Introduction of primary percutaneous coronary intervention for ST elevation myocardial infarction in a district general hospital

SOHAIL QAISAR, MELANIE FELLOWS, HANNAH WHITLAM, RUMI JAUMDALLY, JAMES M BEATTIE, PATRICIA J LOWRY, NADIA EL-GAYLANI, ROBERT G MURRAY, JEROME MENT, MICHAEL PITT

Abstract

The objective of this study was to assess the feasibility and impact of providing a primary percutaneous coronary intervention (PCI) programme for ST elevation myocardial infarction (STEMI) in a district general hospital (DGH) in the UK.

A retrospective review of cardiac catheter laboratory PCI database records and hospital notes was carried out in a 950-bed teaching DGH in the West Midlands, serving a catchment population of 500,000. The patients consisted of 108 men and women aged 28–86 years presenting with thrombolysis-eligible STEMI, treated by primary PCI between November 2002 and August 2004. The main outcome measures used in this study were time from hospital presentation to PCI ('door to coronary device' time), mortality and hospital length of stay.

The median door to device time was 86 minutes (range 25 to 286). Some 78% and 52% of patients had door to device times of less than 120 and 90 minutes, respectively. Median length of hospital stay was five days (range 3–30), compared to eight days in patients treated with thrombolysis in the years 2000–2004. In-hospital mortality was seven patients (6.5%).

We conclude that, in the contemporary era of interventional cardiology, it is feasible to introduce a primary PCI service for STEMI in a DGH setting with acceptable 'door to coronary device' times and mortality.

Department of Cardiology, Heart of England NHS Foundation Trust, (formerly Birmingham Heartlands and Solihull Hospital NHS Trust), Bordesley Green East, Birmingham, B9 5SS.
Sohail Qaisar, Staff Grade in Cardiology
Melanie Fellows, Cardiology Audit Officer
Hannah Whitlam, Catheter Laboratory Manager
Rumi Jaumdally, Specialist Registrar in Cardiology
James M Beattie, Consultant Cardiologist
Patricia J Lowry, Consultant Cardiologist
Nadia El-Gaylani, Consultant Cardiologist
Robert G Murray, Consultant Cardiologist
Jerome Ment, Consultant Cardiologist
Michael Pitt, Consultant Cardiologist

Correspondence to: Dr M Pitt
(email: Michael.Pitt@heartofengland.nhs.uk)

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Introduction

Primary percutaneous coronary intervention (PCI) is the optimal reperfusion strategy for acute ST elevation myocardial infarction (STEMI) if delivered in a timely fashion by experienced medical teams.[1,2]

As with thrombolysis, delay in achieving myocardial reperfusion with primary PCI is associated with increased morbidity and mortality. Any hospital aiming to provide such therapy must develop an efficient patient care pathway and achieve early patency of the infarct-related artery.[3]

In general, there are two models for delivering primary PCI: tertiary 'infarct centres' with transfer of patients from 'feeder' hospitals, or PCI at the point of presentation in a district hospital (PCI with off-site cardiac surgery). Comparable outcomes can be achieved with either model if door to intervention times are under two hours and clinical activity is sufficient to maintain expertise.[4]

Protocols for primary PCI continue to evolve and include technical considerations such as the use of adjunctive therapy with thrombectomy/distal protection devices, intra-aortic balloon counterpulsation and drug-eluting stents. True cost-effectiveness is as yet unproven although primary PCI would appear at worst 'cost neutral'.[5-8]

At present, primary PCI for STEMI using either model is not widely adopted in the UK. We aimed to assess the feasibility and impact of providing such a primary PCI programme in a district general hospital.

Methods

Birmingham Heartlands Hospital has 950 beds serving a population of 500,000. Each year approximately 180 STEMI patients meeting the criteria for thrombolysis are admitted. The cardiology unit has five consultant cardiologists with experience in interventional cardiology and performs more than 650 PCIs per year through a single cardiac catheter facility with off-site cardiac surgical cover.

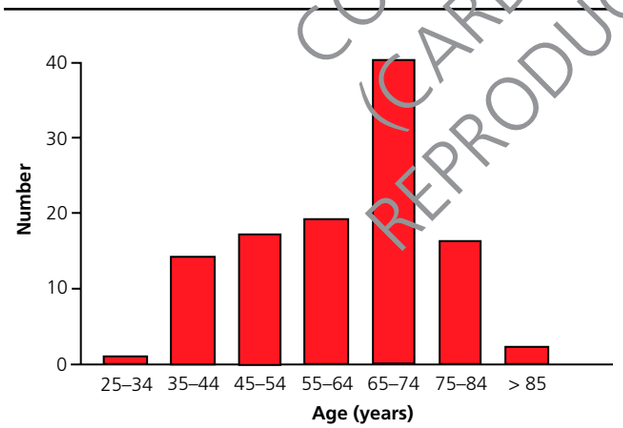
Over the last five years, with the appointment of cardiac triage nurses based in the accident and emergency department,

Table 1. Patient characteristics and procedural details.

Category	Number	
Age in years (SD)	67 (13)	
Male:female	71:37	
Caucasian:Asian	81:27	
Medical history		
- systemic hypertension (%)	41 (38)	
- smoking (%)	50 (46)	
- diabetes mellitus (%)	27 (25)	
- previous CABG (%)	4 (3.7)	
Procedural details		
- arterial access site (femoral:radial)	100:8	
- infarct-related vessel	LMS	3
	LAD	48
	RCA	46
	Cx	11
- extent of coronary artery disease	Single vessel	49
	Double vessel	37
	Triple vessel	22
- cardiogenic shock (%)	8 (7.5)	
- abciximab use (%)	98 (91)	
- thrombectomy/distal protection device use (%)	15 (14)	
Procedural success* (%)	103 (95)	

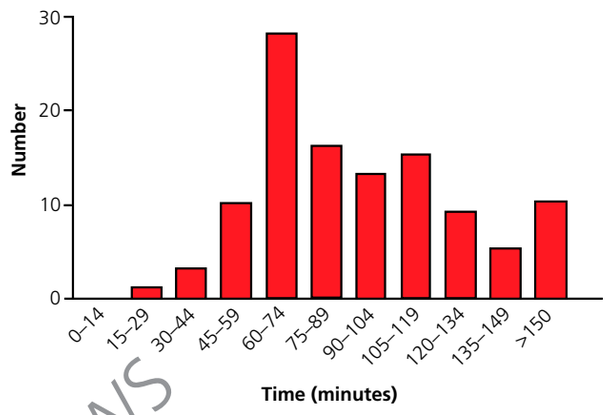
Key: * Defined as deployment of coronary stent to culprit lesion; CABG = coronary artery bypass grafting; LMS = left mainstem; LAD = left anterior descending; RCA = right coronary artery; Cx = circumflex

Figure 1. Age at presentation of ST elevation myocardial infarction patients (n=108)



more than 85% of STEMI patients have received thrombolytic therapy within the Myocardial Infarction National Audit Project (MINAP) target of less than 30 minutes from hospital presentation. For several years those patients admitted to our institution with STEMI but with a contraindication to thrombolysis have been

Figure 2. 'Door to coronary device' times for all ST elevation myocardial infarction patients



managed by PCI. 'Rescue' PCI has also been undertaken in those patients who appear to have failed to respond to thrombolysis.

After November 2002, all thrombolysis-eligible STEMI patients admitted on weekdays between 09:00 and 17:00 underwent primary PCI. From May 2004 the service was extended to seven days a week around the clock. Time intervals from admission to mechanical reperfusion ('door to coronary device' time), mortality and hospital length of stay were assessed. We present data for the thrombolysis-eligible patients treated by primary PCI during the period November 2002 to August 2004. Patient characteristics and procedural details are presented in table 1.

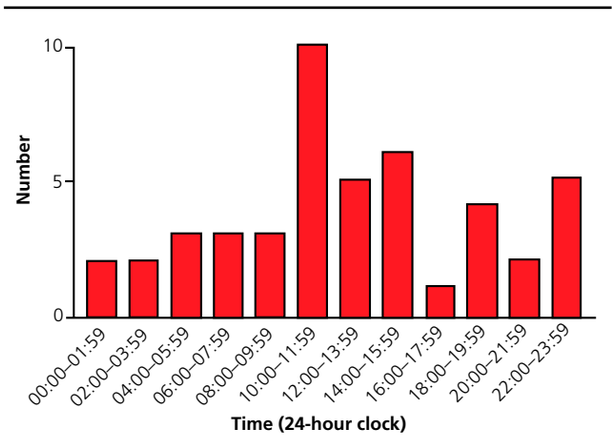
Results

The study population comprised 108 patients. Seven patients died during the in-patient period (6.5%). Four of these patients had presented with cardiogenic shock. The age distribution of all patients is shown in figure 1.

Door to coronary device time distribution is shown in figure 2. The median door to device time was 86 minutes (range 25 to 286), with 78% and 52% of patients having door to device times of less than 120 and 90 minutes, respectively. Median symptom onset to device time was 203 minutes (range 60 to 840). Median length of hospital stay was five days (range 3–30). In our centre, patients receiving thrombolysis for STEMI in the years 2000–2004 had a median hospital length of stay of eight days and in-hospital mortality of 7.2%.

Data on time of presentation to hospital were examined from May 2004 onwards (figure 3). During this period 46 patients were treated by primary PCI and 13 received thrombolysis due to catheter laboratory unavailability (such as servicing or malfunction). Ten PCI patients (22%) presented between midnight and 08:00. Median 'door to coronary device' time for these 10 patients was 95 minutes (range 47–132).

Figure 3. Time of hospital presentation in ST elevation myocardial infarction patients after 'round the clock' protocol was introduced (n=46)



Key messages

- The study aimed to assess the feasibility and impact of providing a primary PCI service in a district general hospital
- The median door to device time was 86 minutes in these thrombolysis-eligible STEMI patients
- The service was delivered without additional staff
- Primary PCI allows shorter duration of hospitalisation in such patients

Conclusions

In the contemporary era of interventional cardiology it is possible to introduce a primary PCI service for STEMI in a district hospital setting. This was delivered with no additional staffing requirement and with acceptable 24-hour 'door to coronary device' times and mortality. The requirement to intervene during the most unsocial hours of midnight to 8am was not extensive.

Direct angiography in STEMI patients (followed by PCI as appropriate) allows immediate evaluation of coronary anatomy and risk stratification as well as allowing early and sustainable myocardial reperfusion. The requirement for subsequent early staged PCI to a non infarct-related artery or surgical revascularisation is assessed on presentation. Prior to the initiation of this activity, in 2002, some 40% of patients in our unit who received thrombolysis for STEMI underwent subsequent pre-discharge, 'ischaemia-driven' PCI (for ongoing chest pain or with a positive pre-discharge exercise tolerance test). Primary PCI merely brings such intervention forward to the time of presentation. A strategy of primary PCI promises to allow shortened hospital lengths of stay, contributing to improved cost-effectiveness. However, at present the true cost-effectiveness of such an approach in our unit and the UK as a whole remains to be determined.

Several issues surrounding early PCI in the acute phase of STEMI remain unresolved. Management of the coronary 'no reflow' phenomena and use of thrombectomy/distal protection devices and intra-aortic balloon counterpulsation are evolving areas requiring further study. Centres that offer a primary PCI service will inevitably show increased overall PCI mortality at local and national audit, making risk adjustment of audit data essential. Further efforts to improve public education are required to reduce the very long pain to device times shown in this and other studies.

Whether primary PCI for STEMI is applicable as the reperfusion protocol of choice in an individual hospital depends upon many local and regional issues, including workforce planning (numbers of consultant cardiologists, cardiac nurses and technicians), close liaison with ambulance services and adoption of models best suited to local cardiac networks.

In our centre, the use of cardiac triage nurses based in the accident and emergency department facilitates early recognition of patients requiring primary PCI. If a patient is deemed suitable for such therapy, all members of the PCI team (consultant cardiologist, cardiology specialist registrar, cardiac technician, radiographer and coronary care nurse) are contacted directly and arrangements are made to transfer the patient to the cardiac catheter laboratory. Out of hours, all home-based members of this team are able to attend the hospital within 40 minutes of initial contact.

Prior to initiation of the primary PCI service, consideration was given to development of a generic catheter laboratory worker. Such a member of staff could combine the duties of the catheter laboratory nurse and cardiac technician ± radiographer. However, our cardiac technicians and radiographers were keen to preserve their roles amid the introduction of the service and they structured their on-call rotas accordingly.

Primary PCI is recognised as an area for investigation by the National Health Service Modernisation Agency and is subject to examination by a joint working group of the British Cardiac Society and Department of Health.

Acknowledgements

Data for the first 36 patients in this patient series were presented in abstract form at the British Cardiac Society (Manchester, May 2004).

MP and RGM laid the groundwork to implement the primary PCI service. MP, RGM, PL, JMB, N El-G, JM, SQ and RJ performed the primary PCI procedures and critically reviewed the data and manuscript. MF and HW collected the catheter laboratory and patient data and manage the PCI database. MP is the guarantor.

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Conflict of interest

None declared.

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