

## Call to needle times after acute myocardial infarction in urban and rural areas in northeast Scotland: prospective observational study

John Rawles, Catherine Sinclair, Kevin Jennings, Lewis Ritchie, Norman Waugh

Medicines  
Assessment  
Research Unit,  
University of  
Aberdeen,  
Aberdeen Royal  
Infirmary, Aberdeen  
AB25 2ZN

John Rawles,  
*honorary senior  
lecturer in medicine*  
Catherine Sinclair,  
*audit nurse*

Department of  
Cardiology,  
Aberdeen Royal  
Infirmary

Kevin Jennings,  
*consultant  
cardiologist*

Department of  
General Practice  
and Primary Care,  
University of  
Aberdeen

Lewis Ritchie,  
*Mackenzie professor*

Grampian Health  
Board, Aberdeen  
AB15 6RE

Norman Waugh,  
*consultant in public  
health medicine*

Correspondence to:  
Dr J Rawles  
john.rawles@  
btinternet.com

BMJ 1998;317:576-8

### Abstract

**Objective:** To determine call to needle times and consider how best to provide timely thrombolytic treatment for patients with acute myocardial infarction.

**Design:** Prospective observational study.

**Setting:** City, suburban, and country practices referring patients to a single district general hospital in northeast Scotland.

**Subjects:** 1046 patients with suspected acute myocardial infarction given thrombolytic treatment.

**Main outcome measures:** Time from patients' calls for medical help until receipt of opiate or thrombolytic treatment, measured against a call to needle time of 90 minutes or less, as proposed by the British Heart Foundation.

**Results:** General practitioners were the first medical contact in 97% (528/544) of calls by country patients and 68% (340/502) of city and suburban patients. When opiate was given by general practitioners, median call to opiate time was about 30 minutes (95% within 90 minutes) in city, suburbs, and country; call to opiate delay was about 60 minutes in city and suburban patients calling "999" for an ambulance. One third of country patients received thrombolytic treatment from their general practitioners with a median call to thrombolysis time of 45 minutes (93% within 90 minutes); this compares with 150 minutes (5% within 90 minutes) when this treatment was deferred until after hospital admission. In the city and suburbs, no thrombolytic treatment was given outside hospital, and only a minority of patients received it within 90 minutes of calling; median call to thrombolysis time was 95 (46% within 90 minutes) minutes.

**Conclusions:** The first medical contact after acute myocardial infarction is most commonly with a general practitioner. This contact provides the optimum opportunity to give thrombolytic treatment within the British Heart Foundation's guideline.

### Introduction

Acute myocardial infarction is most often due to coronary thrombosis. Thrombolytic treatment, if given before myocardial necrosis becomes irreversible, is a

radical treatment for this common and commonly fatal condition; giving thrombolytic treatment is a matter of great urgency.

A working group of the British Heart Foundation developed guidelines for the early management of acute myocardial infarction and recommended that thrombolytic treatment should be given to eligible patients within 90 minutes of their calling for medical help.<sup>1</sup> We report call to needle times in urban and rural areas in Grampian and consider strategies for the provision of thrombolytic treatment within the British Heart Foundation guidelines.

### Methods

After meetings with general practitioners, in which they agreed to take part in this study, we developed a protocol for the management of patients with suspected acute myocardial infarction<sup>2</sup> and designed and printed a referral letter that prompted the recording of relevant times and included a checklist of the indications and contraindications for thrombolytic treatment. These were distributed to 42 "country" practices in Grampian that were 25 km or more from Aberdeen and referred patients to Aberdeen Royal Infirmary. The study was extended later to 34 city and suburban practices in Aberdeen closer to the hospital.

Patients with suspected acute myocardial infarction were identified on admission and followed through to discharge by an audit nurse (CS), who collated timing data extracted from referral letters, ambulance records, and hospital notes. Unless otherwise stated, time intervals are reported as medians.

Patients with suspected acute myocardial infarction seen by general practitioners were admitted directly to the coronary care unit or to general medical wards. Patients not seen by general practitioners but calling 999 for an ambulance were either taken to the accident and emergency department, where thrombolytic treatment was not given, and then transferred to the coronary care unit or, at the discretion of the ambulance crews, were taken directly to the coronary care unit after the unit was notified of their expected time of arrival.

## Results

Records were obtained of 1986 episodes of suspected acute myocardial infarction; the diagnosis was confirmed on 1466 occasions; thrombolytic treatment was given on 1053 occasions. Seven patients were excluded, six had been flown from offshore, and one had been transferred by air from another region, leaving 1046 episodes which form the basis of this report. Of these, 544 were from country practices in Grampian and 502 from the city or suburbs of Aberdeen.

### Country practices

General practitioners from country practices were called and attended patients before transfer to hospital on 97% (528/544) of occasions; only 3% of patients (16) were taken directly to hospital after a 999 call (table 1). When general practitioners gave opiate, the median call to opiate interval was 30 minutes; in patients not seen by general practitioners, the call to opiate interval was almost 60 minutes longer. The call to opiate interval was 130 minutes in those patients seen by a general practitioner and not given opiate but requiring it later in hospital.

Thrombolytic treatment was given by general practitioners on 35% (195/544) of occasions, at a median call to thrombolysis interval of 45 minutes; 93% of times were within the British Heart Foundation guideline. When thrombolytic treatment was not given until after hospital admission, median call to thrombolysis time was 105 minutes longer, and only 5% of times were within 90 minutes.

From these country practices the ambulance journey to Aberdeen took a median of 47 minutes; 88% of journeys were 30 minutes or more.

### City and suburbs

General practitioners from city and suburban practices were called and attended on 68% (340/502) of occasions (table 2). When they gave opiate it was given a median of 25 minutes after being called; when they were not involved, opiate was given about an hour after help had been requested by a 999 call.

No thrombolytic treatment was given outside hospital, and call to thrombolysis intervals were similar (about 100 minutes) for patients attended by general practitioners and those calling for an ambulance and being taken to the accident and emergency department. For patients who called for an ambulance and were brought directly to the coronary care unit, the call to thrombolysis interval was shorter by 38 minutes than for those who were admitted via the accident and emergency department.

Median travelling time was 10 minutes, and 98% of journeys were under 30 minutes.

## Discussion

### British Heart Foundation guidelines

The British Heart Foundation guidelines for the early management of patients with myocardial infarction recommend that all patients with obvious acute myocardial infarction and without contraindications should receive thrombolytic treatment within 90 minutes of alerting the medical or paramedical services.<sup>1</sup> The guidelines go on to recommend that "in localities where transport

times to hospital are prolonged, or where delays in hospital are great, general practitioners should take the initiative for thrombolytic treatment." Other authorities have suggested that thrombolytic treatment should be initiated before the patient is transferred to hospital if travelling time is 30 minutes or more.<sup>3,4</sup>

### Thrombolytic treatment in rural areas

In this study, practices designated as "country" were located 25 km or more from Aberdeen Royal Infirmary, to which all patients in the study were referred. The closest of the practices, Stonehaven, was linked with Aberdeen by a derestricted dual carriage-way but had a median journey time of 30 minutes. Nearly 90% of journey times from country practices were 30 minutes or more.

In these country practices, call to thrombolysis times were within 90 minutes in only 5% of occasions when thrombolytic treatment was not given until after hospital admission, but when this treatment was given by general practitioners 93% of call to thrombolysis times were within the British Heart Foundation standard. Call to opiate times show how soon general practitioners could give thrombolytic treatment. Call to opiate times were about 30 minutes in all patients, whether or not their general practitioners gave thrombolytic treatment; when general practitioners gave treatment, it was started 15 minutes after the opiate.

A few patients were taken to hospital after a 999 call without being seen by general practitioners. Although their call to thrombolysis time was shorter than in patients seen by general practitioners and given thrombolysis in hospital, fewer than one third of call to thrombolysis times were within 90 minutes, and the call to opiate time was an hour longer than in patients receiving opiate from general practitioners.

Results similar to our own were obtained in an audit of rural areas in Scotland where general practitioners have access to beds in community hospitals: the call to opiate interval was 25 minutes, and call to thrombolysis times for treatment given in the home, community hospital, or district general hospital were 35 minutes (100% within 90 minutes), 65 minutes (76% within 90 minutes), and 120 minutes (31% within 90 minutes).<sup>5</sup>

**Table 1** Call to opiate and call to thrombolysis times in patients from country practices

Referral route	No (%) of patients treated (n=544)	Call to opiate		Call to thrombolysis	
		Median (interquartile range) time (minutes)	% of treatment within 90 minutes	Median (interquartile range) time (minutes)	% of treatment within 90 minutes
GP thrombolysis	192 (35)	30 (20-45)	97	45 (35-64)	93
GP, hospital	336 (62)	35 (20-50)	93	150 (120-186)	5
999, hospital	16 (3)	88 (44-110)	60	102 (90-163)	31

**Table 2** Call to opiate and all to thrombolysis times in patients from city and suburbs

Referral route	No (%) of patients treated (n=502)	Call to opiate		Call to thrombolysis	
		Median (interquartile range) time (minutes)	% of treatment within 90 minutes	Median (interquartile range) time (minutes)	% of treatment within 90 minutes
GP, hospital	340 (68)	25 (15-35)	95	105 (82-140)	37
999, accident and emergency, coronary care unit	124 (25)	61 (40-92)	75	96 (79-125)	38
999, coronary care unit	38 (8)	52 (40-66)	94	58 (46-66)	81

**Table 3** Median call to thrombolysis times in unpublished studies of early management of acute myocardial infarction. Latest available data from ongoing studies are reported

Study	Proportion (%) of patients calling GP	Call to thrombolysis	
		Mode of referral	Time (min)
Manchester emergency services audit	—	Various	101
Barnsley	22	999 to CCU	75
		999 to A&E to CCU	106
Royal College of Physicians national audit	46	A&E	95
		A&E to CCU	115
		Direct to CCU	100
Southeast Scotland audit <sup>6</sup>	61	Various	—
UK heart attack study	62	999	86
		GP	115
Aberdeen city and suburbs	68	999	96
		GP	105

GP=general practitioner; CCU=coronary care unit; A&E=accident and emergency department; 999=emergency call to ambulance.

Unpublished data were made available by Dr Kevin Mackway-Jones and Professor David Yates (Manchester audit), Dr W E Rhoden (Barnsley), Dr John Birkhead (Royal College of Physicians national audit), Dr Robin Norris (UK heart attack study).

All these results show that the only way the British Heart Foundation standard can be achieved in the majority of patients from country practices is for thrombolytic treatment to be given in the community; a policy of “scoop and run” to the nearest district general hospital is quite inappropriate. General practitioners are the obvious medical staff to give this treatment in rural areas since they are usually the first medical contact. About 10% of people in the United Kingdom live more than 25 km from a district general hospital.

#### Thrombolysis in conurbations

Two thirds of patients from the city and suburbs were seen by general practitioners before admission to hospital. When general practitioners gave opiate, the call to opiate interval was 25 minutes, similar to that in country practices. Patients calling 999 did not receive opiate until they were in hospital, and their call to opiate time averaged 60 minutes: slightly longer in those taken to the accident and emergency department, and slightly shorter in those taken directly to the coronary care unit. The length of the call to opiate time after “scoop and run” is explained by the double ambulance journey after a 999 call, the loading and unloading time, and the time taken for opiate to be prescribed by a doctor in the emergency department to which the patient is taken.

The delay in call to thrombolysis was about 100 minutes in patients referred by general practitioners directly to the coronary care unit and in those admitted through the accident and emergency department after a 999 call; in either case a referral from one doctor to another (general practitioner to cardiologist, or emergency physician to cardiologist) causes delay. The shortest call to thrombolysis interval was for patients admitted directly to the coronary care unit after a 999 call, but this time, at 58 minutes, is longer than that achieved by general practitioners in country practices (45 minutes) or the time potentially achievable by general practitioners in urban practices (25 plus 15 minutes); furthermore, this mode of admission is available to only a minority of patients. Call to thrombolysis times within the British Heart Foundation's standard are likely to be achieved in more than 90% of patients only if thrombolytic treatment is given before the patient is transported to hospital, and if it is given by the first medical contact.

There are few published reports of call to needle delays from conurbations.<sup>6,7</sup> Unpublished results (table 3) show that call to thrombolysis times are generally about 100 minutes, suggesting that the results from city and suburban practices presented in this paper are probably not atypical, and that our conclusions may have general validity.

#### Conclusions

The magnitude of the benefit from earlier thrombolysis is such that giving thrombolytic treatment to patients with acute myocardial infarction should be accorded the same degree of urgency as treatment of cardiac arrest.<sup>8,9</sup> On this principle, thrombolytic treatment should be given, if practicable, before the patient is transported, and by the first qualified person to see the patient. Only then is the British Heart Foundation's standard of a call to thrombolysis time within 90 minutes likely to be achieved for over 90% of patients.

We thank Dr Kevin Mackway-Jones and Professor David Yates, Dr W E Rhoden, Dr John Birkhead, and Dr Robin Norris for supplying unpublished data of call to thrombolysis times.

Contributors: JR, KJ, and NW designed and set up the study; CS was responsible for data collection, entry, and feedback; JR analysed the data; all authors contributed to interpretation of the results and revision of the manuscript. LR and JR are guarantors.

Funding: The study was supported by grants from Grampian Clinical Audit Committee and Serono Laboratories (UK) Ltd.

Conflict of interest: None.

#### Key messages

- A British Heart Foundation guideline recommends that patients with acute myocardial infarction should receive thrombolytic treatment within 90 minutes of calling for medical assistance
- In urban and rural areas in Grampian, only a minority of patients received treatment within the guideline
- Median call to needle times were shortest when thrombolytic treatment was given by general practitioners
- The first medical contact after acute myocardial infarction was most commonly with a general practitioner in both urban and rural areas
- First contact with a general practitioner provides a matchless opportunity to give thrombolytic treatment within the British Heart Foundation guideline

- 1 Weston CFM, Penny WJ, Julian DG on behalf of the British Heart Foundation Working Group. Guidelines for the early management of patients with myocardial infarction. *BMJ* 1994;308:767-71.
- 2 Rawles J. Guidelines for general practitioners administering thrombolytics. *Drugs* 1995;50:615-25.
- 3 Cobbe SM. Thrombolysis in myocardial infarction. *BMJ* 1994;308:216-7.
- 4 Should general practitioners give thrombolytic therapy? *Drug Therapeutics Bull* 1994;32:65-6.
- 5 Liddell R, Rawles J. *Scottish association of general practitioner community hospitals' audit of call-to-needle times in acute myocardial infarction*. Edinburgh: Scottish Office, 1996. (Occasional paper No 67.)
- 6 Capewell S, Gailey F, Fisher A, Parker S, McDonald I, Padfield P. A pilot audit of acute myocardial infarction management in south east Scotland. *Health Bull* 1997;55:399-407.
- 7 Banerjee S, Rhoden WE. Fast-tracking of myocardial infarction by paramedics. *J R Coll Phys* 1998;32:36-8.
- 8 Cannon CP, Antman EM, Walls R, Braunwald E. Time as an adjunctive agent to thrombolytic therapy. *J Thromb Thrombolysis* 1994;1:27-34.
- 9 Rawles J. Quantification of the benefit of earlier thrombolytic therapy: 5-year results of the Grampian early anistreplase trial (GREAT). *J Am Coll Cardiol* 1997;30:1181-6. (Accepted 29 May 1998)