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A M E R I C A N C O L L E G E O F



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Major Cardiac Arrhythmias in Acute Myocardial Infarction: Implications for Longterm Survival*

Graeme Sloman, M.B., B.Sc., and Ronald J. Prineas, M.B., B.S.

The effect on longterm prognosis of cardiac arrhythmias occurring during an acute episode of myocardial infarction has been examined in 257 patients admitted to a coronary care unit and discharged from hospital. Patients with ventricular fibrillation were found to have a significantly poorer 12-month prognosis than patients without this arrhythmia. No significant difference in the mode of death was found between the two groups. Additionally, the occurrence of congestive cardiac failure occurring in the acute episode of myocardial infarction, despite hospital survival, resulted in a very poor 12-month survival rate.

Previous studies examining the longterm prognostic significance of major cardiac arrhythmias recorded during acute myocardial infarction have given conflicting results. Some authors¹⁻⁴ have suggested that they have an adverse effect on longterm prognosis. None of these studies examined only patients who had been monitored in a coronary care unit. This probably explains why in the latest of these studies⁴ only 16 percent of the 412 patients studied had a major arrhythmia recorded in hospital. It is known that the yield of recorded cardiac arrhythmias is much higher among acute myocardial infarction patients admitted to coronary care units than among similar patients admitted to general medical beds. Because of this, transient episodes of major cardiac arrhythmias may be falsely labelled as poor longterm prognostic factors, if only past studies are examined.

Two recent studies^{5,6} showed that patients with ventricular fibrillation recorded during the acute illness can survive in good health for a long time. However, neither of these studies had control patients with which to compare survival rates.

Because of recent attempts to improve the longterm prognosis after acute myocardial infarction by

reducing cardiac arrhythmias, it is important to examine the natural history of patients with individual cardiac arrhythmias recorded during the acute stage.⁷ Furthermore, it is important that the patients studied have all been carefully monitored during the acute stage of myocardial infarction so that the diagnosis of a major cardiac arrhythmia is not left to chance. The present study examines the longterm risk among such patients carefully monitored in a coronary unit and followed-up for 12 months.

MATERIALS AND 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 were also included in the register. The register was continued until the 1st March, 1970, and then all patients were observed for 12 months after their registration.

During this two-year period 1,278 patients were registered, and, of these, 978 were found to be suffering from a definite acute myocardial infarction.⁸ Of this number, 723 patients 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 either the coronary care unit or the general ward, a *proforma* was completed detailing the clinical presentation, initial physical findings, radiologic and electrocardiographic data and complications experienced during the hospital stay.⁹ Patients were followed in a special coronary follow-up clinic, with full details tabulated at three

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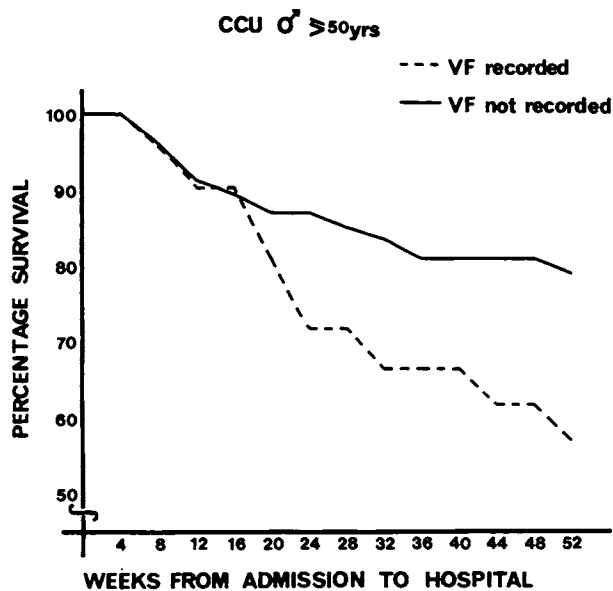


FIGURE 1. Estimated survival of men patients 50 years and over, with and without ventricular fibrillation, during original admission to hospital with acute myocardial infarction.

and 12 months. Complete survival data were obtained on each patient, and the mode of death was recorded for relevant patients.

Sudden death was defined as, "death occurring in less than 24 hours of the onset of a second or subsequent attack;"

Table 1—Survival of 257 coronary care patients for 12 months after admission with acute myocardial infarction related to different arrhythmias recorded during acute illness of definite myocardial infarction.

Arrhythmias* in Coronary, Type	Patients, No.			Survival rate, %	p**
	Survived	Died	Total		
1 All patients	216	41	257	84.0	
2 No arrhythmias	29	2	31	93.5	N.S.
3 ALL ATRIAL ARRHYTHMIAS	123	30	153	80.4	N.S.
4 Sinus tachycardia	51	12	63	81.0	N.S.
5 Sinus bradycardia	46	4	50	92.0	N.S.
6 Atrial premature contractions	38	4	42	90.5	N.S.
7 Nodal rhythm	16	2	18	88.9	N.S.
8 Atrial fibrillation	22	7	29	75.9	N.S.
9 Atrial flutter	2	5	7	28.5	p=0.0012
10 Atrial tachycardia	17	6	23	73.9	N.S.
11 ALL VENTRICULAR ARRHYTHMIAS	178	26	204	87.3	N.S.
12 Ventricular premature beats	84	22	106	79.2	N.S.
13 Ventricular tachycardia	32	7	39	82.1	N.S.
14 Ventricular fibrillation	22	10	32	68.8	p<0.025
15 Ventricular standstill	6	1	7	85.7	N.S.
16 ALL A-V BLOCK	35	5	40	87.5	N.S.
17 First degree A-V block	18	2	20	90.0	N.S.
18 Second degree A-V block	16	2	18	88.9	N.S.
19 Third degree A-V block	20	3	23	87.0	N.S.
20 ALL BUNDLE BRANCH BLOCK	24	13	37	72.0	p<0.005
21 Right bundle branch block	16	5	21	76.2	N.S.
22 Left bundle branch block	13	5	18	72.2	N.S.
23 Other intraventricular	6	3	9	66.7	N.S.

*Types of arrhythmias are not mutually exclusive.

**Comparison between survival of group of patients listed and remaining patients—p values given for groups with significantly poor survival (comparisons were made using Chi-squared test with Yates correction, except for [9] where Fishers exact test was used).

slow death was defined as "that which occurred 24 hours or more after the onset of a second or subsequent attack."

The study group of 257 patients who had been discharged from the coronary care unit and left hospital alive, included a group of 138 men who were 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 four 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 who were aged 50 years or more and 12 women who were aged less than 50 years.

RESULTS

The 257 patients monitored in the coronary care unit who left hospital alive had an over-all 12-month mortality of 16 percent. Examination of the 12-month survival for these patients with different arrhythmia experiences in hospital showed that ventricular fibrillation, atrial flutter and any bundle branch block or other intraventricular block were the only arrhythmias recorded that carried a statistically significant adverse prognosis during that first year (Table 1).

The detailed comparison of survival of patients with and without ventricular fibrillation is shown in Table 2. Of the 32 cases of ventricular fibrillation

Table 2—Twelve-month survival of all patients admitted to coronary care unit with ventricular fibrillation recorded and discharged from hospital.

	Died (41)	Survived (216)	Total (257)	Survival, %
Ventricular fibrillation in hospital	10	22	32	68.8
No ventricular fibrillation in hospital	31	194	225	86.2

recorded in hospital, 30 occurred in men of 50 years of age, or over. The survival of this group was compared with the survival of the remaining men patients aged 50 years, or more. The respective survival curves are shown in the Figure, and it is obvious that there was an excess mortality at 12 months among the patients who had ventricular fibrillation recorded in hospital compared with those who did not. The survival rates were compared using the expression

$$\frac{S_1 - S_2}{\sqrt{(SE_1)^2 + (SE_2)^2}}$$

which has a normal distribution and S_1 , SE_1 and S_2 , SE_2 are, respectively, the survival rates and standard errors for patients who had ventricular fibrillation recorded in hospital and for those who did not. The difference in survival rates is just short of the conventional level of statistical significance with $p < 0.06$.

The group with ventricular fibrillation was also compared with the other older men by other parameters known to affect longterm prognosis. There was no notable difference between the two groups in frequency of previous history of angina pectoris or myocardial infarction, smoking habits, family history of coronary disease, level of serum enzymes during the acute attack, time after onset of acute attack of admission to hospital, or parameters of congestive cardiac failure during the acute attack. This last comparison is important, because patients with congestive cardiac failure were shown to have a significantly worse 12-month prognosis than other patients in the present study.

The latter comparison was made by examining all patients with definite acute myocardial infarction discharged from hospital, whether from the coronary care unit or from general hospital beds. Both groups of patients were examined together because, unlike the cardiac arrhythmias, parameters of congestive cardiac failure were measured in the same manner in each group. Congestive cardiac failure was recorded as present in the acute illness if a gallop rhythm was heard on admission or crepitations were present in any of the lower parts of the

Table 3—Twelve-month survival of 723 patients discharged from hospital after acute myocardial infarction, compared according to presence or absence of congestive cardiac failure (CCF)* during admission with acute illness.

	CCF*	
	Present	Absent
Survived	408	178
Died	121	16
Total	529	194
Survival, %	77.1	91.8

$\chi^2 = 18.8299$, $p < 0.0005$

*See text for definition of CCF

chest after coughing at the admission physical examination or if these signs developed during the patients stay in hospital or the patient complained of increasing shortness of breath, not due to a respiratory illness, or the liver was recorded to become enlarged to palpation. Table 3 shows that congestive cardiac failure, so defined, occurring during the acute illness was a common complication in the patients who survived hospital, and that their 12-month survival rate of 77 percent was significantly lower than patients without this complication in hospital. Additionally, the inpatient death rate of patients with ventricular fibrillation recorded in the CCU was higher (52 percent) than for patients with any other arrhythmias, except ventricular standstill and intraventricular block. This point is noted only to indicate that death after discharge from hospital did not depend on differential death rates between inpatients and those discharged from hospital.

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 (Table 4).

DISCUSSION

The present study has shown that in patients with acute myocardial infarction carefully monitored in

Table 4—Mode of death in all patients admitted to Coronary Care Unit and discharged from hospital, comparing those who had ventricular fibrillation recorded in hospital with those who did not.

Ventricular fibrillation	Mode of Death	
	Sudden	Slow
Present	6	4
Absent*	23	7

$\chi^2 = 0.3761$, $p > 0.5$

*Mode of death unknown in one subject.

hospital, particular cardiac arrhythmias recorded in the acute illness are associated with an inferior 12-month prognosis. Such arrhythmias include bundle branch block and intraventricular block, atrial flutter and ventricular fibrillation. Only with the last mentioned arrhythmia were patients in a suitably matched control group compared. 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 such comparisons ($p < 0.06$). However, it is suggested that this is not a chance finding and this conclusion is borne out by the statistically significant poorer prognosis demonstrated for patients with ventricular fibrillation when the whole coronary care group in this study was examined. This finding is in keeping with the more general findings of Honey and Truelove,³ Beard et al¹ and Dupont et al,¹⁰ but does not accord with the conclusion of Lawrie.⁵ The present results are not in discord with Lawrie's findings, but our conclusions differ. Lawrie did not have a control group, and the ages of his patients were not stated. His finding of 12 percent mortality at 12 months in 41 patients with ventricular fibrillation, recorded during the acute illness, cannot be used as standard survival rate for the patients, unless their ages are known, because age is an important factor in longterm prognosis. Furthermore, it is inadequate to compare patients between different centers at different times, as Lawrie did when concluding that the group of patients he studied did not have an inferior prognosis. His finding of 12 percent mortality does, in fact, have 95 percent confidence limits 3 percent-21 percent. Cross classification is not presented in the analysis, because of the small number of patients who had only one arrhythmia noted. The majority of patients with arrhythmias had multiple arrhythmias recorded in hospital. However, the 12-month excess mortality of the patients with ventricular fibrillation recorded in hospital was not explained by an excess of concomitant intraventricular block nor of atrial flutter.

The findings in the present study do not support the suggestion of Denborough et al⁴ that such patients have an increased liability to sudden death. This may be because our definition of "sudden death" was less stringent than that of the latter authors or because of our very high (87.2 percent) incidence of recorded major arrhythmias in the acute attack. It is important to stress however, that 29 of the 41 deaths (71 percent) after discharge from hospital in the group of patients who had been in the coronary care unit occurred within 24 hours of the onset of a second or subsequent attack. Therefore, the aim of preventing sudden dysrhythmic death after discharge is a valid one, and remains so, despite the lack of success in achieving this aim reported recently by a collaborative group.⁷

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