Thrombolysis in STEMI at Prehospital Settings

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Abstract

Thrombolysis is a rapidly available but semi-effective treatment, whereas percutaneous coronary intervention is a potentially delayed but highly effective therapy. What about thrombolysis in the prehospital setting for ST-elevated myocardial infarction? Does scientific evidence support or oppose? Which patient group is more eligible for prehospital thrombolysis? Is there any skirmish between emergency medicine and cardiovascular professionals? You can find a history of prehospital thrombolysis on the basis of scientific evidence in this writing. *(JAEM 2014; 13: 143-5)*

Key words: Emergency medical services, thrombolytic therapy, myocardial infarction

Introduction

Thrombolysis is a rapidly available but semi-effective treatment, whereas percutaneous coronary intervention is a potentially delayed but highly effective therapy. In the 1990s, the first studies were conducted about prehospital thrombolysis. After that, several studies were published. The results generally demonstrated decreased time-to-therapy time and mortality as well. But, some of them reported insignificant differences, whereas others found significant differences between prehospital thrombolysis (PHT) and primary percutaneous coronary intervention (PCI) on the primary endpoints. This writing summarizes the evidence about thrombolytic therapy in ST-segment elevated myocardial infarction (STEMI) in prehospital settings.

Before and In 2000;

A meta-analysis of 6 major studies conducted in the 1990s was published in 2000. According to the results, PHT for acute myocardial infarction (AMI) significantly decreased the time to thrombolysis and all-cause mortality (1). However, the largest study contributing to the meta-analysis-the EMIP (European Myocardial Infarction Program) study-did not show any statistically significance, but smaller studies did (1,2).

One of the smaller studies was GREAT (Grampian Region Early Anistreplase Trial), which administered thrombolytics at home. The study covered a 6-year follow-up. They administered a thrombolytic 130 min earlier than to patients at the hospital. A 50% reduction was reported in in-hospital mortality, together with greater success in 1-and 5-year survival for those treated earlier. It was concluded that PHT had a benefit that was of utmost clinical importance (3).

From 2000 to 2010;

After 2000, there were many other studies about PHT. The Vienna Registry demonstrated that the time duration from symptom onset to reperfusion was such that it was shortest with PHT, intermediate with in-hospital thrombolysis, and longest with primary PCI (4). The CAPTIM (The Comparison of Angioplasty and Prehospital Thrombolysis In Acute Myocardial Infarction) study included 840 patients with STEMI who were treated with PCI or PHT randomly. The primary endpoint included a combination of death, reinfarction, and non-fatal and disabling stroke at 30 days. When regarding the primary endpoint, the results showed PHT with 8.2% and PCI with 6.2%. When regarding death rate, PHT with 3.8% and PCI with 4.8% were shown. Although the results showed a better outcome for PCI, it was insignificant statistically. Unfortunately, the trial was terminated due to funding. The goal to gather 1200 patients was thus not achieved, and it became underpowered. Despite these facts, some very interesting results were reported. If the patient was randomized within 2 hours, the PHT group had a strong tendency to lower 30-day mortality in comparison with the PCI group (2.2% vs 5.7%). The study concluded that those triaged by emergency medicine service (EMS) personnel within 2 hours of symptoms of STEMI to PHT and then transferred to a hospital with a PCI facility had a 50% reduction in 5-year mortality when compared with those treated by primary PCI. The finding is also valid for patients treated at 2-4 h (5). Several other studies have also identified the mortality benefits of PHT versus in-hospital thrombolysis (6-8).

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In 2010, the American Heart Association (AHA) published cardiopulmonary resuscitation (CPR) and emergency cardiovascular care (ECC) guidelines. It summarizes key points of prehospital, emergency service, and initial critical care interventions. In the acute coronary syndrome (ACS) section, the guideline emphasized improving the early response to cardiac emergencies, which include the early recognition of symptoms by patients themselves, patients' relatives, and health care professionals. Immediate calls to the EMS system were also mentioned. In the ACS algorithm, the EMS assessment priorities were summarized. Besides titration of oxygen therapy and administration of non-enteric aspirin, nitroglycerin, and morphine, EMS personnel should have a 12-lead electrocardiogram (ECG) every time as soon as possible for all patients with symptoms of ACS. If they are not trained to interpret ECGs, the ECG or its computer report should be transmitted to the receiving hospital (9).

The AHA guideline mentioned that if thrombolysis is chosen, it should be initiated as soon as possible, preferably within 30 min of first medical contact (FMC). When PHT was administered to patients with STEMI, it was shown to reduce time to administration of thrombolytic agents and decrease mortality rates (1,10-12). It is also strongly recommended that systems that administer prehospital thrombolytic include: protocols including fibrinolytic checklists, personnel who can interpret a 12-lead ECG and have experience in advanced life support, tools to communicate with target hospitals, medical directors who can manage STEMI, and continuous quality improvement (9).

In order to provide PHT, there should be a cooperative and interdisciplinary effort between EMS agencies, EM physicians, cardiologists, catheterization labs, and critical care units. An agreement between physicians of emergency medicine and cardiology at hospitals with PCI facilities must be provided, so that consideration of PCI does not introduce further delays in thrombolytic treatment (9).

After 2010;

There are many reports related with PHT. One of the important studies was the STREAM (The Strategic Reperfusion Early After Myocardial Infarction) study. It included 192 patients who had symptoms for <3 h but could not be transported to a catheterization lab in <1 h. The patients were randomized to receive either standard primary PCI or an invasive pharmacologic strategy involving PHT followed by immediate transfer to a hospital with a PCI facility. The data about time durations are impressive. Time duration from symptom onset to FMC was 61 min, 100 min to administration of drug in the PHT group, and 178 min to sheath insert in the PCI group. It was reported that there was no significant difference in the primary endpoint at 30 days or in any of the individual components of the primary endpoint. It was valid even in the case of cardiogenic shock and all-cause death (PHT vs PCI 4.4% vs 5.9% and 4.6% vs 4.4%, respectively). The author concluded that PHT followed by timely PCI resulted in effective reperfusion in those with early STEMI for whom primary PCI could not be performed within 1 hour after FMC. It was also mentioned that fibrinolysis had a slightly increased risk of intracranial hemorrhage (13).

However, the last executive summary on the management of STEMI did not have a direct recommendation about PHT. The only detail that was included was about 12-lead ECG interpretation by EMS personnel (14).

In addition to this evidence, there is a reality about developing and even rural areas of developed countries. Most centers do not have any 24-h available PCI service and are fully dependent on thrombolysis. The experience of Salvador, Bahia, and Brazil showed that a preliminary study about regional STEMI networks was effective, achieving primary reperfusion rates comparable with those reported internationally. It was reported to be feasible in developing countries (15, 16). In a study enrolled in rural STEMI patients, PHT was reported to be administered 36 min prior to hospital arrival and saved approximately 2 hours over typical PCI strategies (16).

Conclusion

As a result, PHT would seem to be the preferred treatment if the symptom onset of STEMI is within 2 h before FMC. When time duration is > 4 h, primary PCI is chosen. All patients who receive thrombolytic treatment should have coronary angiography with or without PCI performed within 24 h. More emphasis is also expected on PHT in the future guidelines of CPR and ECC.

References

1. Morrsion LJ, Allan R, Grunfeld A. Mortality and prehospital thrombolysis for acute myocardial infraction: A meta-analysis. JAMA 2000; 283: 2688-92.
2. The European Myocardial Infarction Project Group. Prehospital thrombolytic therapy in patients with suspected acute myocardial infarction. N Eng J Med 1993; 329: 383-9. **[CrossRef]**
3. Rawles J. Magnitude of benefit from earlier thrombolytic treatment in acute myocardial infarction: new evidence from Grampian region early anistreplase trial (GREAT). BMJ 1996; 312: 212-5. **[CrossRef]**
4. Kall K, Christ G, Karnik R, Malzer R, Norman G, Prachar H, et al. Implementation of guidelines improves the standard of the care: the Viennese registry on reperfusion strategies in ST-elevation myocardial infarction (Vienne STEMI registry). Circulation 2006; 113; 2398-405. **[CrossRef]**
5. Bonnefoy E, Lapostolle F, Leizorovicz A, Steg G, Mcfadden EP, Dubien PY, et al. Primary angioplasty versus prehospital fibrinolysis in acute myocardial infarction: a randomized study. Lancet 2002; 360: 825-9. **[CrossRef]**
6. Mathew TP, Menown IB, McCarthy D, Gracey H, Hill L, Adgey AA. Impact of pre-hospital care in patients with acute myocardial infarction compared with those first managed in-hospital. Eur Heart J 2003; 24: 161-71. **[CrossRef]**
7. Danchin N, Blanchard D, Steg PG, Sauval P, Hanania G, Goldstein P, et al. Impact of prehospital thrombolysis for acute myocardial infraction on 1-year outcome: results from the French Nationwide USIV 2000 Registry. Circulation 2004; 110: 1909-15. **[CrossRef]**
8. Stenstrand U, Lindback J, Wallentin L, RISK-HIA Registry. Long term outcome of primary percutaneous coronary intervention vs. prehospital and in-hospital thrombolysis for patients with ST-elevation myocardial infarction. JAMA 2006; 296: 1749-56. **[CrossRef]**
9. O'Connor RE, Brady S, Brooks SC, Dierecks D, Egan J, Ghaemmaghami C, et al. Part 10. Acute Coronary Syndromes: 2010 American Association Guidelines for Cardiopulmonary Resuscitation and Emergency

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Cardiovascular Care. Circulation 2010; 122; S787-S817. **[CrossRef]**

10. Dussoix P, Reuille O, Verin V, Gaspoz JM, Unger PF. Time savings with pre-hospital thrombolysis in an urban area. Eur J Emerg med 2003; 10: 2-5. **[CrossRef]**

11. Rawles J. Quantification of benefit of earlier thrombolytic therapy: five-year results of Grampian Region Early Anistreplase Trial (GREAT). J Am Coll Cradiol 1997; 30: 1181-6. **[CrossRef]**

12. Rawles J. Halving of mortality at 1 year by domiciliary thrombolysis in The Grampian Region Early Anistreplase Trial (GREAT). J Am Coll Cardiol 1994; 23: 1-5. **[CrossRef]**

13. Armstrong PW, Gershlick AH, Goldstein P, Wilcox R, Danays T, Lambert Y, et al. Fibrinolysis or primary PCI in ST -segment elevation myocardial infarction. N Eng J Med 2013; 368; 1379-87. **[CrossRef]**

14. 2013 ACCF/HA Guideline for the Management of ST-Elevation Myocardial Infarction: Executive Summary. A Report of The American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. Circulation. 2013; 127; 529-55. **[CrossRef]**

15. Solla DJ, de Mattos Paive Filhol, Delisle JE, Braga AA, de Moura Xavier de Moares JB, Filgueiras NM, et al. Integrated regional networks for ST-segment elevation myocardial infraction care in developing countries. The experience of Salvador, Bahia, Brazil. Circ cardiovasc Qual Outcomes 2013; 6; 9-17.

16. Crowder JS, Hubble MW, Gandhi S, McGinnis H, Zelman S, Bozeman W, et al. prehospital administration of tenecteplase for ST-segment elevation myocardial infraction in a rural EMS system. Prehosp Emerg Care 2011; 15: 499-505. **[CrossRef]**