

MORTALITY IN THE EARLY PHASE OF ACUTE MYOCARDIAL INFARCTION: A 3 YEAR EXPERIENCE IN THE CORONARY CARE UNIT

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SUMMARY

Mortality in the early phase of acute myocardial infarction occurs both during the pre-hospital period and after admission to the Coronary Care Unit. This report is an analysis of deaths that occurred in the Coronary Care Unit within a 3 year period. Forty percent of 304 patients (13 percent) with acute myocardial infarction died in the Coronary Care Unit. Fifty percent of the deaths were due to cardiac arrhythmias and 45 percent attributable to myocardial pump failure. Mean delay in hospital admission from onset of symptoms was 15 hours. Factors affecting early mortality and their prevention are discussed.

INTRODUCTION

Early mortality in acute myocardial infarction occurs within hours after the onset of symptoms and frequently before the patient is able to seek medical aid. In a series of 998 fatal cases of acute myocardial infarction reported by McNeilly and Pemberton,¹ 60 percent of the deaths occurred outside the hospital. Of these, 25 percent of the fatalities occurred within 15 minutes and 38 percent within 1 hour of the onset of symptoms. The patients seen in the coronary care unit

therefore represent the survivors of this early mortality which is in the pre-hospital phase of acute myocardial infarction. A further mortality is extracted from these survivors during the coronary care unit period of stay. Prognostic factors that influence the mortality rate during this phase include age of patient, development of complications of arrhythmias, cardiac failure, cardiogenic shock, reinfarctions and whether the disease involves single or multiple vessels. Survivors of acute myocardial infarction face greatest risk of death in the first year, particularly in the first six months. Reported mortality rates in the first year ranges from 8 percent - 25 percent and thereafter averaging 3 - 5 percent per year.^{2,3,4}

This report describes the experience in a local coronary care unit with regard to the early mortality pattern in acute myocardial infarction. Mortality in the coronary care unit is studied with reference to : a) Delay between onset of symptoms to hospital admission, b) Time intervals between hospital admission to complications and death and c) Causes of death. Results of this study are compared to other published reports. Factors contributing to early death in acute myocardial infarction and its prevention are discussed.

MATERIALS AND METHOD

The population studied were all deaths consequent to acute myocardial infarction that occurred in the Universiti Kebangsaan Malaysia Division of the Coronary Care Unit, General Hospital, Kuala Lumpur in the 3 year period

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TABLE I
DISTRIBUTION OF PATIENTS BY RACE AND SEX

RACE	MALES		FEMALES		TOTAL	
	No.	%	No.	%	No.	%
Malay	9	23	5	12	14	35
Chinese	8	20	4	10	12	30
Indian	8	20	3	8	11	28
Others	2	5	1	2	3	7
TOTAL	27	68	13	32	40	100

between October 1977 and September 1980. Patients not fulfilling the criteria for acute myocardial infarction and re-admissions were excluded from the study. Also excluded were deaths occurring after discharge from the coronary care unit. For the purpose of this study, the time of onset of symptoms; time of admission; onset of complication preceding death; immediate cause of death and time of death were recorded for analysis. Calculation of the time intervals were made to the nearest half hour. The diagnosis of acute myocardial infarction, cardiac failure and cardiogenic shock were based on the criteria previously described.⁵

RESULTS

There were 40 deaths in the coronary care unit out of a total of 304 admissions in the period of study (13 percent). There were 27 males (68 percent) and 13 females (32 percent). The age range was 36-82 years with a mean age of 64.5 years. Distribution by race and sex is shown in Table I.

SITE OF INFARCTION

Twenty-five of the 40 patients (62 percent) had anterior infarctions. There were 11 with inferior (28 percent) and 4 (10 percent) with mixed infarctions.

TABLE II
DISTRIBUTION OF FATAL CASES BY CAUSE OF DEATH

CAUSES OF DEATH	No.	%
Cardiogenic shock	13	32
Cardiac failure	5	13
Arrhythmias		
Complete heart block	11	28
Ventricular tachycardia/ fibrillation	8	20
Others	1	2
Mixed/Unknown	2	5
TOTAL	40	100

IMMEDIATE CAUSE OF DEATH

The frequency and causes of death are shown in Table II. Cardiogenic shock (32 percent) and complete heart block (28 percent) were the commonest immediate causes of death. Half the deaths were due directly to a cardiac arrhythmia.

TIME INTERVAL BETWEEN ONSET OF SYMPTOMS TO ADMISSION

The range in the delay between onset of symptoms and admission was 0.5 to 72 hours, with a mean delay of 15 hours. Only 15 percent of the patients sought hospital admission within 1 hour of onset of symptoms. Delay up to 12 hours occurred in 72 percent of patients, and one fifth delayed admission to more than 24 hours after the onset of symptoms (Table III).

TIME INTERVAL BETWEEN ADMISSION TO COMPLICATION PRECEDING DEATH

Complications preceding death occurred from 0.5 to 98 hours after admission, with a mean interval of 13.5 hours. Among the patients who died, 81 percent developed the complication

TABLE III
DISTRIBUTION OF CASES BY TIME INTERVALS

TIME INTERVALS	< 1 hr		1-5 hrs		6-12 hrs		12-24 hrs		> 24 hrs	
	No.	%	No.	%	No.	%	No.	%	No.	%
1. Between onset of Symptoms to Admission	6	15	19	47	4	10	3	8	8	20
2. Between Admission to Complication preceding death	15	38	11	28	6	15	3	8	5	12
3. Between Admission to Death	6	15	13	32	6	15	8	20	7	18

preceding death within 12 hours of admission. Of these, more than one third occurred within the first hour of admission. Complications arising after 24 hours were seen in 5 patients (12 percent) (Table III).

TIME INTERVAL BETWEEN ADMISSION AND DEATH

Deaths in the coronary care unit were seen between 0.5 to 132 hours (5.5 days) after admission, with a mean of 16 hours. 82 percent of deaths occurred within 24 hours of admission, the majority of whom died within 12 hours (Table III).

DISCUSSION

Reduction in mortality during the pre-hospital phase of acute myocardial infarction is dependent on decreasing the delay between onset of symptoms to hospital admission. In this period the primary cause of death is malignant arrhythmias. Attempts to improve the survival rate during this phase are directed towards the early recognition and treatment of such arrhythmias. Such attempts include the introduction of mobile coronary care units, prophylactic use of anti-arrhythmic drugs and the training of paramedics in cardio-pulmonary resuscitation. Published data from other centres report a range of 1 to 8 hours in the delay between onset of symptoms to hospital admission.^{1,6} This is in contrast to the mean delay of 15 hours in this series.

The immediate causes of death in the coronary care unit include cardiac arrhythmias, persistent cardiac failure and cardiogenic shock. Identification of these causes are important for their prevention, early recognition and treatment may reduce the overall mortality. By continuous electrocardiographic monitoring, disorders of rate, rhythm or conduction are now recognised to occur in 75 to 95 percent of patients after acute myocardial infarction.^{7,8} It has been shown that one of the factors contributing to the reduction in mortality in the early phases of acute myocardial infarction is the recognition and treatment of cardiac arrhythmias.^{8,9} Various studies have shown that patients who are likely to develop sudden death can be identified. These are patients who develop complex ventricular premature beats which are more frequent than 30 per minute, multifocal in type, occurs in salvos or demonstrate the "R on T" phenomenon. These arrhythmias are most likely to

deteriorate into ventricular fibrillation.^{10,11} There are now available several drugs with proven efficacy in the treatment of such arrhythmias. However, their routine use prophylactically is still not established. Recent studies in the prophylactic use of Mexiletene¹² and Disopyramide¹³ have shown favourable results regarding their anti-arrhythmic properties in the early post myocardial infarction period. Similarly, pacemakers may be used prophylactically in the prevention of sudden death. Its use alone or in combination with drugs serves to correct the frequently transient conduction defects and the control of atrial or ventricular arrhythmias. In this series, 50 percent of the deaths were directly due to an electrical abnormality. In addition, 81 percent of complications preceding death were encountered within 12 hours of admission.

Although there is a significant reduction in mortality in the coronary care unit by prophylactic and prompt treatment of arrhythmias, incidence of in-hospital deaths from pump failure manifest as cardiac failure and cardiogenic shock have not changed dramatically despite newer facilities and drugs. Mortality in patients with cardiac failure and cardiogenic shock ranges from 22 percent to 55 percent and 81 percent to 90 percent respectively.^{14,15} The likelihood of developing pump failure is dependent on the extent of myocardial damage, and it has been established that anterior infarcts are associated with greater left ventricular impairment than inferior infarcts.¹⁵ The quantification of infarct size, which is the main determinant towards the likelihood of pump failure, with methods presently available has its limitations. Such methods include precordial ST segment mapping,¹⁶ enzymatic estimates of infarct size,¹⁷ scintigraphy¹⁸ and Positron-emission transaxial tomography.¹⁹ The treatment approach in infarct size limitation is directed towards the manipulation of factors affecting oxygen supply and demand to the ischaemic, yet salvageable zones of the myocardium. Among the ways of modifying ischaemia are the use of beta-blockers,²⁰ vasodilators,²¹ hyaluronidase²² and emergency coronary revascularization surgery.²³ In this series, 45 percent of the deaths were due to pump failure and about two thirds of the deaths were in patients with anterior infarctions.

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