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Review

Management of Prehospital Phase of Acute Myocardial Infarction

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Abstract

Thirty percent of deaths due to acute myocardial infarction occur before patients arrive at a hospital; thus prehospital care plays a critical role in the management of this disease. Accurate history taking is the most important step in this management, as about two-thirds of all cases of acute myocardial infarction show prodromal symptoms prior to onset. Characteristic symptoms are chest discomfort, including sensations of strangulation and pressure or pain in the chest. These are often accompanied by cold sweats, nausea, vomiting, and even fear of impending death. Acute myocardial infarction should be suspected if these symptoms continue for more than 30 minutes. Physical findings may vary from slight pallor of face and an expression of agony and cold sweating in mild cases, to cyanosis or even shock in severe cases. However, it is important to recognize that these signs and symptoms are often absent. When acute myocardial infarction is suspected, an electrocardiogram should be taken immediately for proper evaluation of acute coronary syndrome. Although the medical and technologic revolution in the last 3 decades has improved clinical outcome in patients sustaining acute ST-elevation myocardial infarction (STEMI), residual morbidity and mortality remain major health concerns. Importance of prehospital delay and optimal sustained patency as modulators of successful reperfusion have been repeatedly demonstrated and discussion about pharmacologic and mechanical reperfusion continues. Despite physician awareness and patient education programs, time from symptom onset to treatment in STEMI remains stalled at approximately 3 hours for pharmacologic reperfusion, as documented in major clinical trials. Multifaceted improvements with advanced paramedic training, transmittable 12-lead electrocardiograms, and bolus fibrinolytics facilitate potential prehospital diagnosis and treatment. Thus, as we proceed into the 21st century, it is essential to re-examine strategies for addressing these and other issues relating to the process of delivering optimal care to most patients with STEMI. Especially notable are the opportunities provided through prehospital management with initiation of therapy, triage to appropriate hospitals, or both as major potential avenues to further enhance patient outcomes.

Introduction

The prompt delivery of high quality coronary care to patients following acute coronary syndromes is of paramount importance. This is especially so in acute myocardial infarction (AMI) with ST elevation on the presenting electrocardiogram, as 26% of patients died before reaching the hospital (Figure 1) while the rapid restoration of patency of the infarct related artery improves survival [1]. Although the medical and technologic revolution in the last 3 decades has improved clinical outcome in patients sustaining acute ST-elevation myocardial infarction (STEMI), residual morbidity and mortality remain major health concerns. Delay in initiating treatment after AMI may be categorized into two phases: patient delay, i.e. the time between symptom onset and call for help and healthcare system delay which encompasses the response to patient call, transport to the institution, and the time to appropriate treatment following arrival at hospital.

Over the years various methods have been proposed to reduce these delays. Provision of out-of-hospital mobile coronary care in the community with staff trained in the recognition and management of acute myocardial ischaemia/infarction reduces transport and hospital delay times. The efficacy and safety of such pre-hospital initiated treatment has been demonstrated in many early studies [2,3]. Patients with ST segment elevation on the initial ECG and suitable for fibrinolytic therapy have been studied out-of-hospital [4,5-11]. A small number of randomized trials have also compared the efficacy of pre-hospital initiated fibrinolytic therapy with therapy first commenced in-hospital [4,5,8-11,12]. These studies have demonstrated consistently a reduced pain to needle time with pre-hospital treatment, with an average gain of 1 hr [13,14]. A physician-staffed pre-hospital coronary care unit in addition to providing early fibrinolytic therapy has the advantage of prompt identification and treatment of the early complications of acute myocardial ischaemia/infarction.

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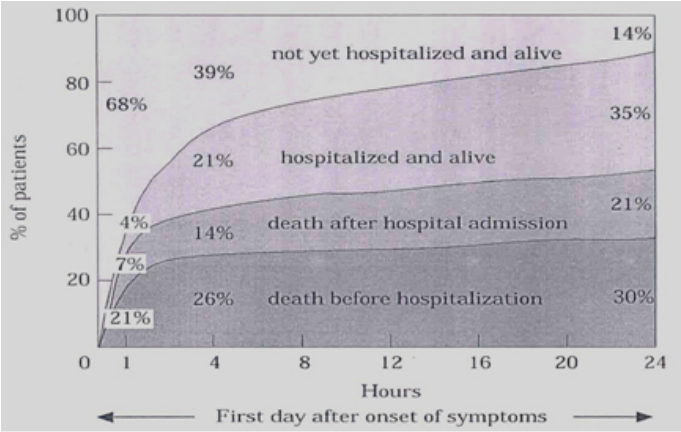


Figure 1. Survival in the first day after acute myocardial infarction

Pathophysiology and Impact of Time

Abrupt coronary obstruction leads to transmural ischaemia within the area at risk determined by the coronary anatomy. The jeopardized myocardium develops irreversible changes starting in the subendocardium and progressing outwards. This progression of necrosis has been termed the 'wave front phenomenon'[15]. In anaesthetized dogs, infarct size increases with duration of coronary occlusion for up to 6 h. After 6 h, reperfusion has no effect on infarct size. The temporal and spatial progression of necrosis across the ventricular wall represents a fundamental pathophysiological phenomenon. Indirect evidence suggests that in humans average infarct size without reperfusion therapy is about 20% of the left ventricle. If thrombolytic treatment is started 1 h after onset, 70% of jeopardized myocardium is salvaged, but it is 0% when thrombolysis initiated 5 h after onset [16,17]. Limited benefit following myocardial reperfusion in acute myocardial infarction may result from an underestimation of occlusion time. On the other hand, coronary occlusion may be intermittent despite the presence of continuous pain. Intermittent spontaneous reperfusion may prevent or limit myocardial damage and benefit may then follow from relatively late therapeutic interventions [18].

Delays in Providing Treatment for Cardiac Emergencies

Delays in providing treatment depends on 4 factors-

1. Patient decision time

2. Doctor decision time

3. Dispatching

4. Ambulence response interval

Patient Decision Time

The interval from the onset of symptoms until medical assistance is sought varies widely. Despite widespread public education, reports on patient delays have demonstrated only small trends to shorter time intervals [19]. Decision time is not closely related to knowledge of heart symptoms. Symptoms are often interpreted incorrectly [20] because of psychological defence mechanisms such as denial [21] or displacement and rationalization [22]; but responses are influenced by severity of pain [23], the emotional reactions to it [24], and the degree of left ventricular dysfunction [25].

Doctor Decision Time

Although call-to-needle times can be very short when general practitioners give thrombolytics pre-hospital [26], many studies have shown that the involvement of the majority who do not themselves give thrombolytic therapy in the management of myocardial infarction results in substantial delay in definitive treatment given after arrival in hospital [27,28]. Calling a general practitioner alone in response to a cardiac arrest may be even less appropriate in countries where few are equipped for defibrillation.

Dispatching

The dispatcher has four decisions to make: (1) whether or not to send an ambulance; (2) if an ambulance is to be sent the type of ambulance to be deployed;(3) how much urgency is needed; (4)whether advice should be given to the caller on actions to be taken meanwhile. The first of these is the most difficult even for experienced medical dispatchers, because the quality of information is frequently too poor for any safe decision not to send an ambulance [29]. Many ambulances are dispatched to patients whose complaints turn out not to have been urgent [30]. Many ambulance control centres send vehicles in response to all requests for help whilst others use algorithms to assess the urgency and priority of calls.

Ambulance Response Interval

The ambulance response interval (which measures the duration from call to arrival at the patient's side) of the first or only tier is in general the shortest of all the delays. In some countries, a time limit is set whereby 95% of all ambulance journeys must be completed within 15 min and 80% within 10 min. In others, strict time criteria are being set for selected cases based on the information received and using systems of prioritized despatch. Both of these approaches are in line with the concepts of early defibrillation for cardiac arrest and early reperfusion for acute myocardial infarction.

Prehospital Ecgs in Patients with STEMI: What are the Benefits ? (Figure2)

Multiple studies have demonstrated the benefits of prehospital ECGs for decreasing door-to-drug time and door-to balloon time in patients with STEMI [31]. The direction and magnitude of the time savings are clinically relevant, resulting in an approximately 10-minute decrease in door-to-drug time and 15- to 20-minute decrease in door-to-balloon time [31,32]. However, these time

savings may not reflect the full potential of prehospital ECGs to decrease delays in reperfusion therapy. In fact, studies have shown further reductions in door-to-balloon time when prehospital ECGs are used to activate the catheterization laboratory while the patient is enroute to the hospital [33-39]. For patients transported by EMS without prehospital ECG, delay from symptom onset to reperfusion therapy, which reflects the overall period of ischemic injury, can be divided into 4 time intervals: (a) symptom onset to EMS arrival, (b) EMS arrival to hospital arrival, (c) hospital arrival to ECG, and (d) ECG to reperfusion. Prehospital ECG programs, if effectively implemented and coordinated with hospital systems of care, would be expected to decrease the latter 3 time intervals. The second interval is composed of time from first medical contact by EMS to hospital door, and EMS personnel may behave with more urgency if a diagnosis of STEMI has been made in the field. The third interval is essentially eliminated with a prehospital ECG. The fourth interval can be decreased by advanced notification of the hospital to receive and evaluate the patient, to activate the catheterization laboratory while the patient is en route, or to bypass the emergency department and transport the patient directly to the catheterization laboratory. Scholz and colleagues reported the impact of prehospital ECGs on these time intervals from 114 patients with STEMI treated within an integrated system of care [40]. The system consisted of acquiring a prehospital ECG by emergency responders, transmitting the prehospital ECG to a fax machine at the percutaneous coronary intervention (PCI) hospital cardiac intensive care unit, activating the catheterization laboratory en route if STEMI was diagnosed, and bypassing the emergency department when the catheterization laboratory team was on-site. The time spent at the scene decreased from 25 to 19 minutes, time spent in the emergency department decreased from 14 to 3 minutes, time from arterial access to balloon decreased

- Recognise AMI
- Identify reperfusion candidates
- Earlier the better: time is muscle
- Reduce time to thrombolysis
- Reduce time to PCI
- Prehospital thrombolysis

Fig. 2 Benefits of prehospital ECG

Current Guidelines for Prehospital Ecgs among Patients with ST-Segment–Elevation Myocardial Infarction

American Heart Association national guidelines [41,42,43], as well as other consensus and scientific statements [44-46], recommend that emergency medical services (EMS) acquire and use prehospital ECGs to evaluate patients with suspected acute coronary syndrome. Despite these recommendations, prehospital ECGs are used in fewer than 10% of patients with ST-segment–elevation myocardial infarction (STEMI) [47], and this rate has not substantially changed since the mid- 1990s. Furthermore, even when a prehospital ECG is acquired, the information is often not effectively translated into action and coordinated with hospital systems of care to decrease delays in reperfusion therapy.

The Chain of Survival for Cardiac Arrest

In no medical emergency is time such a decisive determinant of outcome as in circulatory arrest. The 'chain of survival' concept clearly describes the important links involved [48,49]. The chain is usually regarded as having four links.

Early Access

Immediate access to an ambulance dispatch centre is a primary requirement because any delay in calling the ambulance service inevitably decreases the prospects of survival. The initial contact should not be with a physician, unless he/she has the role of first tier in the EMS and has a defibrillator. The caller's description of the problem should influence the degree of priority that is accorded preferably by the use of one of the evaluated algorithm systems: the dispatcher should be alerted by any suggestion of impaired consciousness and should not be reassured by the statement that the victim is breathing, as gasping may continue for minutes after circulatory arrest. Convulsion and vasovagal collapse may cause confusion. Early cardiopulmonary resuscitation (CPR) It has been estimated that at any point in time between collapse and first defibrillation, bystander CPR at least doubles the chance of survival [50,51], with the possible exception of the first few minutes [51].

Early Defibrillation

In most instances ventricular fibrillation is the initial rhythm associated with circulatory arrest. As time passes, the waveform of ventricular fibrillation loses amplitude and frequency until no deflections can be detected. Electrical defibrillation is the only effective therapy for ventricular fibrillation, and the interval between the onset of the arrhythmia and the delivery of the first defibrillating shock is the main determinant of successful defibrillation and survival. The possibility of successful defibrillation decreases by more than 5% per minute from the time of collapse. To achieve early defibrillation, it is mandatory that people other than doctors be permitted to defibrillate. In particular, all first tier ambulances should be equipped with defibrillators, and ambulance personnel should be proficient in their use [52]. Non-medical ambulance personnel can be trained in defibrillation in as little as 8–10 h, provided they have good training in basic life support.

Automated External Defibrillation

The automated external defibrillator (AED) can be employed by persons with a limited training targeted to use of the equipment, but

without sufficient knowledge for a reliable diagnosis of ventricular fibrillation [53]. This makes it possible to bring the defibrillator to locations with large crowds such as stadiums, airports, shopping malls, and railway stations, where trained first aid personnel can employ them rapidly and in locations where EMS intervention is almost impossible such as airplanes or cruise ships.

Early Advanced Care

In many instances, CPR and defibrillation alone do not achieve or sustain resuscitation, and advanced cardiac life support is necessary further to improve the prospect of survival. In some systems, endotracheal intubation and intravenous medication are not provided out of hospital, while in others advanced life support is available from the first tier of the ambulance service, or more commonly by a second tier. Transportation to the hospital intensive care unit should not be allowed to interrupt appropriate advanced care.

Treatment of Acute Coronary Syndromes in the Pre-Hospital Phase

General Measures for Patients without Overt Complications

(a) Pain Relief

Pain should be relieved as quickly as possible. This is a priority because pain will increase anxiety and the resulting sympathetic stimulation will aggravate myocardial ischaemia. Pain should therefore be controlled adequately as soon as possible. Opioids such as morphine (or diamorphine where its use is permitted) should be administered intravenously and titrated until pain is adequately relieved. Subcutaneous and intramuscular injections should be avoided. Nitrates and intravenous beta blockers that may be given for other reasons can contribute to pain relief by improving the underlying ischaemia. Anxiolytics - in particular benzodiazepines - may be given if anxiety is perceived as a major component of the patient's distress.

(b) Treatment of Early Nausea, Vomiting, Hypotension, and Bradycardia

These common features of the initial phase of acute heart attacks may be due to excess vagal tone and/or the side effects of analgesics, nitrates, and beta-blockers. Antiemetic drugs such as metoclopramide may be used to counter nausea and vomiting. Bradycardia (with or without hypotension) despite the relief of pain and nausea may be improved by the administration of atropine. Persisting hypotension is likely to reflect severe myocardial damage

(c) Aspirin Administration

Aspirin significantly improves the prognosis of patients with suspected acute myocardial infarction or unstable angina [54]. The efficacy of aspirin in reducing cardiovascular death seems to be similar in patients treated early and late [55]. Thus aspirin (150 to 300 mg, preferably) should be given to all patients with acute coronary syndromes in the absence of clear contraindications irrespective of the delay between presumed onset of symptoms and first evaluation. Since antiplatelet activity may be obtained within 30 min antithrombotic protection should not be delayed until arrival in hospital. Aspirin is simple to administer, it does not require specific monitoring, and as a single dose it is well tolerated. The additive effect of aspirin and fibrinolytics on cardiovascular mortality and the preventive effect of aspirin on the 'excess' of recurrence of myocardial infarction with thrombolysis was observed when aspirin was given immediately before the infusion of fibrinolytic agents. If fibrinolytic therapy is given in the pre-hospital phase aspirin should be administered concomitantly to help prevent early reocclusions. Heparin was the reference anti-thrombotic treatment for the acute phase of myocardial infarction, but the risk of major bleeding was significantly increased by 50%. Heparin as an adjunctive treatment to streptokinase and aspirin has not been shown to improve mortality in two large trials but it did increase the risk of bleeding [56,57].

(d) Pre-Hospital Beta-Blockade

The efficacy of beta-blocking agents in preventing death and reinfarction after myocardial infarction is well established. Many trials and meta-analyses [58-61] have assessed the value of starting intravenous beta-blockade early after the onset of symptoms. A meta-analysis of the trials available to early 1985 showed a 13% reduction in total short term mortality (P<0·02), a 20% reduction in reinfarction (P<0·02), and a 15% reduction in ventricular fibrillation or cardiac arrest (P<0·05) and the two subsequent large trials [58,59] were consistent with this evidence. In addition, intravenous beta-blockade reduces ischaemic pain and tachyarrhythmias. Despite these results, experience of beta-blockade in the early phase of myocardial infarction is limited. No evidence of a mortality benefit from early beta-blockade as compared with delayed beta-blockade was seen in one randomized trial but the study was not powered for showing differences in mortality. The ESC task force consider there is no strong indication for systematic use of beta-blockade before hospital admission.

(e) Prophylactic Use of Oral or Intravenous Nitrates

More than 80 000 patients with acute myocardial infarction have been involved in 22 studies comparing early intravenous or oral nitrates with control groups. Two large studies, GISSI-3 [62] and ISIS 4 [63], contributed most of the patients and reported no mortality benefit. A meta-analysis [63] showed only a 5·5% reduction of mortality (P=0·03). This translates into a saving of 3·8 deaths per 1000 treated. Whether this benefit is sufficient to justify routine use of nitrates is debatable, particularly with the added

uncertainties of the pre-hospital phase. Nitrates may be deleterious in cases of right ventricular ischaemia or infarction which may complicate inferior left ventricular changes. Persistent pain or the presence of heart failure may of course be valid indications for their use for patients with these specific conditions, but they are not at present recommended for routine administration.

(f) Prophylactic use of ACE Inhibitors

Long term use of ACE inhibitors started a few days after myocardial infarction has been established as an effective treatment to reduce mortality and reinfarction in patients with clinical signs of heart failure or with an impaired ejection fraction. Early treatment with ACE inhibitors is considered relatively safe, although it increases the risk of hypotension, cardiogenic shock, and renal dysfunction [63]. Because of these side effects and of the lack of information on the early pre-hospital phase, the ESC Task Force do not recommend the prophylactic pre-hospital use of ACE inhibitors.

(g) Prophylactic Use of Antiarrhythmic Therapy

Lidocaine has been advocated to prevent ventricular fibrillation in patients with acute myocardial infarction. Several studies have been performed to test the efficacy of prophylactic lidocaine for this indication. Meta analyses [64,65] have shown a reduction of approximately 35% in the incidence of ventricular fibrillation but also a non-significant trend to an increase in mortality. Studies restricted to the pre-hospital phase have included data on 7386 patients, but these have not provided any evidence for a reduction in mortality as a result of prophylactic antiarrhythmic therapy. With current knowledge routine use of lidocaine or other prophylactic antiarrhythmics in the pre-hospital phase cannot be recommended

Reperfusion Therapy

Prehospital Thrombolysis (PHT)

Current Guidelines

All guidelines are based on the results of RCTs comparing primary PCI (PPCI) and thrombolysis, as well as on observational data from registries. As most guidelines were published a few years ago, the most recent data have obviously not been taken into account. All agree that time is critical and reperfusion should be initiated as soon as possible [66-68]. The American Heart Association (AHA) and the American College of Cardiology (ACC) favour the use of PHT over PCI, placing the emphasis on the time factor rather than on the method of reperfusion. AHA/ACC guidelines state that PHT should be performed only following the confirmation of STEMI on a 12-lead ECG, interpreted by a physician on site or after transmission to a specialist. A reperfusion checklist should also be completed to ensure that the patient has no contraindications to thrombolytics and to identify high-risk patients who would benefit more from PPCI. PHT should be performed within 30 min of the arrival of the emergency services. If PHT cannot be administered and the patient is subsequently transported to a hospital that has no PCI facility, the door-to-needle time (arrival at the hospital to the administration of thrombolytic, DN) should be, 30 min. If, however, the hospital can offer PCI, the door-to-balloon time (arrival to PCI, DB) should be ,90 min [66,69]. The recent update of the ACC/AHA guidelines [66] insists that patients presenting to a hospital with PCI capability should be treated with PPCI within 90 min of first medical contact (level of evidence A). In patients presenting to a hospital without PCI capability and who cannot be transferred to a hospital centre and undergo PCI within 90 min of first medical contact, fibrinolytic therapy should be administered within 30 min of hospital presentation unless contraindicated (level of evidence B). The goal is to organize systems of care such that the total ischaemic time be ,120 min. The goals for each management step are the following: time from symptom onset to first call to emergency medical service (EMS): 5 min, with 1 min EMS dispatch; EMS on scene within 8 min, ECG on scene and consider pre-hospital fibrinolytic therapy by EMS if capable and time to lytic therapy ,30 min; if transportation to a hospital without PCI capability, DN time ,30 min; if transportation to a hospital with PCI capability, EMS-to-balloon time ,90 min (if patient self-transport: DB time ,90 min). In its most recent guidelines [67], the European Society of Cardiology (ESC) recommends reperfusion by PPCI, if performed by an experienced operator within 120 min of the first medical contact or within 90 min of first medical contact if the patients present within 2 h of the onset of symptoms and have a large myocardial area at risk and a low bleeding risk. PPCI should be used in patients with contraindications to thrombolysis and is the preferred treatment for patients in shock. Otherwise, thrombolysis should be administered as soon as possible. If thrombolysis fails (based on the lack of sufficient ST-segment resolution), rescue PCI should be performed within a reasonable time delay (up to 12 h after symptom onset). If thrombolysis is successful (50% ST-segment resolution at 60–90 min, reperfusion arrhythmias, disappearance of chest pain), coronary angiography is recommended in the absence of contraindications. To avoid an early PCI during the pro-thrombotic period following fibrinolysis, on the one hand, and to minimize the risk of re-occlusion, on the other hand, a time window of 3–24 h following successful fibrinolysis is recommended [67]. In contrast, facilitated PCI (using thrombolytics or GP IIb/IIIa inhibitors before primary angioplasty) is not recommended.

Pre-Requities for Pre Hospital Thrombolysis

It is Important to Know the Structure of the Prehospital Thrombolysis Programme. The Programme Includes

1. Well equipped cardiac ambulances.

2. Ability to perform 12 lead ECG in ambulances.

3.Trained medics and paramedics to interpret ECGs.

4. ECG transmission facility to a specialized center.

5. Capability to treat cardiac and cerebrovascular emergencies in ambulances.

6. Availability of bolus dose – thrombolytic agents.

7. Facility to provide awareness and education programme directed at the general population on disease manifestation and strategies to reduce ambulance service time.

Choice of Thrombolytic Agents for Prehospital Thrombolysis

The National Institute for Clinical Excellence supports reperfusion with fibrinolytics, recommending PHT using the newer agents, reteplase and tenecteplase, whose bolus application simplifies administration. Time is crucial here too and therapy should be initiated within 12 h of symptom onset [70]. The European Resuscitation Council guidelines state: thrombolysis is indicated in the absence of contraindications if PCI is not possible within 90 min, or if symptom duration is 3 h and delay to PCI 60 min. PCI is indicated if available within 90 min (60 min if presenting within 3 h of symptom onset) if thrombolytics are contraindicated, the patient is in cardiogenic shock, severe left ventricular failure, or presents later than 3 h. All guidelines stress that a network for STEMI management should be developed on a national and/or regional level, with continuous monitoring to show how reperfusion strategies work in real-life situations.

Prehospital (PHT)v/s in Hospital Thrombolysis (IHT):

However, as documented in a meta-analysis of six randomized trials, PHT is significantly superior to in-hospital thrombolysis (IHT) in terms of hospital mortality and it saved 45 min compared with IHT, which could potentially preserve myocardial tissue and improve outcomes [71].

Fig-3 Prehospital v/s In hospital thrombolysis

Study	Number of patients	Odds ratio (95% CI)	Favours pre-hospital thombolysis	Favours in-hospital thrombolysis
MITI 1993	360	0.69 (0.30-1.57)		
EMIP 1993	5469	0.86 (0.72-1.03)		
GREAT 1991	311	0.56 (0.25-1.23)		
Roth et al 1990	116	0.80 (0.17-3.77)		
Schofer et al 1990	78	0.46 (0.04-5.31)		
Castaigne et al 1989	100	0.74 (0.14-3.86)		
Overall	**6434**	**0.83 (0.70-0.98)**		

References:
Pedley et al. BMJ 2003; 327: 22-26.

Comparison of Thrombolysis with Percutaneous Coronary Intervention in Randomized Controlled Trials

Randomized controlled trials (RCTs) have shown PPCI to be more effective than fibrinolysis for STEMI when performed by an experienced team within 90 min of first medical contact [72-74]. Keeley et al. evaluated 23 trials comparing PPCI with thrombolysis using streptokinase or a fibrin-specific agent. Regardless of the thrombolytic agent, PPCI was more effective, even if transfer to centres with appropriate facilities was necessary.(72-74) Comparison of Angioplasty and Prehospital Thrombolysis in Acute Myocardial Infarction (CAPTIM), compared PHT and PPCI. Patients who received thrombolysis within 2 h of symptom onset showed a strong trend towards lower 30 day mortality than those who had undergone PPCI. Beyond 2 h, the difference between the groups was almost reversed in favour of PPCI [75]. The findings from CAPTIM are consistent with those from PRAGUE-2, which showed that within 3 h of symptom onset, mortality rates were almost identical, but in patients randomized after 3 h, mortality following thrombolysis was much higher [76]. The investigators concluded that if STEMI patients can be transferred within 20–30 min, they should receive PPCI. If this cannot be performed within 60 min, thrombolysis can be administered up to 3 h after onset. Beyond 3 h, thrombolysis should not be used, and patients should be transferred for PPCI. Likewise, in the Primary Coronary Angioplasty vs. Thrombolysis (PCAT)-2 Trialists Collaborative Group meta-analysis [77], 30 day mortality doubled in the fibrinolysis group as the time delay increased from 1 to .6 h. The re-infarction rate was also higher in this group and increased with the time delay (not observed in the PPCI group). Thus, the time delay to reperfusion remains central to the choice of strategy [77]. Another important point is the role of subsequent PCI after PHT. In CAPTIM, 70% of patients in the thrombolysis group underwent PCI before day 30, with 26% requiring rescue PCI. Therefore, the actual comparison in this trial was between PPCI and PHT followed by PCI if thrombolysis failed [75]. Furthermore, the role of systematic PCI within 24 h of thrombolysis was tested in the Grupo de Analisis de la Cardiopatia Isquemica Aguda (GRACIA-1) trial [78] and in the CARESS-in-AMI trial [79]. In both instances, the policy of systematic PCI following thrombolysis yielded better results than conservative management. The WEST (Which Early ST-elevation myocardial infarction Therapy) study extended this concept and compared tenecteplase alone with tenecteplase and mandatory PCI within 24 h and PPCI with a loading dose of clopidogrel. The results suggested that rapidly applied pharmacological reperfusion with follow-up (rescue and routine) PCI within 24 h produced equivalent results to PPCI [80].

Registry Data

Inclusion and exclusion criteria of RCTs imply that only ideal situations are represented. Registry data provide a more realistic view of treatment strategies and outcomes in unselected populations. Consequently, results of registries and trials often differ. Bjo¨rklund et al. demonstrated a 1 year mortality of 8.8% for STEMI patients treated with fibrinolytics in a RCT, in contrast to 20.3% for patients not included in the trial but treated at a trial hospital, and 19.0% for patients treated in a non-trial hospital (P,0.001 for both). Thus, less critically ill patients are preferentially selected for inclusion in RCTs [81].

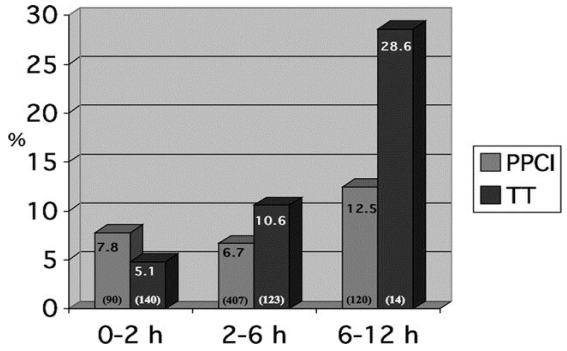
French Registries

The first nationwide French registry, in 1995, showed equivalent results for 1 year mortality with intravenous thrombolysis and PPCI. However, PHT and IHT were not analysed separately, as PHT was seldom used in France at that time [82]. In the USIC 2000 Registry, reperfusion was selected according to several criteria, including the time to reach a catheterization laboratory and the availability of the specialist team. In contrast to RCTs, the USIC 2000 results favoured PHT [83]. This may have been influenced by the large proportion of patients who underwent rapid coronary angiography, similar to that found in CAPTIM, and much higher than in trials such as DANAMI-2, [84] which found PCI to confer a higher survival advantage than IHT if performed within 2 h of symptom onset.

Vienna Registry (Figure 4)

The results of the Vienna STEMI registry, which included 1053 acute STEMI patients admitted to hospital, were similar to those of CAPTIM [75,84]. PHT, when initiated within 2 h of symptom onset, showed a (not statistically significant) trend towards reduced mortality compared with PPCI. Only a small number of patients underwent PPCI within 2 h. As in other registries and CAPTIM, the advantage of PHT was lost as times to administration increased. Overall, PPCI was associated with an increased survival benefit over PHT. However, because 91% underwent coronary angiography (rescue or systematic) while in hospital, the results are not strictly those of PHT alone, rather a combination of thrombolysis and angiography with or without mechanical intervention. The conclusion reflected trial results: within 2 h of symptom onset, thrombolysis should be administered, preferably pre-hospital, if PPCI cannot be performed within 90 min of the first medical contact.

Fig-4 Vienna STEMI registry



In the large RIKS-HIA (Register of Information and Knowledge about Swedish Heart Intensive Care Admissions), PHT had better outcomes than IHT, but patients who received PPCI had lower mortality and re-infarction rates and shorter hospital stays. Comparing 30 day and 1 year results between the ambulance-managed PHT patients and the primary angioplasty group shows that both reperfusion methods yield very similar mortality figures: 5.4 vs. 4.9% at 30 days and 7.2 vs. 7.6% at 1 year, respectively. Time delay to reperfusion appeared very important in the thrombolysis groups, as mortality increased sharply beyond 2 h. The difference was less dramatic for PPCI. Overall, time delay was central to the benefit incurred by any type of reperfusion, but loss of benefit with increasing delay was less pronounced with PPCI. Therefore, the authors concluded that, within 2 h of symptom onset, patients should receive PHT only if PPCI is not available within 4 h. This conclusion, however, did not take into account the results of PHT in ambulance-transported patients.

International GRACE Registry

The Global Registry of Acute Coronary Events (GRACE) followed 44 372 STEMI and non-STEMI patients from 1999 until 2005, looking for improvement in outcomes when evidence-based treatment guidelines were followed [87]. The proportion of STEMI patients eligible for any kind of reperfusion therapy did not change significantly over the study period, but the proportion undergoing PPCI increased by 37%, whereas pharmacological reperfusion decreased by 22%. Correspondingly, in-hospital mortality and cardiogenic shock decreased. However recommended adjuvant pharmacological treatment increased markedly throughout the study. The decrease in mortality can be attributed to increased experience in invasive treatment strategies and more efficient pre-hospital management, but also to the effect of improved

adjuvant therapies. The GRACE registry therefore shows that the implementation of guidelines is central to the provision of improved patient care.

Indian Perspective

In today's practice, evidence based medicine is mandatory. However, we must review each modality of therapy from an Indian perspective. reperfusion therapy of AMI should necessarily have a geographical referral system. This means that the patient will be treated by the nearest quality controlled CCU or prehospital ambulance service. A particular emergency medical care service whether CCU or ambulance service should be marked for a given population in the vicinity of the service. A routinely available ambulance service with the paramedic staff is not geared to provide prehospital thrombolysis today. City based major institutions should provide emergency satellite units to achieve the time benefit required in treating AMI. Implementation of prehospital thrombolysis in India will require support, interest and participation of hospital administrators, dedicated community leaders, physicians, cardiologists and appropriate structuring and resourcing of emergency medical services. Applying evidence based medicine without quality control protocols can be more dangerous than not abiding by the therapy guidelines. This rule applies also to in-hospital thrombolysis and primary PCI. The proposed model of STEMI management in next decade in India has been given in figure 5.

Fig. 5. Proposed model of STEMI management in next decade in India

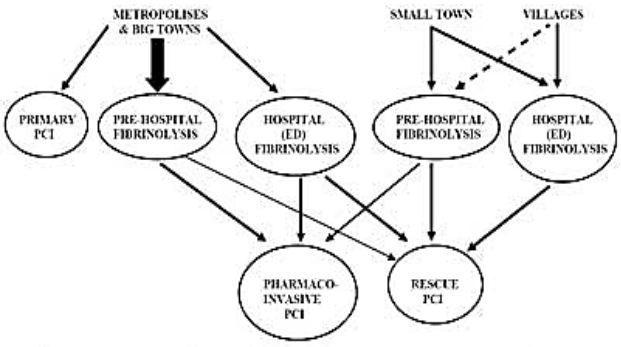


Fig. 1 : A proposed model of STEMI management over the next decade in India

Conclusion

Exercising the opportunities in prehospital cardiac care could substantially enhance patient outcomes. With the current EMS capabilities, the ideal prehospital system should include prehospital diagnosis by clinical symptoms and prehospital ECG with initiation of fibrinolysis or triage to the appropriate medical institution for rapid institution of definitive therapy. At a minimum, we should aim for a dedicated response system to achieve an increase in hospital state of readiness to reduce time-to-reperfusion. Extension of these advances to other cardiac emergencies, including sudden cardiac death, high-risk non-STEMI acute coronary syndromes, and stroke, will continue to improve the outcomes in these common potentially catastrophic conditions. There are no longer logical reasons to delay response to these calls for action, because time is elapsing, and, with it, needless morbidity and mortality are occurring in our patients.

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