

## VENTRICULAR FIBRILLATION IN ACUTE MYOCARDIAL INFARCTION— RELATION TO LONG-TERM SURVIVAL

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### SYNOPSIS

The effect on prognosis of ventricular fibrillation occurring during an acute episode of myocardial infarction has been analysed for a group of 335 patients admitted to a coronary care unit and followed for twelve months. Of 66 patients with ventricular fibrillation in the coronary care unit, 34 died in hospital, 32 were discharged from hospital alive and of these 32, 10 died within twelve months. The group with ventricular fibrillation had a significantly poorer one year prognosis than those patients who were discharged from hospital alive without having experienced ventricular fibrillation. There was no significant difference in the mode of death after discharge from hospital between the group who had experienced ventricular fibrillation and those who had not.

### INTRODUCTION

A number of studies have examined the short and long-term prognostic significance of major cardiac arrhythmias recorded during acute myocardial infarction. (Cole *et al*, 1954; Honey and Truelove, 1957; Beard *et al*, 1960; Denborough *et al*, 1968). None of these studies have restricted their follow-up to patients monitored in the coronary care unit and, as it is known that the number of recorded cardiac arrhythmias is much higher amongst monitored patients than those admitted to a general ward, it was decided to study and follow such a group.

Ventricular fibrillation, being the most dramatic arrhythmia seen in the coronary care unit, has been chosen for specific study. Two reports (Lawrie, 1969; Stannard and Sloman, 1969) illustrated that patients who had experienced ventricular fibrillation and survived could return to a normal life. However, neither of these studies examined any control group so that survival rates could not be compared.

Because of recent attempts to improve the long-term prognosis after acute myocardial infarction by reducing the incidence of lethal cardiac arrhythmias (collaborative group 1971) it is very important to examine the natural history of patients with specific cardiac arrhythmias recorded during the stage of acute infarction. We here present an assessment of the influence of ventricular fibrillation occurring in patients monitored in a coronary care unit followed for twelve months.

### METHODS

Commencing on the 1st. March, 1968, a register was maintained of all patients admitted to The Royal Melbourne Hospital with a provisional or proven diagnosis of acute myocardial infarction. Those patients who suffered an acute myocardial infarction in hospital or in whom an infarction was confirmed at autopsy, without prior clinical diagnosis, were also included. The register was continued until the 1st. March, 1970 and all patients were followed for twelve months after registration. During this two year period 1,278 patients were registered and of these 978 (76%) were confirmed as suffering from a definite acute myocardial infarction (using criteria from W.H.O., 1968). Of this number, 335 (34%) were admitted to the coronary care unit and monitored. The remainder were managed in general medical ward beds. Of this number, 723 patients (74%) survived to be discharged (from hospital—257 had been admitted to the coronary care unit and 466 had been managed in the general medical wards.

At the time of admission to the hospital, a pro forma was completed detailing the clinical presentation, initial

physical findings, radiological and electrocardiographic data and subsequent complications experienced during the hospital stay (Sloman and Brown, 1970). Patients in the coronary care unit had continuous electrocardiographic monitoring until transferred to a general medical ward. All patients were followed clinically during their hospital stay and attended a special follow-up clinic at three months and twelve months following infarction. Complete survival data was obtained for each patient and the mode of death was recorded, where relevant.

Sudden death was defined as death occurring in less than 24 hours of the onset of a second or subsequent attack of pain; slow death was defined as that which occurred 24 hours or more after the onset of a second or subsequent attack.

Of the 335 patients admitted to the coronary care unit with definite infarction, 257 patients were discharged from the unit alive and subsequently left hospital. This group consisted of 138 men aged 50 years or over and 80 men who were aged less than 50 years. There were 35 women aged 50 years or over and 4 women aged less than 50 years. Of the 466 patients who were managed in ward beds and left hospital alive, 260 were men who were aged 50 years or more while there were 64 men who were aged less than 50 years. 130 women were aged 50 years or more and 12 women were aged less than 50 years.

### RESULTS

Table I lists the number of patients experiencing various specific arrhythmias in the coronary care unit and details their outcome with respect to their hospital stay. Of the 335 patients admitted to the coronary care unit, 78 died giving a hospital survival rate of 77%. Of the 78 patients who died, 54 succumbed in the coronary care unit and 24 (30%) died in general wards after discharge from the coronary care unit (Fig. 1). Amongst those patients monitored who had no arrhythmias detected, there was a hospital survival rate of 94%. Those patients who experienced ventricular standstill had a hospital survival rate of 16%. Of the 66 patients who experienced ventricular fibrillation while in the coronary care unit, there were 32 survivors giving a hospital survival rate of 48%. The age and sex of the 66 patients with ventricular fibrillation are detailed in Table II.

At least one other major arrhythmia, excluding ventricular standstill, was recorded in 24 (71%) of the 34 patients who died in hospital following the occurrence of ventricular fibrillation in the coronary care unit. 13 of these 24 had a major atrial arrhythmia while 19 of the 24 experienced at least one paroxysm of ventricular tachycardia. The remaining 10 patients who died in hospital after the occurrence of ventricular fibrillation did not experience any other significant atrial or ventricular arrhythmia. However, the 257 patients monitored in the coronary care unit who left hospital alive had an overall twelve months' mortality of 16%. Examination of the twelve months' survival for these patients with many different arrhythmias experienced in hospital showed that ventricular fibrillation, atrial flutter, bundle branch block and other intra-ventricular blocks were the only arrhythmias that carried a statistically significant adverse prognosis during that first year (Table III). The twelve months' survival of all patients admitted to the coronary care unit who had ventricular fibrillation recorded and were discharged from hospital is shown in Table IV. Of the 32 patients with ventricular fibrillation recorded in hospital, 30 occurred in men of 50 years of age or over. The survival of this group was then compared with the survival of the remaining male patients aged 50 years or over who had not sustained ventricular fibrillation. The survival curves are shown in Fig. 2 and it can be seen that there was an excess mortality at twelve months amongst the patients who had

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335 MONITORED CCU PATIENTS.  
1 YEAR REVIEW

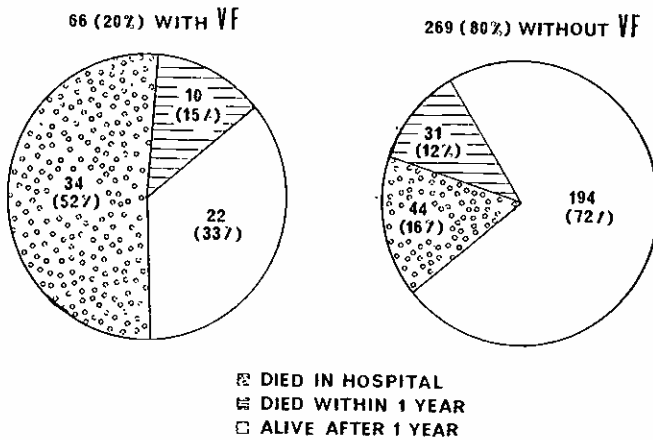


Fig. 1. Fate of 335 patients admitted to a coronary care unit with definite acute myocardial infarction.

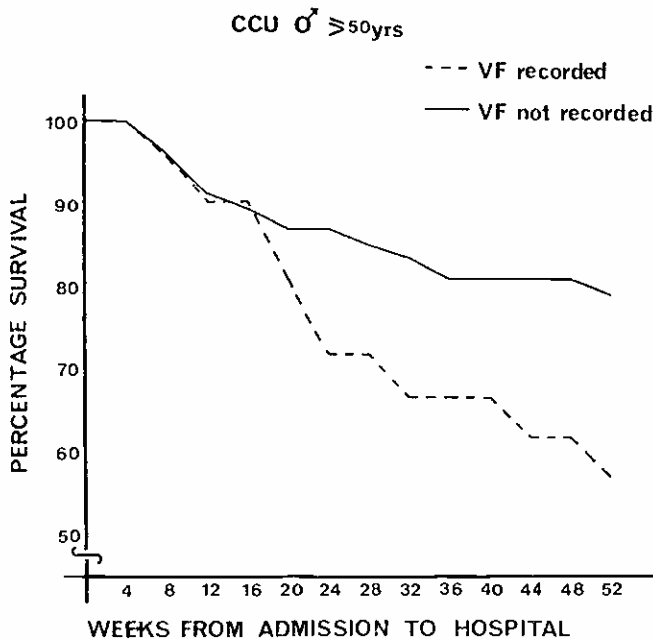


Fig. 2. Survival curve of 30 male patients, 50 years and over, discharged from hospital alive having experienced ventricular fibrillation and the other male patients, of similar age, discharged from hospital not having experienced ventricular fibrillation.

TABLE I

HOSPITAL SURVIVAL  
TOTAL PATIENTS DEFINITE A.M.I.

Hospital survival details of 335 patients initially admitted to hospital with a diagnosis of definite acute myocardial infarction.

| Number of Patients Experiencing Various Arrhythmias in the Coronary Care Unit | Number of Patients |      |       | Hospital inpatient survival rate from time of admission to Coronary Care Unit |
|---|--------------------|------|-------|---|
|   | Survived           | Dead | Total |   |
| 1. All patients   | 257                | 78   | 335   | 77  |
| 2. No arrhythmias   | 31                 | 2    | 33    | 94  |
| 3. All atrial arrhythmias   | 153                | 58   | 211   | 72  |
| 4. Sinus tachycardia  | 63                 | 39   | 102   | 62  |
| 5. Sinus bradycardia  | 50                 | 15   | 65    | 77  |
| 6. Atrial premature contractions  | 42                 | 17   | 59    | 71  |
| 7. Nodal rhythm   | 18                 | 11   | 29    | 62  |
| 8. Atrial fibrillation  | 29                 | 15   | 44    | 66  |
| 9. Atrial flutter   | 7                  | 4    | 11    | 64  |
| 10. Atrial tachycardia  | 23                 | 15   | 38    | 60  |
| 11. All ventricular arrhythmias   | 204                | 72   | 276   | 74  |
| 12. Ventricular premature beats   | 106                | 39   | 145   | 73  |
| 13. Ventricular tachy   | 39                 | 31   | 70    | 56  |
| 14. Ventricular fibrill   | 32                 | 34   | 66    | 48  |
| 15. Ventricular standstill  | 7                  | 38   | 45    | 16  |
| 16. All AV Block  | 40                 | 29   | 69    | 58  |
| 17. First degree AV block   | 20                 | 11   | 31    | 64  |
| 18. Second degree AV block  | 18                 | 7    | 25    | 72  |
| 19. Third degree AV block   | 23                 | 21   | 44    | 42  |
| 20. All bundle branch block   | 37                 | 38   | 75    | 50  |
| 21. Right B.B.B.  | 21                 | 15   | 36    | 58  |
| 22. Left B.B.B.   | 18                 | 15   | 33    | 54  |
| 23. Other intraventricular block  | 9                  | 12   | 21    | 43  |

TABLE II

VENTRICULAR FIBRILLATION RECORDED IN CORONARY CARE UNIT  
(66 PATIENTS)

Age, sex and outcome of 66 patients who experienced ventricular fibrillation while being monitored in the coronary care unit.

|                                 | Male |       |          |         | Female |      |          |         | Totals |          |         |
|---------------------------------|------|-------|----------|---------|--------|------|----------|---------|--------|----------|---------|
|                                 | No.  | %     | Ave. Age | Range   | No.    | %    | Ave. Age | Range   | No.    | Ave. Age | Range   |
| Total in C.C.U.                 | 49   | 74.2  | 57.6     | 39 - 73 | 17     | 25.8 | 61.2     | 48 - 78 | 66     | 58.5     | 39 - 78 |
| Died in C.C.U.                  | 12   | 54.6  | 60.6     | 49 - 73 | 10     | 45.4 | 61.9     | 48 - 78 | 22     | 61.2     | 48 - 78 |
| Died in General Ward            | 10   | 83.3  | 57.6     | 42 - 68 | 2      | 16.7 | 57.5     | 55 - 60 | 12     | 57.6     | 42 - 68 |
| Died in 3 months from discharge | 2    | 66.7  | 61.0     | 59 - 63 | 1      | 33.3 | 64       | 64      | 3      | 62.0     | 59 - 64 |
| Died in 12 months               | 7    | 100.0 | 59.9     | 53 - 66 | 0      | 0.0  | —        | —       | 7      | 59.9     | 53 - 66 |
| Alive at 12 months              | 18   | 81.8  | 54.4     | 39 - 73 | 4      | 18.2 | 60.5     | 53 - 75 | 22     | 55.5     | 39 - 75 |

TABLE III

## TOTAL PATIENTS (DEFINITE A.M.I.)

One year survival details of 335 patients initially admitted to hospital with a definite acute myocardial infarction.

| Number of Patients Experiencing Various Arrhythmias in the Coronary Care Unit | Number of Patients |      |       | 12 Month Survival rate from time of admission to Coronary Care Unit |
|---|--------------------|------|-------|---|
|   | Survived           | Dead | Total |   |
| 1. All patients   | 216                | 119  | 335   | 64  |
| 2. No arrhythmias   | 29                 | 4    | 33    | 88  |
| 3. All atrial arrhythmias   | 123                | 88   | 211   | 58  |
| 4. Sinus tachycardia  | 51                 | 51   | 102   | 50  |
| 5. Sinus bradycardia  | 46                 | 19   | 65    | 71  |
| 6. Atrial premature contractions  | 38                 | 21   | 59    | 64  |
| 7. Nodal rhythm   | 16                 | 13   | 29    | 55  |
| 8. Atrial fibrillation  | 22                 | 22   | 44    | 50  |
| 9. Atrial flutter   | 2                  | 9    | 11    | 18  |
| 10. Atrial tachycardia  | 17                 | 21   | 38    | 45  |
| 11. All ventricular arrhythmias   | 178                | 98   | 276   | 64  |
| 12. Ventricular premature beats   | 84                 | 61   | 145   | 58  |
| 13. Ventricular tachy   | 32                 | 38   | 70    | 46  |
| 14. Ventricular fibrill   | 22                 | 44   | 66    | 33  |
| 15. Ventricular standstill  | 6                  | 39   | 45    | 13  |
| 16. All AV block  | 35                 | 34   | 69    | 51  |
| 17. First degree AV block   | 18                 | 13   | 31    | 58  |
| 18. Second degree AV block  | 16                 | 9    | 25    | 64  |
| 19. Third degree AV block   | 20                 | 24   | 44    | 45  |
| 20. All bundle branch block   | 24                 | 51   | 75    | 32  |
| 21. Right B.B.B.  | 16                 | 20   | 36    | 44  |
| 22. Left B.B.B.   | 13                 | 20   | 33    | 40  |
| 23. Other intraventricular block  | 6                  | 15   | 21    | 29  |

TABLE IV

Fate of 32 patients discharged from hospital alive after experiencing ventricular fibrillation while being monitored in the coronary care unit.

|                                 | Total Number | Males | Females |
|---------------------------------|--------------|-------|---------|
| Discharged from Hospital alive  | 32           | 27    | 5       |
| Died in first 3 months          | 3            | 2     | 1       |
| Died between 3rd and 12th month | 7            | 7     | 0       |
| Alive at 12 months              | 22           | 18    | 4       |

ventricular fibrillation recorded in hospital compared with those who did not. This difference in survival rate is just short of the conventional level of statistical significance with  $p=0.06$ . No other notable difference between these two groups could be detected by analysing the frequency of previous myocardial infarction, past history of angina pectoris, smoking habits, family history of coronary disease, peak level of serum enzymes during the acute attack, time after onset of acute attack and admission to hospital or the

presence of congestive cardiac and admission to hospital or the presence of congestive cardiac failure after admission to the coronary care unit.

Death after discharge from hospital did not depend on the differential death rates between inpatients and those discharged from hospital as the death rate of ventricular fibrillation was higher (52%) than with the patients with any other arrhythmia except ventricular standstill and bundle branch blocks.

There was no significant difference in the mode of death "sudden" or "slow" between patients with and without ventricular fibrillation who died after discharge from hospital. Information was available concerning the mode of death in 40 of the 41 patients who died. 10 of these patients had experienced ventricular fibrillation in the coronary care unit; 6 of these (60%) died suddenly. Of the 30 patients who had not experienced ventricular fibrillation in the coronary care unit, 23 (76%) died suddenly. There is no statistically significant difference between these two figures. It should be further noted that, of the 41 deaths, at least 29 occurred suddenly within 24 hours of recurrent chest pain strongly suggesting an arrhythmia as the cause.

## DISCUSSION

This prospective study of patients monitored in the coronary care unit has shown that certain cardiac arrhythmias recorded during the acute illness are associated with an inferior twelve months' prognosis. These arrhythmias are bundle block, intra-ventricular blocks, atrial flutter and ventricular fibrillation. By matching the patients with ventricular fibrillation against a suitably matched control group, a poorer prognosis was shown for the group with ventricular fibrillation and this finding would be likely to occur by chance less often than one time in 16. However, it is suggested that this is not a chance finding and this conclusion is in keeping with the findings of Honey and Truelove (1957), Beard *et al* (1960) and Dupont *et al* (1969) but does not accord with the conclusion of Lawrie (1969). It is noted that the majority of patients with arrhythmias recorded in the coronary care unit had multiple arrhythmias. However, the patients with ventricular fibrillation recorded in hospital did not appear to have an excess of associated intra-ventricular block or atrial flutter. Although our definition of sudden death extended to 24 hours after the onset of an attack, it is very important to stress that 29 of the deaths that occurred in the patients after discharge from hospital did so within 24 hours of this onset of a second or subsequent attack. This finding leads logically to the conclusion that death in the year following infarction is often due to a sudden dysrhythmia.

## ACKNOWLEDGEMENTS

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