transport time and/or either fibrinolytic ineligible and/or in cardiogenic shock
   d. Administration of fibrinolytic therapy prehospital or in a STEMI Referral Center for fibrinolytic eligible patients with anticipated time to primary PCI exceeding 90 minutes
   e. Emergency transfer to a STEMI-Receiving Center of patients who develop STEMI while in hospital at STEMI Referral Center (non-PCI hospital).

4. When taken directly to a STEMI-Receiving Center, all STEMI patients should be transported to the most appropriate facility as determined by Mission: Lifeline hospital criteria, with a system goal of first medical contact to balloon inflation (initial device used) within 90 minutes.

5. EMS medical director or designate should monitor care related to EMS patients with STEMI by meeting at least quarterly with prehospital providers, emergency physicians, interventional cardiologists, nursing staff, receiving hospital representatives, and other appropriate individuals (i.e. STEMI Survivors).

6. The following measurements should be evaluated on an ongoing basis:
   a. Symptom onset to 9-1-1 call
   b. Time 9-1-1 call is first received by primary public safety answering point to vehicle arrival at the hospital door
   c. Time from first medical contact to balloon inflation (first device used).
   d. Time from prehospital ECG to balloon inflation (first device used).
   e. Proportion of patients with non-traumatic chest pain > 35 years treated by EMS for whom 12-lead ECGs were obtained
   f. Proportion of patients with STEMI treated by EMS for whom 12-lead ECGs were obtained
   g. Proportion of patients with field diagnosis of STEMI and activation of the Cardiac Catheterization Laboratory for intended primary PCI that
      i. do not undergo acute catheterization because of misdiagnosis
      ii. undergo acute catheterization and found to have no elevation in cardiac biomarkers and no revascularization in the first 24 hours
   h. Proportion of patients with EMS-treated ventricular fibrillation (VF) who are taken to the Cardiac Catheterization Laboratory
   i. Survival to hospital discharge of all STEMI patients and of patients with VF (EMS and STEMI-Receiving Center to monitor jointly)

American Heart Association - Mission: Lifeline™
Strategies for the Ideal EMS

Initial Contact:

By an EMT Basic or Intermediate Provider
- 911 operator trained to recognize potential acute cardiac symptoms and dispatch appropriate EMS resources to potential STEMI patient
- ECG equipment and personnel dispatched to allow for 12 lead ECG within a total scene time of less than or equal to 15 minutes
- ECG acquisition to be extended to basic providers, including EMT basic and first responders
- ECG obtained on all patients with chest discomfort suspected to be of ischemic origin
- In the field ECG (to be interpreted by receiving physician on arrival or by transmission)
- Documentation of symptom onset
- Scene time of less than 15 minutes
- Patient stays on an ambulance stretcher for STEMI evaluation for hospitals that routinely transfer all or some patients by the same ambulance

By an EMT-Paramedic

In addition to the above:
- Training to diagnose STEMI by symptoms and ECG
- In the field ECG with a goal scene time of 15 minutes (An ECG machine should be dispatched to all potential STEMI calls to meet this 15-minute window)
- Administer prehospital fibrinolytic checklist (See Appendix A)
- If the patient is fibrinolytic ineligible, EMS notifies and diverts to a STEMI-Receiving hospital, as long as transportation time < 90 minutes
- Early notification of the receiving hospital on all STEMI patients prior to arrival that includes direct communication with the physician capable of activating a reperfusion plan regarding symptom onset, ECG findings, and prehospital fibrinolytic checklist in addition to:
  - Patient Age, gender, and DNR status
  - Time of onset of symptoms
  - Primary physician/cardiologist
  - Whether the patient taking warfarin
  - Past hx of MI, PCI/stent/CABG, renal failure, contrast allergy
- Administer aspirin (162 to 325 mg chewed) to chest pain patients suspected of having STEMI unless contraindicated or an adequate dose of immediate-release aspirin can be verified as taken
- EMS data elements collected, made available to receiving hospitals via run event sheet, and reviewed on a regular basis regarding symptom onset, time of 1st medical contact, ECG performance and findings, and transportation complications, including arrest and death

Recommendations and Guidelines for Patient Transfers

- All treatment facilities need to have procedures in place that allow for the closest, most appropriate transport unit (ground or air resource) to be dispatched to pick up a STEMI patient and transfer them to the closest, most appropriate facility.

- Non-PCI facilities need to have a protocol with the goal to transfer the patient to a PCI facility within 30 minutes.

- Non-PCI facilities need to have a plan to facilitate inter-facility transfers that provide for the patient's transfer to a PCI facility within 30 minutes or less. This may be accomplished by ground and/or air transport.

- PCI centers need to have a plan in place to properly receive transferred patients.

American Heart Association - Mission: Lifeline™
Recommendations for Inter-hospital Transfer

- STEMI patient for reperfusion has the same priority as 911 call and trauma.
- Patient stays on EMS stretcher for STEMI evaluation for inter-hospital transfer.
- Transfer plan including preferred transport modality and backup transport modality is established.
- Transport directly to the catheterization laboratory when the laboratory is staffed and available for PCI without reevaluation in the ED.
- When possible, minimize or avoid continuous IV infusions such as nitroglycerin or heparin.
- Transfer protocol should focus on rapid transport to the catheterization laboratory rather than pain relief with medications.
- Transfer patients to STEMI-Receiving hospitals with similar consideration to patient registration, bed availability, and accepting physician as trauma patients (use of dummy registration numbers, acceptance of all STEMI patients regardless of bed availability, and reliance on a single accepting physician that is on call 24 hours per day / 7 days per week).
- When transporting a patient treated with fibrinolysis who has continued chest pain and < 50% ST resolution (in the lead showing the worst initial elevation) after 90 minutes following the initiation of fibrinolysis, notify the receiving hospital about the potential need for rescue angioplasty.
- Hospital records should be faxed to the receiving catheterization laboratory so as not to delay patient pickup.
- EMTALA/COBRA/medical necessity of transfer form should be completed as soon as possible after the decision to transfer.

Helicopter Transfer: In addition to the above:
- Local EMS should generally be used if available, and 30 minutes of transportation time to the destination hospital.
- Whenever possible, helipad adjacent to the emergency department.
- Helicopter capable of transporting patients on ten minutes' notice 24/7; When not available, alternate transport options identified.
- Immediately activate helicopter transport during initial communication between the referral hospital ED and receiving hospital regarding the need for reperfusion.
- Establish a system whereby all patient transfers of any type can be specified as time critical within one hour versus diversion possible.

Recommendations for All Hospitals

- All ED-based STEMI protocols should emphasize rapid evaluation and decision-making to determine reperfusion strategy and to administer adjunctive medical treatments as appropriate. Process maps are helpful in the development phase of these protocols.

  - All STEMI hospitals should have written guidelines and standing orders for the administration of fibrinolytic therapy and adjunctive treatments.

- Emergency physicians in all STEMI hospitals should be empowered to activate cardiac catheterization laboratory resources within a standardized clinical pathway without fear of reprisal for false-positive activation.

- All ED staff taking care of STEMI patients should complete specific educational modules adapted to the local process.

- Mock STEMI drills should be encouraged in low-volume centers (as defined by ACC guidelines) to maintain skill sets and to help further refine processes that cause delays at these individual institutions.

- All participants in a STEMI system should receive formal feedback as part of an organized quality improvement process.

Recommendations for Non-PCI Hospitals and Free-Standing EDs

- Quick STEMI identification and rapid transport/transfer to a PCI facility is the goal of non-PCI facilities.

    - Is there a STEMI identification protocol in place?
    - Are there standardized transport protocols?
    - Direct communication with the receiving facility?
    - Is there a QI process?

- Based on AHA guidelines, STEMI identification should be made by ECG interpretation within 10 minutes of patient arrival. A STEMI Alert Notification should be activated that immediately activates a transport service and notifies the PCI center.

- All treatment facilities need to have procedures in place that allow for the closest, most appropriate transport unit (ground or air resource) to be dispatched to pick up a STEMI patient and transfer them to the closest, most appropriate facility.

- The key data elements needed to monitor performance at a non-PCI facility are:
    - EMS pick-up time if applicable.
    - Hospital arrival time
    - Initial EKG interpretation time
    - Transport service arrival time
    - Transport service left non-PCI facility time
    - Transport service arrival time to PCI facility

- Processes should be monitored to minimize the time intervals of each of these processes.

- Facilities need to share their STEMI patient-related data and identify a liaison for their facility to collaborate regionally with quality improvement and data review activities.

American Heart Association - Mission: Lifeline™
Recommendations for Non-PCI Hospital/ STEMI Referral Center

1. Appropriate protocols and standing orders should be in place to identify STEMI. At a minimum, these protocols should be present in the intensive care unit/coronary care unit and emergency department (ED).

2. Each ED should maintain a standardized reperfusion STEMI care pathway that designates primary PCI as the preferred reperfusion strategy if a transfer of patients to a primary PCI hospital/STEMI- Receiving Center can be achieved within times consistent with ACC/AHA guidelines.

3. Each ED should maintain a standardized reperfusion STEMI care pathway that designates fibrinolysis in the ED (for eligible patients) when the system cannot achieve times consistent with ACC/AHA guidelines for primary PCI.

4. If the reperfusion strategy is for primary PCI transfer, a streamlined, standardized protocol for rapid transfer and transport to a STEMI-Receiving Center should be operational.

5. If the reperfusion strategy is for primary PCI transfer, all patients should be transported to the most appropriate STEMI-Receiving Center where the expected first door-to-balloon (first device used) time should be within 90 minutes (considering ground versus air transport, weather, traffic).

6. The STEMI Referral Center should have an ongoing quality improvement process, including data measurement and feedback, for the STEMI population and collect and submit Mission: Lifeline required data elements (using Get With the Guide Lines (GWTG)

7. A program should be in place to track and improve treatment (acutely and at discharge) with ACC/AHA guideline-based Class I therapies.

8. A multidisciplinary STEMI team, including EMS, should review hospital-specific STEMI data on a quarterly basis.
   a. Door-to-first ECG time (goal <10 minutes)
   b. Proportion of STEMI-eligible patients receiving any reperfusion (PCI or fibrinolysis) therapy
   c. STEMI Referral Center ED door-to-balloon (first device used) time for patients transferred to PCI center
      i. STEMI Referral Center ED door to ED discharge
      ii. STEMI Referral Center ED door-to-balloon (first device used) time within 90 minutes (including transport time)

Recommendations for PCI-Capable Hospitals

- Quick STEMI identification.

    - Is there a STEMI identification protocol in place?
    - Is there a QI process?

- Based on AHA guidelines, STEMI identification should be made by ECG interpretation within 10 minutes of patient arrival. A STEMI Alert Notification should be activated.

- Facilities need to share their STEMI patient-related data and identify a liaison for their facility to collaborate regionally with quality improvement and data review activities.

- Designated emergency physicians and nurse leaders, and cardiologists should be identified and involved in their institution's STEMI system development, management, quality improvement, and outreach to referring hospitals, physicians, and EMS providers.

- The hospital administration should provide infrastructure support to the emergency physician and nurse and cardiology leaders, which should include protected time for activities related to STEMI system management.

- Protocols should be established that allow EMS-diagnosed STEMI patients to bypass the ED to go directly to the cardiac catheterization laboratory when appropriate.

- Protocols should be established to minimize the time it takes to get the patient to the cath. lab, when appropriate.

American Heart Association - Mission: Lifeline™
Recommendations for Primary PCI Hospital/ STEMI-Receiving Center

1. Protocols for triage, diagnosis, and Cardiac Catheterization Laboratory activation should be established within the primary PCI hospital/STEMI-Receiving Center. A single activation phone call should alert the STEMI team. Criteria for EMS activation of the Cardiac Catheterization Laboratory should be established in conjunction with EMS offices.

2. The STEMI-Receiving Center should be available 24 hours/7 days a week to perform primary PCI.

3. The Cardiac Catheterization Laboratory staff, including the interventional cardiologist, should arrive within 30 minutes of the activation call.

4. There should be universal acceptance of STEMI patients (no diversion). There should be a plan for triage and treatment for the simultaneous presentation of STEMI patients.

5. Interventional cardiologists should meet ACC/AHA criteria for competence. Interventional cardiologists should perform at least 11 primary PCI procedures per year and 75 total PCI procedures per year.

6. The STEMI-Receiving Center should meet ACC/AHA criteria for volume and perform a minimum of 36 primary PCI procedures and 200 total PCI procedures annually.

7. The STEMI-Receiving Center should participate in the Mission: Lifeline-approved data collection tool, [ACTION Registry-GWTG™](#).

8. A program should be in place to track and improve treatment (acutely and at discharge) with ACC/AHA guideline-based Class I therapies.

9. There should be a recognized STEMI-Receiving Center liaison/system coordinator to the system and a recognized physician champion.

10. There should be monthly multidisciplinary team meetings to evaluate outcomes and quality improvement data. Operational issues should be reviewed, problems identified, and solutions implemented. The following measurements should be evaluated on an ongoing basis:
    a. Door-to-balloon (first device used) time, non-transfer within 90 minutes
    b. STEMI Referral Hospital ED door-to-balloon (first device used) time, transfer within 90 minutes
    c. First Medical contact to balloon inflation (first device used) non-transfer within 90 minutes
    d. First Medical contact to balloon inflation (first device used) transfer
    e. Proportion of eligible patients receiving reperfusion therapy
    f. Proportion of eligible patients administered guideline-based Class I therapies
    g. Proportion of patients with field diagnosis of STEMI and activation of the Cardiac Catheterization Laboratory for intended primary PCI that
        i. do not undergo acute catheterization because of misdiagnosis
        ii. undergo acute catheterization and found to have no elevation in cardiac biomarkers and no revascularization in the first 24 hours
    h. In-hospital mortality

Recommended Data Collection Points

Prehospital & Inter-Facility

- # cardiac patients
- # of STEMI patients
- Aspirin given – when?
- Nitrates given?
- Oxygen
- Morphine?
- Utilization of 12 lead
- Time to initial ECG reading
- On-scene time
- Use of medevac
- Activation of STEMI team
- Transport time to definitive care

Hospital

- Presentation – time from pain onset
- Time spent in ED
- ED to lab time
- Lab time to balloon interval
- Transmission capabilities with EMS
- PCI Center
- Non-PCI Center
- False STEMI ID
- Contraindications to fibrinolysis
- Patient Outcome

Note: Facilities are encouraged to use uniform data collection. An example of uniform data collection can be found on Page 22.

Recommended Acute STEMI Protocol for Hospitals Without PCI Capability

A. Initial adjunctive therapy:

1. ASA 162 –325 mg PO.
2. Nitroglycerin
3. Pain Control   *Consider Fentanyl based on Morphine's effect on antiplatelet absorption
4. Supplemental O_2 if oxygen saturation < or = 94%

B. Indications for Fibrinolytic Therapy:

1. Expected First Medical Contact (FMC) to balloon greater than 120 minutes.
2. Catheterization laboratory occupied/not available or vascular access difficulties.
3. *Target: door-to-needle time $\leq$ 30 minutes.*

C. Indications for Primary PCI:

1. Primary PCI should be performed in patients with STEMI and ischemic symptoms of >12 hours duration.
2. Primary PCI should be performed in patients with STEMI and ischemic symptoms of >12 hours duration contraindicated to fibrinolytic therapy, irrespective of the time delay from FMC.
3. Severe CHF/pulmonary edema, cardiogenic shock.
4. Contraindications to fibrinolysis(see Appendix A): ↑ risk of bleed, intracranial hemorrhage.
5. Diagnosis is not certain (e.g. equivocal ECG with symptoms of MI).
1. Target: 1st hospital door-to-balloon time *< 90 minutes*.

D. Contraindications to Primary PCI:

1. Asymptomatic patients > 12 hours after onset of STEMI, and they are hemodynamically and electrically stable.
2. Extensive co-morbidities in which the risks of revascularization outweigh the benefits (e.g. significantly advanced age, prolonged CPR with uncertain neurological status).
3. Delay to cath lab; consider fibrinolytic therapy.
4. Vascular access difficulties; consider fibrinolytic therapy.

E. Primary PCI protocol:

1. Emergency department (ED) <u>first calls transport</u> (ambulance, helicopter). If the patient initially arrived at ED by ambulance, then keep the ambulance at ED for possible transfer to another hospital with cardiac cath lab.

2. ED then calls the hospital access line to activate the team and contact the cardiologist on call. The cardiologist is connected to the ED to discuss the case. Transport and the cath team will be activated prior to any discussion with the cardiologist on the ED physician's decision to proceed with PCI.
3. Local hospital with a STEMI call roster will inform the access line who will contact the receiving physician. (Must be an Interventional Cardiologist).
4. **When the diagnosis is made in the field, EMS should notify the ED at the receiving facility to expedite care.**

5. **Adjunctive medical regimen for PCI**: 1.1

   1. Heparin IV 60 units/kg bolus (max 4000 units)
   2. Clopidogrel 600 mg oral bolus/*Brilinta* 180 mg oral bolus (*optional prior to cath and in consultation with receiving facility/cardiologist*)

Target times:
   1. *Door-to-ECG and decision: 10 minutes.*   ***ED door-in to***
   2. *Call for transport-to-door out: 20 minutes*   ***door-out < 30 minutes***
   3. Transport time: approximately 30 minutes.
   4. Cath lab arrival-to-balloon time: 30 minutes.

   * Goal 1st hospital door-to-balloon time $\leq$ 90 minutes.

Important notes:
   1. When primary PCI is indicated, call transport immediately and <u>do not wait for a response from the cardiologist</u>. A decision to cancel transport can always be made afterward.
   2. In order to reduce transport time, <u>avoid continuous IV infusions</u>.
   3. If the patient initially arrived at ED by ambulance, then <u>keep the ambulance</u> for possible transfer to another hospital with cardiac cath lab.
   4. ED may fax ECG to cardiologist if requested; however, activation of transportation (call for ambulance) should <u>not</u> be delayed.

American Heart Association - Mission: Lifeline™
STEMI Systems of Care
(All five must be present in order to be certified)

1. The System should be registered with Mission: Lifeline.

2. There should be ongoing multidisciplinary team meetings that include EMS, non-PCI hospitals/STEMI Referral Centers, and PCI hospitals/STEMI-Receiving Centers to evaluate outcomes and quality improvement data. Operational issues should be reviewed, problems identified, and solutions implemented.

3. Each STEMI System should include a process for pre-hospital identification and activation, destination protocols to STEMI Receiving Centers, and transfer for patients who arrive at STEMI Referral Centers and are primary PCI candidates and/or are fibrinolytic ineligible and/or in cardiogenic shock.

4. Each system should have a recognized system coordinator, physician champion, and EMS medical director.

5. Each system component (EMS, STEMI Referral Centers, and STEMI-Receiving Centers) should meet the appropriate criteria listed above.

DEFINITIONS

12-Lead Electrocardiogram (ECG) – A test using a device that measures the electrical activity of the heartbeat and can help medical personnel determine if a heart attack has occurred. It can also help determine whether the heart attack was a STEMI or non-STEMI event. When a 12-lead ECG is done, 12 wires ("leads") are attached to the arms, legs, and chest. These wires each record electrical impulses, but from a different position in relation to the heart.

Acute – In medicine, a disease with a rapid onset and/or short duration.

Acute Myocardial Infarction (AMI) – Commonly known as a heart attack, is the interruption of blood flow to part of the heart.

Angioplasty – is a surgical procedure that requires a slender balloon-tipped tube to be threaded from an artery in the groin to a trouble spot in the artery of the heart. The balloon is then inflated, which compresses the blockage and widens the narrowed artery to restore blood flow.
used to treat patients with a partially or completely blocked artery that restricts blood flow through the heart.

Acute Coronary Syndrome (ACS) – This is an umbrella term for types of coronary artery disease associated with a sudden rupture of plaque inside the coronary artery. These may include unstable angina, non-ST segment elevation myocardial infarction (NSTEMI), and ST-segment elevation myocardial infarction (STEMI). These are all life-threatening conditions requiring emergency medical care.

Balloon Inflation – see angioplasty

Cath lab – is the department in a medical facility that specializes in cardiac catheterization, which is a procedure to examine blood flow to the heart and test how well the heart is pumping.

Cardiogenic Shock – is a state of inadequate tissue perfusion due to cardiac dysfunction, most commonly caused by acute myocardial infarction.

Door to Balloon Time – is the amount of time between a heart attack patient's arrival at the hospital and the time he/she receives percutaneous coronary intervention (PCI), such as angioplasty.

Door to Needle Time – is the amount of time between a heart attack patient's arrival at the hospital to the time he/she receives clot-busting medications, referred in medical terms to fibrinolytics or thrombolytics.

Electrocardiogram (ECG/EKG) – is a recorded tracing of the electrical activity of the heart.

Emergency Medical Services (EMS) – is a system of healthcare professionals, facilities, and equipment providing pre-hospital emergency care.

Fibrinolysis – is a normal body process that keeps naturally occurring blood clots from growing and causing problems. Primary fibrinolysis refers to the normal breakdown of clots. Secondary fibrinolysis is the breakdown of blood clots due to a medical disorder, medicine, or other cause.

Fibrinolytic Therapy – is the use of pharmaceuticals or injections of medications to break up a blood clot inside an artery or cavity of the heart so that blood flow can be improved or restored. Also called thrombolytics.

First Medical Contact (FMC) – "first medical contact" is defined as the time of emergency medical services (EMS) arrival on scene after the patient calls EMS/9-1-1 or the "time of arrival at the emergency department door" [whether PCI-capable or non-PCI-capable] when the patient self-transports.]

Mission: Lifeline™ - is the American Heart Association's national initiative to improve healthcare system readiness and response to STEMI patients. It seeks to reduce mortality and morbidity and improve the overall quality of care and outcomes for STEMI patients. The ultimate goal of Mission: Lifeline is to save lives by closing gaps that separate STEMI patients from timely access to appropriate treatments.

Non-PCI Hospital – is a type of hospital that does not have the means to deliver the percutaneous coronary intervention (PCI), the preferred means of treating a STEMI heart attack patient if done within the critical 90-minute window. Non-PCI hospitals can: administer clot-busting medicines that meet the healthcare needs of non-STEMI patients, refer STEMI patients to PCI hospitals, and treat STEMI patients with medications when it is not feasible for them to get to a PCI-capable hospital for treatment in a timely manner.

Percutaneous Coronary Intervention (PCI) – see angioplasty

PCI-Capable Hospital – is a hospital that has the equipment, expertise, and facilities to administer percutaneous coronary intervention (PCI), a mechanical means of treating heart attack patients.

Point of Entry (POE) – is part of the healthcare community where treatment of a patient begins, such as when emergency medical services arrive on the scene, or the patient walks into the emergency department at a hospital.

Reperfusion Therapy – is one or more techniques to restore blood flow to part of the heart muscle damaged during a heart attack. It may include clot-dissolving drugs (thrombolysis), balloon angioplasty, or surgery.

STEMI (ST-segment elevation myocardial infarction) - is an acute ischemia (lack of blood) to the heart tissue sufficient to cause tissue damage where there is ST segment elevation on the electrocardiographic (ECG) readings.

Thrombolytics – is the use of pharmaceuticals or injections of medication to break up a blood clot inside an artery or cavity of the heart so that blood flow can be improved or restored. Also called fibrinolytic therapy.

Documents Used in the Development of This Plan

Development of Systems of Care for ST-Elevation Myocardial Infarction Patients: The Emergency Medical Services and Emergency Department Perspective, Moyer, Ornato, Brady, Davis, Ghaemmaghami, Gibler, Mears, Mossess, Jr., Zane; AHA Circulation 2007; 116, 43-48

EMS and STEMI; George Lindbeck, MD; October 8, 2009

Northern Virginia Regional EMS Council STEMI Committee Process Action Team Report; October 9, 2008

Northern Virginia Regional EMS Council PI and Trauma Committee; March 2, 2016
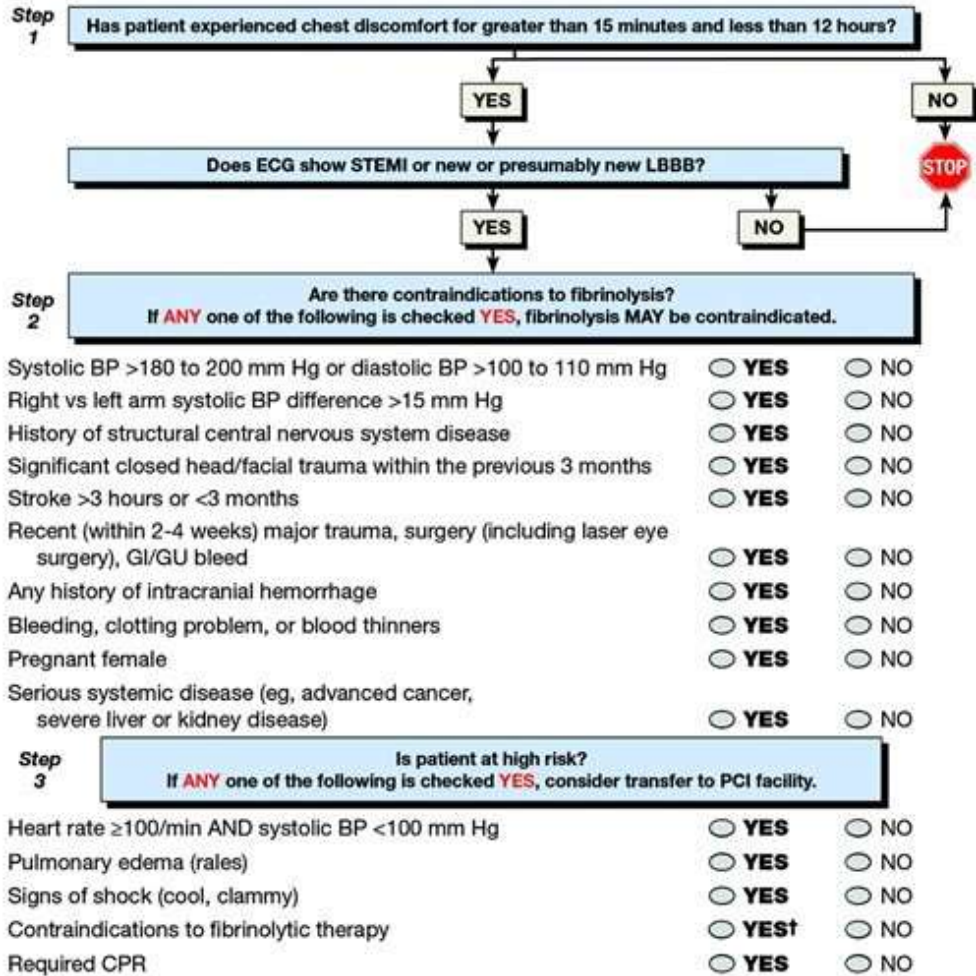
AHA Mission Lifeline Link:
https://www.heart.org/HEARTORG/HealthcareResearch/MissionLifelineHomePage/Mission-Lifeline-Home-Page_UCM_305495_SubHomePage.jsp

APPENDIX A

Prehospital fibrinolytic checklist.

Prehospital Fibrinolytic Checklist*

Step 1 — Has patient experienced chest discomfort for greater than 15 minutes and less than 12 hours?

- YES
- NO → STOP

Does ECG show STEMI or new or presumably new LBBB?

- YES
- NO → STOP

Step 2 — Are there contraindications to fibrinolysis?
If ANY one of the following is checked YES, fibrinolysis MAY be contraindicated.

Systolic BP >180 to 200 mm Hg or diastolic BP >100 to 110 mm Hg	○ YES	○ NO
Right vs left arm systolic BP difference >15 mm Hg	○ YES	○ NO
History of structural central nervous system disease	○ YES	○ NO
Significant closed head/facial trauma within the previous 3 months	○ YES	○ NO
Stroke >3 hours or <3 months	○ YES	○ NO
Recent (within 2-4 weeks) major trauma, surgery (including laser eye surgery), GI/GU bleed	○ YES	○ NO
Any history of intracranial hemorrhage	○ YES	○ NO
Bleeding, clotting problem, or blood thinners	○ YES	○ NO
Pregnant female	○ YES	○ NO
Serious systemic disease (eg, advanced cancer, severe liver or kidney disease)	○ YES	○ NO

Step 3 — Is patient at high risk?
If ANY one of the following is checked YES, consider transfer to PCI facility.

Heart rate ≥100/min AND systolic BP <100 mm Hg	○ YES	○ NO
Pulmonary edema (rales)	○ YES	○ NO
Signs of shock (cool, clammy)	○ YES	○ NO
Contraindications to fibrinolytic therapy	○ YES†	○ NO
Required CPR	○ YES	○ NO

*Contraindications for fibrinolytic use in STEMI are viewed as advisory for clinical decision making and may not be all-inclusive or definitive. These contraindications are consistent with the 2004 ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction.
†Consider transport to primary PCI facility as destination hospital.

Robert E. O'Connor et al. Circulation. 2010;122:S787-S817

American Heart Association.

Keep this form in the ED –do not send to cath lab!

PROJECT
UPSTART
Excellence in Best

STEMI ALERT
Data Sheet A

Apply Patient Sticker Here

University of Virginia

Date	ED Attending
Patient Name	ED Resident
Patient MR#	ED Nurse

Section I -completed by ED staff

Indicator	Time
Time of onset of chest pain	
1st ECG done by EMS prior to arrival? Y / N (circle one) If so, was that ECG transmitted to the ED? Y / N	Time of pre-hospital ECG: **Time transmitted:**
Time patient arrived in ED	
Time of first EKG in the ED:	
Time EKG read by ED attending:	
Time cath lab activated:	
Did ED attending activate cath Lab?	Circle one: Yes No
If not, time CCU fellow paged	
Time CCU fellow responded to page / activation	
Time CCU fellow arrived in ED	
Time cath lab team called for patient	
Time patient left ED	

Keep form in the ED –do not send   to cath lab with patient!

Section II -completed by cath lab staff

Indicator	Time
Time cath lab calls ED for patient	
Time patient arrived in cath lab	
Time cardiology attending arrives in lab	
Lido time	
Access time	
Time of 1st wire across lesion	
Time of 1st balloon inflation	

ATTENTION:
This form must stay in the ED!
Place in mailbox of
Barbara Craighead with other
STEMI packet info
Do not send to cath lab with pt.

Resource Numbers:
- ED Team Mgr 531-5839
- CCU Fellow #1309
- CCU 924-2582
- Cath Lab 982-0976
- ED attending #1 531-5701

Please provide comments on the back of this form for QI.

Thanks !

www.projectupstart.com   NOT PART OF THE MEDICAL RECORD   3.25.10