sample, having a cervical smear, and having a tooth drilled all caused more discomfort than mammography.

The most important measure for predicting discomfort was expectation of pain. What the woman brings to mammography, psychologically, seems to be of greater importance than anything else we measured. Bust size, which folklore has sometimes implicated, played no part.

Since pain and discomfort were generally short lived, were less than experienced with other routine procedures, and had little effect on dissatisfaction they are unlikely to affect reattendance rates. It is important, however, to continue to monitor reattendance. The finding that two thirds of the women experienced less discomfort than they had expected has implications for attendance. Most women have no personal experience of mammography and so build their expectations on whatever information they have available. The risk is that only the most available and readily recalled information will be used—typically negative reports from newspaper and television features—and that positive reports will be overlooked. Since expectation of pain was an important predictor of experience it is important that health education and

promotion try to ensure that accurate and representative information is made available and publicised. Attendance for breast screening is known to be affected by whether the woman believes those around her want her to attend,¹ and relatives and friends who have had mammography may have an important part to play in encouraging positive expectations.

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Time delays in provision of thrombolytic treatment in six district hospitals

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Abstract

Objective—To measure the delays between onset of symptoms and admission to hospital and provision of thrombolysis in patients with possible acute myocardial infarction.

Design—Observational study of patients admitted with suspected myocardial infarction during six months.

Setting—Six district general hospitals in Britain.

Subjects—1934 patients admitted with suspected myocardial infarction.

Main outcome measures—Route of admission to hospital and time to admission and thrombolysis.

Results—Patients who made emergency calls did so sooner after onset of symptoms than those who called their doctor (median time 40 (95% confidence interval 30 to 52) minutes v 70 (60 to 90) minutes). General practitioners took a median of 20 (20 to 25) minutes to visit patients, rising to 30 (20 to 30) minutes during 0800-1200. The median time from call to arrival in hospital was 41 (38 to 47) minutes for patients who called an ambulance from home and 90 (90 to 94) minutes for those who contacted their doctor. The median time from arrival at hospital to thrombolysis was 80 (75 to 85) minutes for patients who were treated in the cardiac care unit and 31 (25 to 35) minutes for those treated in the accident and emergency department.

Conclusion—The time from onset of symptoms to thrombolysis could be reduced substantially by more effective use of emergency services and faster provision of thrombolysis in accident and emergency departments.

Introduction

Delays in the admission and treatment of patients with acute myocardial infarction have been recog-

nised for over 20 years.¹⁻³ Intravenous thrombolytic treatment reduces mortality after acute myocardial infarction,^{4,6} and the expectation that early treatment should be more beneficial than that given after six hours is supported by large clinical studies,^{7,9} the results of which have produced a new impetus for the rapid evaluation and treatment of patients with suspected acute myocardial infarction.

Studies of thrombolysis before arrival at hospital are in progress,¹⁰⁻¹² but it is unlikely that this will find widespread applicability in the near future. We examined the time from the onset of symptoms to hospital admission and to the administration of thrombolysis in 1934 patients admitted to six district general hospitals with probable acute myocardial infarction. The overall delay was broken down into component times to explore means by which these delays could be shortened.

Methods

Data were collected continuously for six to eight months from six hospitals on all patients admitted with suspected acute myocardial infarction (table I). This group of hospitals provided a wide range of catchment population. In one hospital (Doncaster) data were

TABLE I—Origin of patients included in the study

	Catchment population	No of patients with possible infarction
Northampton	315 000	431
Brighton	340 000	267
Bath	400 000	445
Telford	200 000	293
Doncaster	290 000	330
Merthyr Tydfil	150 000	168
Total	1 695 000	1934

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collected from the patients of one consultant for three months and from the patients of all admitting consultants for the subsequent four months. In all patients in whom a diagnosis of myocardial infarction was considered the time from the onset of symptoms to the arrival at the cardiac care unit and the time of thrombolysis, where appropriate, were recorded.

Information was entered on a printed two part form on which the patient was identifiable to only the admitting hospital by a preprinted accession number. Data were entered by either a nurse in the cardiac care unit or an audit assistant. Junior staff were required to record information on the timing of events in the hospital notes at the time of the initial clerking of the patient. Timings were recorded to the nearest five minutes.

Data were extracted from the hospital notes while the patient was in the cardiac care unit, and when necessary additional information was obtained from the patient. A copy of the completed form was then forwarded to the data collection centre at Northampton. Each hospital was responsible for ensuring that forms were completed as far as possible, and when data were missing from forms received at the data centre they were assumed to be unavailable.

Results

Data were collected between December 1990 and August 1991 on 2373 patients admitted to the cardiac care units of six district general hospitals. Of 2373 patients admitted 1934 had symptoms suggestive of acute myocardial infarction; 439 patients had other conditions and are not considered further. The figure shows how the patients with symptoms suggestive of acute myocardial infarction reached hospital.

RESPONSE TIME BY PATIENTS

Most patients (1375/1531) were at home when they called for help. The median decision time for those calling for help when away from home was half that of those at home: 30 (95% confidence interval 20 to 50) minutes against 60 (60 to 70) minutes for those at home. A total of 353 patients had symptoms for more than four hours before calling for help.

Patients who called a doctor from home (n=1020) did so after a median delay of 70 (60 to 90) minutes, while patients making an emergency call from home (n=355) did so after 54 (45 to 60) minutes. A similar trend towards earlier calls to the emergency service was seen for patients away from home. Overall, the median call time was 70 (60 to 90) minutes for those calling a doctor (n=1091) and 40 (30 to 52) minutes for those calling an ambulance (n=440).

CALLING FOR HELP

The proportion of calls directed to the emergency service or to the general practitioner varied widely among districts (table II). Most patients (1271/1934) with acute chest pain called their doctor. The time taken for a doctor to attend was available for 886

Route of admission to hospital in patients with suspected myocardial infarction

TABLE III—Median (95% confidence interval) ambulance journey times (minutes) for different types of call

	General practitioner urgent call (n=97)	General practitioner emergency call (n=38)	Patient emergency call (n=34)
Time to leave ambulance station	3 (1 to 4)	2 (1 to 2)	1 (1 to 2)
Time from call to arrival at hospital	41 (33 to 48)	23 (22 to 32)	26 (21 to 31)
Cumulative time call to arrival	45 (38 to 53)	29 (24 to 33)	28 (23 to 36)

patients; the median time was 20 (20 to 25) minutes. Analysis by four hour periods showed that the response time was longest between 0800 and 1200 (median time 30 (20 to 30) minutes), and shortest between 2000 and 0000 (15 (15 to 20) minutes). During 0800 to 1200 28% (251) of all patients with symptoms suggestive of infarction telephoned their doctors.

AMBULANCE JOURNEY TIMES

In a small sample of patients (n=169) in four districts (Northampton, Brighton, Bath, Telford) data were obtained from ambulance service records. Three types of call could be distinguished: an emergency (999) call made by or on behalf of a patient by a member of the public; an emergency call made by a doctor; and an urgent call made by a doctor. The ambulance service recognises two levels of call from doctors; emergency, which is equivalent to a 999 call, and urgent, which is dealt with as soon as possible but which defers in precedence to any emergency call. An urgent call took more than 15 minutes longer to complete than an emergency call, whether the emergency call was initiated by a doctor or by a member of the public (table III).

JOURNEY TO HOSPITAL

Data on transport to hospital were available in 1799 cases. Most patients (1548/1799) travelled to hospital by ambulance, 198 travelled by private transport, and 53 walked or came by public transport.

TABLE II—Numbers (percentages) of patients admitted with possible acute myocardial infarction, by hospital and response to symptoms

	Called general practitioner and seen	Called general practitioner and not seen	Emergency call	Made own way	No information	Total
Northampton	211 (49)	50 (12)	103 (24)	42 (10)	25 (6)	431
Brighton	107 (40)	9 (3)	127 (48)	15 (6)	9 (3)	267
Bath	360 (81)	8 (2)	40 (9)	19 (4)	18 (4)	445
Telford	213 (73)	13 (4)	38 (13)	18 (6)	11 (4)	293
Doncaster	185 (56)	20 (6)	100 (30)	20 (6)	5 (2)	330
Merthyr Tydfil	82 (49)	13 (8)	48 (29)	12 (7)	13 (8)	168
Total	1158 (60)	113 (6)	456 (24)	126 (7)	81 (4)	1934

TABLE IV—Median (95% confidence interval) times (in minutes) to call for help, from call for help to arrival at hospital, and from onset of symptoms to arrival at hospital for 1375 patients at home when calling for help

	Decision time	Call for help to arrival	Overall time: onset to arrival
Admission by general practitioner to accident and emergency or medical team (n=678)	70 (55 to 90)	84 (76 to 88)	182 (165 to 202)
Admission by general practitioner direct to cardiac care unit (n=250)	60 (50 to 90)	110 (105 to 120)	210 (190 to 235)
General practitioner called, patient not seen (n=92)	58 (45 to 93)	45 (38 to 50)	115 (94 to 148)
Emergency call by member of public (n=355)	54 (45 to 60)	40 (39 to 43)	103 (90 to 116)

TABLE V—Time to reach the cardiac care unit and to receive thrombolysis after arrival in hospital in patients treated in unit

	No of patients	Median (95% confidence interval) from arrival in hospital to arrival in cardiac care unit (minutes)	No having thrombolysis in cardiac unit	Median (95% confidence interval) time from arrival in hospital to thrombolysis (minutes)
Arranged admission to accident and emergency or medical team	793	81 (73 to 85)	274	88 (78 to 102)
Emergency call by member of the public	456	76 (67 to 90)	166	85 (73 to 90)
Admission direct to cardiac care unit	330		93	55 (35 to 60)
Total	1579		533	

TABLE VI—Time to thrombolysis in patients treated outside cardiac care unit

	No of patients	No of patients having thrombolysis	Time to thrombolysis after arrival in hospital (minutes)
Delayed admission as cardiac care unit full	116	35	105 (95 to 133)
Thrombolysis given electively in accident and emergency department	142	142	31 (25 to 35)
Total	258	177	

The means of admission affected the time interval from the call for help to the time of arrival at the hospital (table IV). The data in table IV relate only to the 1375 (89%) patients who were at home at the time of calling for help. The median time to reach hospital from home for those seen by a doctor was 90 (90 to 94) minutes; those who called for an ambulance or who were sent to hospital without being seen by a doctor arrived more quickly (median time 41 (38 to 47) minutes).

CUMULATIVE DELAYS

The time from the onset of symptoms up to the time of arrival at hospital was recorded in 1375 patients who were at home (table IV). The difference in median times between those who saw their doctor and those who did not was 79-107 minutes, depending on how the patient reached hospital. A substantial contribution to delays before reaching hospital, whatever the route of admission, was created by the delay of the patient in seeking help.

EVENTS WITHIN HOSPITAL

Of the 1837 patients who arrived at hospital and for whom satisfactory data were available, 1579 were admitted to the cardiac care unit for treatment; 142 patients were given thrombolysis electively in the accident and emergency department before transfer to the unit. A further 116 patients were not directly admitted to the cardiac care unit because it was full, 35 of whom had thrombolysis in a ward area outside the cardiac care unit.

Tables V and VI show the times taken to reach the cardiac care unit and for thrombolysis to be given. The time to reach the cardiac care unit and to receive thrombolysis did not differ between those patients who were sent to hospital by their doctor (median 81 and 88 minutes respectively) and those who called an ambulance (median 76 and 85 minutes). It was not possible to compare patients sent directly to the cardiac care unit with the others as there was no reference point.

Thrombolysis was given much earlier to patients treated in the accident and emergency department than in those transferred to the cardiac care unit for treatment (median 31 minutes *v* 85 minutes). Thrombolysis was given in the accident and emergency department mainly (122/142, 86%) in one hospital. Thrombolysis was given more quickly to patients admitted directly to the cardiac care unit (median 55 minutes) than to those who had been admitted to the cardiac care unit through the accident and emergency department, but less quickly than when thrombolysis was given in the accident and emergency department. Patients whose admission to the cardiac care unit was delayed received thrombolysis least quickly (105 minutes).

FINAL DIAGNOSIS

Of the 1837 patients admitted, 1124 (61%) had a final diagnosis of definite or probable myocardial infarction, 654 (58%) of whom received thrombolysis, 486 (43%) within six hours. A further 460 (25%) patients had a final diagnosis of unstable angina while 253 (14%) did not have a final diagnosis of cardiac ischaemia.

Discussion

The interval from the onset of symptoms to the time that the patient calls for help (the decision time) can be long. Though the median decision time in this study was 60 minutes for patients at home and 30 minutes for those who were away from home at the time of calling for help, a substantial number (23%) delayed for four hours or more before calling for help. Our median decision time can be compared with those of 110 minutes for patients in Doncaster in 1971,² 71 minutes in Teesside in 1976,³ and 90 minutes in Stanford, United States, in 1977.¹³ It seems that the decision time is becoming shorter, and this may reflect increased public awareness of coronary disease and the symptoms of myocardial infarction. Nevertheless, the decision time by the patient remains an important component of the delay in the time to thrombolysis.

TRENDS IN EMERGENCY SERVICES

Patients who make an emergency call do so more than 15 minutes earlier than those who call a doctor. This difference may partly reflect more severe symptoms in those calling an ambulance,¹⁴ but other factors influence frequency of use of emergency calls; the use varied among centres with a range of 9-47%. The highest use was in Brighton (47%), where there has been longstanding encouragement by local cardiologists for patients to use emergency services for acute chest pain. Nevertheless, the proportion is low compared with the 75% of patients with suspected heart attack in north west London who call emergency services (R Greenbaum, personal communication). Bath was the most rural of the areas examined in this study; and had the lowest frequency of calls to emergency services (9%) and highest to doctors (81%) compared with a study average of 59%.

There seems to be a tendency in heavily populated areas to bypass the general practitioner in emergencies, while in more rural areas the traditional contact with the general practitioner persists. This has important implications for the provision of thrombolysis. In urban areas the doctor may have contact with only a few of the patients with acute chest pain, and thrombolysis would be given most quickly by rapid transfer to hospital, whereas in rural areas the general practitioner may be with the patient before the ambulance has arrived and could give thrombolysis before transfer to hospital.

We did not examine the question of incorrect diagnosis before arrival at hospital and did not record

patients who, having arrived in hospital with suspected myocardial infarction, were considered to have another condition and were not admitted to the cardiac care unit. We have no information on the number of inappropriate emergency calls that were made on the basis of symptoms of chest pain. Wider use of the emergency services may result in inappropriate calls and attendances at the accident and emergency department but the size of the problem is not known.

In 91% of cases when a doctor was called he or she attended the patient, an ambulance was sent without the patient being seen in only a few cases. Although the median time to visit the patient was only 20 minutes, it must be difficult, given all the other commitments of a doctor, to be able to respond rapidly to emergencies such as acute myocardial infarction. This is reflected in the longer response times between 0800 and 1200 when 28% of patients with symptoms suggestive of acute infarction rang their doctor. In urban areas where the emergency ambulance response time is less than the time that it takes for a doctor to attend the patient¹⁵ it must be questioned whether it is realistic to expect a doctor to provide an emergency service for conditions such as chest pain as well as fulfilling regular commitments. In such circumstances it may be more appropriate to call an emergency ambulance and then attend the patient if this is feasible.

Doctors telephoning the ambulance service are asked whether the call is an emergency or an urgent call. An urgent call has a lower level of priority than an emergency call such that an ambulance answering an urgent call to a patient with chest pain may be diverted for an emergency call (from another doctor or the public). Some common reasons for emergency calls from the public are trivial; one of the commonest causes of collapse necessitating an emergency call in Nottingham was being drunk and incapable.¹⁶ The data recorded directly from the ambulance service records indicate a difference in the median callout times between urgent and emergency calls (from receipt of call to arrival at hospital) of over 15 minutes. All cases of suspected myocardial infarction should be treated as emergencies rather than urgent cases and the ambulance service advised accordingly.

DELAYS WITHIN HOSPITAL

The time from arrival in hospital to the time of arrival in the cardiac care unit and subsequent thrombolysis was not dependent on the means of admission to hospital. We found no evidence that patients admitted after an emergency call, who are seen first by the accident and emergency medical staff and then by the medical staff on call take longer to reach the cardiac care unit than patients admitted directly to the medical team on call. The median delay of 73-85 minutes is similar to previous reports in Britain and the United States.¹⁷⁻¹⁹ The delay to thrombolysis is more than twice as long after admission to hospital if given after transfer to the cardiac unit rather than in the accident and emergency department. Similar differences have recently been described in hospitals in Newcastle upon Tyne,²⁰ and Edinburgh.²¹ Admission direct to the cardiac care unit resulted in an in-hospital delay intermediate between that in the accident and emergency department and after transfer to the cardiac care unit, but as there were longer out of hospital delays in this group there was no overall advantage in time to thrombolysis.

Rapid thrombolysis requires good organisation and the cooperation of nursing and medical staff in the accident and emergency department and the medical team on call. Specialist cardiac care teams will not be available in most hospitals, and rapid thrombolysis should be achieved with conventional staffing arrangements. A specially trained triage nurse can perform

electrocardiography when a patient is admitted to the department; the results can be shown immediately to either the medical team on call or an accident and emergency doctor. Evaluation of the patient and the exclusion of contraindications need not take much time. Thrombolysis within 30 minutes of arrival in hospital is a realistic target for patients with typical electrocardiographic changes, and this can be initiated by either the on call team or the accident and emergency staff, depending on immediate availability.

The additive effect of the before hospital and within hospital delays results in wide differences in the speed with which thrombolysis is given. Our study suggests that a patient calling an ambulance and receiving thrombolysis in the accident and emergency department might receive treatment within 75 minutes of calling for help, while a patient who calls a doctor and is then admitted to a cardiac care unit might wait 180-200 minutes. Changes in current practice could shorten the delays which occur both before and after admission to hospital, and these changes should improve the efficacy of thrombolytic treatment.

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