PAPERS AND ORIGINALS

Policy for early discharge after acute myocardial infarction

Y K LAU, JANICE SMITH, S L MORRISON, D A CHAMBERLAIN

Summary and conclusions

Simple criteria were used to select a low-risk group of patients after acute myocardial infarction. The criteria depended on the presence or absence of diabetes, pulmonary oedema, serious rhythm disorders, and recurrent cardiac pain. Patients in the low-risk category with a suitable home environment were discharged from hospital after five to seven days (mean 6·2 days); they constituted 47% of the 267 hospital survivors over 18 months. Mortality in the selected patients was 2·4% at six weeks and 7% at one year.

Most complications preventing early discharge were identified on the first day. Provisional selection for a short hospital stay was made after two days, and 76% of those judged suitable at 48 hours remained free of complications. Early selection of a low-risk category is justifiable and of practical value, though subsequent events will delay discharge for some patients.

All patients who died in hospital or within two weeks after infarction had developed overt complications by the end of the fourth day. The results suggest that a policy of hospital discharge after four days would be justifiable for a low-risk group selected by the present criteria.

Introduction

The major role of hospital care for patients with acute myocardial infarction is to treat the malignant arrhythmias that tend to occur in the very early phase of the illness. The short-term[1] and long-term[2] success of ventricular defibrillation justifies a major effort to encourage hospital admission promptly after the onset of persistent cardiac pain; in Brighton this includes the possibility of self-referral using a resuscitation ambulance system.[3] Though we discourage admission more than three hours after the onset of symptoms, save for pressing clinical or social indications, our policy inevitably attracts patients with acute coronary disease and places a burden on inpatient services that might be insupportable. We have partly overcome this by increasing the emphasis on early discharge of patients with uncomplicated myocardial infarction. Other studies[4–6] suggest that shortening the conventional duration of hospital admission after uncomplicated coronary heart attacks has no discernible effect on mortality or morbidity. The earliest reasonable time for discharge in such cases is still unresolved.

We have examined the value of simple guidelines to identify patients for discharge within seven days after infarction and looked for any possible effect on early readmission rate or mortality. We have also noted how reliably selection for early discharge may be made within 48 hours after admission.

Patients and methods

The study was restricted to patients from a defined area within the Brighton health district served by the resuscitation ambulances. Entry was from 1 May 1977 to 31 October 1978. We considered for inclusion all patients admitted to the Royal Sussex County Hospital under the care of DAC with a history suggesting that myocardial infarction had occurred within the past 24 hours. They constituted over 90% of patients admitted with this provisional diagnosis. Confirmation of the diagnosis demanded at least two of the following: a typical history, characteristic evolution of electrocardiographic changes, and activity of cardiac enzymes (aspartate aminotransferase and lactate dehydrogenase) in serum raised acutely to twice normal or more. All patients who survived 48 hours in hospital were admitted to the study.

Careful records were kept of all patients with confirmed infarction who survived 48 hours in hospital irrespective of the time of discharge. The possibility of early discharge was invariably considered within two days after admission but was restricted to patients with home and social circumstances judged suitable for convalescence from coronary heart attacks. The project nurse questioned patients and their relatives on the availability of a caring person in the home most of the time for the first few days after the patient's return and checked that a telephone was readily accessible. Provisional arrangements were then made for patients to leave hospital after five to seven days provided defined complications did not occur.

Elimination from the early-discharge group on clinical grounds

Centre for Medical Research, University of Sussex, Falmer, Sussex BN1 9RH

Y K LAU, MB, MSC, research fellow
S L MORRISON, FRCPED, FFCM, director

Department of Cardiology, Royal Sussex County Hospital, Brighton BN2 5BE

JANICE SMITH, SRN, research assistant and project nurse
D A CHAMBERLAIN, MD, FRCP, cardiologist

depended on simple criteria based on recognising four types of complication: severe myocardial dysfunction, serious electrical instability, clinical instability from progressive ischaemia, and diabetes mellitus. The presence of diabetes or pulmonary oedema (alveolar or interstitial) excluded the patient immediately. The other complications —namely, further bouts of ischaemic chest pain, serious arrhythmias requiring active treatment, bifascicular block, and atrioventricular block of second or third degree—precluded early discharge only if they occurred after the first 24 hours of admission. Some patients with non-cardiac medical problems such as infection and persistent fever also stayed in hospital more than seven days, though this was not planned prospectively. The timing of any disqualifying complication was noted.

Mobilisation in hospital began as soon as pain and any early complication had resolved. Patients and those who would care for them at home were given verbal and written advice on further convalescence and rehabilitation. The importance of seeking advice in the event of recurrent persistent cardiac pain was emphasised, but in a manner designed to allay rather than to induce anxiety. Patients were told that direct access to the resuscitation ambulances was possible if a general practitioner was not immediately available for a potentially urgent problem.

Patients not discharged early because of medical or social contraindications, or both, had a longer hospital stay according to need. For analysis patients were divided arbitrarily into the early-discharge group (up to seven days in hospital), a conventional-discharge group (8-12 days), and a late-discharge group (13 days or longer); most patients in the last group had persisting complications. Long-term survival of discharged patients was analysed by the life-table technique.[7]

Patients discharged early were followed up at home by the project nurse two or three days later and again at about six weeks. At these visits any medical, social, or psychological problems were dealt with. A postal follow-up was arranged at six months and one year after admission. A sample of patients in the conventional-discharge group were similarly followed up.

Results

During the 18 months of the study 319 patients with confirmed acute myocardial infarction fulfilled the criteria for entry. Figure 1 summarises their progress. Of the 319 patients, 13 were excluded from

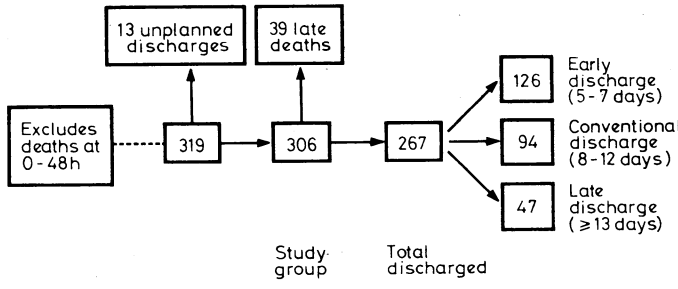

FIG 1—Relation of three discharge groups to number of patients admitted with myocardial infarction.

further consideration: six discharged themselves from hospital against medical advice, and seven were discharged early for personal reasons, although they had early medical contraindications to such a discharge. All, however, had clinically uncomplicated conditions at the time of discharge.

The remaining 306 patients constituted the study group; they comprised 267 patients who were discharged and 39 who died subsequently in hospital. Of the 267 survivors, 126 (47%) were discharged early, 94 (35%) had a conventional discharge, and 47 (18%) were discharged late. Table I gives the details of the three groups.

EARLY IDENTIFICATION OF PATIENTS SUITABLE FOR EARLY DISCHARGE

Forty-eight hours after admission 179 (58%) of the 306 patients remained free of any of the specified medical complications contraindicating early discharge. Over the next four days this figure declined to 136 (44%)—that is, 76% of patients without the specified medical complications 48 hours after admission continued to have an uneventful hospital course over the next four days (table II).

Table III lists the disqualifying medical complications and the time of their occurrence. The commonest complications in the second part of the hospital stay were recurrence of ischaemic chest pain and non-cardiac problems (especially infections and late fever) occurring after the original coronary event.

TABLE I—*Characteristics of patients in early-discharge, conventional-discharge, and late-discharge groups*

	Early discharge (n = 126)	Conventional discharge (n = 94)	Late discharge (n = 47)
Mean age (years) ± SD	59·4 ± 10·0	62·5 ± 8·6	66·3 ± 7·1
Median duration of hospital stay (days); range in parentheses	6 (5–7)	10 (8–12)	16 (13–47)
No (%) of men	101 (80)	81 (86)	31 (66)
No (%) with previous infarction	23 (18)	16 (17)	7 (17)
No (%) with location of infarction predominantly:			
Anterior	36 (29)	42 (45)	19 (40)
Inferior	61 (48)	41 (44)	23 (49)
Lateral and posterior	8 (6)	2 (2)	4 (9)
Subendocardial	18 (14)	7 (7)	0
Indeterminate (includes left bundle-branch block)	3 (2)	2 (2)	1 (2)

TABLE II—*Patients remaining free of medical contraindications to early discharge while in hospital*

	Time of observation (day)				
	2/3	3/4	4/5	5/6	6/7
No free of complications at 48 h	179	165	155	143	136
% free of complications beginning at 48 h	100	92	87	80	76

Of the 127 patients who had developed complications by 48 hours after admission, 32 (25%) died subsequently in hospital. In contrast only 7 (4%) of the 179 patients who had remained free of complications 48 hours after admission died subsequently in hospital; all of these developed overt problems on the third or fourth day. No hospital deaths occurred in the few patients who developed complications after the fourth day.

Few patients who remained free of complications were kept in hospital because of unsuitable home or social circumstances. Of all 306 patients studied, only nine fell into this category. Delay in arranging transport prevented another eligible patient from being discharged early. Thus of the 179 patients who were identified 48 hours after admission as medically suitable for early discharge, 126 (70%) were discharged early.

PROBLEMS AFTER DISCHARGE

Home visits by the project nurse to discharged patients did not uncover any problems unique to the patients discharged early. A general air of nervousness and unease was apparent to varying degrees in patients and those caring for them in both the early-discharge and conventional-discharge groups. Nearly all patients needed and sought reassurance and encouragement that they were making satisfactory progress.

READMISSIONS WITHIN SIX WEEKS AFTER INFARCTION

Of the 126 patients who were discharged early, 7 (6%) were readmitted within a week. A further 5 (4%) were readmitted within six weeks after the onset of their original infarction. None of these 12 patients died during their readmissions.

Five of the readmissions were for reinfarction, which in four cases occurred within 10 days after the original event. Four other patients were readmitted for cardiac pain without evidence of fresh infarction. One patient was readmitted for each of the following problems: persisting arrhythmias, superficial venous thrombosis of the leg, and

pulmonary embolism. The mean duration of the second hospital admission for these 12 patients was eight days, the range being five to 10 days.

MORTALITY IN SIX WEEKS AFTER INFARCTION

Three patients discharged early died suddenly within six weeks after the onset of acute myocardial infarction, their deaths occurring three, 16, and 17 days respectively after discharge. The mortality from discharge to six weeks after the onset of acute myocardial infarction for the low-risk patients was thus 2·4%. The earliest of these deaths occurred when the patient might still have been in hospital with a conventional length of stay. Review of the clinical records showed that he had pulmonary oedema on admission, which should have disqualified him from early discharge.

is on early mobilisation and discharge. Studies have shown the possibility of discharging within a week patients with an uncomplicated hospital course.[4–6] The potential advantages of early discharge include minimising physical and psychological disability after prolonged immobilisation in hospital, a smaller risk of thromboembolic complications, and sparing hospital resources.

A uniform discharge policy is neither possible nor desirable for patients with the protean manifestations of acute coronary disease. Though some unpredictable deaths occur, mortality is highest in groups that may be defined. The most important risk factors may be identified within the first 24 hours: thus patients with diabetes mellitus[9 10] or pulmonary oedema[11 12] have a higher mortality both during the acute phase of infarction and after discharge from hospital. But late complications may also occur. Recurrent ischaemic pain and the occurrence of serious cardiac arrhythmias demand special caution because they may herald reinfarction or sudden death. Other clinical features during the early course of myocardial infarction have been associated with higher risks to the patient, notably persisting sinus tachycardia and ST-segment elevation.[13] ST-segment elevation, however, is a crude measure of infarct size and may provide no additional predictive information on early risk compared with clinical assessment.[14] Sinus tachycardia is a manifestation of heart failure[13] or, particularly when acute, inappropriate sympathetic drive[15]; the first would be seen on the chest *x*-ray film, and the second is amenable to treatment. We therefore ignored sinus tachycardia and ST-segment elevation per se.

TABLE III—*Medical complications and time of occurrence in 306 patients who survived at least 48 hours in hospital* (numbers of patients who subsequently died in hospital given in parentheses)*

Day of occurrence	Diabetes mellitus	Interstitial or alveolar pulmonary oedema	Serious tachycardia or bradycardia requiring treatment	Ischaemic cardiac pain	Other medical complications	Total
1	13 (1)	82 (20)			5† (5)	100 (26)
2		12 (1)	13 (4)	2 (1)		27 (6)
3		2 (1)	2 (1)	6 (1)	4 (1)	14 (4)
4		1	3 (2)	4 (1)	2	10 (3)
5		1	1	4	6‡	12
6			1	4	2§	7
Total	13 (1)	98 (22)	20 (7)	20 (3)	19 (6)	170 (39)

*Only first complication counted when more than one occurred.
†All patients were comatose or required ventilation, or both.
‡Includes one patient with cerebral embolism.
§Includes one patient with pneumothorax.

LONGER-TERM SURVIVAL

Figure 2 shows the one-year survival curves for the three groups. Excluded from this analysis were the 10 patients who did not have an early discharge for social reasons, and three patients in the conventional-discharge group who died of carcinoma (stomach, lung, and prostate respectively) 6-12 months after the onset of acute myocardial infarction. The survival rate at one year was slightly better in the early-discharge group (93%) than in the conventional-discharge group (84%), but the difference was not significant. Survival of the late-discharge group at one year (75%), however, was significantly less than that of the early-discharge group ($p < 0.01$).

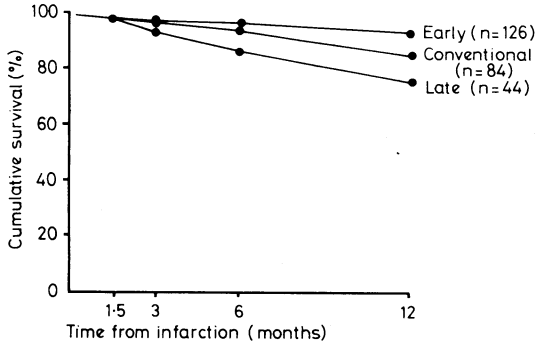

FIG 2—One-year survival of patients in three discharge groups (analysed by life-table technique[7]).

Discussion

The duration of hospital admission for acute myocardial infarction has changed considerably over the past 20 years. Whereas six weeks of bed rest was common,[8] the emphasis now

Based on these considerations, our criteria for early discharge were simple; they were clearly defined and required no great clinical expertise. They were apparently successful, since in the six weeks of follow-up mortality was low in the early-discharge group. But no system is infallible: the earliest death occurred in a man who was, in retrospect, wrongly classified. We did not reclassify this patient for analysis, since we were testing a policy designed as a guideline suitable for staff of varying experience, and in this one case the policy failed. We recognised that unspecified complications would delay some patients' discharge. In the event these related principally to infection and fever and were relatively uncommon.

The trend towards different mortality patterns over 12 months for the three discharge groups was predictable because similar factors determine risk in the short term and long term.[12] The most important of these is the extent of myocardial necrosis.

We believed that provisional selection for early discharge should be made within 48 hours after admission. This is important because arrangements for continuing care at home must sometimes be made several days before discharge. In the event 126 out of 179 patients who qualified 48 hours after admission (70%) went home early. In addition to one for whom

transport could not be arranged, a further 9 (5%) would have been discharged early had their social and home circumstances been satisfactory. While we had hoped to achieve a slightly higher figure, we are satisfied that early provisional selection is worth while. The value of an optimistic approach to early discharge and rehabilitation offsets even the disadvantage of temporary disappointment for the few who are delayed. Moreover, we may have been unduly cautious in keeping patients longer in hospital because of residual fever and slight recurrent chest pain.

The readmission rate for patients discharged early was slightly higher than in other reports.[4 5] The commonest cause for readmission was recurrent pain. Patients with this complication may be more liable to return to hospital in Brighton than elsewhere because of the "open-house" policy for patients with coronary disease and the possibility of self-referral via the resuscitation ambulance system if general practitioners are not immediately available. No hospital deaths occurred in this readmission group. Pozen *et al*[16] emphasised the disparity between morbidity and mortality in patients classified as low risk.

We remain committed to a policy of easy access to hospital for patients with chest pain because we believe that an important reduction in mortality can be made only if patients are seen early after the onset of symptoms. Though we discourage referrals for admission of uncomplicated cases diagnosed over three hours after the onset of major symptoms, our policy inevitably makes demands on hospital resources that are difficult to meet. Selective early discharge provides a partial answer, which we believe is also in the best interest of most patients.

We are not yet certain of the optimum time for discharge in uncomplicated cases. Our present policy of discharge at five to seven days is satisfactory, but it may be safe to shorten hospital admissions a little more for this selected group. All of our patients who died in hospital or within two weeks after infarction had developed overt complications by the end of the fourth day, whereas of those who developed complications for the first time later on, all survived. McNeer *et al* reported similar findings from Duke University in 1975.[6] We believe that the safety of convalescence at home from the fifth day could justifiably be tested for patients maintaining an uncomplicated course to that time. The earlier we can achieve admissions and the earlier we can discharge patients safely the greater will be the efficiency and the contribution of hospitals to the management of myocardial infarction.

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ONE HUNDRED YEARS AGO It is now many years since Mr Max Greger, by the introduction into this country of well-selected well-made Hungarian wines, succeeded in creating for the products of the vineyards of Hungary a large and continuous demand. His success was greatly due to the favourable opinion which medical men came to entertain of the quality of these wines, and of their value as elements of alcoholic diet and treatment. Carlowitz especially obtained for itself the great medical reputation which it has steadily maintained and still enjoys. The popularity of the Hungarian wines has been still further increased by the successful application of an ingenious system of distribution known as the wine-flagon system, by which incidental expenses of bottling and conveyance have been much diminished and the relative prices of the wines proportionately diminished. Mr Max Greger has now made a further step in the same direction; it appears to us to be made very judiciously and advantageously. The Archduke Albrecht, uncle to the present Emperor of Austro-Hungary, has for the last half-century spared neither time, trouble, nor expense in extending the wine-producing capacity of his country, and in improving the quality of Hungarian wines. For this purpose, he has employed not only the choice Kadarka grape, but has imported and planted over a large space of ground the best stocks of Burgundy and Bordeaux. With a favourable soil and a fine climate, and by the employment of skilled methods of cultivation, he has succeeded in producing wines on the Bellye estates, which were first reserved entirely for the use of the Imperial family and of other private and royal persons. The produce of the estate has in the course of later years been considerably increased, and it has become during the last few years of great importance, so as to leave an annual surplus of some million of bottles of the different varieties. The administrator of the estate, Herr von Rampelt, has assigned, and, on behalf of the Archduke, completed an arrangement with Mr Max Greger by which he secures for him for six years, the entire produce of the Bellye estates, on the condition that every bottle shall be sold as bottled at the vineyards, and branded with the archducal stamp. The wines thus introduced are essentially of two kinds, the Red Kadarka and White Riesling. They are of different qualities and prices; some very moderate in price, as low as two shillings a bottle, and still not only of undoubted purity and sold as bottled, but of excellent quality. The uses of wine, and especially of the lighter class of wines such as are here represented, have been of late years more and more carefully discussed and considered by the medical profession. On one point, at least, there is considerable unanimity; and that is, that the wines used should be the natural product of the grape, perfectly made, and free from any subsequent addition either of raw spirit, or artificial ethers, of fuchsine colouring matter, or of any of the numerous devices by which thin and poor wines are made by artificial combinations to assume the character of sound, wholesome, and naturally well-made wines. On this score, the Kadarka and Riesling offer very desirable guarantee; and the testimony of Dr von Schmerling is in such circumstances hardly necessary, although it is very weighty, and testifies to their medical and dietetic value within the limits which medical opinion or experience may in each individual case assign to the use of wine. The inspection and criticism of all who are interested is openly invited by Mr Greger; and those who wish to satisfy themselves of the accuracy of his statements with regard to the Hungarian wines, can do so at any time at his offices in Old Bond Street and Mincing Lane. (*British Medical Journal*, 1880.)