

# **Literature Review and Recommendations**

## **Prehospital Fibrinolytics Administration for Acute Myocardial Infarction**

EMS Bureau Protocol Review Steering Committee

### **Background**

In 2009, approximately 683,000 Americans were affected by acute coronary syndrome; up to 40% of these experienced ST-segment myocardial infarction (STEMI). The 2015 American Heart Association (AHA) guidelines recommend that EMS preferentially transport patients with STEMI directly to a percutaneous coronary intervention (PCI) capable hospital for primary PCI, with an ideal “first medical contact” (FMC) to device of 90 minutes or less. The goal of FMC to device time is less than 120 minutes if circumstances require transport first to a non-PCI capable hospital before urgent transfer to a PCI capable hospital. If neither goal is achievable, AHA recommends fibrinolytic treatment for appropriate STEMI patients within 30 minutes of arrival in a non-PCI capable hospital. <sup>1</sup>

In New Mexico 8,676 people were admitted for Acute Myocardial Infarctions (AMI), including STEMI, between 2006 and 2014. Due to the rural/frontier nature of New Mexico, many New Mexicans are not able to get to either a PCI capable or a non-PCI capable hospital within recommended treatment windows.

### **Question**

To decrease time from first medical contact to definitive treatment should New Mexico EMS providers administer fibrinolytics to appropriately identified STEMI patients who otherwise would not receive appropriate STEMI care in an AHA recommended treatment window?

### **Method**

Key words used: STEMI, pre-hospital, PCI, Fibrinolytic, FMC

Search engine(s) used: MEDLINE (PubMed up to January 2015), and Cochrane Library (Cochrane up to January 2015)

Review process used: A review of the literature was conducted using two electronic medical literature databases. Medical Subject Headings, keywords and a pre-hospital search filter were used to yield relevant literature.

Number of articles reviewed: 10

Number of articles deemed to be relevant and fully read: Eight

Articles cited and used to draw conclusions or formulate recommendations: six, which included three studies using retrospective chart reviews, one retrospective cohort study, one micro-simulation model, and a literature review.

## Results

Laeknabladid aimed to study transport times and adherence to clinical guidelines in patients with STEMI transported from outside of the Reykjavik area to Landspítali University Hospital in Iceland. A retrospective chart review was conducted of all patients diagnosed with STEMI outside of the Reykjavik area and transported to Landspítali University Hospital in Reykjavik in 2011-2012. Eighty-six patients had signs of STEMI on electrocardiogram (ECG) at first medical contact. In southern Iceland, nine patients (21%) underwent PPCI within 120 minutes (median 157 minutes) and no patient received fibrinolysis. In northern Iceland, where long transport times were expected, 96% of patients eligible for fibrinolysis received appropriate therapy in a median time of 57 minutes. Significantly fewer patients received appropriate anticoagulation treatment in southern Iceland compared to the northern part. The study concluded that in places where time from first medical contact to PCI is longer than 120 minutes pre-hospital fibrinolysis should be considered as first line treatment. <sup>2</sup>

A retrospective cohort study with historical control of patients treated for STEMI evaluated the outcomes obtained from the implementation of a pre-hospital thrombolysis protocol in 3 rural emergency care teams. It also reviewed delays and strategies of reperfusion applied in the treatment of STEMI patients. Emergency care teams, hospital computerized medical histories and registry reports were analyzed to obtain epidemiological and clinical features of pre-hospital treatments, hospital treatments, reperfusion status, time intervals, and mortality.<sup>3</sup> The study showed that the hospital based emergency care teams had a slightly better diagnostic rate (85.3% versus 76.9%). Otherwise, the researchers found similar use of nitroglycerin, morphine and aspirin as well as thrombolysis within the first 2h, with a median time of 40 minutes by pre-hospital care teams. It was determined that the protocol is effective, safe, and reliable. It reduced delays and improved pre-hospital outcomes. <sup>3</sup>

A decision-analysis micro-simulation model was constructed with a 30-day component and a long-term health state transition component.<sup>4</sup> The objective was to estimate the expected health outcomes, costs and cost-effectiveness of changing from current practice, where thrombolytic therapy is given in hospital, to paramedic practice where thrombolytic therapy is administered by appropriately trained paramedics pre-hospital for STEMI patients. A review of the literature was employed to obtain data on time-to-needle in order to populate the model. The primary health outcome was quality-adjusted life years; secondary outcomes included cardiac events, procedures and survival. On average, STEMI patients who received pre-hospital thrombolytic therapy gained an additional lifetime cost of \$343. The incremental cost-effectiveness ratios were \$3428 per life-year gained and \$2601 per quality of life year (QALY) gained. The most important factor was the time-to-needle. The greater the difference between current practice times and paramedic practice times, the greater the health benefits and lower the cost per QALY

(and life-year) gained. A key factor in the model was the substantially lower incidence of heart failure from earlier time-to-needle. The researchers concluded that paramedics administering thrombolysis can avert some STEMI deaths and the pre-hospital administration of thrombolysis is good value for the money. <sup>4</sup>

Michael McCaul, Andrit Lourens, and Tamara Kredo sought to assess the morbidity and mortality of pre-hospital versus in-hospital thrombolysis for STEMI. They conducted a search of the Cochrane Central Register of Controlled Trials (CENTRAL), MEDLINE (OVID), EMBASE (OVID), two citation indexes on the Web of Science (Thomson Reuters) and Cumulative Index to Nursing and Allied Health Literature (CINAHL) for randomized controlled trials and grey literature published up to June 2014. The Cochrane Heart Group conducted the primary electronic search which included randomized controlled trials of pre-hospital versus in-hospital thrombolysis in adults with ST-elevation myocardial infarction diagnosed by a healthcare provider. Their search found pre-hospital thrombolysis reduces time to thrombolytic treatment, based on the results of three studies conducted in HICs. The authors concluded that pre-hospital thrombolysis for STEMI has the potential to reduce the burden of disease in especially in individuals who have limited access to in-hospital thrombolysis or PCI (e.g. those living in rural areas). <sup>5</sup>

In 2011, Crowder, et al used retrospectively abstracted data to describe rural EMS systems' experience with tenecteplase in the treatment of STEMI patients. His team used records of patients receiving tenecteplase, utilizing standard chart review guidelines. Primary outcomes included time saved by EMS-initiated thrombolysis, aborted infarctions, serious bleeding events, and in-hospital mortality. Secondary outcomes included re-infarction, rescue angioplasty, and appropriateness of treatment. Time savings was defined as transport time after tenecteplase administration plus 90 minutes, which is the typical door-to-balloon time for PCI laboratories. 73 patients received prehospital tenecteplase; this treatment was determined to be appropriate in 86.4% of cases. The mean patient age was 59 years, and 71.6% of the patients were male. Mean scene-arrival-to-drug time was 26.2 minutes, the mean scene-arrival-to-hospital arrival time was 73.0 minutes, and the mean transport time was 46.0 minutes. Tenecteplase was administered 35.9 minutes prior to hospital arrival, and the estimated reperfusion time savings over PCI was 125.9 minutes. Aborted infarctions were observed in 24.1% of patients, whereas 9.6% suffered re-infarction, 47.9% underwent rescue angioplasty, and 16.7% required coronary artery bypass grafting (CABG). Serious bleeding events occurred in 15 patients and there were four deaths. The authors concluded that the administration of tenecteplase 36 minutes prior to hospital arrival saved approximately two hours over typical PCI strategies and resulted in aborted infarctions in one-fourth of patients. They state that these results indicate that, in a rural setting with lengthy transport times to PCI facilities, tenecteplase appears to be a feasible prehospital intervention. <sup>6</sup>

## **Discussion**

Field administration of fibrinolytics for appropriate STEMI patients has been shown to be effective in these studies. The practice of pre-hospital administration of thrombolytics is common in Europe, where ambulances often respond with physicians. The AHA suggests that this may be of potential benefit in rural areas, and recommends further research into this area.

The Wilkes County EMS system uses paramedics, who are in constant radio, phone, and telemetry contact with their medical control physicians. In contrast, the areas in New Mexico that would benefit most from field administration of fibrinolytics often only have ILS or BLS, and have minimal communications capability with online physicians. Some of these services do not have 12-lead EKG capable cardiac monitors.

For New Mexican STEMI patients destined for fibrinolytic therapy, but at significant distance from a PCI center, it may be advantageous for EMS providers to initiate fibrinolysis in the field. Using fibrinolytics in certain EMS settings is a potentially beneficial treatment for rural/frontier patients experiencing STEMI.

## **Recommendations**

- The EMS Bureau does not feel that there is enough data to suggest an addition of fibrinolytic therapy to the general scope of practice; there are simply too many critical aspects to a program of this nature. Medical direction, local hospital and physician support, and multiple technological requirements need to be in place.
- The EMS Bureau strongly encourages agencies and systems capable of the requirements described in the discussion section to initiate fibrinolytic programs through the special skill process administered by the Medical Direction Committee and EMS Bureau. A rigorous educational and protocol special skills package, including online physician consultation and EKG transmission, should be developed for pilot agencies throughout New Mexico to trial this treatment modality. Pilot agencies should have experienced and involved physician medical direction, be at least ILS level, 12-lead EKG capable, and have FMC to device times greater than 90 minutes average. Pilot agencies should also have good radio, phone, and telemetry coverage in the majority of their response area (such that the focus of the study is on the treatment and methods, not communications logistics).

## References

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