

The management of acute myocardial infarction: guidelines and audit standards

REPORT OF A WORKSHOP OF THE JOINT AUDIT COMMITTEE
OF THE BRITISH CARDIAC SOCIETY AND THE ROYAL COLLEGE OF
PHYSICIANS

ABSTRACT—Successful management of acute myocardial infarction depends in the first instance on the patient recognising the symptoms and seeking help as quickly as possible. Once in hospital, fast track admission procedures and protocols for pain relief, early thrombolysis and appropriate ancillary measures (eg aspirin, IV betablockers) should be promptly instituted. Specialist advice and, if necessary, transfer to specialist units should be considered if additional complications arise. Follow-up management after discharge from hospital requires cooperation between primary and secondary care to prolong survival by reducing risk factors, using aspirin, betablockers and angiotensin converting enzyme inhibitors and instituting a suitable rehabilitation programme. Audit measures are included in the report to help general practitioners and hospital doctors review their practice and assess it against the standards set.

Introduction

Acute myocardial infarction is a major cause of morbidity and mortality, and accounts for a substantial proportion of acute hospital admissions. This paper summarises the working papers presented and the ensuing discussion at a workshop held under the auspices of the Joint Audit Committee of the British Cardiac Society and the Royal College of Physicians in September 1993. Following a convention previously established in audit papers from the Royal College, potential audit points are identified in the text by [A], and points which are the subject of controversy, or require further research, by [R]. For convenience, audit and research points are also summarised in the Appendix.

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Presentation, out of hospital care and admission to hospital

Acute myocardial infarction characteristically presents with the acute onset of severe chest pain, although atypical presentations with different types of pain, or even its absence, are well documented. The population prevalence of ischaemic heart disease increases steeply with age, but the median age of patients admitted to hospital with myocardial infarction in a large UK survey was 64 years [1]. Patients older than 65 years present more often with atypical features [2]; they are more likely to die before hospital admission, and there may be bias against admitting them to hospital. Most patients experience the first symptoms of myocardial infarction at home rather than at a workplace.

The first priorities in treating patients with suspected acute myocardial infarction are to bring them within reach of a defibrillator [3], and to relieve pain and anxiety. The best ways of achieving these aims will vary with local conditions: in urban areas defibrillator-equipped ambulances may be able to respond within minutes, whilst in remote rural regions rapid response will largely depend on the general practitioner [4]. Local plans need to be agreed between general practitioners, the ambulance service and hospitals. Patients often delay too long before seeking advice, even those who have previously experienced infarction. Fears that encouraging patients to summon help from emergency services by ringing 999 would lead to excessive and inappropriate self referral have not been realised [5]. There may be scope for further patient education, perhaps by means of information leaflets distributed with prescriptions for anti-anginal medication [R].

Local guidelines for ensuring rapid and appropriate assistance for patients with possible myocardial infarction should be agreed between general practitioners, the ambulance service and hospital consultants [A]. The guidelines should emphasise the need for prompt access to a defibrillator and personnel trained in its use. Education should be directed at patients with known ischaemic heart disease to encourage them to seek assistance early. In urban areas, there should be a response to 90% of calls within 20 minutes [A].

Diagnosis and treatment of acute myocardial infarction

Diagnosis in the community

The best guides to the diagnosis of acute coronary thrombosis in the community are the history and clinical examination (Table 1). The electrocardiogram is specific, but of limited sensitivity, ie a normal electrocardiogram does not exclude an evolving coronary thrombosis [6].

Diagnosis in hospital

Once the patient has reached hospital the electrocardiogram is a useful guide to those patients who will benefit from thrombolytic therapy (Table 2).

Cardiac enzyme measurements, particularly of plasma creatine kinase, are helpful in assessing myocardial damage, but results are seldom available early enough to help with decisions about thrombolysis. This information is however important in making decisions about length of coronary care unit or hospital stay [R].

Delays in diagnosis and treatment after hospital admission are common and need to be avoided or reduced by clear local guidelines on 'fast track' admission procedures and by delegating decisions about management to junior doctors working to carefully specified treatment protocols [A].

Treatment

Adequate pain relief with intravenous opiates and antiemetics is important. Specific treatment for myocardial infarction consists of the early administration of oral aspirin, thrombolytic agents and, in appropriate cases, intravenous betablockers [7]. Whether (or not) thrombolytic therapy is administered in the community or after admission to hospital depends on local circumstances. Early thrombolysis is important for optimal results: at least 50% of eligible patients should receive thrombolytic therapy within 90 minutes of the onset of major symptoms [A]. Thrombolytic

Table 1. Clinical features of acute myocardial infarction

Background:	More common in men than women. Incidence increases with age.
Symptoms:	Severe pain, persisting at rest and despite nitrates; pain seldom described as stabbing. Nausea, vomiting are common.
Signs:	Signs of sympathetic activation (pallor, sweating). Narrow pulse pressure. Occasionally: frequent extrasystoles, third heart sound, features of pulmonary oedema.

Table 2. Relationship between ECG findings and mortality

Left bundle branch block	20%
Anterior ST elevation	12%
Inferior ST elevation	8%
ST depression*	15%
Normal ECG*	2%

*Groups not shown to benefit from thrombolytic therapy

Table 3. Contraindications to thrombolysis

- Previous haemorrhagic stroke
- Any stroke within six months
- Arterial or other major surgery within one month
- Active peptic ulceration or other internal bleeding
- Oesophageal varices
- Pregnancy
- Severe proliferative retinopathy

therapy has been shown to be of potential benefit up to 12 hours after the onset of major symptoms [7,8] and may be considered in patients with a longer history if there are features of continuing ischaemia.

When necessary, thrombolytic therapy can and should be administered in an accident and emergency department or admission ward without waiting for coronary care unit (CCU) admission. CCUs are important as centres of expertise and training and for the haemodynamic or electrocardiographic monitoring of critically ill patients, but lack of a CCU bed should not be a reason for withholding thrombolytic treatment [A]. The relative and absolute contraindications to thrombolysis are well recognised (Table 3); age is not, in itself, a contraindication to thrombolysis.

Streptokinase is the most widely used thrombolytic agent. It should be given with aspirin but there is no convincing evidence for any additional advantage in giving heparin as well [9]. Streptokinase is antigenic and repeat use within at least one year should be avoided [10]. Alteplase (tissue type plasminogen activator) when given as a front loaded infusion in combination with oral aspirin and intravenous heparin has shown, in one trial, better survival results than streptokinase (absolute survival improvement about 1%) [11], but it is more expensive, has a more complex administration schedule and is associated with a higher risk of cerebral haemorrhage, especially in patients over 65 with hypertension and/or body weight less than 65 kg [12]. Survival after receiving anistreplase is no better than with streptokinase but it has a simple administration schedule which can be useful in thrombolysis out of hospital.

Apart from aspirin, the only additional therapy which has consistently improved outcome when administered acutely is intravenous betablockade [13]. This should be used more widely, particularly for patients with hypertension and inappropriate tachycardia [A]. Intravenous magnesium sulphate produced a significant improvement in survival in the LIMIT-2 study [14], but this was not confirmed in the larger ISIS-4 trial (personal communication).

Role of specialist units or tertiary care centres

Most patients suffering myocardial infarction in the UK will be admitted to district general hospitals and managed by general physicians with an interest in cardiology. Specialist cardiological advice should be available for complications, and agreed criteria established for the transfer to tertiary centres of patients suffering from ventricular septal rupture, severe mitral regurgitation, persistent chest pain, recurrent ventricular arrhythmias, and patients who require permanent pacemaker implantation [A].

The initial diagnosis of myocardial infarction, and hence the decision to transfer a patient to hospital, should be made on the basis of the clinical history and examination. The electrocardiogram is a useful guide to those patients who will benefit most from thrombolysis. Units should develop and review local policies to ensure that all eligible patients receive thrombolytic therapy and appropriate ancillary therapy promptly, and that the use of thrombolysis is audited. At least 50% of eligible patients should receive thrombolytic therapy within 90 minutes of the onset of major symptoms [A]. Intravenous streptokinase and oral aspirin remain the appropriate 'front line' thrombolytic regimen for patients not previously given streptokinase.

Follow-up after myocardial infarction

The aim of follow-up treatment after infarction should be to reduce long term mortality and to expedite rehabilitation. Aspirin, betablockers and angiotensin converting enzyme inhibitors (in patients who have shown evidence of mild heart failure [15]) all improve survival when administered as long term treatment after myocardial infarction. Although they are all presumed to act by different mechanisms, it is not known whether their effects are additive, and there is no clear evidence if or when they should be stopped [R]; nor is it known how survival with long term anticoagulation compares with aspirin; exceptions are patients with atrial fibrillation, or who have had extensive anterior infarction with aneurysm formation, in whom anticoagulation reduces the risk of thromboembolism [R]. Hypercholesterolaemia is a marker for reduced long term survival and an increased risk of cardiac events in patients of all ages, including those over 65; there is evidence from meta-analysis, but not yet from

individual trials, that this risk is reduced by lowering blood cholesterol [16] [R]. Acute stress, such as infarction or unstable angina, causes a fall in cholesterol concentrations which may persist for six to eight weeks. Because of this, the incidence of hypercholesterolaemia in infarct patients will be underestimated unless cholesterol concentration is measured in blood taken immediately on admission. Analysis of a repeat sample two to three months after infarction is also helpful [A].

Long term survival after infarction is progressively worse with increasing age, in those with large infarcts, and in those with severely impaired left ventricular function. It is best in younger patients with normal left ventricular function and good exercise tolerance [17]. Routine exercise electrocardiography after infarction has been advocated as a strategy to detect patients with residual ischaemia who would be candidates for myocardial revascularisation [18]. Patients with a good exercise capacity (> Stage 3 on the Bruce protocol) have a good prognosis, and the negative predictive power of exercise testing is good, but its positive predictive power is limited, ie only a proportion of those with a 'positive' test go on to reinfarction [19,20]. The worst prognosis is in patients unable to exercise because of heart failure or chest pain, or whose blood pressure falls during exercise. It has been suggested that 'routine' exercise testing in patients aged 65 years or older adds little to the prediction of subsequent cardiac events within one year [21]; conversely however, objective demonstration of good exercise tolerance is often of considerable value in rehabilitation.

There is no convincing evidence to support a policy of routine coronary angiography after myocardial infarction, even in young patients [22,23]. Angiography may, however, be appropriate for patients with post infarct angina, or whose blood pressure falls on moderate exercise, and patients with persistent symptoms or multivessel coronary disease will benefit from revascularisation. Left main coronary artery stenosis is very uncommon in patients studied shortly after acute infarction, possibly because they have a high initial mortality rate [23,24].

Radionuclide ventriculography measures left ventricular ejection fraction, which is a good predictor of long term outcome. Echocardiography also provides information about ventricular function, and in addition is helpful in diagnosing ventricular septal defect, papillary muscle rupture, partial ventricular rupture and pericardial effusion. Echocardiography (preferably with colour-flow Doppler) is indicated in any patient who develops a new murmur after infarction, or in any patient who becomes haemodynamically acutely unstable.

All patients should be given aspirin unless contraindicated [A], and should be considered for treatment with betablockers, angiotensin converting enzyme inhibitors and cholesterol lowering therapy according to clinical judgement and local protocols [A].

Exercise electrocardiography should be available to all units looking after acute myocardial infarct patients [A]. It should be used and interpreted in the light of other clinical information and of clinical judgement. Echocardiography and radionuclide facilities should be used when clinically indicated. Units which do not have their own facilities for coronary angiography should have a suitable arrangement with a specialist unit providing this service, and defined referral criteria should be agreed as part of this arrangement [A].

Post infarct rehabilitation

Post infarct rehabilitation is a process of restoring physical and psychological fitness, and is also a vehicle for secondary prevention measures such as stopping smoking and controlling hyperlipidaemia. Many hospitals have rehabilitation programmes which are extremely popular with patients and their relatives. Individual trials have often been too small to show a significant effect on major outcome measures, but meta-analysis indicates a reduction of about 20% in total and cardiovascular mortality, though not in the risk of recurrent myocardial infarction [25,26]. For optimal results, follow-up and reinforcement may be needed for up to 12 months [26], and this may only be realistic for community rather than hospital based projects [R].

Communication between primary and secondary care

There should be a clear understanding, based on agreed local protocols, for which aspects of post infarct follow-up and rehabilitation the hospital will take responsibility and which will be provided by general practitioners [A]. Ideally, general practitioners should be warned in advance of the forthcoming discharge of a patient after myocardial infarction; in any event, the general practitioner should receive a discharge summary within seven days [A]. It should give the diagnosis and the evidence on which that is based, record any post infarct complications such as cardiac arrest or heart failure, give an indication of risk stratification, and include a management plan, with details of any rehabilitation arrangements or follow-up appointments.

Minimum data sets for recording information about patients with myocardial infarction

Recording data for audit purposes is only worthwhile if they will actually be useful for recording and modifying practice. A number of excellent computer databases are available for CCU use, but information collected from other hospital areas may need to be more limited in scope. The following lists are neither exclusive nor intended to be used indiscriminately.

Prehospital phase: time of receipt of call, time of attendance and time of hospital arrival (from ambulance logs or a special admission proforma); note of any difficulty or delay in securing hospital admission; prehospital complications such as cardiac arrest or arrhythmia; medication administered before admission.

Early hospital phase: time of arrival, time to initial assessment, time of transfer to ward, time to thrombolysis; ECG findings; whether thrombolysis administered, and if not, why not; other medication administered.

At hospital discharge: final diagnosis; duration of stay in CCU, in hospital; complications such as cardiac arrest, heart failure; medication on discharge; risk stratification and risk factors.

At follow-up: level of rehabilitation; presence of angina or heart failure; medication; risk factors.

Outcome: survival (adjusted for age and gender); major complications.

APPENDIX—Audit points

Initial presentation to admission

Primary care—'process' audit

- Is there a practice policy on advising patients what to do in the case of a suspected heart attack?
- Is there a practice policy on the management of suspected heart attack?
- Is a record kept of suspected heart attack and its outcome?
- Is there a policy for training staff and patients in basic or advanced life support?
- Is there a policy for the aftercare and rehabilitation of patients discharged from hospital after a heart attack?

Primary care—'outcome' audit

- How many patients in the practice suffer actual or suspected myocardial infarction in a year?
- What proportion made a first call to the GP?
- What was the average response time?
- What proportion of patients with actual or suspected MI were admitted to hospital?
- What proportion suffered cardiac arrest or required medication?

Secondary care—'process' audit

- Is there a policy, agreed with the ambulance service and GPs, on the process for rapid admission of suspected infarct patients?

- Are guidelines on the 'fast track' assessment of suspected infarct patients available on the admission ward or in the accident and emergency department, and are staff aware of them?
- Are times of arrival, assessment and treatment of infarct patients always documented?

Secondary care—'outcome' measures

- Number of patients with suspected infarcts seen for assessment
- Number (proportion) with time of arrival and assessment documented
- Number (proportion) having ECG within 15 minutes of arrival
- Number (proportion) receiving thrombolytic therapy within 30 minutes of arrival
- Number (proportion) receiving thrombolytic therapy within 90 minutes of onset of major symptoms

Hospital admission to discharge

Secondary care—'outcome' audit

- Number of patients admitted with suspected MI
- Number (proportion) of patients in whom MI was subsequently confirmed
- Number (proportion) receiving thrombolytic therapy; betablockade; aspirin; ACE inhibitor

Hospital discharge and follow-up

Primary and secondary care—'process' audit

- Is there an agreed policy between hospital and general practice for the rehabilitation and discharge of post infarct patients?
- Does it include specific provision for patient and family education and secondary prevention?
- Is there a policy for exercise testing and referral, if appropriate, for other investigations including angiography?
- Are appropriate facilities available for rehabilitation and education?

'Outcome' audit

- What proportion of MI patients are discharged alive?
- What proportion receive advice about lifestyle and rehabilitation?
- What proportion receive continuing hospital follow-up?
- What proportion return to work?
- What proportion achieve a significant modification of risk factors?
- What proportion are readmitted within one, six or 12 months?

Participants in the joint workshop

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This report, including background papers submitted to the Joint Audit Committee, is to be published as a book at a later date. Reprints of this article, in booklet form, are available on payment of £4.00 to: The Publications Department, Royal College of Physicians, 11 St Andrews Place, Regent's Park, London NW1 4LE.

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