Increased mortality from inadequate provision of coronary care unit facilities

D M Walker MRCP[2]   **M Wicks** RGN[1]   **W N Hubbard** MRCP[1]   **R D Thomas** FRCP[1]
[1]Cardiology Department, Royal United Hospital, Combe Park, Bath, Avon BA1 3NG and
[2]Hatter Institute for Cardiovascular Studies, University College Hospital, London, UK

Summary

Over a 6-month period, all patients admitted to the Royal United Hospital, Bath, with acute ischaemic heart disease were prospectively followed for the period of their hospital stay. Strict admission and discharge criteria were defined for the Coronary Care Unit (CCU), so that groups of patients could be identified in which the treatment was not ideal. The mortality in the groups of patients who were admitted to the CCU without delay and for an appropriate length of time was 5.1% (18/355). It was significantly higher overall in the groups of patients who were either not admitted (14.3%, 4/28) or whose admission was delayed (17.4%, 4/23). The results underline the importance of the provision of adequate coronary care facilities.

Introduction

Coronary care units (CCU) aim to provide optimal treatment for patients with acute myocardial infarction, unstable angina and other serious acute cardiac conditions. Since their inception in the 1960s the success of such units in treatment has been established[1].

The prevalence of coronary artery disease in the population is so great and the efficacy of treatment proven that adequate provision of coronary care facilities can be justified. However, the number of coronary care beds needed in a district is not clear.

An American attempt to quantify the number of coronary care beds required was based on the number of patients admitted to coronary care over the year, combined with their estimated average days' stay[2]. As the patient load throughout the year is not even, it also suggested that one or two additional beds should be provided to accommodate these fluctuations. Unfortunately, such calculations are not applicable here because they are based on unlimited access to facilities.

In 1987 the British Cardiac Society proposed a minimal requirement of three coronary care beds per 100 000 population[3]. This was based on a consensus of opinion without workload data (Chamberlain, personal communication). However, this report was prior to the full impact of successful coronary thrombolysis which may have lead to an additional demand for admission to coronary care units in the UK. In particular, increased referral of more elderly patients is likely in view of the results of the age-benefit analysis in ISIS-2[4].

We have found very considerable pressure on our six coronary care beds in the Bath Health District which has a population of 400 000. Although the

clinicians were aware of inadequate bed numbers we were unable to convince management of this. We prospectively studied the mortality of acute ischaemic heart disease in the Royal United Hospital, Bath.

Method

Strict admission and discharge criteria were defined for our coronary care unit and circulated to all junior medical staff with responsibility for admission to the unit. The majority of the patients who pass through our unit are admitted directly from home after discussion with the referring general practitioner. Some of these patients prove not to have coronary artery disease or significant arrhythmias and these have been excluded from the study. This leaves those with acute myocardial infarction, unstable angina, angina in association with a tachyarrhythmia or ventricular tachycardia.

Daily consultant ward rounds took place to decide who was ready for discharge to the general ward. Uncomplicated myocardial infarcts were discharged after 48 h, whereas patients at high risk of in-hospital cardiac arrest were kept on the unit for 5 days. These included patients with extensive anterior myocardial infarction or previous ventricular fibrillation. Cases of unstable angina were discharged to the general ward only when free from pain for 24 h after discontinuing intravenous therapy.

Using these criteria, data were collected by the junior medical staff every day for 6 months, on:

1 Patients not admitted to coronary care at any stage of their in-patient care, due to a shortage of beds;
2 Patients whose admission to coronary care was delayed for more than 4 h due to a lack of beds;
3 Patients who were discharged to the general ward early to create beds for further admissions.

Particular note was taken of the characteristics of patients in the different groups to ensure that they were comparable. All patients identified were then followed-up for the length of their hospital stay and were compared with patients with a 'correct' admission and discharge course on the CCU.

Statistical analysis was performed using the χ^2 test with Yates' correction.

Results

In the 6 month survey there were 355 patients with acute ischaemic heart disease who were admitted to the CCU for an appropriate length of time. Of these, 18 died (5.1%). There were 28 patients who were not admitted, of whom four died (14.3%). Twenty-three were delayed admissions and of these, four died (17.4%). The cardiovascular mortality in these two

Table 1. Main criterion for allocation of patients to coronary care units (CCU)

Patient course	Correct course	Not admitted	Delayed admission
Number	355	28	23
Male	267	18	17
Female	88	10	6
Age (mean$\pm$SE)	65.1$\pm$0.6	65.7$\pm$1.8	63.4$\pm$1.6
Anterior MI	84	9	4
Inferior MI	80	2	8
Other MI	39	3	2
Angina	112	9	8
Arrhythmias	40	5	1
Deaths	18	4	4
Mortality (%)	5.1	14.3	17.4

MI=Myocardial infarction

groups whose treatment was less than ideal (15.7% overall), was significantly increased ($P<0.01$).

In addition, there were 70 patients who were prematurely discharged from the unit and of these, three died (4.3%, P=NS). The majority of these patients were uncomplicated myocardial infarcts, discharged at 24 h.

As the main criterion for allocation into these groups was the bed state on the CCU, we subsequently analysed the patients' ages, sex, final diagnoses and sites of myocardial infarction (where appropriate), for comparison (Table 1). There were no significant differences between the groups.

Finally, the time from onset of symptoms to admission to hospital was assessed for patients in the different groups with proven myocardial infarction. We found that 11/14 (78.6%) of patients who were not admitted to the unit arrived within 6 h of the onset of pain, compared with 11/13 (84.6%) in the delayed group. In the correct coronary care course group, 111/203 (54.7%) of the patients were admitted within 6 h. Therefore the majority of patients who were not admitted to the unit arrived in hospital in time for thrombolysis.

Discussion

From our data, 121 of 476 patients (25.4%) did not receive ideal treatment according to our coronary care criteria, due to a shortage of beds on the CCU. Although the study was not randomized, patients were treated according to bed availability and there did not appear to be any obvious difference between the patient groups. We demonstrated a higher mortality in patients either not admitted or with delayed admission to the CCU, which confirmed our clinical impression. As a result of our study we have been able to increase our bed numbers to eight, although this is still less than the recommendation of the British Cardiac Society for a District of this size.

It is not possible, however, to look at coronary care facilities in complete isolation. Resources in the National Health Service are limited and so consideration must be given to the relative priority of coronary care in comparison with other acute medical specialities. Such considerations of resource management are beyond the scope of this article, but

it should be noted that the benefits of high quality coronary care apply to a relatively large proportion of the population and are not confined to the reduction in in-hospital mortality shown in this study. Prompt thrombolysis improves left ventricular function at discharge and this improvement is reflected in a sustained reduction in mortality rates for at least 5 years[5]. Long-term mortality benefits may also emerge from the early use of angiotensin converting enzyme inhibitors[6] and intravenous magnesium[7], both of which are under evaluation.

One area with scope for more optimal use of resources is how quickly patients may be discharged from CCU. In our study, patients who were discharged early because of a bed shortage were carefully selected in order to identify those at low risk of in-hospital arrest. Perhaps it is not surprising therefore, that they had an overall mortality which is not statistically different from the group of patients whose treatment was 'ideal'. This suggests that there is probably some scope for safe early transfer in uncomplicated cases, however, sudden and unexpected movement of patients, often at night, can cause considerable stress and this must also be considered. Although not directly comparable, evidence in support of the safety of this early transfer policy comes from a study looking at early hospital discharge (day 3) of patients after uncomplicated myocardial infarction with no evidence of ischaemia on an exercise thallium scan[8]. Although only a small percentage of patients proved eligible, this early discharge policy was not associated with any increase in mortality or morbidity.

In conclusion, the results of our study suggest that adequate provision of coronary care beds (and in particular their immediate availability) is not a luxury, for even a small shortfall appears to be translated into an unacceptable increase in mortality.

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