Mobile cardiac unit

Experience from a West Midland town

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The organization, staffing, and equipment of a mobile cardiac unit in a West Midland district is described. Two hundred and eighty calls made in the first 18 months of its existence are analysed. The unpredictability of early post-infarction arrhythmias with the risk of sudden and preventable death is emphasized and the role of a mobile cardiac unit in their prevention and treatment is described.

The successful operation of coronary care units resulting in early detection and control of life-threatening post-infarction arrhythmias has so far produced a gratifying and instructive impact on the management of acute myocardial infarction. The first few hours after an attack are, however, the most critical. Yater *et al.* (1948) showed that 60 per cent of the deaths from coronary heart disease occur within an hour of the onset of the pain and 85 per cent within 24 hours. Nixon (1968) reported that 47 per cent of the coronary deaths occurred before the arrival of an ambulance and 13 per cent during transportation. This prompted the concept of moving the cardiac care unit out of the hospital to the patient's side as soon as possible after the attack of myocardial infarction to prevent and control the fatal early-occurring arrhythmias. The mobile cardiac unit started operations from our hospital in December 1971, and the purpose of this paper is to describe our experience.

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Population served

The population covered by our mobile cardiac unit service is roughly 350,000 and the area is about 50 square miles. However, there are four hospitals with medical departments in the group, though only Burton Road Hospital has an MCU. A proportion of the patients, therefore, may be admitted to the nearest hospital as a matter of preference and for this reason numbers may be somewhat misleading.

Method

The mobile cardiac unit consists of a Vauxhall Viva Estate Car fitted with blue flashing light and two-tone horn, two-way radio communication with Dudley Ambulance Control, and the following portable equipment: a monitor (Portascope), defibrillator, and electrocardiograph, all mains/battery powered, a portable infusion stand, Sabre-Saturn resuscitator, and a case with emergency medications. The unit is staffed by a resident and a Sister experienced in coronary care, either of them driving the car. Calls for the mobile cardiac unit are accepted from the general practitioners, ambulance

TABLE I Distribution of 280 calls attended by mobile cardiac unit

Diagnosis	Myocardial infarction			Total	Non-cardiac cases	Dead on arrival of mobile cardiac unit	Call cancelled	Total
	Definite	Probable	Possible					
No.	125	11	49	185	57	37	1	280
Per cent	44.6	4	17.5	66.1	20.4	13.2	0.3	100

staff police, or nurses attached to factories by the coronary care unit through the hospital switchboard. The team then proceeds with all speed to the patient and on the way radios the destination to the ambulance control, which arranges for an ambulance to stand by. On arrival the patient is immediately connected to the monitor and, if the general condition and the cardiac rhythm is satisfactory, a twelve-lead electrocardiogram is taken. All the necessary treatment is then given. When the patient's condition permits, the ambulance is summoned via the radio telephone and the patient being continuously monitored is transferred into it. The mobile cardiac unit team with the equipment accompany the patient, the vehicle being driven back by one of the ambulance crew. The return to the hospital is made as calmly as possible.

Results

During the first 18-month period the mobile cardiac unit has been summoned 280 times. The average time required to reach the site of call was 15 minutes though there were a few occasions when it took about 25 minutes because of traffic conditions. There were 37 (13.2%) patients who were dead before the arrival of the team, presumably because of coronary artery disease. The distribution of the calls attended by the unit is shown in Table 1.

This shows that 66.1 per cent of the cases were due to myocardial infarction, the diagnosis of which was based on World Health Organization criteria (1969). The non-cardiac cases consisted of respiratory diseases, cerebrovascular accidents, and upper gastrointestinal disease. Of the 185 cases of myocardial infarction, 43 were women, a male:female ratio of 4.3:1. The age distribution of the patients is given in Table 2.

The time interval between the onset of symptoms and the beginning of intensive care is shown in Table 3. The majority of cases, 152 (82.1%), had the benefit of intensive care within 4 hours after the onset of chest pain.

Out of 185 cases of myocardial infarction attended by the mobile cardiac unit, 133 were treated for various complications (Table 4). Thirty-seven (20%) cases were in sinus rhythm with a heart rate varying from 60 to 90 a minute. Fifteen (8.1%) cases had

TABLE 3 *Time interval between beginning of symptoms and that of intensive care by mobile cardiac unit in 185 cases of myocardial infarction*

Time interval	0-1 hr	1-2 hr	2-3 hr	3-4 hr	4-5 hr	5-6 hr	7-8 hr	>8 hr	Total
No.	41	48	42	21	9	2	7	15	185
Per cent	22.1	26	22.7	11.3	5	1	3.8	8.1	100

TABLE 4 *Complications treated by mobile cardiac unit in 185 cases of myocardial infarction*

Complications	No.	Per cent
Sinus bradycardia < 60/min	13	7
Atrial tachycardia	5	2.7
Atrial fibrillation	19	10.2
Ventricular premature beats > 6/min and/or R on T	35	19.0
Ventricular tachycardia	3	1.6
Ventricular fibrillation	8	4.3
Complete heart block	3	1.6
2:1 block with bradycardia	3	1.6
Left ventricular failure	40	21.6
Cardiogenic shock	4	2.1
Total	133	71.7

evidence of sinus tachycardia more than 90 a minute. Twelve cases were resuscitated outside the hospital.

Discussion

There has never been any doubt that the majority of deaths from myocardial infarctions occur early, and it was against this background that the concept of the mobile cardiac unit was pioneered by the Belfast team (Pantridge and Geddes, 1967; Pantridge and Adgey, 1969). It was suggested by some (Oliver, Julian, and Donald, 1967; Lown and Ruberman, 1970; Sidel, Acton, and Lown, 1969; Shillingford, 1971) that the units are too expensive to run and wasteful of medical manpower. We felt that the expense of a specially equipped ambulance with standby drivers was probably not justifiable in our situation but that a mobile cardiac unit as described, manned by a resident and a nurse who are in any case already on duty, made it a worthwhile proposition. This, however, presumes that the medical department to which the coronary care

TABLE 2 *Age distribution of 185 cases of myocardial infarction*

Age group	30-39	40-49	50-59	60-69	>70	Total
No.	9	28	63	62	23	185
Per cent	5	15.1	34	33.5	12.4	100

unit is attached is large enough to have two residents on call all the time. Our staffing is 1 registrar, 4 senior, and 2 pre-registration house physicians and comparable to that of Ulster Hospital, who also reported gratifying results with a very similar arrangement (Walsh *et al.*, 1972).

It is obvious that the best results would be obtained should the patient get under the protective umbrella of the coronary care unit immediately after the attack. This, of course, hardly ever happens. The causes of the delay were analysed by Armstrong *et al.* (1972) and Sandler and Pistevo (1972). Time would be saved if the mobile cardiac unit could be directly summoned by a patient or relatives on a 999 call. This would require considerable education of the public, on one hand to make sure that the mobile cardiac unit is not attending every stroke or epileptic attack, and an increasing number of cardiac neuroses, and on the other hand that the patient does not play down his symptoms, being reluctant to call for help. However, this is a matter which is being considered. At present (Table 3) only 41 (22.1%) of the 185 cases of myocardial infarction were reached by the mobile care unit within an hour of onset of the symptoms, and in 82 per cent of cases the intensive care was started within 4 hours. This delay was mostly due to the time lag before the patient sought medical attention and occasionally because the general practitioner was not immediately available, especially during the weekends.

Nixon (1968) reported that the number of deaths during transportation to hospital of cases of myocardial infarction was 13 per cent and figures of Pemberton and McNeilly (1967) were even worse, 25 per cent. It is, therefore, obvious that risk to the patient during this period is considerable and that the mobile cardiac unit is of great help.

It will be noted that 37 patients (13.2%), who presumably were alive when the call was placed, were dead on arrival of the mobile cardiac unit team. A similar experience has been reported by Grace and Chadbourn (1969). Pantridge (1970) found that 11 per cent of patients seen within the first hour after the onset of symptoms had ventricular fibrillation during this period. It has also been pointed out that bradycardia was present in 31 per cent of patients, especially those with inferior infarction. Bradyarrhythmia with ventricular premature beats, which frequently coexist, will reduce cardiac output and, therefore, coronary perfusion pressure. This in turn may result in the extension of the original area of the infarction and increased incidence of cardiogenic shock. Since the treatment of this condition is currently singularly unrewarding, our efforts should be directed to its prevention and, therefore, to the

earliest initiation of the intensive care (Adgey *et al.*, 1971). The need for speed is thus further emphasized.

We resuscitated 12 patients outside the hospital (6.6%), whereas Pantridge and Geddes (1967) reported 10 such examples (6.5%) and Kernohan and McGucken (1968) mentioned 5 similar cases (5.3%).

The total number of calls in our mobile cardiac unit was 280 in the first 18-month period compared with 338 calls in 15 months in Pantridge's series and 164 calls in 6 months reported by Kernohan and McGucken. The smaller number of calls in our cases was mostly because the general practitioners were not sufficiently aware of the unpredictability of the postinfarction arrhythmias and the high risk of sudden and preventable death in these cases.

When after 12 months' operation, during which our mobile cardiac unit was called out 154 times, the statistics and implications were sent to all general practitioners in the area in the middle of February, the increase in the use of the services of the mobile cardiac unit in the next 6 months (that is to the time of writing this report) was remarkable, the mobile cardiac unit being called out 126 times, bringing the frequency in line with the above-mentioned reports.

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