PREHOSPITAL CARE

Observational study of prehospital delays in patients with chest pain

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Objective: To define and measure patient reported prehospital delay in presentation to the emergency department with chest pain and identify simple strategies that may reduce this delay. The authors investigated the null hypothesis that the patients choice of service to call for acute medical help has no effect on the timing of thrombolysis.

Method: A prospective observational study of prehospital times and events was undertaken on a target population of patients presenting with acute chest pain attributable to an acute coronary syndrome over a three month period.

Results: Patients who decided to call the ambulance service were compared with patients who contacted any other service. Most patients who contact non-ambulance services are seen by general practitioners. The prehospital system time for 121 patients who chose to call the ambulance service first was significantly shorter than for 96 patients who chose to call another service (median 57 min *v* 107 min; p<0.001). Of the 42 patients thrombolysed in the emergency department, those who chose to call the ambulance service had significantly shorter prehospital system times (number 21 *v* 21; median 44 *v* 69 min; p<0.001). Overall time from pain onset to initiation of thrombolysis was significantly longer in the group of patients who called a non-ambulance service first (median 130 min v 248 min; p=0.005).

Conclusions: Patient with acute ischaemic chest pain who call their general practice instead of the ambulance service are likely to have delayed thrombolysis. This is likely to result in increased mortality. The most beneficial current approach is for general practices to divert all patients with possible ischaemic chest pain onset within 12 hours direct to the ambulance service.

The importance of thrombolysis within six hours of myocardial infarction is well known. Within hospitals, process re-organisation and quality assurance have reduced median hospital arrival to initiation of treatment time from 80 minutes to as low as 30 minutes. However, prehospital delay has not been a broad focus of objective investigation and simple strategies for reducing prehospital delays have not been applied with the same vigour as post-arrival delays. Published median prehospital delays are 180 minutes,[1] to 240 minutes.[2] If time is muscle in the setting of acute revascularisation, then it would seem that most muscle is lost before patients present to hospital.

The prehospital time has been defined as the time from when the patient first gets symptoms until time of arrival at an emergency service.[3] This time can be subdivided into the period before (decision time) and after (system time) the patient starts action to seek medical care.

Those studies that have examined prehospital decision time have found that longer times correlate with nocturnal onset,[3] low pain severity,[4 5] rural origin,[3] female sex,[4 6] age,[5] and diabetes.[3] Long prehospital system times correlate with attendance of medical practitioners in the home, age and low pain severity.[3 5]

Studies of interventions aimed at reducing prehospital time have been restricted to comparisons of delays before and after media based public education campaigns.[1 7] These studies produce conflicting results and the benefits of targeted media campaigns to modify the population's behaviour when seeking acute medical care for chest pain remain unclear.

Consideration of benefit from interventions aimed at reducing prehospital time must also be compared with those demonstrated by prehospital thrombolysis.[8] One study found that a median time gain of 50 minutes in patients thrombolysed in the prehospital setting correlated with significantly improved five year survival (92% *v* 84%).[9] Despite this prehospital thrombolysis is not common, possibly because of the work practice and communications infrastructure investment required.

This study aims to investigate the middle ground between costly broad based public education campaigns of questionable benefit and the investment and work practice changes required for prehospital thrombolysis. We believe that there is potential to reduce mortality from transmural myocardial infarction by identifying prehospital delays and developing simple strategies to reduce these delays.

The setting for this study was the Royal United Hospital Emergency Department, Bath, from 1 May 2001 to 31 July 2001. The hospital services an estimated catchment of 480 000 persons, and has 50 000 patient presentations a year to the emergency department. Bath, population 100 000, is the only city, and there are several market towns with populations up to 20 000. Otherwise the geography is predominantly rural. The area is generally affluent, although there are some areas of significant rural poverty.

METHOD

A target population of patients who present with acute chest pain subsequently diagnosed as an acute coronary syndrome was identified. Acute chest pain was defined as non-traumatic and onset within the previous 24 hours. Decision time was defined as the time from the onset of pain until the first call for help. System time was defined as the time from the first call for help until hospital arrival as recorded by ambulance (for ambulance cases) or accident and emergency (A&E) triage (for all other cases).

Emergency department clerical staff prospectively identified all patients with non-traumatic chest pain or discomfort

Box 1 Patient dataset for observational chest pain study

- Unit medical record number
- Age
- Sex
- Post code
- History of ischaemic heart disease
- History of diabetes
- Diagnosis made in emergency department
- Thrombolysis given
- Time of onset of pain
- Time of first call for help
- To whom the first call for help was made
- Time of first medical attention
- Who attended patient first
- Mode of transport to hospital
- Time of arrival at hospital
- Severity of symptoms
- Time of thrombolysis if given

and attached sequentially numbered orange data collection forms to their notes. Data were recorded on these forms by nursing and medical staff who assessed the patients in the emergency department. For severity grading patients were asked to grade the worst pain they had experienced during the presenting episode as mild, moderate, or severe. Data collection forms were collected by clerical staff on patient discharge or admission. Box 1 lists the dataset collected.

Objective time data on data collection forms were cross checked with the medical and ambulance record. Data on total number of patients seen and total number of patients with all types of chest pain were obtained from the hospital's A&E computerised information system. Mann-Whitney U test was used for calculation of all p values.

RESULTS

During the data collection period 13 266 patients attended the emergency department. Data collection forms were distributed to 423 of these patients. Three hundred and eighty four of the 423 distributed sequentially numbered data collection forms were returned to the collection point. In 85 cases patients either had been unable to report the time of onset of pain, and/or when the first call for help was made. The remaining 299 cases had complete contemporaneously recorded time data. A clinical diagnosis of acute coronary ischaemia was made in 222 of these patients after ECG and medical assessment in the emergency department. These 222 patients comprise the study group for the description and analysis that follows.

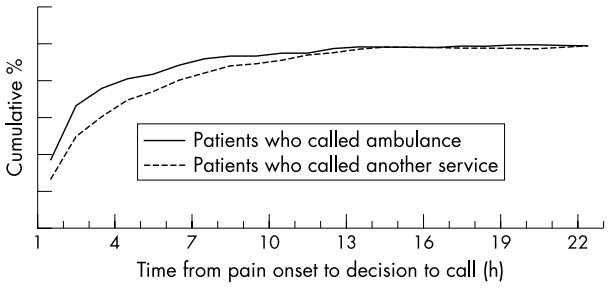

Figure 1 Decision time.

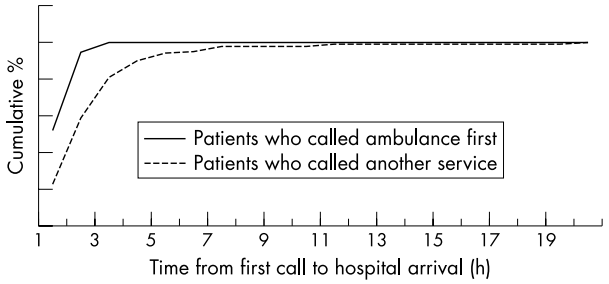

Figure 2 System time.

Table 1 Service called first by 217 patients with acute chest pain

Service	Number of patients
Ambulance	121
General practitioner	80
RUH A&E	7
Community nurse	4
NHS Direct	2
NHS Walk in centre	2
Cardiologist	1

Table 2 First providers of medical care for 222 patients with acute chest pain

Service	Number of patients
Ambulance	151
General practitioner	56
RUH A&E	9
Community nurse	3
Cardiologist	2
NHS Walk in centre	1

Table 3 All patients who decided to call for help: comparison of system time for patients who decided to call the ambulance service with patients who contacted any other service

	Called ambulance	Called another service
Number	121 patients	96 patients
Mean	62.6.min	136.8 min
Median	57 min	107 min
IQ Range	41–81 min	60–164 min

p<0.001 Mann-Whitney U Test.

The study group consists of 71 women (mean age 71, median age 72, range 38–97 years, SD 12.7 years) and 151 men (mean age 66, median age 68, range 33–87 years, SD 12.4 years).

Prehospital decision times are presented in figure 1. Having decided to get medical care, five patients presented directly to A&E without calling for help. The first call for help by the other 217 patients is presented in table 1. The prehospital system times are presented in figure 2. The first providers of acute medical care are presented in table 2.

Subsequent to medical assessment 42 patients were thrombolysed acutely in the emergency department and a further five were thrombolysed later during their admission. Those patients thrombolysed acutely had a mean door to needle time of 32 minutes (median 27 min, SD 23 min, range 0–91 min).

To test our hypothesis patients who decided to call the ambulance service were compared with patients who contacted any other service. The system time for the 121 patients who chose to call the ambulance service first was significantly shorter than for 96 patients who chose to call another service (median 57 min *v* 107 min; p<0.001; table 3). The system time

Table 4 Patients thrombolysed acutely: comparison of system time for patients who decided to call the ambulance service with patients who contacted any other service

	Called ambulance	Called another service
Number	21 patients	21 patients
Mean	45.1 min	104.0 min
Median	44 min	69 min
IQ Range	30–61 min	60–126 min

p<0.001 Mann-Whitney U test.

Table 5 Patients thrombolysed acutely: Comparison of time from pain onset to starting thrombolysis for patients who decided to call the ambulance service with patients who contacted any other service

	Called ambulance	Called another service
Number	21 patients	21 patients
Mean	201.4 min	323.7 min
Median	130 min	248 min
IQ Range	93–203 min	172–334 min

p=0.005 Mann-Whitney U test.

Table 6 Characteristics of patients with ischaemic chest pain who decided to call an ambulance compared with the patients who called another service

	Called ambulance (121 patients)	Called another service (96 patients)
Age		
Mean	69.7 years	66.5 years
Median	70 years	69 years
Male:female	1:0.42	1:0.55
History of IHD	57%	51%
History of diabetes	6.6%	12.5%
Severe pain	38%	22%
Location in Bath city	24%	29%

Table 7 All patients who decided to call for help: comparison of decision time for patients who decided to call the ambulance service with patients who contacted any other service

	Called ambulance	Called another service
Number	121 patients	96 patients
Average	153.5 min	188.9 min
Median	74 min	120 min
IQ Range	32–177 min	60–300 min

p=0.029 Mann-Whitney U test.

for 21 acutely thrombolysed patients who chose to call the ambulance service first was significantly shorter than 21 acutely thrombolysed patients who chose to call any other service (median 44 *v* 69 min; p<0.001; table 4). Overall time from pain onset to initiation of thrombolysis in this group was significantly longer in the group of patients who called a non-ambulance service first (median 130 min *v* 248 min; p=0.005; table 5).

Reasons for the delay of patients who called non-ambulance services were examined. Most (56 of 96) of these patients are seen in community general practice before transfer to hospital. Only 5 of 21 thrombolysed patients in this group were instructed to call an ambulance. The remaining 16 patients were assessed in general practice before the emergency services were called.

The characteristics of patients with ischaemic chest pain who decided to call an ambulance are compared with the patients who called another service in table 6. Of note is those patients who decided to call another service also had longer decision times than those who called the ambulance (median 74 min *v* 120 min; p=0.029; table 7).

DISCUSSION

It is probable that the selection of our 222 study patients is affected by bias. Sixty nine cases were excluded from study selection as their data forms were distributed but never returned; then 77 cases were excluded on the basis of unavailability of key time data. It is probable that some of these excluded patients fulfil the study criteria. Furthermore, there may be patients included in the study group who did not have an acute coronary syndrome as their selection depended on a clinical rather than a pathological diagnosis. The size of these biases is hard to measure. Despite this, the rate of acute transmural myocardial infarction and subsequent thrombolysis indicates a high rate of acute ischaemic cardiac disease in the study group, and on this basis we suggest that the observations we make are valid.

The main observation of this study is that patients with ischaemic chest pain who call the ambulance service arrive at hospital earlier than if they call another service. This is an expected result. No conclusions are possible about the general quality of care these patients received in the prehospital environment. However, the biological significance of our observation is based on what we already know about delay and thrombolysis.

In the analysis of thrombolysed patients, comparison of means suggest that the patients who called a service other than the ambulance had their thrombolysis delayed by about an hour. Mortality has been measured to increase at a rate of 1% per nine minutes of delayed thrombolysis for critical periods in the first six hours of myocardial infarction[10] although overall the rate seem to be about 1% per 30–60 minutes.

The cause of delay seems to be that most patients who called their general practice about acute chest pain were seen by a general practitioner before emergency services were called. It is difficult not to conclude that patients with acute chest pain who are accepted for assessment in the general practice setting are coming to harm as a result of delayed thrombolysis.

The study was started with the aim of identifying prehospital delays and developing simple strategies to reduce these delays. The simplest strategy seems to be to divert patients with acute chest pain to emergency services capable of timely thrombolysis instead of assessment in general practice. As thrombolysis has been shown to be of most use within the first 12 hours of infarction we believe that the most beneficial approach in the current environment is for general practices to divert all patients with possible ischaemic chest pain onset within 12 hours direct to the ambulance service.

Alternatives such as NHS Direct call centres may carry the burden of selective diversion in the future. The fact that only 2 of 222 study group patients called the NHS Direct indicates that most people still access acute medical services in traditional ways. The logistics of changing these traditions may entail an intrusive change in general practice, but we believe this change is currently necessary to save patients' lives.

Thrombolytics can, of course, be delivered in the prehospital setting by physician assisted paramedics[8] and medical practitioner emergency home visit.[10] To function well, both models would require health service resourcing, reorganisation, and education. Furthermore, both models are also

dependent on the main recommendation of this study: selective diversion of acute chest pain patients to an emergency service capable of timely thrombolysis.

In conclusion, patients with acute ischaemic chest pain who call their general practice instead of the ambulance service are likely to have their initial emergency management provided by general practitioners. This practice results in delayed thrombolysis and is likely to result in increased mortality. The most beneficial current approach is for general practices to divert all patients with possible ischaemic chest pain onset within 12 hours direct to the ambulance service.

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Contributors

T Hitchcock initiated, participated in design and data collection, performed statistical analysis, and is the primary author of the manuscipt. F Rossouw, D McCoubrie, and S Meek participated in design, data collection, and writing of the manuscipt. All authors act as guarantor for the paper.

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