

A Study of Prehospital Delay Patterns in Acute Myocardial Infarction in an Urban Tertiary Care Institute in Mumbai

Ashar Khan¹, Milind Phadke², Yash Y Lokhandwala³, Pratap J Nathani⁴

Abstract

Objective: There is now increasing awareness about the need for early diagnosis in patients presenting with chest pain. Pre-hospital delay remains a major hurdle in the institution of early reperfusion therapy, which is crucial in salvaging 'at-risk' myocardium and reducing adverse cardiovascular events following ST elevation myocardial infarction (STEMI). This study aims to determine the incidence and the determinants of delayed presentation STEMI and the potential impact of such delay on adverse cardiovascular outcomes.

Method: We prospectively evaluated all patients who were admitted in the emergency department of our hospital with STEMI from March 2014 to February 2016. Data was collected sequentially at the time of admission, discharge and during follow-up. Patients were evaluated with serial ECGs, continuous ECG monitoring and echocardiography.

Results: Out of 1386 patients with STEMI, delayed presentation was seen in 1148 (> 2 hrs) and 805 (> 4 hrs) patients. The duration from onset of symptoms to the presentation in the emergency room (pre-hospital delay) was 228 ± 341 minutes. The door to needle time was 34 ± 24 minutes. The major factors for pre-hospital delay were misinterpretation of symptoms (45%) and transportation problems (27%).

Conclusions: The problem of pre-hospital delay continues to remain a major hurdle in initiating timely reperfusion therapy in patients with acute STEMI. Lack of awareness and poor transportation facilities are the major contributors. It should be the goal of STEMI care programmes of the future to make a concerted effort to addressing these factors, in order to optimize the benefit of reperfusion therapy for this high risk group of patients.

Editorial Viewpoint

- Early hospital reporting and diagnosis is critical in myocardial infarction.
- Prehospital delay is a major cause of increased morbidity and mortality in myocardial infarction.
- This study finds lack of awareness and poor transportation facilities as the major contributors to the delay in management of myocardial infarction.

fibrinolysis with cost-effective agents like streptokinase (STK) continues to be one of the commonest modalities for reperfusion. Patients with STEMI are most benefited when thrombolytic therapy is administered early, especially within the first "Golden Hour" after the onset of symptoms; absolute mortality reduction is by 1% for every hour saved, and can be seen upto 6 hrs.² Beyond the first few hours, benefit is significantly reduced.³ Yet, due to a variety of reasons, thrombolytic therapy is often instituted late during the course of treatment. The time interval between first onset of symptoms and the institution of reperfusion therapy is known as the total ischemic time. This has several components,⁴ including time for

Introduction

Acute STEMI is a major cause of mortality and morbidity worldwide. Most of the deaths (80%) occur within the first 24 hrs, of which the first hour is the most critical, contributing to 40 to 65% of the mortality.¹ Half of these deaths are sudden and occur even before the patient has first

medical contact. The in-hospital as well as long term mortality and risk significantly reduce with early reperfusion - either thrombolytic therapy or primary angioplasty. In a developing country like India,

¹Senior Resident, ²Associate Professor, ³Visiting Consultant, ⁴Professor and HOD, LTMMC and GH, Mumbai, Maharashtra
Received: 14.08.2016; Accepted: 22.08.2016

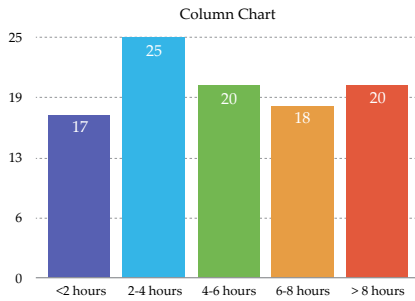


Fig.1: Percentage wise distribution of patients in relation with prehospital delay in presentation after symptom onset

first medical contact, transportation time, and time from arrival of the patient to thrombolysis ('door to needle time') or to primary PCI (door to balloon time). As observed in earlier studies, delays can occur at many levels - factors contributing to delay in treatment of patients with STEMI include time to first medical contact, time spent in transit to hospital, delay in evaluation of patient in the emergency department, recording/interpretation of the ECG and dispensing thrombolytic therapy. As systems try to focus on shortening the time from arrival of the patient to onset of reperfusion, it is increasingly recognized that the pre-hospital delay contributes significantly to total ischemic time. Careful analysis of the reasons for pre-hospital delay is therefore warranted in order to plan remedial measures and development of STEMI care systems.

Method

This was an observational study conducted at a tertiary university hospital located in Mumbai. Data was collected prospectively of patients admitted in our institute with STEMI from March 2014 till February 2016. The diagnosis of STEMI was made on ECG showing ST segment elevation of more than 2 mm in two consecutive precordial leads, or more than 1 mm in two contiguous limb leads, with rise in cardiac troponins. The exclusion criteria were: i)

thrombolytic therapy administered elsewhere, ii) development of STEMI after hospitalisation, iii) unknown time of symptom onset and iv) LBBB. Using a standard questionnaire, information was sought regarding demographic characteristics, educational class, past history of ischemic heart disease, coronary risk factors, time of onset of chest pain, time between symptom onset and presentation to hospital, initial treatment given by primary attending doctor, events between chest pain and presentation to hospital, type of doctor consulted and mode of transport to the hospital. The door to needle time was calculated considering the time of admission to the time of starting STK, as documented in the indoor papers.

Statistical Analysis

Statistical analysis was done using SPSS software. The mean and median were calculated from the variables studied. Comparison of demographic and clinical characteristics were done using t test and Anova test; for the rest of the variables, t test, chi square test and mid p exact test were used; a p value < 0.05 was considered to be statistically significant.

Results

A total of 1932 patients with STEMI were admitted during the study period. Of these, 1386 (973 men, 413 women) received STK. The remaining 546 patients met one or more of the exclusion criteria. Out of 1386 patients, only 234 (17%) patients were able to reach the hospital in less than 2 hours, whereas 333 (25%) patients reached between 2 to 4 hours after onset of symptoms (Figure 1). The pre-hospital delay was 228 ± 341 mins. A longer pre-hospital delay was found in women, patients > 55 yrs and diabetic patients. On the other hand, location of MI, time of presentation (day/night), hypertension and obesity were not found to be associated with delayed

presentation.

Out of 234 patients who reached hospital in <2hrs, 103 (44%) patients came by their own transportation facilities and 131 (56%) patients came by an ambulance ($p > 0.05$). Among the 1152 (83%) patients who reached the hospital after 2 hrs, 449 (39%) patients came by their own vehicle and 703 patients came by ambulance (Table 1). Presentation to hospital by an ambulance was not significantly associated with shorter pre-hospital delay. A medical consultation before coming to the emergency room was obtained in 882 (62%) patients, while 504 (36%) patients presented directly without any prior consultation. The main factors responsible for pre-hospital delay (Table 2) were misinterpretation of symptoms (45%) and transportation problems (29%).

Discussion

This study has attempted to analyse the magnitude and common reasons for pre-hospital delay in patients of STEMI presenting to a tertiary care hospital in the urban metropolis of Mumbai. There have been previous studies assessing pre-hospital delays in patients with STEMI from India.^{5,6} Xavier et al⁶ found only 58.5% of Indian STEMI patients received thrombolytics, with an average interval between symptom onset and hospital arrival (pre-hospital delay) of 5 hours, which was more than that of our study. This was twice as long as the median delay seen in the second Euro Heart survey.⁷ Increased pre-hospital delay in India has previously been attributed to poor patient knowledge about ACS, lack of emergency medical services (EMS) infrastructure, and transportation difficulties.

A major factor causing outdoor delay is lack of knowledge about symptoms of STEMI and denial of the disease both by patient and relatives. In our study, only 17% patients reached our emergency

Table 1: Comparison of prehospital delay times by demographic and clinical characteristics

Factors	Delay time (mins)	
	N	Mean±SD
Total	1386	228± 341
Sex		
Male	1113	222± 312*
Female	273	338 ±566
Age		
< 55 years	567	184± 201*
>55 years	819	286± 398
Time of day		
Day	1078	241± 352
Night	308	260± 217
Mode of transport		
Ambulance	834	237± 482
Non- ambulance	552	262± 536
MI location		
Anterior	933	235± 348
Non-anterior	453	272± 476
Hypertension		
Yes	910	252± 290
No	476	229± 298
Diabetes		
Yes	560	301± 202*
No	826	207± 332
Smoking		
Yes	506	239± 255
No	880	254± 389
Obesity		
Yes	175	258± 257
No	1211	244± 389
Previous MI		
Yes	126	238± 376
No	1260	244± 328
Prior consultation		
Yes	882	264±460*
No	504	123± 273
Socioeconomic status†		
Upper (26-29)	42	230±580
Upper middle (16-25)	189	255±361
Lower middle (11-15)	427	241± 560
Upper lower (5-10)	560	281± 402
Lower (<5)	168	301± 409

†Modified Kuppusswami score; *P<0.05, All others P>0.05

room in less than 2 hours and 39% of the patients arrived after 6 hours. Our results were consistent with various earlier studies showed a pre-hospital delay of 1.5 to 4 hours in acute coronary syndrome.⁸⁻¹³

We found that female gender (p = 0.004), age>55yrs (p = 0.007) and diabetes (p = 0.005) were associated with longer pre-hospital delay, similar to previous studies.¹⁴

Table 2: Chief causes responsible for prehospital delay in study population

Chief Cause of Pre-hospital delay	Number of Patients	Percentage
Misinterpretation of symptoms	623	44.94
Delay during Transportation	396	28.57
Prior consultation	267	19.26
Financial reasons	60	04.32
Wrong initial diagnosis	24	01.73
No help available	16	1.1

¹⁶ Reasons for delay in women included not considering the symptoms to be serious, waiting for the symptoms to improve, not wanting to be a burden on anyone, finding it unpleasant or embarrassing to seek medical help. For the elderly, reasons for delay were mainly more limited access to medical care and failure to recognize or appreciate the symptoms of AMI. Silent ischemia or atypical symptoms often lead to diagnostic delays or errors in diabetic individuals - a phenomenon which is well recognized and documented in the literature.¹⁷

In our study, 834 (61%) patients arrived at the hospital by an ambulance and 552(39%) patients by other means of transport. Interestingly, presentation to hospital by an ambulance was not significantly associated with shorter pre-hospital delay. (p= 0.14) Previous studies have found that patients presenting to the emergency room by an ambulance had shorter pre-hospital delay.^{18,19} One explanation for this finding could be that due to the anticipated traffic delays and availability of other tertiary care institutes, a sizeable number of patients presenting to us tended to be from localities relatively close to the hospital, and could therefore manage to arrange their own transport to reach the hospital.

The commonest cause of pre-hospital delay in our study was misinterpretation of symptoms

(45%) followed by transportation problems (29%). Initial medical consultation was obtained in 62% - this can be a potential source of delay, especially if the first medical contact is not trained in recognising the symptoms and/or ECG findings of acute STEMI. In our study, 670 (49%) patients had consulted an allopathic doctor and 192 (14%) had consulted a non-allopathic doctor prior to presentation in the emergency department. Pre-hospital consultation was identified as a cause of significant delay in our study (p <0.001), thus increasing pain to door time.

According to the standard guidelines, an ECG should be obtained immediately within the first 10 mins of arrival to hospital in patients suspected to have suspicion of acute coronary syndrome, and the ideal door to needle time should be less than 30 mins.²⁰ In our study mean door to needle time was 34 ± 24 mins and the average door to ECG time was found to be 16 mins, both of which were more than the recommended guidelines. In a study by Mohannan et al,²¹ less than one-third of STEMI patients who received thrombolysis had door-to-needle times more than 30 min. Door-to-needle time <30 min was associated with lower in-hospital mortality.²¹ The probable causes of these indoor delays are thought to be as follows: Indoor admission delay (time delay in OPD/IPD registration), indoor transport delay (lack of manpower, insufficient transportation carrier), delay in recording and interpretation of ECG. This indoor time delay can be reduced by starting thrombolytic therapy in the emergency room or in the pre-hospital setting in cardiac ambulances. The universal availability of cardiac ambulances with trained doctors and facilities for obtaining and electronically transmitting ECGs to an expert Cardiologist/physician - as is routinely done in several countries- can be a valuable way of achieving

shorter ischemic times .

Conclusions

The present study demonstrated that pre-hospital delay continues to be a common phenomenon, thereby significantly increasing the total ischemic time with consequent increase in in-hospital mortality and morbidity. Misinterpretation of symptoms and transport delays continue to contribute the most to pre-hospital delays. Systems of STEMI care will have to focus on these variables to make a significant impact on patient outcomes in ST elevation myocardial infarction.

Limitations of the Study

This study has demonstrated the two commonest causes of pre-hospital delay - however, there can be many other reasons with more than one cause in a given patient - this needs further analysis. Inability to analyse and classify patient with multiple causes of delay has been mentioned as a limitation of the study. Second, it would be of interest to correlate the immediate and long term outcomes as a function of pre-hospital delay - however, this correlation is now well established and accepted in literature and hence was not the primary aim of conducting such a study.

References

1. Timerman S, Marques FBR, Pispico A, Ramires JAF. Tratamento pré-hospitalar da síndrome isquêmica aguda com supradesnivelamento de segmento ST: Já temos suficiente evidência para implantar de rotina?. *Rev da Soc Cardiol* 2004; 14:868-86.
2. Piegas LS, Timerman A, Nicolau JC, et al. III Diretrizes para o tratamento do infarto agudo do miocárdio. *Arq Bras Cardiol* 2004; 83:3-86.
3. Nallamothu BK, Antman EM, Bates ER. Primary percutaneous coronary intervention versus fibrinolytic therapy in acute myocardial infarction: does the choice of fibrinolytic agent impact on the importance of time-to-treatment? *Am J Cardiol* 2004; 94:772-774.
4. de Boer MJ, Zijlstra F. STEMI time delays: a clinical perspective. *Netherlands Heart J* 2015; 23:415-9.
5. George E, Savitha D, Pais P. Pre hospital issues in acute myocardial infarction. *J Assoc Physicians India* 2001; 49 320-323.
6. Xavier D, Pais P, Devereaux PJ, et al. Treatment and outcomes of acute coronary syndromes in India (CREATE): a prospective analysis of registry data. *The Lancet* 2008; 371:1435-42.
7. Mandelzweig L, Battler A, Boyko V, et al. The second Euro Heart Survey on acute coronary syndromes: characteristics, treatment, and outcome of patients with ACS in Europe and the Mediterranean Basin in 2004. *Eur Heart J* 2006; 27:2285-93.
8. McGinn AP, Rosamond WD, Goff DC Jr, et al. Trends in prehospital delay time and use of emergency medical services for acute myocardial infarction: experience in 4 US communities from 1987-2000. *Am Heart J* 2005; 150:392-400.
9. Grace SL, Abbey SE, Bisailon S, et al. Presentation, delay, and contraindication to thrombolytic treatment in females and males with myocardial infarction. *Womens Health Issues* 2003; 13:214-21.
10. Dracup K, Moser DK, McKinley S, et al. An international perspective on the time to treatment for acute myocardial infarction. *J Nurs Scholarsh* 2003; 35:317-23.
11. Rasmussen CH, Munck A, Kragstrup J, Haghfelt T. Patient delay from onset of chest pain suggesting acute coronary syndrome to hospital admission. *Scand Cardiovasc J* 2003; 37:183-6.
12. Goldberg RJ, Steg PG, Sadiq I, et al. Extent of, and factors associated with, delay to hospital presentation in patients with acute coronary disease (the GRACE registry). *Am J Cardiol* 2002; 89:791-6.
13. Luepker RV, Raczynski JM, Osganian S, et al. Effect of a community intervention on patient delay and emergency medical service use in acute coronary heart disease: The Rapid Early Action for Coronary Treatment (REACT) Trial. *JAMA* 2000; 284:60-7.
14. Johansson I, Stromberg A, Swahn E. Factors related to delay times in patients with suspected acute myocardial infarction. *Heart Lung* 2004; 33:291-300.
15. Moser DK, McKinley S, Dracup K, Chung ML. Gender differences in reasons patients delay in seeking treatment for acute myocardial infarction symptoms. *Patient Educ Couns* 2005; 56:45-54.
16. Hwang SY, Ryan C, Zerwic JJ. The influence of age on acute myocardial infarction symptoms and patient delay in seeking treatment. *Prog Cardiovasc Nurs* 2006; 21:20-7.
17. Wackers FJ, Young LH, Inzucchi SE, et al. Detection of Silent Myocardial Ischemia in Asymptomatic Diabetic Subjects. *Diabetes Care* 2004; 27.
18. Bassan R, Pimenta L, Leães PE, Timerman A. I Diretriz de dor torácica na sala de emergência. *Arq Bras Cardiol* 2002; 79:1-22.
19. McLean S, O'Reilly M, Doyle M, et al. Improving Door-to-Drug time and ST segment resolution in AMI by moving thrombolysis administration to the Emergency Department. *Accid Emerg Nurs* 2004; 12:2-9.
20. O'Connor RE, Brady W, Brooks CS, et al. Acute coronary syndromes: 2010 American Heart Association guidelines for cardiopulmonary resuscitation and emergency cardiovascular care. *Circulation* 2010; 122:S787-S817.
21. Mohanan PP, Mathew R, Harikrishnan S, et al. Presentation, management, and outcomes of 25 748 acute coronary syndrome admissions in Kerala, India: results from the Kerala ACS Registry. *Eur Heart J* 2013; 34:121-9.