

Delays in Thrombolytic Therapy in Acute Myocardial Infarction: An Audit from the East Coast of Peninsular Malaysia

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Abstract

The objectives of this study were to evaluate the time delays between the onset of symptoms and admission to hospital and provision of thrombolytic therapy in patients with suspected acute myocardial infarction; and to examine the accuracy of the clinical diagnosis and the therapeutic decision on thrombolysis in these patients. An observational study of 96 patients with suspected myocardial infarction was undertaken over a period of 15 months in the Coronary Care Unit of Hospital Kuala Terengganu. Seventy per cent of the patients arrived in the hospital within 6 hours of the onset of symptoms. After arrival in the emergency room, it took a median time of 85 minutes before the administration of thrombolytic therapy. Of the 67 patients who were given thrombolysis, 46 were treated within 6 hours of the onset of symptoms. About a quarter of patients said that they had delayed seeking treatment at the hospital. Treatment delays occurring in the hospital were mainly due to admission procedures as well as late diagnosis. Eighty-one patients had confirmed myocardial infarction of whom 59 received thrombolytic therapy. Eight patients receiving thrombolytic therapy had no confirmation of myocardial infarctions. Improvements in diagnostic accuracy and reduction of delays in the provision of thrombolytic therapy could be achieved by better training of health care staff as well as by further streamlining of admission procedures.

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Introduction

The use of thrombolytic agents in acute myocardial infarction (AMI) over the last decade has radically altered the management of this condition, with significant reduction in mortality when given appropriately.^{1,2} Nonetheless, the data also showed that not all patients benefited from thrombolysis and that the treatment itself is not entirely risk free.³ Furthermore, the timing of thrombolysis is critical and there is a clear and marked deterioration in the efficacy of the therapy with delay in its administration, especially when given more than 6 hours after onset of symptoms.^{3,4} Physicians are now faced with the challenge of quickly and correctly diagnosing AMI as well as ensuring that the therapy, which needs to be given as soon as possible, is appropriate for the particular patient.

This study attempts to look at some of these issues within the setting of Hospital Kuala Terengganu (HKT) which is the only centre in the east coast state of Terengganu able to offer thrombolytic and coronary care services. Besides serving its own district, the hospital is a tertiary referral centre for a network of 4 smaller

district hospitals and a sprawling collection of health centres, some of which are more than 100 km away from HKT. Industrialisation has only covered 0.1% of Terengganu's land area and most of the 890 000 population are rural folks who are ethnically Malay.⁵

Obviously this creates special problems in the provision of a rapid thrombolytic therapy service for AMI patients and one of the main aims of the study was to see how long it took from the onset of symptoms until the patient's arrival at the Accident and Emergency (A&E) Department of HKT. We then examined the time delays involved in admitting the patient to the Coronary Care Unit (CCU) as well as in the final administration of the thrombolytic therapy. Instead of just looking into the overall delay, evaluation of the various components of the delays would help us in planning strategies to reduce the delays.

Nonetheless, the quality of a thrombolytic service depends not only on speed but also on correct patient selection. An ideal service would ensure that all AMI patients eligible for thrombolysis would receive it and that thrombolytic therapy would not be given to non

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AMI patients. As such, we monitored the clinical course of our patients to verify the accuracy of the diagnosis and to establish the reasons behind any possibly erroneous decisions.

In 1990, only 7 of our patients received thrombolytic therapy but in 1994, the number had increased ten-fold. As part of a quality assurance programme we felt that it was now time to take a careful look at the speed and accuracy of our service and to implement whatever remedial measures necessary to improve matters.

Materials and Methods

Admission and Thrombolytic Procedure in HKT at the Time of Study

In HKT, patients with suspected myocardial infarction, including cases referred from elsewhere, would be assessed first by the A&E Medical Officer who would decide where to admit the patient. On admission, the decision for administration of thrombolytic therapy would then be made by a medical officer from the Medical Unit. Thrombolytic therapy is given only in the CCU setting and is guided by a printed check list of criteria, with the principal ones being electrocardiographic (ECG) changes consistent with AMI such as ST segment elevation, symptom duration less than 12 hours and age of patient less than 75 years. The check list also details a number of situations where there are possible contraindications to thrombolysis. Among these are patients with conditions such as active peptic ulcer, bleeding disorder, recent major surgery or trauma within the past 6 weeks, history of intracerebral haemorrhage and so on.

Study Subjects

Any patient in the CCU of HKT with a clinical diagnosis of AMI was eligible to be entered into the study which started from November 1994 through to January 1996. Data concerning the timing of events such as the onset of symptoms, time of admission and time of starting thrombolytic therapy were recorded onto a structured form. Reasons for delays were also identified wherever possible and noted down. Sources of data included patient interview and scrutiny of the admission record, case notes and electrocardiograms. Timings were recorded to the nearest 5 minutes. Patients unable to give any history were excluded from the study as well as those who died before they could be fully evaluated.

The clinical course of the patient was monitored and the serial ECGs and cardiac enzymes were scrutinised by a specialist in internal medicine to decide whether AMI had occurred or not, based on the presence of at least two of the three WHO diagnostic criteria for myocardial infarction.⁶

1. Typical central ischaemic chest pain lasting more than 30 minutes;
2. Typical serial ECG changes of either pathological Q or non Q evolution and ST-T changes (elevation of at least 0.1 mV) in two or more leads in a standard 12 lead ECG;
3. Serial cardiac enzymes elevation (to more than twice the upper limit of normal) and subsequent return to normal, in at least 2 of the following i.e. creatine kinase, lactate dehydrogenase and aspartate aminotransferase.

Results

Of the 96 patients studied, 67 (69.8%) received thrombolytic therapy. There were 81 (84.4%) patients with confirmed diagnosis of AMI.

Time from Onset of Symptoms to Arrival in HKT

A substantial proportion of the patients (70.8%) arrived in the A&E Department within 6 hours of the onset of their symptoms, with a median of 3 hours 40 minutes. Twenty-three patients (24%) said that they had delayed their decision to come to the hospital (Table I), 19 of whom were subsequently shown to have confirmed AMI.

Most patients (60.5%) were from the local district of Kuala Terengganu itself. The main bulk of outside referrals came from the 2 centres in the districts which were closest to Kuala Terengganu. Other districts located close to the state borders had the option of sending their patients to tertiary centres in neighbouring states. We analysed the data based on the district the patients were referred from and the results are shown in Table II.

Patients referred from the centre in District B seemed to show marked delays and a sizeable number (8/14) arrived in the A&E Department of Hospital Kuala Terengganu more than 12 hours after the onset of symptoms and thus were not given thrombolytic therapy. We reviewed the medical records and electrocardiograms of patients from District B and found that management shortcomings by health care staff accounted for the delays experienced by 5 infarct patients who satisfied the criteria for thrombolysis. The staff in

TABLE I: PATIENT'S REASONS FOR NOT PRESENTING TO HOSPITAL EARLIER

Reason given by patient	Number (n = 23)
Thought that pain was not severe or serious	7
Tried own medication	5
No transport to hospital	4
Preferred to try treatment from family doctor rather than be admitted to hospital	4
Tried massage	2
On oil rig	1

TABLE II: TIME COURSE OF PATIENTS CATEGORIZED BY DISTRICT

District	Number of patients	Distance from HKT	Median time from onset of symptoms until arrival in A&E HKT	% of patients arriving in A&E HKT within 6 hours of onset of symptoms
Kuala Terengganu	59	local	160 min	71.9%
District A	10	40 km	200 min	60%
District B	14	75 km	780 min	14.6%

A&E: accident & emergency department; HKT: Hospital Kuala Terengganu

District B had a tendency to wait for the cardiac enzymes results before referring the patient to our CCU and this contributed to the delay.

Time from Arrival in HKT to Admission in the CCU and Thrombolysis (if given)

The median time for thrombolysis after arrival in the A&E Department was 85 minutes, with 70.1% receiving it within 2 hours of presentation. Delays in the CCU were apparent, with a median time of 20 minutes from the time the patient arrived in the CCU until the time the thrombolysis was actually started. Analysis of the procedures involved showed that this delay occurred due to the practice of repeating the ECG in the CCU before deciding on thrombolysis. For 62.7% of the patients who were given thrombolysis, previous ECGs done in the A&E Department had sufficient changes to satisfy the criteria for thrombolysis. In such cases, repeat ECGs in CCU are only necessary in those who have not had the diagnosis of coronary artery spasm ruled out by an ECG recording after the administration of a sublingual nitrate.

Some 15 patients who were later confirmed to have AMI were admitted from the A&E Department to the general ward before making their way to the CCU and this added about 90 minutes of delay. Review of these cases showed that 5 of these patients had clear-cut ECG changes which were not correctly interpreted by the A&E doctors and as such, led to a marked delay in the diagnosis of AMIs. The remaining cases had equivocal ECGs which subsequently evolved.

Overall analysis showed that the median time from onset of symptoms to thrombolysis was 270 minutes, with 68.6% receiving therapy within 6 hours of symptoms.

Accuracy of Diagnoses and Decision on Thrombolysis

Twenty-two (27.2%) of the 81 patients with subsequently confirmed AMI were not given thrombolysis. Of these, 5 cases could be attributed to diagnostic errors, 5 to the patients presenting late while the remaining 12 were not given thrombolysis because they did not satisfy the laid down criteria (age >75 years and serial ECGs performed within 12 hours of onset of symptoms did not show ST segment elevation).

Thrombolysis was given to 67 patients but subsequent analysis showed that of these, 8 (11.9%) did not have confirmed AMI. Four of the 8 had evidence of previous anterior infarction and this made ECG interpretation more difficult. Of the remaining 4 patients, 3 had non-specific ST segment changes with no rise in the cardiac enzymes and they were eventually diagnosed as having unstable angina. Finally, one patient had ST elevation which rapidly resolved with the administration of an intravenous nitrate and was later diagnosed as having coronary artery spasm. In this case it was unfortunate that the attending physician did not retract the order to give thrombolytic therapy.

Discussion

Table III summarises the main reasons behind the occurrence of delays in the administration of thrombolytic therapy in HKT. Clearly, patient delay in seeking treatment was a substantial factor in the overall delay and the data from HKT are not much different from that in other countries.^{7,8} Within Malaysia, previous data from a large urban centre gave very similar figures of 70% of patients presenting within 6 hours of their symptoms.⁹ As most of our AMI patients (77.8%) said that they did not have any previous history of ischaemic heart disease, educating the patients in our cardiac clinics to come early when they develop symptoms would be of limited benefit. Public awareness campaigns have not been judged to be of great value either.^{7,8,10} Our study, however, proved useful in demonstrating that delayed referrals were coming from a particular district centre. We have since taken steps to

TABLE III: SUMMARY OF THE CAUSES OF DELAY IN THE MANAGEMENT OF AMI PATIENTS

Cause of delay	Number
Patient delay in seeking medical attention	23
Delayed referral from district health centre	6
Delay in Hospital Kuala Terengganu due to late diagnosis of AMI despite clear ECG changes	7
Time spent on doing ECG in CCU despite diagnostic ECG earlier	42

AMI: acute myocardial infarction; ECG: electrocardiogram; CCU: Coronary Care Unit

TABLE IV: COMPARISONS OF TIME DELAYS (MEDIAN TIMES)

Study	Arrival to thrombolysis	Onset of symptoms to thrombolysis	A&E to CCU
HKT	85 min	270 min	55 min
Royal College of Physicians (UK) ¹²	85 min	Not available	76 min
Edinburgh(1987-8) ¹¹	93 min	210 min	60 min
Edinburgh (fast track protocol) ¹³	49 min	150 min	32 min

A&E: accident & emergency department; HKT: Hospital Kuala Terengganu; CCU: Coronary Care Unit

update the staff in the district hospitals and health centres on the need for rapid management of patients with suspected AMI.

As far as in-hospital delays were concerned, Table IV shows that HKT had similar figures to that of some centres in the United Kingdom although the goalposts have since shifted with the introduction of a "fast track" admissions protocol in Edinburgh.¹¹ In HKT, 68.6% of the patients received thrombolysis within 6 hours and this is comparable to the 74.3% in the multicentre Royal College of Physicians (UK) audit.¹²

In-hospital delays in HKT seemed to be due to specific admission procedures. Furthermore, about 10% of patients who were given thrombolysis had delays in their management due to difficulties in making correct diagnosis of AMI in the A&E setting. Patients whose infarcts were not diagnosed until they were already admitted to the general medical wards experienced delays of about 90 minutes as they had to be moved to the CCU for thrombolysis.

To improve the diagnostic process, patients in the A&E Department with possible AMI should be urgently referred for the opinion of the on duty Medical Unit doctor who should then rapidly assess the patient and ECG in the A&E Department itself. When required, he should instruct the CCU staff by phone to prepare the thrombolytic agent so that it can be administered as soon as the patient arrives in the CCU. If coronary artery spasm has already been excluded by the persistence of ST segment elevation on the ECG following the administration of sublingual glyceryl trinitrate, time need not be wasted on performing a repeat ECG in the CCU before starting thrombolysis.

One problem arising from the need for urgency in thrombolytic therapy is the possibility of error in the administration of the drug to patients who do not have AMI, and this is amply illustrated in our study. Interpretation of ECGs may be difficult for the more junior staff, particularly so with patients who have a history of previous cardiac events. One solution would be for our cardiac patients to keep a copy of their ECG on them so

that rapid detection of any new ECG abnormalities can take place if they are seen in the emergency room. A centralised records office with 24-hour access is also being planned and this will enable staff to quickly obtain and review any previous ECGs of a particular patient. To minimise diagnostic and management errors resulting from relatively inexperienced staff, a restructuring of the on-call system was carried out. Coronary care patients are now managed by more experienced medical officers who have had several months training in acute internal medicine.

Data from Edinburgh and from other centres confirmed that in-hospital delays do occur, but in contrast to patient delays which may not be controllable, better organised protocols could be used to overcome the in-hospital problems.^{11,13,14}

Thrombolysis in the A&E Department also appears to be significantly quicker than that in the CCU and in future, this approach will probably become generally adopted.^{8,12,15}

Conclusion

It is clear from our audit that at least 16% of patients with confirmed AMI experienced delay in their management due to late referral and late diagnosis by health care staff. Admission procedures also caused delay in a large proportion of patients. Better education and an increased level of awareness in health care workers, as well as a more streamlined admissions protocol, will be necessary steps towards resolving quality problems present in our thrombolytic service.

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